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RAPPORTEUR'S SUMMARY*

Session One.
Transmission Rights, Transmission Wrongs, and Renewable Resources:
Conflicts Over Access, Pricing, and Jurisdiction

There has been considerable policy debate over the "chicken and egg" problem regarding whether wind projects should be built in the hope that transmission will come, or whether the transmission should be built in the hope that the wind generation appears. The debate, not surprisingly, has been expanded to the terms and conditions under which wind and other renewable generators can access the grid. Because of wind's social benefits, some are advocating new legislation that would incorporate environmental values into dispatch protocols by requiring priority access for renewable generation over fossil-based generation. Should such provisions be enacted? How do renewables interact with grid operations?

Should renewable generators be required to pay to compensate for priority in the queue? It could be argued, for example, that because of its intermittent nature, wind poses a particular burden for dispatchers and schedulers that should be more fully reflected in the transmission rates associated with wind energy. It has also been contended that large wind farms frequently, because of distance from load centers and their intermittent character, require more ancillary services than other sources. How should that factor into priority access? In addition, how well does wind fit into the dispatch protocols of ISO's and what unique difficulties, if any, do wind generators encounter in regions without organized markets?

Speaker 1.

The theory I want to address today sounds very simple. In essence, energy consideration of renewable generation and resources reduce emissions of greenhouse gases. I don't know to what extent this theory has gripped the masses, but apparently it has gripped the bosses. So, is it always true? Does it matter where or when we reduce electricity demand? Does it matter where we locate renewable generation? If it matters, what should we do about this? These things do matter, so let's discuss what to do. Much of the following discussion is based on a paper written by Pablo Ruiz and Aleksandr Rudkevich, on Marginal Locational Carbon Intensities that I expect to come out in the IEEE journal, Transactions on Power Systems.

I will discuss an economist's approach, which is follow the money. Money follows prices, and prices are locational marginal prices. In this

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analysis, they define as a change in the system-wide dispatch according to small changes in demand. Prices follow the behavior of marginal generators in the system. The idea is to systematically track the change in emissions in response to the change in demand. Ultimately, this also follows the behavior of marginal generators. This can show one how different actions taken within the industry affect carbon emissions. The final equation that gets developed is something called marginal carbon intensity

It's a change in the CO2 emissions for the entire system in response to a small demand reduction taken at a given place in the system at a given moment in time. Clearly, it may be time-dependent or location-dependent. Let's consider time-dependency. Imagine power systems dominated by three technologies: a conventional coal-generating capacity, a combined-cycle gas-fire capacity, and a peaker. Each has its own heat rates, fuel prices, variable O&M [operations and management], and emission rates. Coal emits 0.9 tons per megawatt hour, combined cycle emits 0.4, and the peaker emits approximately 0.6. One can assume a $10 per ton carbon price. Thus coal costs $29 per megawatt hour to generate, combined cycle is $42, and the peaker is $66.

Over a time demand curve, coal is in the margin at some hours, sometimes gas, and the peaker at the peaks. By following what's on the margin the marginal carbon intensity [MCI], the amount of carbon one will avoid in this system by reducing demand, is actually changing over time, and quite significantly. When coal is on the margin, MCI is 0.9, which is mostly during off-peak hours. During intermediate hours with gas on the margin there's a 0.4 MCI value and it's 0.6 at peak hours. Those numbers may vary by more than double. The same demand reduction action has a different impact on carbon reduction through the day.

How does MCI vary by location in a transmission system? Assume there are three locations in a system, A, B and C. And in location A there is a gas-fired combined cycle generator and a small load, 1 megawatt. At location B there is a coal generator and also a small load. At location C there is no generation and a 50 megawatt load. 52 megawatts are needed by this system. Coal is cheaper, so they would use coal and dispatch it up to 30 megawatts, and the remaining 22 megawatts will come from the combined cycle. It's assumed there is no congestion in this transmission network. The marginal carbon intensity for this network would be 0.4 in all locations, because the gas-fired combined cycle is on the margin.

To summarize, generation number one emits 0.4 ton per megawatt hour, and it's marginal. It marginally displaces itself. The net impact is zero. If the capacity of this generator is increased, it would not make any difference on carbon emissions, because it's underutilized anyway. For coal, it emits 0.9, but marginally displaces gas with 0.4. The net impact is only 0.5. If the capacity of the coal generator is increased by one extra megawatt, it displaces the combined cycle generator and the net increase would be 0.5 ton of emissions.

On the load side, the marginal carbon intensity is 0.4, which means additional 1 megawatt of load will result in a 0.4 additional tons of emission reductions. And transmission, since it's unconstrained, has no impact on the system.

Now let's assume that the transmission system is constrained. The line from B to C can only take 20 megawatts and the line from A to C can only take 32. The previous dispatch I discussed becomes invisible, because it was approximately 27 megawatts. Now, to maintain the security of the system the generators have to be re-dispatched. The operator has to ramp down the coal, ramp up the gas so the flow through the line from B to C is only 20 megawatts. Now there are two marginal generators. Coal is dispatched only at 11 megawatts, and gas is dispatched at the middle of the demand.
If one reduced demand at location A, what happens? The only way to accommodate that would be to reduce combined cycle generation in that location. That would save 0.4 of carbon. If one reduces demand at location B, the only way to accommodate that would be to reduce coal generation because of transmission constraints. And that would actually save us 0.9 ton per megawatt of carbon.

What would happen if demand is reduced at location C? This relieves congestion on the line from B to C. It allows the operator to increase

the dispatch of coal by 1 megawatt and reduce the dispatch of gas-fired generation by 2 megawatts. The net would be a 1 megawatt reduction. At location B an extra 0.9 ton of carbon would be produced. At location A, 0.8 ton of carbon would be reduced. This would result in an increase of carbon emissions by 0.1 ton.

To summarize, adding 1 megawatt of wind at bus C, reduces demand at that bus by 1 megawatt, which would actually increase carbon emissions in the system by 0.1.

On the transmission side the line from B to C is congested. However, congestion can help reduce emissions. If one relieves this congestion, emissions of CO2 will increase. We relieve it by 1 megawatt, the emission will go up.

What if the price of carbon is $40 per ton, not $10? Congestion now occurs in the A-C line. If that line becomes constrained, coal is more expensive than gas. The results are quite different now. In this situation, relieving congestion on line A to C would reduce carbon emissions.

These examples have important policy implications. Generally, good carbon policy would be in the form of a carbon tax, or cap and trade. However, reporting the marginal carbon intensity on a locational basis would still be helpful to evaluate how good the policy is.

However if policy measures are in addition to setting up a carbon price, through additional incentives paid for load reductions, or additional incentives given to renewables, then the above discussion is very relevant and we may see situations where these policies may actually increase carbon in certain situations. It's important to know if the policies are achieving the goals on the basis of which they are subsidized.

The underlying mathematics used in setting up these examples are fully scalable. Marginal carbon intensities could be computed in real systems with very small change to existing market engines to generate this data in real time. It would be easy for the system operators.

If emission reduction is claimed as a benefit, then calculations of MCI ensure that the reduction does in fact occur, and that the subsidy is equitably distributed to participants according to the goal. One can look at demand reduction, and promote it at locations with a positive carbon intensity. It doesn't make any sense to promote it in a location with negative marginal carbon intensity. Further, in locations with positive MCI, it should be subsidized at the actual level of carbon reduction that occurs.

Finally, with RPS, renewable portfolio standards, this should be considered as well. So far all the product programs are being considered as percent of load or megawatt hour targets. However, depending on the time and location, the efficiency in carbon reduction of these programs can vary considerably as I've discussed. Is it equitable to give them the same payment on the per-megawatt-hour basis?

This information of marginal carbon intensities should and can be produced. It should be given to the policy makers, to the market participants and to the public so they can make more informed decisions about how to design and implement these policies.

Question: In the low carbon credit case under congestion, the reduction in the demand contributes to increased carbon intensity. In that example, is the value saved by cost minimization sufficient to buy credits that would enable a whole net reduction in cost. In other words with the credits included it would still create a net carbon reduction. In other words, there's a slightly higher carbon intensity in, but are the savings compared to the cost of the carbon credits large enough that on a dollar basis one would be better off? The credits are designed to promote trade-offs, right? Are the savings sufficient to pay for a trade-off directly for carbon intensity increase? If the efficiency savings are large enough, then they would be enough to buy credit offsets to account for the slight carbon increase.

Speaker 1: In the example I gave there are no savings created. It wouldn't matter whether carbon was zero, $10 or $40, the dispatch would still be the same.

Question: If there's more carbon usage, it would raise the cost of carbon in a closed system. The increased usage could create a higher price which then promotes greater conservation elsewhere.

Speaker 1: Well, in the global carbon picture, it's not a complete example. However, we should recognize that current models used to simulate carbon policy don't take into account how the power grid actually operates. One needs to consider operational implications of carbon policies.

Question: What are the assumptions for the dispatch? Is it economically grounded? Is it grounded in environmental concerns? Within a single ISO? If there are different owners of each generational source, how do they get played back into the mix?

Speaker 1: It's assumed to be a security constraint dispatch, a centralized cost-minimization dispatch. Only in a centralized dispatch is it trackable.

Question: This analysis measures marginal carbon intensity on a tons-per-megawatt-hour basis. With intermediate and higher peak use, the marginal carbon intensity decreases. Sorry. However, is there also room for an analysis to look at the total carbon being emitted. Coal is being almost fully dispatched or fully dispatched even during the base period? In essence, the same carbon is being produced, even though on a per-megawatt-hour basis it reduces. Does this perspective create different conclusions about RPS design and other incentives?

Speaker 1: Right. This only applies to the marginal changes, in the same way as when we measure prices. It does not always reflect full avoided costs of doing certain things. But that would require much more extensive analysis. This approach is useful because it can be integrated into market operations, can create market signals with respect to carbon that are similar to prices.

Speaker 2.

I'm going to address rights and wrongs for access, pricing and jurisdiction, but also address the goals of the system. The challenge has to be considered in the broader context of climate change. Climate change will completely shape the way our systems are built and run in the next century. It is getting more severe. It's happening faster than we thought. The complications are enormous. The imperative is to reduce carbon emissions as quickly as possible to make the impacts minimal. The benefits of taking this action, especially early actions, far outweigh the costs that we're like to incur.

The consequences of failing are remarkable. There's been no parallel in human experience since the last Ice Age. One in 20 people could be displaced by rising sea levels. A whole third of the world species face extinction by the end of the century. The poorest nations on this planet will face the earliest and most disastrous consequences and have the least ability to adapt. It will result in climate refugees and resource conflicts around the world, some occurring already. Some argue that the droughts in Africa have led to displacements that have contributed to the conflicts in Darfur and elsewhere. It is hard to know what we will be dealing with for sea level rises. One-half of the West Antarctic and Greenland ice shelves melting could result in a sea level increase of seven meters.

The U.S. has a very important role to play as the largest per capita emitter of carbon in the world. We must lead. We're the largest contributors. We have access to technology and innovation that developing countries lack. We have the ability to transform challenges into opportunities. This is transforming the way we power the world's largest economies. The challenge is very difficult. However, a whole array of new industries, economic opportunities, and job creation can flow from this. These are all motivating factors.

The U.S. has experience with large-scale economic transitions. We haven't seen one in a long time, but a hundred years ago there were virtually no automobiles in this country. Now there is an interstate highway system and an enormous gasoline distribution. The U.S. can create a massive economic engine for ourselves by moving forward and embracing this change.

Coal is 52% of overall fuel mix for the electricity sector and 80% of carbon emissions.

We need to move away from coal and fossil fuels and move to renewables as a key component. Many decisions about how to spread the costs of transmission enhancements and renewable energy development don't account for carbon reductions. We simply cannot afford new coal plants to make adequate progress on climate change. Further, the country should phase out existing coal plants as quickly as possible. According to the inter-governmental panel on climate and many of the leading scientists in this field, there is a decade or so to make progress on this. It is a relatively small window.

What's preventing the renewable transition? The situation in California shows that it's about transmission. And it's similar everywhere else. The tax credit situation is at least temporarily addressed. That's the largest barrier to ambitious RPS standards for California. Second is the transmission and that's the concern here.

The other obstacles are the cost of renewable energy. It seems inflated due to the lack of carbon pricing. Once carbon is monetized properly and there are caps the economics will work better. Further, the system then becomes easier to address in terms of transmission. General grid upgrades won't simply allow underutilized coal plants to produce more energy to increase their carbon emissions, primarily in the Eastern Interconnection.

Concerns about land use siting for transmission are significant. They can be a much larger barrier than people realize. Most business as usual planning, cost allocation and siting issues are really about territorial issues, about service territories, and about more limited geographies than what we're talking about. In the Western United States, building out for renewable energy resources requires building a regional energy market that can wield power from places like Wyoming to markets in Los Angeles, Las Vegas, Phoenix and elsewhere. There is a need for instruments that overcome a parochial view about cost allocation and need. A transmission line from Utah to Oregon might need six certificates of public convenience and necessity. We need national solutions for these sorts of problems

What about dispatch for these resources? It needs to be equitable and cost effective. One question is what gets on the lines, and what gets on the lines first. The nation needs to address carbon backsliding where new transmission lines enable increased coal. We can't afford new coal interconnections. If carbon capture and sequestration comes into play then this question can be addressed again. In the meantime, several environmental groups have proposed the Greenhouse Gas Interconnection Standard. This is primarily important in the Western United States where you have a lot of coal resources high levels of renewable energy resources in the same areas. The standard would only allow carbon emissions as low as a peaking gas plant to interconnect onto new transmission lines that are proposed for renewable energy resources. This would allow for balancing of load, but also minimize new high-carbon interconnections. This prioritizes grid enhancements for renewables. As the previous speaker just demonstrated, when all sources are in play, one can end up with increased carbon in certain situations on an economic basis only. We need similar low-carbon priority policies for the Eastern Interconnection too.

This is particular important without carbon pricing. Even if we get carbon pricing, it may not be an adequate enough price so this policy acts as a default. A cap with adequate carbon pricing would probably reduce the need for these kinds of policies but we may not get enough of a price for the right incentives.

Intermittency is a problem for connection to renewable resources with the grid. However, firming of renewable resources can be done in ways that don't require additional carbon resources. In many places one can firm wind with other wind resources in other nearby regions. The combination of solar, wine, and geothermal together can really firm up resources. Geothermal can function as base-load resources. Natural gas is going to be a very important transitional fuel until storage problems, demand reduction, and other approaches come into place.

Technological advances in renewable energy storage will be very helpful in addressing intermittency. There are molten salt technologies now for solar thermal projects, compressed-air capacitors, and other technologies that are

coming forward. Some will be great and others will fizzle.

The need for lines should be tied to the national greenhouse gas reduction goals. There are not formal goals right now. The president has articulated goals for an 80% reduction in greenhouse gas emissions by 2050. That's in line with the IPCC [Inter-governmental Panel on Climate Change].

For interconnection planning, some key principles leap out. One needs to involve key stakeholders up front, not just a limited number of people making judgments about electrical connections. One approach is to identify renewable energy development zones that have few conflicts. This idea was pioneered in Texas and is being pursued by California and the Western Governors Association. It's not always simply the best resource quality areas. One has to consider utilizing areas that aren't of high ecological value to gain broader public acceptance and easier environmental review moving forward. The lines that are identified in interconnection-wide planning should be prioritized and federally authorized for greenhouse gas reduction goals.

Siting for transmission is difficult. Siting should remain with the states, with fallback authority with the Federal Energy Regulatory Commission if they don't act within a given period of time. Others have recommended that interconnection-wide siting should be done regionally and include the states as stakeholders. There's a number of ways to go at this but getting the regional balance right and ensuring the states still have a seat is important.

Who are these key stakeholders? Clearly load-serving entities, utilities, and independent transmission sponsors are key. The federal and state regulators, the local and county governments, tribal governments, the environmental community and planning entities and sub-regional planners. There are not ISOs everywhere in the United States. In order to create regional markets, there can be ad hoc or unofficial sorts of planning organizations and sub-regional planners. Some of them don't actually produce plans. They certainly look at what's needed over the long term and their input is critically important.

One still has to avoid designated protected areas, to plan for eco-system resilience. There are going to be many changes as a result of climate change. Entire ranges of habitats are shifting and we don't really know what we're going to need to do to preserve much of the natural world for future generations. The balance between interconnections and existing natural resources will have to be carefully considered. It will mean looking beyond the boundaries of some designated protected areas for corridors to simultaneously interconnect and protect biological and genetic resources.

Expansion needs to incorporate long term resource planning. This can use existing rights of way to a large extent. We can have transmission resources that add circuits or increase voltage ratings. Getting new rights of way is absolutely murder. Congress took it on in the Energy Policy Act of 2005, in section 1222, and it resulted in many states suing over the designations.

Further, agencies have to collaborate. The federal government agencies have often been siloed and Balkanized. They need to be able to work cooperatively together, and they need to be compelled to do so, and they need to work cooperatively with the states.

Let's consider a quick example. The Mohave generating station is closed due to litigation. There is extensive infrastructure at that site, including transmission and it's in a great solar energy resource area. That's a perfect place to get renewable energy resources up and running very quickly on a large scale. However, their interconnection queue position may mean that they're unable to get on in a reasonable period of time to meet power purchase agreements. That's what needs to change. It is this kind of prioritization that needs to be addressed.

Similarly, we need to use system capacity for distributed generation too. It is moving far too slowly. Similarly, there needs to be ways to factor in, especially in interconnection planning, the accelerated use of energy efficiency.

Question: You argued that cost recovery should be interconnection-focused. Is this to be spread across everybody, or to beneficiaries identified

on the whole interconnection? What does that mean exactly?

Speaker 2: It should be interconnection-wide dispersion of cost, but one has to look at beneficiaries as well. People are still considering how to best do it. However, if one considers interconnection-wide cost recovery, the average rate payer would have almost negligible cost. The lines would be linked to a national goal and need determination that qualifies a line for interconnection-wide cost recovery.

This would make folks freer to look at innovations that may be somewhat more costly, and get projects done more rapidly. This could include facets like undergrounding lines, using superconducting technologies, and other new technologies. Especially in the Western United States on public lands, these things are justifiable and may help with siting. They address view-shed and ecological issues. These improvements will be here for a half-century or more.

Question: You're advocating that some types of generation would be allowed to interconnect, some would not. How would this proposal address current law around non-discriminatory open access?

Speaker 2: These lines would be authorized through interconnection-wide planning and their need is to address a national concern for interconnecting renewables. There would be expedited review and interconnection-wide cost recovery. Lines that are supposed to be for renewables should be for renewables. The interconnection standard that would be limited by the amount of greenhouse gases emitted by the targeted interconnection sources. The intention is to prevent new coal interconnections on lines that are supposed to be for renewable energy resources. Particularly since these lines would be getting preferential treatment because they are for renewable energy resources. Anybody that wanted to build lines for other purposes would have to go through the normal system and process. No one is saying you couldn't do it.

Question: When you were talking earlier about prioritizing enhancements for renewables, there's a concern. Renewable electrons are not color coded, and there is a grid and the issues of non-discrimination are in play. How does one differentiate renewable electrons?

Speaker 2: Well, there's no way to tag an electron as "wind" or "coal." Once they're on the grid, they're on the grid. We're looking at other proposals for operators to prioritize renewable resources; from both an operational and a policy perspective.

Speaker 3.

I will do this in two parts. The first part being kind of more of a policy high-level think piece about wind and transmission. Second, I will get specific about some of the physical realities for addressing these problems. I will try to address these issues from the perspective of companies building and operating transmission.

So where are we today? Forecasts for wind growth this year are still close to 6,000 megawatts of new wind energy, even with the current state of the economy. Last year 8,500 megawatts of wind was added. MISO and SPP have a tremendous amount of wind resources available.

The lack of transmission investment is the biggest barrier to getting that wind into load centers. The classic chicken and egg problem: one can't get the wind developed because there isn't transmission and one can't get transmission developed because there's no assurance the wind will be built.

However, states are adopting RPS standards continually. There are 27 with standards or goals in some form. The debate continues in Washington about a national RPS standard, so the trend towards more wind will continue.

Wind requires a robust transmission system. Wind is different than most resources because it has no flexibility for siting. Traditional resources can be located near the fuel source or the load. Wind must be located where the wind blows. Wind is also different because of variability. It's a variable resource to meet a variable load.

Transmission service for wind energy is often classified as economic rather than reliability.

New wind resources must compete for transmission with existing generators and project financing. The lack of transmission has the ability to derail these wind resource developments. There's little dispute right now that the nation's transmission system needs to be upgraded and modernized. The stimulus package has extensive money for smart grid and renewable energy-type programs.

Let's consider the barriers. Siting and approval processes differ widely from state to state. It's a process that needs to be dealt with.

Second, Order 888 policy stating that an entity requesting new or changed transmission service has to pay for the upgrades required to grant that service can slow things. That has a big effect in different RTOs and ISOs, especially when integrating a lot of new transmission into the upper Midwest.

There are the typical interests of generators that are benefiting from the system and its status quo nature. If a particular generator's benefiting from congestion, then obviously anything that's going to remove or reduce that congestion is going to be an issue of concern for them, even though it's going to benefit consumers by reducing congestion and costs.

There is some financial uncertainty. There is some concern that if one invests in transmission, it's not clear how the money will be earned. Cost allocation for economic projects as opposed to reliability projects is a concern because the revenue stream is designed differently. Overall the banks see transmission as a solid investment, but it does depend on the specifics.

We hear a lot about the problems of integrating wind. However, integrating wind into the system really isn't the issue. The issue is access and transportation to the load centers. For instance, one of the main reasons why Mid-American Energy was considering joining MISO was because of the wind and MISO's footprint and scheduling wind into the system. The larger the footprint of the market the wind is located in, the better one can address variability. Firming wind can be more easily done in large RTOs because they have a larger generation mix, and larger set or resources that is more widely dispersed.

There is action in Washington. First, there's an emphasis emerging on independent regional planning. It needs to be done as broadly and as inclusively as possible. It needs to surmise regions, not just states. As long as there's some authority, be it FERC, DOE, or otherwise, that can take those individual regional plans and roll them up into one master plan. A process independent of the RTOs is important because they are sometimes wedded to certain constituents, particularly ones that threaten to drop out. It's the adult version of my ball, my rules, and I'm going to go home if you don't play by my rules. If someone does not want to participate in the market, that's fine. When it comes to independent regional planning, it needs to be mandatory just like participation in NERC needs to be mandatory and it needs to be funded appropriately.

Most of the expertise when it comes to regional planning is within those existing RTOs. A process that leverages that would be good. We don't need to reinvent the wheel. It's just a matter of taking what's there and making it better.

A second priority is federal transmission siting authority. This depends on the context. In some situations siting isn't necessarily an enormous problem. However, for problem areas a FERC backstop siting authority is needed.

Third is cost allocations. If the issue is high-voltage transmission lines that are moving power throughout a large region, the cost allocation should be addressed accordingly. The legislative amendments coming out of committee in Washington require measurable benefits before cost can be assigned. That sounds good on its face. However, it's virtually impossible to calculate measurable benefits for high-power transmission lines that cross the entire Eastern Interconnect. Obviously if that's ultimately the law, then we'll all deal with it.

Transmission needs to be a market enabler and not just a means to deliver bulk power from the generators to load centers. We need to address the economic versus the reliability issues, and get FERC a backstop authority. We've never seen policy converge in Washington on energy issues as it is doing today.

If you could design a transmission system that's going to bring the benefits of renewable energy to consumers and ignored state boundaries, RTOs and utility service territories, and considered AC versus DC and the basic fundamentals of transmission planning, what would you come up with? From that comes a large transmission system that will truly interconnect the wind resources in the Upper Midwest; a green power express. That is much of the vision that has being coming from the Obama administration, although it's certainly a question whether we will get it.

A transmission system like this would end up with termination points up in North Dakota, the northernmost termination point of this proposal is in Antelope Valley, which just happens to be in the lignite mine regions. In addition to wind, there's a very large coal plant sitting right there. As much as one might want to restrict what flows on these lines to renewable resources, the open access rules are a serious issue.

Recent studies concluded that with wind at a 32 or 42% capacity factor it can compete on its own, even without the production tax credits, against coal and natural gas. If we build it, they will come.

Question: Who determines the need? It's a big question. Are transmission companies telling the rest of us dummies what's needed?

Speaker 3: No.

Question: Particularly since you discussed how difficult it is to assess the benefits. Should companies get a rate of return on something that might actually be a huge boondoggle?

Speaker 3: I'll take exception with the word boondoggle. However, I agree. When it comes to the issue of measurable benefits it's very difficult. A regional transmission project, that's moving wind, there's a benefit at the macro level. It's hard to get down to the micro level and assign those benefits to a consumer in Indiana. The independent regional planning authority should determine need. Barring that, it's the RTOs.

Speaker 4.

I'm going to discuss activities in the California ISO. I'm happy to say they finally got their nodal markets up and running. If they had not done a good launch, the two consumer advocacy groups – called UCAN and TURN – would form a collaborative called UTURN. [LAUGHTER]

The initial goals were to price the physics. However the system operators need to remember the stakeholders are the consumers who can respond to price signals. The idea behind these nodal prices is they would signal where they needed demand, and demand response. Nodal prices also show everyone where transmission upgrades are needed.

The appearance of an insufficient transmission infrastructure might be just a lack of pricing. Policy makers, once there is nodal pricing, have clear information to support their decisions. This can move risk off the backs of consumers and put it on the independent investment, the risk managers and shift that paradigm. However, when they consider all this new planning and renewables; do they really have all the information they need to make decisions?

Another concern is barriers to entry. A KEMA report developed for the California Energy Commission discusses feed-in tariffs and the fact that they need an above-market price, take or pay. It's the most anti-market thing one can imagine. The prices are needed to increase the willingness of developers to take on risk in siting, permitting or other barriers. However, this takes away the risk from the independent developers and puts it back on the consumers. The risk is sloshing back and forth. On the one hand we have a pro-markets environment with a working nodal market and alternately, the renewable incentives and transmission planning have significant non-market components.

California has a strong FERC order 890 approved process. The first pass in their planning is for reliability. There are ever-growing NERC standards that are incorporated into that. Second are economic signals and trying to address congestion. The ISO does cost-benefits around upgrades versus just paying congestion. Now they are wondering if they should have a third pass to address public policy

that isn't reliability or economically based. I'm going to discuss RETI [Renewable Energy Transmission Initiative] a bit to address some of these policy objectives.

California has a renewable portfolio standard, they need to have 20% by 2010. By 2020, 33% of their energy from renewable resources. There is $1 billion a year in energy conservation and investment. They have a $5 billion investment on smart meters.

There are issues for adequate generating resources in the LA area because of restrictions on air credits. Balancing these sorts of environmental issues and reliability can be difficult. There is a ban on once-through cooling technology coming. Generators on the coast that use sea water, where the load is, will get shut down. There is a 50,000 megawatt pool and the first pass for the sea water restrictions means shutting 22,000 megawatts of generation. The ISO is trying to figure out the proper glide path for this. Similarly, they are trying to hook in distributed technologies like a million rooftop photovoltaics. There are enormous transmission, distributions, generation, and environmental challenges for the state.

The wind has some issues. It is remote, and it's inversely proportional to our demand curve. There are some bizarre outcomes. In the spring there is lots of water and wind, and it creates negative LMPs in the off-peak hours. The state is paying to get wind and then paying someone to take it away. Trying to address the need for wind when the state needs it at peak hours means that traditional resources are still needed for now.

Solar's helpful for those peaks. However, some peaks are after dark in California. The state is the last place the sun goes down, so it can't be imported from more eastern states like Nevada.
RETI, the Renewable Energy Transmission Initiative, brought most of the stakeholders into one conversation for the first time. It's been painful, slow sausage making. It's shown the need for collaboration with all stakeholders, other states.

California identified 37 zones that have good renewable potential. Next they will look at which areas don't have significant environmental concerns. Ultimately they want to have a short list of a few projects; maybe 6-8. These would be done on a per-segment basis so that at any point in time you're able to kind of take your foot off the gas if you need to. They will plan for a full build-out based on something for 2020, 2030, 2040. However, uncertainty becomes more and more problematic. They are trying to accommodate for changing conditions.

They have a facility designation called LCRIF, a location constrained resource interconnection facility. It means one can't transport your fuel source. Mainly solar and wind. There are threshold questions for these because nodal pricing does not work here; they often have negative nodal prices. The question for California is how to do this in a price responsible way?

One idea is to lower the barriers to entry for LCRIF. The designation provides a financing mechanism for generators that want to interconnect through the TAC, the transmission tariff. The ISO has to determine that the facility is needed. There also has to be a sufficient amount of projected development, it's an energy resource area. Once they have the RETI definitions this will be easier. Right now it's being decided by the California Board of Governors but the RETI designations will fill in once they are determined. The facilities must be high-voltage, not a network facility. Finally, there are certain thresholds of application. They need at least 60% capacity in an interest queue and 25% signed up. That's a prudency standard.

Let's consider some other issues. When California went to nodal pricing system control was vastly improved. They are more able to operate the system within normal bounds. As they bring on variable, intermittent resources, they will need more load-following capability. Around 800 megawatts in the up direction, and from 500-900 megawatts in the down direction. It will require more area regulation. The markets in California have a lot of volatility in the real time market because there's thin participation. They're struggling with who's available to do load following now and concerned even more about the future. They need to unpack and better price ancillary services because load following is going to be even more important.

With a 20% renewable requirement, it means that demand response, storage, and generation are all in one conversation. Part of the problem is they just talk about renewable production. They also need to discuss getting demand off the grid, it's the most green thing I can think of. They haven't figured out a way to quantify that.

There's smart grid too. They have the beginnings of automated metering in California, which works well with the new markets. There's good work being done on smart tariffs. Ultimately they need a smart grid that is smart enough to help offset some of this new variable supply. Creating more demand predictability will help with that and smart grid provides some very useful potential.

There are some real concerns for California. What is their obligation, our duty, our responsibility? Is it prudent to be thinking about reducing barriers to entry? Part of the movement is towards markets but some of the renewable requirements are moving risk back to the consumer. Their ISO is trying to reduce barriers to renewable implementation without moving all the risk back onto the end-use consumer.

California is also looking at feed-in tariffs. There are proposals now for up to 20 megawatts, which is a lot of generation in one place. It's a fixed priced above market, take or pay. Alternately they are trying to aggregate Target, Wal-Mart to be price-responsive. How many Wal-Marts does it take to offset one 20-megawatt feed-in tariff?

My concern is that the feed-in tariffs send the wrong kind of message, the wrong direction. The CPUC should reexamine the setting of the renewable portfolio standards, rather than slam on a full set of feed-in tariffs that completely undercut all the market fundamentals.

Finally, there is storage. They need to take a look at ancillary services. There are enormous options for the new plug-in electric vehicle technology. The new technology from Nissan comes with no gas backup. It means when you run out of electricity, no matter what the prices look like, no matter what the location looks like, you may need to go get a charge. The biggest thing we need to provide consumers is choices and fuel diversity. These questions need more thought.

California has finally moved back to workable competitive electricity markets. They need price signals to drive investment. In places with high prices they can get good demand response or new investment, that is cleaner, greener. The ISO has a challenge to remain technology and fuel neutral. They need good diversity to keep the lights on. Second, they don't want to predetermine innovation. NERC has a new report on wind. We're in our fourth generation of wind technology. Each one of them has gotten better. The ISO has to hold the line and say come with your solutions. They need to define the business problem and allow players to come in. They need to do this in a market environment, and address the environmental concerns in ways that will foster innovation, and a wide variety of solutions across the board.

Question: In Ontario Canada they have an economic regulator. However, they just had a legislative change that makes them responsible for promoting the connection of renewable resources and to facilitate smart grid. They also have to protect consumers on price, and maintain quality and reliability of service. Speaker three did not discuss costs in their presentation.

This is a huge generational change, so how much? The connection cost of renewable resources is not just transmission, it's distribution as well. In Ontario they're changing the distribution system to a low-voltage transmission system, and that will be costly. There's also the costs of the new resources themselves and then the cost of carbon. So how much and over what period of time? What is appropriate and over what period of time does all this cost? Because this is very costly.

Speaker 2: Well, I don't have a specific price. If we're calculating costs then we have to include climate change costs that will come onto society. The Stern Report shows that costs are going to increase dramatically, and early actions have a much higher cost-benefit ratio. If we monetize carbon, a lot of that issue about competitive pricing is addressed. Then the renewables will be considered on a level playing field. If coal is artificially low in cost because there is no price

on carbon, then it's really hard to compare real prices.

Question: Ontario is shutting all their coal assets by 2014, which leaves base-load nuclear for 60% of our production. If we're discussing doubling the transmission rate base, what is the appropriate cost for society to bear? How do you deal with that globally? There are currently severe economic dislocations. What should regulators say to a customer in a rate-setting process, what is appropriate?

Speaker 2: In a larger context, interconnection-wide cost recovery reduces the burden on individual rate payers within a specific territory. We should consider regional energy markets for renewable rather than territory-specific enhancements. Not upgrades solely for reliability and bounded by cost considerations that may frustrate the ability to do larger scale renewables that are more remote to load centers.

Speaker 4: The KEMA report for feed-in tariffs similar to programs in Europe talk about $8 billion. Initial studies done at the ISO call for at least six new transmission lines, around $8 billion. Those are numbers for California.

Question: We've heard about designating renewable energy zones, and planning on an interconnection-wide basis. Consider this. Recently the New England governors have been saying they want offshore wind, even if it's not, the least cost alternative. Often they want it for economic development, to create jobs. Others say we need wind from the Dakotas with long-haul transmission lines. This is wind versus wind. Who decides? Are there regional ways to comply with the national standard versus an interconnection-wide decision? If it is on an interconnection-wide basis, who decides? Does FERC take that role and maybe has to tell the New England governors, those criteria aren't important? What is the right process when we're talking about big subsidies and competing sub-regions for similar green fuel?

Speaker 2: There's lots of ideas bouncing around. There's six different transmission bills in Congress, four in the Senate, two in the House. Most involve interconnection-wide planning. Whether that's done by an independent entity that would be established by the government that would include all stakeholders, perhaps. It has to be created. Business as usual has the country completely boxed so we need a new process. It could be FERC, or an interagency arrangement that would be overseen by the Council on Environmental Quality.

I favor an independent entity that would be facilitated by FERC. It would involve the states as favored stakeholders in the planning processes, with siting at the state levels. There have to be good policies for determining those decisions. They should incorporate distributed generation and energy efficiency needs. Decisions about offshore wind aren't simply economic. They're also decisions about the simplicity of the relative transmission solutions. How much wind in each location. How much siting controversy and other environmental concerns. All of these issues should be addressed.

The Western Governors Association understand the need for a regional energy market. The Eastern Interconnection is much more complicated and difficult. Taking into account all the relevant factors will be very complicated.

Question: Who tells the New England governors that their priorities with regard to wind are not as important as the priorities of the Midwest governors? Who makes that call?

Speaker 2: Both sets would be participants in an interconnection-wide plan. FERC would ascribe the need for the lines on a national basis. A renewable line to meet a national goal, focused on reducing greenhouse gas emissions. The cost recovery of those lines would be based upon that need. The final decisions about that would be made through a federal entity, probably FERC would be the one that would have to certify that. They have to figure in demand response, energy efficiency and other issues that I've discussed. The question is important, but it can be addressed, and we need to figure out the right process for making the decision. We have to do things quickly and then we have to adjust. It is an iterative process.

Speaker 3: I don't care who the planner is so long as some transmission gets built. We've had RTOs and ISOs in place now for an excess of

ten years with not a single mile of regional transmission lines being built. We especially need a process for transmission projects that traverse multiple RTOs or multiple service areas with utilities that aren't part of RTO.

Question: Yes, but who makes the final call when the New England governors say they'd rather have their local resources.

Speaker 3: An authority is needed like NERC is for reliability. We need something similar on the planning side. It could be FERC or DOE.

Speaker 4: It should be FERC. And so what we're looking at is, you know, being asked to call balls and strikes on is wind from British Columbia superior to wind from Tehachapi? And we're not prepared to evaluate wind from British Columbia against wind from Tehachapi. And so I really think it needs to be FERC stepping in. I mean, I look at PJM, which is electrically the size of WEC and say I think we have sufficient scope, sufficient reach in some areas. When I look at California you look at a WEC transmission expansion map, it looks like spaghetti thrown at the wall. There's no rationalization about why did we pick these lines? And so, and we don't have good transparency in the West. We don't have good congestion management. We don't have good transparency. We don't have good data to do good joint planning. So I take exception. I think the West is quite inadequate in its ability to be prepared to do something regional yet. And I'm optimistic we can get there. I think the conversations we're having push us toward the obvious need much faster than we've ever been pushed before. But at the end of the day, the answer is it has to be FERC.

Speaker 1: I afraid of seeing a transmission czar emerging in this country and making ultimate decisions. However, we do need informed decisions that consider all the various implications of any given line. Let's make sure that we provide the decision makers with the needed operational information.

Question: Implicit in many of the speakers' comments this morning is that all is well with the wind industry right now. It is not. They had a ramp up. The industry was able to produce wind turbines to meet demand of about 8.4 gigawatts last year. That demand has now collapsed and the industry is not seeing orders now. There's some hope that the stimulus package will help bring in some incremental demand, but not yet. The Waxman-Markey bill that was just passed isn't sufficient to drive new wind into the system over the next three years.

The industry is ramped up for a certain level of capacity and that demand is not going to be there. As many as 40,000 people could be laid off in the wind industry this year if demand doesn't change. It could bankrupt some of the smaller players. I think this fact has not been addressed by the speakers.

Moderator: You violated a basic rule, which is not to bring financial and economic reality into the discussion. [LAUGHTER]

Speaker 2: It's not just the wind industry. The solar industry has gone through a huge contraction. It's not as well established as the wind industry is. It is much younger, especially in the large-scale end. We're seeing major players drop out, huge consolidations, lots of layoffs. The irony of the situation is this past year have had the lowest greenhouse gas emissions in years because of the economic slow-down. Longer-term prospects are very good for the renewables industry. I expect a rebound.

Question: It is very hard to simply ramp up these industries and ramp them back down. We're considering longer-term policy goals and objectives, however the near term implications for industry structure and supply chains are hard. It's not so different from the current automobile industry crisis. My suspicion is that the policy implications need to consider the near term.

Speaker 3: From a transmission development perspective, only about 200-300 high-voltage transmission lines can be built a year. Mitsubishi's capacity to build transformers for this project at 100% capacity for six years would not be enough. We have to observe what's going on in the industry as a whole and adjust the plan accordingly.

Question: Many places are trying to address this kind of growth. Bring the wind from upstate New York into New York City, wind from

northern New England into southern New England. Why is the answer to the problem of getting remote resources to load within regions in the Eastern Interconnection to use interconnection-wide planning? and start to draw a national extra high-voltage transmission map. If one can't resolve these issues within regions, then how will bringing wind from the Dakotas to New York City instead of upstate New York to New York City? Who's going to do the analysis? Will we actually reduce carbon emissions?

Speaker 2: Interconnection planning is one way to incorporate the views of all of the various regional entities. Clearly we have to make choices about which lines make more sense to be built. The purpose of interconnection-wide planning is to make the best choices and only the best choices then are certified as needed. If offshore wind is a better solution because it's easier, more likely to be built because the transmission requirements are more easily met that is fine. Let's do the most rational thing. If upstate New York wind is a better line to be built than bringing North Dakota wind to New York, well fine. Let's include all the stakeholders and make rational decisions.

Question: In the Eastern Interconnection those processes exist in PJM, ISO New England, and the New York ISO. My concern is that a national highway is seen as a way to overcome a hurdle that exists within regions. It's still about who decides and who pays. I'm concerned that national approaches to this problem will be no better or worse than the regional and RTO processes that exist already.

Speaker 4: It's more like a rate case. There are similar problems in California and comparing wind from Tehachapi in California to wind from British Columbia. We need FERC to decide, not even a Western planner can decide. There isn't good underlying data to even study.

Moderator: If one factors in what causes the most greenhouse gas emissions to occur because of congestion on the grid, at what level is that incorporated? Does FERC even have jurisdiction to decide that question? It's a multidimensional problem.

Speaker 4: In California the air board wants this, the water board wants this. So every board wants a different initiative and how do you pull them all together?

Speaker 2: The institutions that we need in order to help make these decisions don't exist. That's part of the current discussion? How to involve the people who actually have the ability to provide the information that's needed to make the good decisions? WAPA [Western Area Power Administration] just got $3 billion in bonding authority in the stimulus bill. Their mission was changed so that they could do a renewable program, which they had no authority to do until now. There's a recognition, imperfect as it may be in Washington, that there needs to be a refocusing of charges for some institutions, including FERC. Clearly the don't have any environmental purview but they are a logical institution to have decision making authority. A broader planning effort that can illuminate the various issues that FERC wouldn't normally consider should be given to them.

Question: I want to consider whether there is room on a renewable transmission line for non-renewable generation. Trying to incorporate the fact that some renewable policies can backfire as discussed earlier and integrating variable resources there are some real questions. In the near future we still need conventional generation, gas-fired peakers. Maybe in the future storage becomes more economic. So this is a line driven by renewables. However, can a line not have any carbon on it?

Speaker 2: One can't really prevent carbon from getting on a line. We can't do anything about resources that are already interconnected. The to deal with already connected resources is with dispatch rules. Or via a price on carbon.

However, if expedited consideration is being given in interconnection planning to wheel renewables then we don't want to connect anything to those lines, especially if they traverse public lands. Big compromises are going to have to be made. If we want public support for lines that are intended to help reduce greenhouse gas emissions, then that's what they should do.

The Energy Future Coalition has a vision statement that this is a reasonable expectation. This is a broad agreement from utilities, load-serving entities, the environmental community, and from regulators. This won't necessarily preclude fossil resources if they are within a reasonable emission standard. For instance, a gas-peaking plant with quick ramp-up resources that could help firm load in situations like Texas, for example.

Question: That's helpful. How would one guarantee that a line is going to be green? The current environment for renewable development is difficult. It takes seven to eleven years to build a transmission line. One would expect renewables early on and up front in that process. There's still many years left in that transmission development cycle. Generators are living on a much shorter commitment schedule. How will they address interconnection queue positions, and interconnection requests? There's no 100% guarantee that the resources that we think will show up are going to be the ones to show up. That's markets.

Speaker 2: You're right. They have to figure out where the best resource areas are for generation and plan the transmission solutions to get that power to market. For every challenge, there's a corresponding opportunity too. It's a complicated and difficult environment, especially until this economy rights itself but it will move forward.

Speaker 1: I have a concern with this concept. If it is a radial line, a direct fit to a renewable resource and only renewables are to be connected to that line, I can envision how that could happen. If it is a 765 KV backbone in the middle of the system, I can't understand how to prevent any other resource from using this line.

Further, you stated that we may need additional dispatch rules to accommodate renewables. That can interfere with good economics, market signals, and reliability. Dispatch is complicated enough already.

Speaker 4: We need to think about planning a system, not a line. The job is plant a system. The challenges are in the siting to be honest. California just said no to the Sunrise project because it went through a state desert park. Those are not easy fast choices to make.

Speaker 2: There will be difficult trade-offs. Dispatch rules will not be necessary if there is a carbon cap. That provides a price signal. One approach is to have interconnection standards with a sunset clause for carbon prices. Personally I would like good price signals. That would also stop any backsliding on the transmission side of things.

Question: I like price signals and internalizing environmental externalities. I'm concerned about dispatch. There is extensive regulation for load-following needs. If wind and renewables aren't necessarily in the system under an economic price merit order dispatch, there will be a cost for system re-dispatch. The cost of ancillary services necessary to maintain 60 Hertz. Currently they're uplifted to all of the customers. They're not set at the foot of the resource itself, which is normally the case. How do we address this issue?

Speaker 4: The dispatch problem and ancillary services need to be carefully unpacked. The ISO measures renewables in energy prices, not ramp prices. More carefully analyzing ancillary services is needed to understanding any pricing concerns. They may need put some market pricing on them but no one knows right now.

Question: You said that some ancillary services were allocated to generators for other things. In fact ancillary services are almost always allocated to demand on a load-weighted-average basis. If one is going to discuss allocating some AS costs to wind, then it should happen for other thermal generators. For instance, we charge load for spinning reserve. This is done in jurisdictions outside of the US, but it is inappropriate just to single out wind.

Speaker 4: In the West it's even worse, because there isn't a balancing market for energy outside the ISO. It's like Bonneville putting moratoriums on wind interconnections because they don't have a market. It's a big problem.

Question: Speaker 4 discussed the need for a third pass on policy. I'd like to hear more discussion of that from the panel, but with the following context. In order to get the price

signals to use our current system, which includes reliability and economic considerations, it takes significant time to develop the consensus on pricing and then build the software. For MRTU [Market Redesign and Technology Update] it took nine years in California. Can we really wait? Are policy makers going to wait? How does the third pass get thrown into this methodology even with the current mechanisms?

Speaker 4: The ISO's third pass is ready. The CPUC, CEC, and the ISO are the three sponsors, if you will. It does require every stakeholder in the state getting together. It's messy.

Speaker 1: It won't take a long time to implement new additions to the MRTU code or the market engines of other RTOs. Making adjustments for marginal carbon intensity or other adjustments is easy once the base system is in place. Just a few lines of code and a bit of data management. Creating the policy implications and agreements is a different story, but once the consensus is there it can be implemented within a few months.

Speaker 4: Yes, the challenge is picking what we want, because we hear carbon but what about water, and other environmental externalities. It's figuring out all those policy decisions and making them cohesive.

Question: I'd like to revisit interconnection-wide cost allocation for new transmission facilities. In the 2005 Energy Policy Act some stakeholders – mainly coops and munis – beat back an attempt to enshrine participant funding as the preferred cost allocation method in the statute. Now we're looking at the complete opposite, enshrining interconnection-wide cost allocation. Both extremes are a concern. Individual circumstances are all very different and need to be addressed in regional plans.

Second, I'm hearing that interconnection-wide allocation is being spread so widely there's no cost at all. This has a certain moral hazard that, since it's not "really costing anything" because it's spread so widely, one can just build it. Where is the fiscal discipline on what facilities get built?

Speaker 2: No one is saying that there's no economic hit on anyone. The issue is that it is more equitable to not impose it on a single service territory for something that has a broad benefit across the society and to meet a national goal. Further, this would only apply to lines that carry out that national goal. It's the most sensible way for the broad societal problem of carbon, and it shouldn't necessarily be used for other aspects of electricity infrastructure development. It's unique to this particular problem. Further, it's unique solution for a problem that encompasses areas with markets but also without.

Speaker 3: Normally cost allocation issues should not be at the extremes, but in this case it's the right way to remove a lot of resistance. It stimulates the debate to the point where people say well, maybe there are actual regional benefits to some particular projects. That won't be true for other projects.

Speaker 4: In many situations there's not enough good information to do specific cost allocation. In the west there is not good utilization of the existing grid. They don't know how much more transmission they need. They don't have good data to share as an interconnection for planning. There is no transparency outside the ISO. And there's interstate conflicts over allocation, so a broadly shared cost allocation is probably right for such large projects.

Session 2.
Linking Regulatory Means and Environmental Ends: Intended and Unintended Consequences

The turn towards a green energy revolution provides an uncommon opportunity to avoid a common mistake. "To forget one's purpose is the commonest form of stupidity." (Nietzsche) The source of a market failure, structure of an externality, or statement of a goal should affect the design of an intervention. A little reflection on the experience with the Fuel Use Act of 1978 should provide humility in mandating an answer (prohibiting use of natural gas) rather than targeting a market failure (the structure of natural gas price regulation).

New opportunities abound for better policies. If GHG emission control is inexpensive, then a low safety valve could be appropriate as a risk reduction mechanism. If market penetration by a new technology produces large learning benefits, then initial subsidies should be both large and quickly disappearing. If there are multiple objectives, then there may be a need for multiple instruments. What is the right way to frame the connection between the diagnosis and prescription? How can we target diseases rather than symptoms? Faced with uncertainty, how can regulations, incentives, and subsidies best stimulate innovation? How can internalizing externalities balance competing agendas and diverse preferences?

Speaker 1.

The assignment here is impossible and it's not that interesting. How to do policy right is boring. So there's much more creativity involved in doing it wrong, so that's what I'll talk about. [LAUGHTER]

I want to start with some of the silliness that economists do, so you can get a sense of how to go wrong. Economists have naïve rules, which is everything's competitive and everybody's well-informed and there aren't any spillovers and they don't discuss national defense and other public goods. They also say if people don't have the information they need to make decisions, maybe there's a role for government to give them the information. Where there really are spillovers, where actions by some agent, firm or individual, affects somebody else directly, not by altering market prices, well, then it should be addressed. One can tax, subsidize, or limit quantity. In a simple world without uncertainty, they come to the same thing.

So that's how to do it right, and it's very boring. The creativity is in doing it wrong. For instance, CAFE standards are a lovely example of picking the wrong target. There's a problem; driving gasoline or diesel fuel vehicles creates a spillover that isn't properly regulated? One can make the argument. There's issues with congestion, national security, and inadequate environmental regulation potentially. The obvious target is the use of motor vehicle fuels – tax, subsidize, or limit quantities. That's the naïve economist prescription.

The creative, wrong thing to do is to set fuel economy standards. This invites gaming over what's a car or a light truck? Ignore heavy trucks because they have a pretty effective lobby. It makes new vehicles more expensive, so this works to keep old, low-mileage, inefficient vehicles on the road longer. It has the beauty of lowering the per-mile cost of driving, so it encourages driving on the margin. The policy's costs are beautifully hidden. Drivers don't think there's a cost at all. It's buried in the cost of the vehicle and various cross-subsidies; nobody can see them. This is a particularly effective technique. Choose the wrong target and get the wrong policy with creative side effects.

Another favorite is to assume that consumers are idiots and make decisions for them. Now obviously you certainly don't want to give them information that they can act on. The problem with this technique is that sometimes consumers truly are idiots. Even an economist has to admit this, so the world is a little more complicated.

Another favorite is invent the science. In the Clean Air Act it's assumed there are thresholds. There will be no damage below or above a certain concentration of air toxin. First, this depends on the ability to measure. It rules out costs and benefits analysis. Another favorite one from the Clean Air Act, is regulate only new sources. New pollution sources don't have votes. This has the beautiful effect of raising the incentive to keep old, dirty sources alive forever. It's a particularly good way to do policy wrong.

Another bad policy favorite is to require particular technologies. If the requirement is to use technology X, this removes all incentive to innovate. Historically, the ability of Congress or any other legislative body to actually pick technologies is not encouraging, e.g., ethanol, which I'll return to later.

Another bad approach is to impose performance standards. This removes all incentives to beat the standard. Like CAFE standards, it tends to focus on bad stuff per unit of output, instead of the total amount of bad stuff, which is usually the problem. So these are a number of techniques, but there are more. [LAUGHTER]

A favorite in energy policy is to assume that if the stuff costs too much, then build a lot of it and people will learn how to make it cost less. Well, the problem here is learning doesn't imply spillovers. If Boeing's costs go down per 747, that's not a case for government intervention unless there's a spillover to Airbus and everyone else to get the benefit of Boeing's new knowledge. If only Boeing gets the benefit from Boeing's learning, there's no case for intervention. Moreover, there are spillovers that this approach neglects that come from doing basic research of various sorts.

If you're going to do learning wrong, then make sure to subsidize inputs, not output. This removes the incentive to produce output efficiently. It will subsidize capacity, not generation.

Another bad technique is technology forcing, which Congress loves. If you require it, it will happen. For instance, simply require that CO2 emissions be cut by 80% by 2050. Magically the ability to do that will bubble out of the wonderful inventive spirit of the private sector. This is a very popular device and sometimes it actually works. But it does depend on religion.

Another common approach is to use command and control to hide costs. For instance, require ethanol to be used, not to mention subsidize it and put a tariff on it. The implicit subsidy as well as a higher cost of the fuel, is hidden. GPF standards are in the '92 energy bill, this is gallons per flush. [LAUGHTER] So what do gallons per flush standards have to do with energy policy? You'll see them if you go into the restrooms. I asked that question of one of the Senate staff people. It's cold water, no heated. He said the industry proposed it and nobody opposed, so it's in the bill. That's command and control. Undoubtedly it makes toilets more expensive but no one can see the costs.

Renewable portfolio standards that exclude hydro and nuclear, hide costs and keep subsidies hidden. Another favorite is California water policy. They can't reallocate water from growing rice in the central valley to use as drinking water in Los Angeles. The farmers have the rights to that water. Why not just make those water rights tradable? The people in Los Angeles will be better off and the farmers will be better off. It was explained that it was impossible because it would reveal the size of the subsidy. Once people saw the size of the subsidy, it wouldn't be tolerable. Another great example of wrong policy.

One can use other distortions as an excuse. If all environmental regulation is inadequate, then that is an excuse to subsidize anything green. Now the people who follow these techniques are not somehow stupid. These are techniques that have political rationale and power. It was clear in the '90 Clean Air Act Bill that's specifying the use of ethanol in motor fuel made no sense as opposed to a performance standard. It was kindly explained to those of us who were naïve that if we'd like Senator Dole's help getting the bill passed in the Senate, there would be an ethanol requirement. So there's an ethanol requirement.

However it actually does make sense to look for a more efficient policy. And I will stray from my chosen topic to address some questions for the panel. The difficulty faced by somebody trying to do policy right, is that we're always in the world of the second or third best. We're not able really to follow the rules of tax, subsidize, or restrict because they really are naïve. Instead, what one normally does is ask some questions in hopes of improving policy a little bit. Here are a few of those.

The first is to be clear about what the problem is. What are we trying to solve? If we want more renewable energy, then renewable standards to get more renewable energy may be right. It is hard to get the right question sometimes into the debate as CAFE versus gasoline tax discussions illustrate. So first is to clearly diagnose the problem.

The second one is to find the right incentives. Is there a way to harness market forces, to solve the problem at the lowest social cost? That usually involves some kind of tax, subsidy, or tradable rights.

Third, can we provide information in useful ways? Do we have to preempt all decisions? It's not always easy to do this. The warning label on prescription drugs is not too useful. Can we find ways of providing information to improve decisions? In technology development, and this

is getting to be a big deal in the climate context, can we think through a strategy of how we make decisions? What requires learning and what requires basic research? Instead of legislation that picks favorite technologies and favorite paths, can we find a way to do that thoughtfully?

And finally, is there a socially inexpensive way to move the project forward, i.e., to bring special interests into alignment? Those are the questions we must ask to get policy right.

Speaker 2.

I'm going to consider an economic and environmental focus. My comments should be considered in the context of several market failures going on at once. I'll try to hone in on just one of them amidst the impossible task of addressing the whole agenda. Ultimately we're going to need several different policies to deal with these failures, even though I'm going to focus just on the first.

So we want to identify what the problem is and what the market failure is that government is trying to solve. For us it's global warming and greenhouse gas emissions. The obvious externality is CO2 emissions from the power sector and other areas. There are some other market failures going on too that might require different policy instruments than the policy we design just to deal with the negative externality of the pollution.

Innovation and learning by doing were discussed in the previous presentation. Technology spillovers can be positive spillover, spillover from firm to firm is possible. Further basic R&D, provides a positive externality and suggests the need for a subsidy perhaps.

A third market failure is the coordination problem that comes with network effects. For instance, how to spread electric vehicles. If electric vehicles are a good opportunity to reduce emissions from the transportation sector, then how do we get a network of distribution centers in place? Or a network distribution of hydrogen in place? Will the market take care of that network or do we need government intervention?

Finally, there are market failures in information that affect consumer behavior. I'll come back to this when I talk about consumer behavior later on. I will focus on the negative externality from carbon dioxide emissions. It is the most relevant to the policy conversations taking place right now in Washington.

First is the question of matching means to ends. The focus must be on emissions of CO2, rather than the fraction of renewable energy in the system. An RPS, while politically attractive, is neither necessary nor sufficient to accomplish the ultimate goal. It is likely to raise costs. Perhaps the emphasis should be on cap and trade, not an RPS.

There are other examples of less effective policies. The ethanol example in transportation is a good one. Or is it a question of determining whether to reduce CO2 emissions from more renewables in electric power, or are there better opportunities in the transportation sector with electric vehicles? We don't need to answer that question. What we need is a policy framework that lets incentives and markets determine which of those is the better choice. It's best done with a quantity instrument like a cap and trade program with marketable permits that gives the price on CO2 that drives that economic incentive. That being said, it's obviously not going to be so simple as just putting a cap on carbon and then walking away.

Second, unintended consequences, in creating new markets does one create new market failures. We've seen cautionary tales certainly in the California electricity market and the reclaim air pollution market. We've seen examples of unintended consequences where market power arose that wasn't anticipated. We have to think carefully about how to structure carbon as a financial market and the relationship between a carbon market and the existing electricity markets. I don't have answers, but it is a crucial issue to consider.

Third, we're operating in a second or even a third best world. The most efficient or economically preferable policy will not always emerge. For instance, there is a price equal to marginal cost in the competitive markets. We're adding on the cost of a carbon price from an allowance market. That full price signal should

be passed on to consumers so they see the marginal costs of producing electricity, and also the marginal social cost of the pollution. However, that price isn't equal to marginal cost to begin with. A position where price doesn't equal marginal cost raises interesting questions about how important the price signal is for consumers.

Second, there's a capital bias in regulated cost of service markets, something called the Averch-Johnson Effect. Meredith Fowlie has been writing about how this affects emissions trading markets. She also shows how regulated electric utilities over-invest in capital-intensive abatement technologies relative to restructured utilities. Thinking about how incentives in electricity regulation interact with incentives in a new emissions market is important.

Fourth, we have to understand how consumers make decisions. Behavioral economists are looking at the really smart and stupid behavior of consumers. This is especially relevant for energy efficiency and energy-efficient appliances. For instance, people buy cheap, inefficient air conditioners, rather than spending more on an efficient model. There is a line between consumer preferences, behavioral biases, and heuristic mistakes. Can government fix these market failures or provide better information?

There are also principal agent issues. For instance, when the landlord buys the appliances and the tenant pays the utility bills. The landlord will buy a cheap inefficient device.

To come back to the marginal price issue, if one is trying to influence energy conservation by consumers, is the marginal price what people pay attention to? Or is it just the total cost of the bill? If it's the total cost of the bill, then having price equal to marginal cost to begin with has to be reconsidered. These are all complications of the clean simple decision processes that economists assume.

Fifth, we have to acknowledge political institutional constraints. One has to get the economic analysis right but also address political rationality. There's a real limited attention issue for any member of Congress. You've got to get them to focus on one issue that's in a number of issues for them. The goal is not to get everything perfect, but to set up a framework that's good enough to last and that's resilient and robust and can be improved on later. The things I worry about most are the setbacks that have lasting consequences. For instance, the California electricity market problems which pretty much stopped electricity restructuring in its tracks. Designing a climate policy, cap and trade might be the centerpiece, but there are going to be lots of other components to get the framework right and avoid the possibility of a really big blowup in a couple of years. That's a real priority.

Is real time pricing green? This idea comes from a terrific economist named Aaron Manzer. His work with Stephen Holland, looked at real time pricing in different electricity markets. They showed that real time pricing is green only when the dispatch order of plants in a particular area is set properly. Real time pricing smoothes out the demand curve over time; shaves the peaks and raises the valleys. If a region is increasing base load coal generation and reducing relatively clean natural gas peakers, then real time pricing might not be green.

This is the wrong policy question, not the wrong research question. It's an interesting research question. We shouldn't be implementing real time pricing because we think it's going to reduce emissions. If we want to reduce emissions, we should put a cap on emissions.

Question: You talked about needing a cap price on carbon and then you mentioned marketable permits. How they would function?

Speaker 2: This is a cap and trade program that's a centerpiece of legislation moving through the House right now. It will have a declining limit on greenhouse gas emissions covering the electric power sector, the transportation sector, major manufacturers, natural gas and heating oil. That limit will decline over time. Early on there will be 5 billion tons of greenhouse gas emissions allowed. For each ton, the government would create an allowance, and that allowance can be traded among utilities or among regulated entities. The only requirement is at the end of the year every entity has to hand in as many allowances as it emitted tons in the previous year. Where it gets those allowances and how it

gets them on a market, and whether it gets them, whether it manages to reduce its emissions below its own share and has extra allowances that it can sell or whether it wants to emit more and has to buy allowances from other regulated entities, that's up to the individual firms. The economic incentive that arises is because there is a market for these emissions permits. That market will determine a price which makes it costly to emit a ton of greenhouse gases. The key difference between this and a tax on CO2 is that the government sets the limit on emissions and the market is sets the price, whereas the government sets the price directly through the tax and the amount of emissions is determined by industry.

Question: I have a question for Speaker 1. NERC planning standards are standards. Where would you situate them in a taxonomy of good or bad policy?

Speaker 1: Standards weren't on my list and they tend not to be on the economist's list. They come under Speaker 2's discussion of coordination or network effects. There's certainly benefits from standardization, particularly compatibility. The classic example is the standard for a trailer hitch, which enables all kinds of interconnections.

This doesn't fit easily into an Econ 101 kit. There are public benefits from setting standards. What's the optimal standard in any given situation? There's no calculus for that. A public standardization process works pretty well. Nobody thinks it's optimal, but it works.

Question: There was a slide about research spillovers and photovoltaics – can you expand on that?

Speaker 1: The concern there is at an early stage of development of that technology, do you count on learning to get the price down? Or subsidize purchase one way or another, or require it, in effect subsidizing it. Or put the money into research to try to change the technology? Will learning get the technology to where it is needed? Or is something else needed? Society can't achieve its goals simply by producing this technology cheaper. Those are the options. If you subsidize the research to change the technology and let that information out, that's a spillover. Learning, if it's only within one company, is less of a spillover.

Speaker 3.

This is an important topic. Some could argue the action is in Washington and if stakeholders aren't taking part in the legislative markup then they're not involved. If so, why are we here and what are we doing? I have a different view of that. What's going on in Washington is extremely important and I hope they do a good job.

I believe this is similar to the experience in the run-up to the Energy Policy Act of 1992, which also had a lot of things going on. A bill was produced, marked up, and got enacted in law. Then the really interesting conversation started. The same thing is going on here. The really interesting conversation is going to be sustained, it's a long-term problem. I hope we don't get completely crazy things out of the process now, but it's going to be very far from the final word.

I endorse what you've heard from the previous two speakers about asking the right question. There's lots externalities. One could debate whether they're really externalities or can they be internalized in different ways. Air pollution and greenhouse gases are very different than network congestion. The industry knows how to deal with the network congestion problem. It was an externality until we fixed it. The other problems are different.

Second, there are different kinds of market failures. The R&D story is different than the infant industry story, which is different from the sustained pollution that's going to go on forever problem. Each needs different solutions and will be addressed with varying success. Asking the right question and figuring out what you're trying to accomplish should influence the process.

There are lots of ways to do it. Quantity targets, the RPS, feed-in tariffs, production tax credits, investment tax credits. These all have dramatically different effects, different degrees of success, different costs, and different levels of compatibility with the rest of the system being designed. The discussion of interconnection

queues from this morning is an example of how green policy can be incompatible with electricity distribution policy.

There is a question about costs and the benefits. The implied carbon price from Bill Nordhaus at Yale and the implied carbon price from the Stern analysis are both high, and quite different, the Stern report being more expensive. The Stern report models CO2 at $156 by 2050 and Nordhaus modeling would be about $32 at the same time.

The differences are extreme, so the assumptions in an analysis have a large impact on policy outcomes. The assumptions in this case mean that carbon looks like it will be 5 times more expensive under the Stern assumptions.

Similarly, one can model the impact on per capita consumption, think of it as GDP under each of these assumptions. The Stern assumptions produce enormous reductions, like 15%, very early on, but provide greater benefits later. The Nordhaus policy has very tiny reductions in GDP in the early days and has benefits that come up over a longer period of time. These kinds of projections provide the answers to the questions of cost and benefit. It's a benchmark. The numbers are quite different depending on what set of assumptions you're making.

Now I'm going to switch gears and switch to a case study of the California Solar Initiative. This is the subject of a paper in Energy Journal by Benthem, Gillingham and Sweeney, "Learning-by-Doing and the Optimal Solar Policy in California," in 2008. It's an example of learning by doing and linking regulatory means and environmental ends.

The Schwarzenegger Initiative was announced in 2004 for the million solar roofs initiative. They wanted to provide leases for photovoltaics on households, mostly in some retrofits, some new, with a target date of 2015. So to go back to the process, it's a quantity target. One million. That sounds like a carefully derived analytical number [LAUGHTER].

The California Solar Initiative provides solar installation incentives over a period of 11 years. The analysis is built on a model of consumer choice, so people won't put these on the rooftops unless it's beneficial to them. Consumers do a net present value calculation of benefit. There is a diffusion process that goes on as more people learn about this. There's an externality from the environmental effect of CO2. The PV panels themselves exist as part of a world market. The impact of California's experience on the world market is essentially negligible. Arguably, there is no learning in California from installations of the panels that affects the global market. However, the plumbers that have to go out and install it, the balance of system cost of building and making it operational is a different thing entirely. The local people do learn from that and there are spillover effects as all of these people develop experience.

Some academics put together analysis in Energy Journal that models demand curves, a diffusion rate and a base demand updating process and a calculation of net present value for consumer choice, learning, and net present value. It's fairly straightforward economics. Ultimately, we should be doing more of this. They analyzed production costs, and cumulative production in California for the balance of systems costs, that's the installation story. There was a conversation with stakeholders about what the learning rate is. Now this is a fuzzy number but there are some empirical estimates of this. If you double the cumulative production then there is a 10% reduction in the cost installation, which is a central issue. Those costs were combined with estimates of the carbon benefits and the learning effects and the quantities. They made reasonable assumptions about electricity price growth rate and consumer incentives and modeled the entire solar initiative. The numbers and assumptions are truly reasonable estimates – they are not excessive. It's very admirable economic analysis.

There's also the subsidy requirement. Finally, they said what's the net present value with no incentives or subsidies from the point of view of the household? The answer is, it's a turkey. [LAUGHTER] They lose $7,000 in a retrofit and $2,000 in a new facility. With the incentives however, it becomes a positive. Further there is significant adoption and significant program growth.

The cost and benefits of the California Solar Initiative for a retrofit comes out. There are negative values in the early years because of incentives and rebates for customers. However, there is then slow accumulation of benefits over time. The program ends in 2017 and drops off. But then it starts taking off because the learning-by-doing effect and the spillover on the installation costs makes this a sustainable business on its own. It gets to a point where it becomes profitable. They get over the threshold where it's profitable for people to install solar because the price of electricity has gone up enough, and the cost of the solar has come down enough. It's a big incremental benefit that comes along going forward with what you see after that. Further, without the initial subsidies, these effects wouldn't occur.

Even better, there's a CO2 story. It's not just the economic benefits to the households of a cheaper source of electricity because of learning. Ultimately, the effect on the environmental externality of CO2 is a pittance by comparison, but there is a benefit there.

The number of systems operational under this program in 2018 is 215,000, not a million. This will vary depending on the learning by doing rate. There's a lot of uncertainty. That's OK. It it's more successful there's no problems there. If the learning rate is less the program is still a net benefit but with fewer units. They are not tying it to a quantity target. They're trying to focus on the learning and the benefits. Small variations in the learning rate have enormous effects on the degree of success however. Getting the correct estimate of the learning rate is important. However, they have clearly modeled the program well, it's a matter of determining which assumptions are correct.

Question: The learning meant that people would install it, and the driver of that is the increased price of electricity in the future, right?

Speaker 3: It's part of the story. Costs to install are going down, electricity prices are going up.

Question: The embedded energy in a solar panel with current technology is about three years' worth of the electricity it produces. So as well as getting smarter at installing them, if you're installing it ten years down the track, the embedded energy to manufacture the panels is going to be more expensive. Did they take that into consideration? It takes you three years to get back as electricity the energy to build the panel. And most of that's electricity.

Speaker 3: No. They take the cost of the panels as exogenous.

Question: On the assumptions for the Nordhaus and Stern assumptions, did they attempt to forecast consumption to the 24th century? [LAUGHTER]

Speaker 3: Yes, it's a very important part of it, particularly in the Stern case. The benefits will take a long time to kick in but they will be substantial. Without the long-term forecast the answers get flipped. Stern argued strongly for a low discount rate in order to evaluate the benefits going forward. It's embedded in that analysis.

Question: What provoked the analysis that you have described?

Speaker 3: I've interviewed the authors. It is similar to what was actually implemented by the CPUC. Sweeney is a member of the Schwarzenegger energy kitchen cabinet. The other two are graduate students. They jumped in and dealt with the solar stakeholders to look at learning rates. The analysis was not formally part of the process but it was tied to it.

Speaker 4.

The agenda was an impossible assignment for us four speakers so I have morphed my presentation somewhat as well. Usually I'm a very optimistic person, but I'm grouchy in this presentation. So I'll discuss energy policy, some conceptual themes and different types of public policy. That'll be a little bit of political science 101.

Energy policy is a quilt with many designers making it up as they go along. It happens over time. There are a lot of different rationales. Energy policy as strategic investment is one. Look to the 1930s and the Tennessee Valley Authority, or Bonneville Power Administration, get electrification going and some economic

development as well. In some ways the loan guarantee programs in the Energy Policy Act are similar. Strategically invest in low carbon, and different types of technologies. The transmission funding in the Recovery Act follows from the same pattern. Invest in the heartland with energy as a lever of social change. Rural electrification also falls under this kind of category. The Indian title, Title V of the Energy Policy Act, for self-determination on tribal reservations and the deployment of energy resources is another example.

Energy can also function as a protection against market power or make markets work better. It can be trust busting, using the development of the strategic petroleum reserve as an offset to the OPEC cartel. The Energy Independence and Security Act is another example of protections against market power. CAFÉ standards and biofuels are a part of energy independence. They make the economy less vulnerable to market power in oil markets.

There are external effects of energy production and use. A variety of the environmental issues are in this. The Energy Policy Act of '92 and Transmission Access function as enablers of markets. Restructuring for competition in the electric and gas industries are other examples. National security is important too. The U.S. investment in the North Korean nuclear program fits there. Some of the competitiveness provisions being debated in the Climate Bill would fit into that category.

This is truly a patchwork quilt of purposes and provisions, and rationale. Each one of these policies is really sticky. It's like a spider web. Once you put one down, it never goes away. They're internally inconsistent too. As a result there's a lot of layers folded on top of each other. There's no unified theory, we don't have an energy policy? Well, we do, but that's what it looks like.

There are theories of public policy making in political science. There are three archetypes for different types of public policy, distributive, redistributive, and regulatory. They are not mutually exclusive. It's a continuum. Distributive is about pork. The benefits are highly concentrated. They're consensual politics. The people who are paying are not paying attention. There's lots of examples in the energy area where that works.

Redistributive moves wealth from one group to another. This is usually big mega politics typically. Very controversial. They take a long time and they're infrequent. Carbon policy belongs in this place. It is a market issue, but it's really about redistributing wealth in the economy as well.

Regulatory policy is fairly simple and the losers are known. They know they're going to lose if a policy gets adopted, it's their behavior that's being targeted. The winners are quite diffused. These are also difficult politics to get done.

Now in public policy making, the public interest is one of the most common phrases. Of course, it's all about how one decides the public interest. Evaluate the evidence, assess how people are making arguments. But at the end of the day, it's about the public good or the general welfare. It is fundamental to the management of government. Some industries, not all, are imbued with the public interest. The experience over the past 15 years about whether electricity is a commodity or an essential service is at the heart of this kind of issue.

The public interest is really hard to define. The best way to do it is by looking at what people actually decided over time in decisions. This is where it gets easy to be cynical. It's very hard to understand what is driving any legislator's definition of the public interest. It's hard to get agreements that are very specific at times. Notwithstanding the fact that thousand-page bills are coming out of Washington.

In energy policy, everything is local. But local is more than ideological at times and local is more than ideology about markets. It's about producer versus consumer. It's really about redistribution and distribution issues, views about green versus brown states, and urban and rural issues.

If one contrasts a map with electricity prices and a map with coal deposits it's easy to see that low prices correlate strongly with coal. There will have to be bargains struck with the heartland and its dirtier coal. The coal heartland set of votes will have to be met, notwithstanding all the support for green energy. Votes on the House

and Senate committees on energy, the authorizing and appropriations committees. It's a lot of bargaining space.

Finally, some observations about policy development cycles. In the early '90s, prices change in the electricity industry. Vertical integration begins to fray at the edges and there are lots of rate increases. The average price of electricity is higher than the marginal cost of electricity. There is a lot of pressure to restructure the market to take advantage of that. Low gas prices, customer choice pressures that pushed a lot of policy toward transmission access. ISO markets come into play, zoning and siting are modified to allow more merchant generation.

A decade later. Divested generation in parts of the country and a ton of new capacity that's gas-fired. Prices are set by natural gas on the margin, in most of the Eastern markets for sure. Some of the rate price caps come off and cause political problems. There's little customer migration. Natural gas prices rise. Generator surplus risk is very tough. There are real concerns coming out of California about market manipulation, shifting of average and marginal prices. Policy now reacts to a new set of circumstances. There's moves towards contracting and forward capacity markets. There's a need to address reregulation versus continuation of markets. Finally, what to do about the current financial and economic crisis as it affects this industry? There's a new set of issues about energy investment as a stimulus for economic development.

In just two decades the entire set of problems changes completely. There are enormous tensions in those policy development cycles and there are no easy answers anywhere along the way.

So how to do policy design and do it better? It is a noble activity and I spend a ton of my time on that activity. It's not a waste of time. There are lots of ways to build in some designs so that policies can go away or so they're not so sticky. Sunset clauses, the production tax credit is a perfect example. There are ways you can use triggers for administrative action or a formula hit or discretionary action that should be taken. There's force majeure clauses that are in many kinds of regulatory statutes. One can have variances.

However, policy making is not very clean at the beginning, which I described in some of those political policy making 101 descriptions. Our ability to imagine how things are going to play out is severely impaired. We don't have the intelligence or imagination to see where a market will go, let alone some of these dysfunctions. Nonetheless, it doesn't stop the need for policy makers to have to act routinely. Often it is the action that is as important as the substance of policies unfortunately.

Unfortunately, there's often a lack of constituencies in the process to make sure that a policy has some internal integrity. Laws are passed which are mutually inconsistent. My favorite is the loan guarantee in the Energy Policy Act. It requires that taxpayers subsidize pre-commercial technology, but requires that the applicant show that they've got a lot of commercially viable technology ready to go and sufficient backing from financial institutions that they can write down all the risk for consumers in a lump sum payment right up front.

So getting the financing if a commercial entity is pre-commercial is pretty hard. The sweet part of the legislation is it's supposed to be subsidizing risk, that's the purpose of the law. However, the law also says the taxpayer isn't going to pick up risk. So who is?.

So what are the implications? Transmission is a tough one as we heard from this morning's panel. Is it a strategic investment? What is its role? All the questions we heard about earlier. Some people think about transmission as a bad thing because it will prevent energy efficiency or demand response, or enable more coal production to occur. So what is transmission? Answers to those questions will lead you to very different outcomes in Washington and in the states.

So, grouchily, we never get to the end of this stuff. No government ever voluntarily reduced itself in size. History, and policy making tend to move in zigzags, and doing it right is an enormously challenging task.

Question: When we're dealing with acid rain or any type of a policy issue where the geophysics have some rough correlation with the political boundaries of the United States, there might be some benefit on the margin. However, carbon is a problem where the dimensions are global, and getting the pricing right in an isolated equilibrium that occurs only in the U.S. doesn't address the global aspect. How do we factor in that global dimension in all this?

Speaker: The notion that there is a right U.S. price is wrong. We don't have a clue. The idea that if we don't act globally we don't solve the problem is right. If the U.S. doesn't act, countries like India and China won't.

The one clear reality is that if it's a real problem the U.S. must take real action. Finely calibrated action is impossible but at least the U.S. can look at the rest of the world and argue for making a finely calibrated global solution to the problem. I also favor quantities over prices because I can't imagine how you'd harmonize global tax regimes.

Speaker: The only way to make sure that China and India and other major emitters don't do anything is for the U.S. not to do anything. The only route to tackling this globally is for the U.S. to take some leadership.

Speaker: There's a project at Harvard called the Harvard Project on International Climate Agreements that Rob Stavins is directing. One paper out of the project is by Jeff Frankel. He posed a series of six political statements or axioms. One is that we have to get trained and be involved now in meaningful ways, with meaningful targets. Further, there are certain limits on economic costs that we can impose on countries. We can't require developing countries to do the same thing that's being done here, but they can do it later. There's a whole series of constraints that he puts on the problem, and then he asks, is this set empty? Is there any way to design a structure that meets all those constraints simultaneously. No, it's not empty.

He goes on to explain that for every region and time period, there's a trading story, there's transfers of resources. He uses a quantity base on carbon. It's an extremely thoughtful piece of work that tries to look at this whole comprehensive problem.

Question: The heart of our problem confronting energy policy is conflict, conflicting objectives. Almost anything we do creates another problem. Two examples come to mind. Energy independence versus controlling greenhouse gas emissions. If I want to be energy independent I want to burn a lot of coal. Sometimes those two are sold as if they are the same objective, but they're in complete conflict. Second is conservation versus economic strength. We want to conserve energy but we don't want to increase prices, because that has adverse economic impacts. Am I correct, or is this outside the issue you're addressing?

Speaker 4: That was my central theme, there are bargains, and they short shrift each approach. The Energy Policy Act of 2005 is a perfect example, the climate program will be a perfect example. One cannot get around it because energy is economic, it is about global security issues, and it's environmental, it's just inherent in the issues.

Speaker: We all hear there is no national energy strategy. In the Bush 41 administration, the energy act stated that the goal of complete energy independence is ridiculous. That is true, but they were trashed when people said an energy strategy should solve all our problems. There's constant tradeoffs.

Speaker: There is also the concern for unintended consequences. This happens particularly when people start to confuse political rhetoric with the real goals of a program. So in climate change, many supporters say that one should not mention cap and trade, or global warming. Instead talk about this as an energy security and jobs bill. There's a real problem with that. For instance, a really good energy security and jobs program is called domestic oil drilling. If they set up those criteria, then they're walking right into the trap. It's important to keep eyes on what is the goal.

Speaker 4: The U.S. has an interest group politics system where people come with their single issue and shoot each other to death with it. Several years ago, the National Commission on Energy Policy had an architecture for the cap

and trade program. From the environmentalist point of view it had an absolute toxic element, a safety value. It was necessary politically in order to ensure that the architecture itself was set up properly. The Commission was massacred by their friends the environmentalists because they had to make a politically pragmatic decision.

Speaker: That may have been a political judgment that wasn't sensitive to the politics. The argument two years ago was that one could never have a cap and trade bill pass Congress without a safety valve. That's incorrect because organizations have been successful at strategically changing the landscape. Political judgments have to take into account the potential for shifting political dynamics. The political judgment may not have been correct.

Question: Let's assume that the right question is about climate change and reducing CO2 emissions. Is it possible to implement an optimal policy? Is it possible to get that optimal policy and then take all the interest groups that may be hurt, and implement an optimal policy with transfers so that nobody is left worse off? Or does that become and empty set, or do the transfers then provide incentives which make the optimal policy suboptimal? I'll take your thoughts.

Speaker 4: One of the nifty things about an architecture for a cap and trade program where you auction the allowances and roll them back through the income tax system, is that it can get there. It blunts opposition.

Speaker: The importance of geography is critical. I love the income tax idea, but it's never going to fly. There was an Obama administration budget proposal for auctioning carbon allowances and using them to lower taxes on the margin especially for low income households, and it was shot down in Congress.

This is a geographical problem. If we are raising revenue with carbon allowances, and using that to reduce taxes which will go eventually to the coasts, then the Midwest states will go to war. However, there is the potential to compensate a lot of the people who will bear the burden. It doesn't have to be through auction revenues, it can also be through allocation of the allowances. Everybody focuses on how much of the allowances are auctioned, and how much is allocated as if that's a sufficient statistic for what's going on with the distribution.

For all it's getting pilloried, the current legislation is actually pretty good. 44% of the allowances over the lifetime of the bill would go directly to households, either through their electric utility bills or through tax refunds. A lot of these tradable allowances will be returned to local distribution companies, which are required to pass that value on to consumers. The bill expresses a strong preference that as much as possible the value should be passed on in the form of fixed rebates, or a lump sum payment. The bill prohibits local distribution companies from passing it on in a way that's directly proportional to the quantity of electricity consumed. Why is this important? It means that the bill has something very smart from an economist's perspective, they've split compensating the consumer, but still preserving the marginal price signal. That's a surprising example of getting the policy right.

Speaker: The acid rain negotiations in the Senate had a resulting allocation of allowances. That's handing out money to get a deal done. One can do that in a tradable allowance system without affecting the efficiency of the outcome. It's basically handing out money. As long as it's done in ways that don't blunt incentives. If you start crafting a deal by fiddling with the tax regime it will destroy efficiency because there are no lump sums to hand out. There is a way to build a coalition in a tradable permit system without wrecking the efficiency.

Speaker: There's a close analogy which is the allocation of auctioned revenue rights to the existing capacity in the transmission grid. That's making sausage well, and doesn't affect the efficiency of operations, and the incentives for expansion.

Question: With climate change, will we see legislation that will just set the stage for further discussion? Or will we see something that can really tackle the problem?

Speaker 4: The House bill can go through but I don't think that bill can make it through the Senate. Bargains will have to still be struck with that middle of the country. So this is a warm-up.

I wish it were going to pass this year, because we cannot hold our face up leadership-wise in Copenhagen unless there's real action but I'm not optimistic.

Speaker: I agree. Last year was clearly a dress rehearsal for the Senate. The folks in the House are really serious. Not just the chairs, but their staff is really terrific. With the Senate, it depends a lot on the administration. If President Obama invites some people into the oval office and says, you're voting for cloture. It's not impossible but it's challenging. This is not just a dress rehearsal. People are playing for keeps. The conversations won't end when the bill is passed, there'll be plenty of stuff to address in the EPA and other places..

Speaker: Even if it doesn't pass this year, the game has changed. If it doesn't pass, people will try again.

Speaker: The normal process in these bills is to wait until you get to the conference committee to give away the goodies. In particular the allocation of the permits. However, most of them have been given away. There's not a lot left. That doesn't augur well for what's coming.

Moderator: I think it's going to be extremely hard to get 60 votes. The larger question if I'm right is what the policies will be instead. I suspect we will become more dependent on natural gas along with renewable. We'll need infrastructure for that.

Question: Does the panel share my concern that the cap and trade system is a necessary but not sufficient mechanism to get us to the targets that are being discussed long term? This is because there's a graduated ramp up of those targets. The prices from a cap and trade system are not sufficient to drive critical technologies. Particularly carbon capture and storage [CCS] which is necessary for both coal and natural gas at the end years.

If cap and trade is not sufficient, then you need some other policy mechanism to drive early stage drive of technology which becomes a problem of picking winners. Do we set up this policy regime because the market is insufficient? The assumption that technology will appear in a competitive market is insufficient. What is the appropriate way to go?

Speaker: The government's record at picking technologies is not encouraging. We need a significant R&D effort. The earlier drafts of climate bills were larded with picking technologies at a billion here, and a billion there. That is completely implausible, no one can pick technologies. I don't have the answer to it.

Government programs like DARPA won't necessarily do it either. Nobody's quite bottled that magic and understood it. This research issue needs as much attention if not more than the design of a cap and trade system. We kind of know what that looks like and we don't quite know what a good R&D program looks like.

Speaker 4: I agree with the premise of your question. A large amount of money is needed for a variety of research approaches. Secretary Chu has focused on designing an international program so that different people would bring proofs to the table. Washington politics will not allow that to happen. Most of the actual decisions about spending money like that end up as pork.

There are ideas like technology prizes that hold some promise but it has to be done all through the chain. We need to avoid picking winners, perhaps with the exception of CCS. There's a range of things with infrastructure. CCS in particular, needs a liability regime, and pipelines and network infrastructure.

I want to challenge the premise that the prices are not enough to drive technology. The great advantage of a cap versus a tax is that the price will settle where it needs to be to drive the technologies. Now we clearly need an additional array of policy instruments to help drive technological change, because there are additional market failures. The price and the technology are a two way street that will function interactively in a carbon market. The real challenge is to have well set goals out to 2050, a long enough time horizon that you can get people started so that the price starts to adjust to where it needs to be to drive technology.

Speaker: In Washington people don't discuss price the way we just heard. This is because in order to get the politics right you have to talk about the price being low enough. The price needed to really drive technology is probably much higher than politically feasible.

Speaker: There's also a problem of credible commitments. Firms will discount that into the future because there's regulatory uncertainty as to those long-term credible commitments. Firms have to severely discount government's willingness to commit to those high prices over long periods of time.

Question: It's rumored that there are several bills meandering around Capitol Hill. Will FERC be the likely arbiter of last resort on many thorny issues? The EPA? Who will be making the specialized regulatory decisions?

Moderator: My fear in this for FERC is that legislation gets too weighty and it craters. They may not get things that can move them forward, particularly on transmission issues like siting and cost allocation. They would have to ramp up if they're given REC trading authority for carbon.

Speaker: There are some interesting tradeoffs in terms of the learning curves of the agencies. EPA does not have the experience that FERC has on market manipulation issues. FERC's markets are typically physical markets, and an allowance market is not a physical market in the same way.

Speaker: I'm not as worried about the allowance market as I am about a derivatives markets. One of the tough jurisdictional questions is how the markets get split. There's a cash allowance market that looks like an extension of electricity markets. At least in the early years. Alternately, there's a derivatives market that looks like an extensive of energy commodities markets, although an allowance is not a commodity, nonetheless it shares a lot of those features.

At first it looks like something for FERC. Second, it might be for the CFTC [Commodity Futures Trading Commission]. If they split them up and there's a gap there could be unintended consequences. If there's a big gap in the middle where there's different regulations or different layers, things get overlooked. It's a big concern; the inevitable links between the physical electricity and energy markets that FERC now oversees, versus the allowance derivative market and financial markets at CFTC. It's going to end up getting resolved by jurisdictional battles and turf fights among committees rather than what the right policy is.

Question: I thought we still had a bill floating around that was an economy-wide cap and trade that included lots of things other than electricity. I don't see the rationale for having FERC handling the allowance market. The CTFC is the right place to do this. Alternately, transmission issues, access, and electricity market design are a different kettle of fish. FERC is the right place for that. Am I missing something here?

Speaker: These are distinct from maintaining the registry and tracking of carbon RECs, which is clearly EPA's oversight. Trying to control manipulation in the cash allowance market is something else. In the early years it would be an extension of the electricity market, because the contracts and kinds of transactions will be inner linkages between allowance contracts, power supply contracts, and coal contracts. The electric utilities will have a coal contract and a power supply contract and some allowance contracts. They will have to line them all up.

Speaker: There are three old-line agencies, each with their interests.

Speaker: Let's remember acid rain. There were futures deals done. There were SO2 contracts linked to coal contracts. Even that market, which was not as broad and deep as this one's going to be, functioned pretty well. There were a lot of players and it was relatively non-concentrated. This market could be manipulated but this is not a big deal overall.

Question: The energy externalities are mostly issues that are location oriented. Is carbon dioxide different? It's a more fungible issue, a ton in Boston is the same as reducing a ton in Beijing. If there is a price for it, does market manipulation become a smaller challenge? Is carbon different than the other challenges that we've looked at here?

Speaker 3: Yes it's different. For example, the safety valve. Practically, it's impossible not to have one. One can't bind future Congresses. If the price of these permits turns out to be too high, they'll change the rules so they aren't too high. If it turns out China and India don't come on board in a few years, they'll change the rules. Having certainty in this problem is extremely illusory. Those kinds of international issues are dramatically different than dealing with acid rain, which was local to the U.S. Further, there's no precedence for this. It's an open question as whether we have the international capability to mount and sustain policies necessary to deal with this.

Speaker: People have argued for certainty about that price. However, we don't know much about the price of anything 20 years from now let alone the price of carbon. The government can't guarantee a price trajectory for anything. Carbon will be like many other commodities, like oil or natural gas.

Moderator: The challenge to carbon is that we'll all be dead before we know whether it worked. It is the most difficult public policy challenge that Congress has ever tried to solve.

Question: To put this in perspective, I'm involved in solar development and a wind generation equipment company. Solar is maybe a 40 to 50% capacity factor on peak, so it's not bad as a base load contributor. Wind is extremely variable and very difficult for base-load generation.

That being said, we're on the verge of repeating over-dependence on natural gas as a generation source. Prices are pretty cheap now but they were triple that 2 years ago, and we're using more than we're finding. So what about baseload? That includes the N word, nuclear, because that's something that exists. You don't have to reinvent that. It's there.

Speaker: I agree. However, the realities are nuclear is only going to be developed in a few regions of the country. Domestic gas production was up 7.8% last year because of new shale. Demand was only up 0.1%. That will suppress prices for maybe a couple of years. Your larger point is a good one. Policy makers have to realize that we're going down this road and be ready when prices go up again because of gas dependence.

Speaker: I am uncomfortable in relying on LNG as a fuel source because it comes from a lot of countries that the U.S. is not friendly with, just like petroleum.

Question: We've heard the track record of government picking technology winners is not a terrific one. Assuming that the technology will appear is an act of religious faith. However, this industry spends less on R&D than almost any other. But it's close to the bottom. How do we choose between government subsidies for R&D, which picks technologies, or making these leaps of religious faith?

Speaker: Well, the electric utility industry doesn't itself spend money on R&D, however those who sell to it have historically spent on R&D. Hopefully government can concentrate its R&D spending upstream, in basic research, early demonstration, and scale. Then let it be commercialized by those who can. With the correct carbon price, there will be an incentive to bring it to market. That can work.

Speaker: The Department of Energy is trying to improve the kind of intelligent investment along the spectrum of pre-basic to pre-commercial work. They have a team of people with experience in these kinds of issues. It's a real time experiment about whether they'll be able to navigate these challenges. There's a lot of improvement that could be done.

Speaker: I'd advocate for the leap of faith argument. We need smart policies that promote technologies without picking winners. We should get started now. In the SO2 program we knew how to address it with scrubbers. Alternately we hear that we don't know what we're going to do with carbon.

However, SO2 was actually solved in a way that was highly unexpected. The railroads were happy to deliver low-sulfur coal from Wyoming to the Midwest. Boiler engineers figured out that when there was an economic incentive, they could burn low-sulfur coal in boilers even though they were designed for Illinois basin coal. SO2 was a fraction of the expected cost, in a way that was completely unanticipated when

the bill was originally passed. There's no such thing as low-carbon coal but the general lesson that we don't know what the right technology is going to be, still holds. That's something we can take away from the SO2 experience.

Question: I was surprised to hear that markets for trading carbon won't be a problem, particularly after our current experience with financial markets. Similarly with the California experience on trading electricity and all of the issues around an improperly designed market and the need for proper oversight mechanisms and enforcement. Given that Congress has not resolved the issues in the financial markets for commodities and derivatives, it makes the trading environment for carbon potentially very risky. I have a great faith in markets but they have to be structured and enforced properly and our experiences in the last 20 years has shown us that it's very easy to get it wrong. Perhaps you can delineate how we're going to do it right this time.

Speaker: This market is almost certainly going to differ. What went wrong in the financial markets was a bubble and it burst. The assets involved were held by organizations with a lot of leverage. There was a knock-on effect of systemic risk and impenetrable instruments that badly understood and not cleared through exchanges. The spot market for allowances is unlikely to have any of that. There will be people who will take high trading positions. New regulation in financial institutions will be significantly stronger. The spot market for SO2 went up and down, and the world didn't end. The spot market for oil goes up and down, the world doesn't end.

Is it possible that in derivatives we can get into a mess? Well, sure. We need more oversight of those markets generally than we have had. The logical entity is the CFTC. If we didn't have the bizarre structure in Congress that led the CFTC and the SEC to have their separate committees, neither one of which will give up jurisdiction, we would have merged those two 40 years ago. However, the agriculture committee can't imagine not having a regulatory agency. We need regulation of derivatives markets and it will happen. Can there be speculation? Of course. You can't rule that out. It won't be catastrophic.

Speaker: Last summer there were remarkably high oil prices that were clearly not linked to anything fundamental. That did spill over into the cash market, so I'd argue that the two can have linkages. The industry must set something up with protections around it. Markets are rarely in equilibrium. Even utilities go through discrete cycles where everybody does not price risk well.

Pricing carbon with a potential link between a derivatives market and a spot cash market makes me nervous, particularly with the SEC and CFTC potential for loopholes. This question absolutely needs attention, there are vulnerabilities.

Speaker: Most people I know who've studied the oil prices last summer suggest there were fundamentals at work. It's hard to tell a speculative bubble story that's logically coherent with what went on in the spot market. The notion that the futures market drove the spot market is a little tough given what happened to oil storage. There wasn't a large amount pulled off the market. The world didn't end. Whatever happened, whether it's a bubble or a short run phenomenon, the world didn't end. We trade oil on markets. We trade coal on markets. They're not even organized exchanges. Carbon will be traded similarly. Do we need to worry about derivatives in those markets? Yes. Does carbon pose any special unique problems? No.

Speaker: I'm OK with the spot market but have concern about the derivatives market. Congress could pull the plug on a climate policy if there's something like a carbon-backed securities problem. I worry about that kind of backlash. We'll need a resilient system. Carbon is different because it's not simply a commodity that arose organically because people wanted to trade energy. The allowances are created by government as a public good. My preferred solution would be to put everything on exchange and require everything to be standardized contracts, at least for the beginning period in derivatives.

Commodity traders at a major Wall Street bank argued this is a terrible thing. They want things over the counter because the capital requirements are too high on exchange and it's too tough for firms to have that kind of capital. However, another finance person pointed out

what they had just said was we need over-the-counter transactions because we need more leverage. The original folks were from J.P. Morgan, they invented credit default swaps, but now they want high leverage in the carbon market. Now I'm sure we some strong regulation. They said trust us, this time it will work, and that's when I got really nervous.

Question: We all agree that we are not the greatest at picking technology and fuel winners. The practical political realities are that we do that. And we do tend to go to one winner or another. Nonetheless, we need to do something. What is a basic framework that may be developed that would allow the flexibility to swing from one thing to another as impractical from an economic point of view as it may be? Can we allocate cost relatively efficiently, allow for innovation, and get to a policy where we hope to get to a more carbon-neutral economy? Is it impossible?

Speaker: I don't know. Perhaps the Department of Energy could issue a performance spec that was transparent on what risks would be subsidized. It's very murky right now. There could be exercises that don't pick winners, but pick the design specs that are pre-commercial and then go from there.

Question: Is there a market framework rather than having to pick a technological framework?

Speaker: I don't think so. If they're handing out research dollars they have to determine that this project is more promising than that project. They have to make the judgments. One would like that judgment made on technical/economic grounds rather than as pork. There was a National Academy panel some years ago that proposed an independent agency with that kind of independence that would get the money stream and decide how to spend it. That's a non-starter politically. So somebody has to make a determination.

Speaker: That's done by venture capitalists for some segment of the marketplace.

Question: That's certainly true for the R&D part of the story. However, a cap and trade system, improving market design, extending the RTOs to the rest of the country, and getting the authority on siting decisions rationalized - these are all things that can be done. That will create a dramatically different set of incentives for lots of different people and new stakeholders. Some things are going to be important that no one can think of at the moment.

Question: We heard earlier that consumers are idiots sometimes. Behavioral economics suggests consumers are predictably inconsistent or irrational. There's new literature on making consumer default choices that are more efficient; the libertarian paternalism movement.

Given the importance of energy efficiency and engaging consumers with price response in making electricity markets efficient, what should the research agenda be to figure out how this plays with carbon reduction? Are there specific experiments that regulators should seek to have their utilities engage in? Are there additional policy options beyond just making the default option more efficient that we should implement?

Speaker 1: Despite the fact that they can be inefficient, information provision is still important and useful but we can't just send out price signals and assume consumers will react appropriately.

"Nudge" by Thaler and Sunstein is about making good default decisions for consumers. How a question or choice is framed affects how consumers decide. Consumers are set to default at the most efficient choice but they can choose other options. We should not make the choices for them. Consumers differ. Economics is in a fascinating and productive path, approaching consumers' real behavior seriously.

Speaker: There are different ways to think about information provision. Most of the time it's information asymmetries, so we want to make sure the price signal gets through clearly. Good things happen with clear prices.

There's also providing information to consumers about the options they have. It can be a different types of air conditioners or it can be learning from other consumers. One experiment used social information on utility bills that showed up with a smiley face or a frowney face. If you consume less than the average household in your area, you get a smiley face. If you consumed

more than average you got a frowney face. Just having that smiley face on the utility bill apparently made a huge difference in people's behavior. It's social effects.

Speaker 4: we need to apply the same rigor to understanding social effects in combination with massive energy efficiency programs. The same as we do with capacity factors of power plants and a variety of technical questions. They are just as important.

Session Three.
Comprehensive Transmission Planning:
New Challenges To Coherence, Functionality, and Economic Efficiency

The transmission planning debate has at least two quite different dimensions: substantive and institutional. Substantively, the question revolves around the definition of planning. Some, particularly in the environmental community, view transmission planning in the broadest sense, incorporating such externalities as environmental values and land use considerations. Traditional utility planning, in the context of RTOs or even single utilities, emphasizes planning for linkages between generation and load.

Decisions regarding externalities need to be resolved in siting and other regulatory processes. Institutionally, the planning process is in flux. New York, California, and ERCOT, for example, are essentially single state islands for planning purposes. MISO and PJM, while geographically spanning broad swathes of territory, follow quite different approaches to planning. The New England ISO, cut off from the rest of the U.S. by NYISO, follows its own model. The notion of regional and interregional planning seems distant. New frameworks and allocation of responsibility appear almost daily. Groups and counter-groups are forming. Will we continue to "muddle through" or will someone take charge? Are the inherent tensions between system autonomy and regional integration simply too complicated to resolve? What additional levers will be required for effective oversight of planning?

Moderator: We have a great panel. I was a little worried by the title when it talked about coherence. Putting coherence and transmission planning in the same sentence was amusing.

I'm going to discuss a bit of Western perspective to tee up this topic. It's complex, there is transmission for reliability in economics, and now renewables. There are multiple objectives, multiple states, multiple regions, and multiple stakeholders. Even single state islands like California approach planning as part of the broader Western region.

In the West, there are three sub-regional planning organizations with enormous activities at all levels; especially with the renewables mandates and the Renewable Energy Transmission Initiative. Western planning occurs under Transmission Expansion Planning Policy Committee (TEPPC) and also a planning committee under WECC (Western Electric Coordinating Council). There's shared databases and shared modeling, but the projects need to be picked up by individual transmission owners.

As we heard earlier, there's a lot of proposals in California, and I expect at least three to be realized. The length of time for transmission development – 7-11 years – will be a big factor in all this. There are multiple discussions on planning initiatives. FERC has added regional conferences on integrating renewables into transmission planning efforts.

There are two cases in California that illustrate some of the challenges in transmission development. There's a $2 billion line out to the Tehachapi region. They've broken ground on the first part of that. The utility is going through the approval process at the state level for the second half of that, and there's local opposition and some stakeholder friction in the transmission planning process, especially on the siting and licensing side, but it is moving forward.

Alternately, Southern California Edison has decided not to pursue the Arizona portion of the Devers-Palo Verde Two project. This is purely on an economic basis. This illustrates the complexity of the decision processes. These take

a lot of time because they're complex but there's an urgency to get things built. In the case of the Devers Two line, it was supposed to be online by this year but was denied by the Arizona Commission in 2007. It may get some sort of alternate workup but that remains to be seen. This was a purely economic line and the economic test had to be met all the way through. Just as the utility was getting ready to appeal and re-file the application, they ran the economics again and time was the enemy. In the intervening period from the initial denial to the application appeal, a lot had changed. The economy had soured, load forecast had come down, renewable projections had gone up. Fuel prices in Arizona and California had equalized. The economic benefits of the line had disappeared.

Unfortunately, they may have made the wrong decision for the right reason. The right decision is still to build a line like that. Nobody has regretted building wire 10 or 20 years later. The project may find some life later on in the interconnection process. These projects illustrate just some aspects of the kind of complexity involved in transmission planning. With that, let's move to our first speaker.

Speaker 1.

As the first speaker, I get the privilege to look at the big picture. First off, words in this industry matter. This is an industry where common words invoke visceral, almost violent reactions from people. "Planning" is such a word. Let me give you an example. To some, planning invokes this idealized process which results in the perfect balance of demand and supply arrived at through a broad stakeholder consensus. It's like those old 1950s documentaries about the perfectly planned city that had the right mix of resources for the working dad and the stay-at-home mom and the two kids. For market advocates, planning invokes the night of the living dead [LAUGHTER] and the Soviet Five-Year Plan.

These visceral reactions find their way into the industry's ever-changing policy and approach to various issues. One could create a regulatory museum of great failed initiatives in regulation. It could include IRP plans, the standard market design wing, the Northeast and Southeast RTOs. The legal bills associated with all these would separately be on parchment. The premise of this museum is to memorialize the country's tendencies for "regulation by fad." One area starts something and everybody else follows.

There's plenty of regulation by fad in the planning arena. There was the hands-off regulator. Those were days when company was told just go build it, I'm the regulator, don't bother me with this thing, I'll see you at the end of the line and we'll put it in rate base. Otherwise, don't ask, don't tell. Once we got to the 1970s and prudence reviews, that model didn't work. The industry went 180 degrees in the opposite direction. We seized on this model of integrated resource planning [IRP], where a group grope to find the perfect mix of demand and supply side resources would occur. Then we moved to competition, markets, and a big focus on generator interconnection. The market will take care of everything else. Congress recently gave us the concept of transmission corridors, probably a short-lived concept and destined for the regulatory museum.

This leaves us in a bit of a hodge-podge today. At the RTO level, PJM has been assigned only two specific tasks in the area of planning: reliability violations, and more recently for economics to clear congestion on the grid and enable long-term agreements. There's no mission to plan a super highway or integrate wind. Those are new assignments.

Even within existing assignments, this isn't easy stuff. Planning for reliability is cut and dried, right? We find a violation of NERC criteria, and we order transmission to fix that reliability violation. Sounds very cut and dried but it's not. Is it short term or long term? Do you just put band-aids on? Do you simply fix each reliability violation with a just-in-time solution? Or does the planning entity say, I've got reliability violations in 2012, 2016 and 2020, and why don't I come out with the solution to all of them? But that sounds like a good idea, but load forecasts change too. That hit us like a brick in the recession. A violation that planned for in 2020 now may be in 2028. Do they keep changing the plan? At some point, you have to lock it down. An ever-changing forecast is not good for anyone. The line between changing plans versus holding to them, and long term

versus short term is an interesting policy question, because the industry is ultimately playing with consumers' money.

A third aspect in reliability is demand response. Planners will take into account demand response in the capacity market or in long-term contracts. What about the demand response which may or may not occur? Does the operator risk a reliability violation on the wish that demand response may solve the problem? At what point does demand response count? A very difficult question, particularly for reliability. Even the simple is difficult.

When you get to economics, it is more challenging. The RTO or operator has a task that involves a whole lot of judgment: future load forecasts, future prices of electricity, etc. PJM originally went forward with a tariff that allowed a fair amount of discretion in terms of balancing those things and the FERC said no, it's got to be clear formulaic approach. Now the RTOs need a series of formulas to identify very difficult things to quantify. Both PJM and Midwest ISO have their own separate set of clear formulas, and New York may have a third set soon. This brings the question of cross-border projects between RTOs, do you layer a new formula on top of each other? Will this become yet another barrier to getting projects built?

The latest buzzword is the transmission superhighway. I'm not sure if it's a fad destined for the regulatory museum. Nonetheless, the Congress is clearly hell-bent on telling the planners how to plan. Unfortunately, Congress punts on the difficult issues like cost allocation, but adds more processes and proposals. The bill in the Senate Energy Committee is heavy on process and light on policy. FERC is designed under this legislation too. They set very broad principles for planning. This provides upfront understanding and commonality but the detail is very unclear.

For instance, there is a lot of concept discussion over "interconnection wide planning." Again, this causes violent reactions in people. Is it a return to the IRP process? Some argue for an IRP process with the right mix of demand and supply, with a layer of land use determinations. Make it a routing process for new transmission lines. However, the planning process is traditionally focused on electrical needs as opposed to land use needs. Should the RTO or planner be making difficult land use decisions? Should they be determining that one person's commercial property is less value that somebody else's residential property? Grafting those into the planning process trumps an individual landowner and their due process rights.

This model that Congress is considering may be too much. PJM proposed a simpler approach that asks Congress to provide national policy, and consistency across the regions. They've argued for consistent measures of cost benefit in MISO, PJM, New York, and New England. There ought to be some FERC approval of the plan, and some clarity with cost allocation and siting. We should all be worried about a regulatory morass. PJM advocates removing the process in the statute and attend to the really hard issues of cost allocation. Or give the FERC some cover and authority to call balls and strikes in this issue.

The state of the industry today is that we're stuck on a highway between two hills. We don't have the propulsion to move forward or the ability to move backward. If we're not careful, a semi truck could come over and hit us at any moment. The challenge for us all is to make this process work, and get results.

Speaker 2.

Transmission planning has enormous passion, and not really much understanding. Not being an engineer or an economist in a room full of people who are really good at both, I decided to approach this as a cultural anthropologist, it's easier to fake. [LAUGHTER]

There is a culture around transmission planning in the way we think about these issues. It requires significant change. We are contemplating fundamental change in energy supply in this country and no one is ready for it. I will discuss some history and think about assets: how they occurred and how we think about them.

The transmission system is old, with little significant physical additions to the system. IRP was the rule of the day. I don't think it was a regulatory fad. It built a huge amount of

transmission and generation. Optimization occurred primarily on the basis of a single system or utility. The tight power pools are an exception to that. The logic of large scale was driven by economies of scale, an expectation of load, and expected economic growth. That was the context and some of it is quite robust. Some of it is not.

It had a lot to do with the individual choices of the planners involved. The 500 KV system in PJM, and the 765 system that AEP built are robust systems that are intimately tied to the integration of generation in those regions. Good systems were built in this paradigm but we really haven't designed and built transmission as we must do in the future.

Today we have RTO-based planning, and no one was ever charged to go out and plan under a new paradigm. Instead it evolved in a happenstance fashion. The RTOs should address that mission more directly than they do. When FERC introduced market concepts they ended up figuring out market development rules and figuring out how to make the best use of the assets that were already there. The theory was to provide new energy-efficient marketplaces and rules to facilitate that. So the RTO paradigm was focused on developing market rules and governance procedures, in which FERC was the most prescriptive.

The planning criteria was not nearly as proactive an exercise for FERC. The industry was not focused or expecting a whole lot of new transmission to be built. While we have done a good job of tapping out the system as fully as we possibly can, the industry has exacerbated and strengthened the seams. Pricing rules appear to create economic integration, but as a physical matter, and in terms of planning, the seams have intensified.

Generally, the problems getting solved are always a near-term reliability problem. What are the current circumstances? What is the minimum I can do from a cost perspective to solve that problem or simply to delay it? There is a continuum that exists from congestion and reliability. Congestion is a reliability problem waiting to happen. Planners come up with a patch for that. There is a strong preference inherent in both the market and planning rules for generation solutions. This is because generation solutions are patch solutions, good short-term band-aids. A good transmission solution is not a patch solution; it's a longer term solution. It requires a broad range of assumptions about different kinds of generation resources, upfront investment, and a lot of time. The current paradigm is that we don't have a lot of patience, confidence, or certainty about those kinds of investments.

Let's consider a couple of examples. In parts of the country, Texas and other places where RTOs are not involved, they're following FERC rules. The issue is to get the generator interconnected. The utility carries proof of prudence. If they want to do more, like siting for deliverability issues, long-term reliability and congestion, it is very hard to get that passed. It has created a very high threshold for economic projects which is difficult to integrate into the planning processes. However, the supply paradigm is going to shift, primarily via carbon legislation, but also for new and replacement infrastructure. I expect a significant retirement of fossil generation from climate change legislation. EPA says that's not the case, but that can't be true given the realities. I'd be stunned if we didn't see 10 to 15% of fossil generation retired, although it's not clear on what time frame.

We need to build a system that is sufficiently robust for a variety of power supply choices over a long period of time. For reliability planning, that is a leap of faith but this national policy is a leap of faith.

Transmission has longer planning horizons with respect to transmission. Generation choices are going to be separated from transmission planning. A transmission provider has to figure out what they're going to do. They need a 20- to 30-year planning horizon. Especially with potentially variable power supply like wind and solar until storage improves. We have to anticipate that and the industry will not have the luxury of a great big map that says we're going to put four gas plants here, and X amount of wind there. If we want to move power efficiently, then the system will have to be robust and adaptable.

With respect to reliability, 99% loading on the lines is a reality. It's as efficient as it can get.

However, we should change the planning criteria to account for double contingencies in really robust lines. We have to integrate the policy decisions that drive generation and transmission choices, and increase operational flexibility. That means going to a much higher voltage than incremental planning would provide.

Congressional legislation is needed. There simply isn't enough of a political signal and direction about the way forward. We have a federal generation policy. Now we need a federal transmission policy to get the job done.

Question: What do you mean exactly by broad deliverability?

Speaker 2: When a transmission company interconnects a wind farm, they design the project to get the power into the grid. They have no guidance or requirement about how much wind has to flow and when, and how it actually gets to market. They may not design around congestion in the system. Broad deliverability means the plan has an expectation of a significant addition of resources of all varieties, so that as much gets to market unconstrained as possible, at the right time.

Question: You mentioned N minus two [N-2] criteria instead of N-1. What is the motivation for that? Is it literally to deal with double contingencies? Or is it to address the fact that we don't where the generators are going to be, so the more stringent criterion can integrate new generation wherever it comes online?

Speaker 2: The motivation is for double contingencies. There is concern about N minus one in a context with different kinds of generation sources and a high level of variability. The second point is an important one too however, because it means the system is robust enough for the long term. They both get you to the same place actually.

Question: Are there ballpark estimates on the cost of moving from N-1 to N-2? What about the reduction in capacity of the system?

Speaker 2: AEP and the American Wind Energy Association have tried to model the equivalent of a 765 system across the system. The ballpark price of just the overlay, was $60 to 70 billion. That understates what would be required underneath, because many systems under that overlay that would need to be upgraded to work with it.

Speaker 3.

I'm going to discuss some of the activities of the Energy Future Coalition [EFC] and its work in Washington on transmission planning and the new energy legislation. They convened a process in October 2008 and started listening to a broad set of stakeholders. There has been a lot of expertise in the room; more than 100 different organizations and companies. There are several large-scale policy goals that people have to address some key issues.

A critical part of this is developing a renewable industry around remote renewable resources, wind and solar in particular. These resources are usually located far from load centers. It is a tremendous domestic resource that can be used domestically for national security purposes and can serve climate change goals.

Climate change and national security concerns are a new issue for transmission planners climate change. These are large-scale, national goals that cross over the planning regions that currently exist. If one considers it from the climate change perspective alone this problem has to be addressed. This is a highly regulated sector of the economy and those regulatory issues have to be addressed.

The EFC came up with a vision statement supported by a broad group of environmental organizations, the wind industry, labor organizations to talk about federal legislation to address interconnection-wide planning, cost allocation, and siting. All three have to be considered together.

It's one thing to have a plan and another to have the authority to execute it. There is tremendous support for a planning process that would be linked to new authority for cost allocation and siting. What really drives the ability to solve the cost allocation and siting problems is a robust participatory planning process. The lack of participation and understanding of what's happening, what's at stake in the planning

process, and what the benefits are among broad groups in society is extensive. This sets up fights at the end of the process, whether it's cost allocation or siting or both. It also contributes to long processes and inaction. The planning process is also key to getting the political buy-in. It's not easy.

Despite the best intentions of the entities engaged in planning, the RTOs, the utilities, and others they are not in a position to take on these larger issues and larger scale, without a framework and federal direction. The EFC has become convinced that federal authority and legislation is needed.

I'll tick off some of their main conclusions. First, interconnection-wide planning to move renewable power from remote areas to population center is the key. It should be robust. It should engage all interested parties very early, and should look at siting issues. One cannot resolve all detailed siting and routing issues in a planning process, but those issues need to be included in a discussion early on. It can have a very beneficial effect.

Many of the environmental stakeholders believe it is critical for transmission to build clean power. If there is siting authority associated with this then every effort in the planning process should be devoted to siting problems but these sacrifices must be in the service of building a renewable energy industry. They do not accept a planning process that is agnostic as to the sources of generation. Facilities that come out of the planning process are expected to have restrictions on the types of generation that could connect directly to those facilities.

Cost allocation is an issue. The urgency of dealing with the problem of climate change really drove this thinking that simple broad-based cost allocation is the way to go. Cost allocation procedures are a barrier to developing a lot of these renewable resources. There's a certain set of resources for which broad cost allocation makes sense. A FERC directed process can be developed to determine which facilities ought to be eligible for broad cost allocation, based primarily on which kinds of resources are being connected.

The group did consult with the RTOs although they have not signed onto their vision statement. The input from them is that we need to build on what's working well today. A process overseen by FERC really ought to build on the best that's taking place in planning, and despite some of the things we've heard today, there are parts of the process that have improved and are working well.

Interconnection-wide planning should be conducted by the organizations in each interconnection and they should form an entity, multi-state transmission authorities, to do the planning. FERC would then delegate the authority to them to conduct the planning under a set of rules that they would issue.

The last important consideration is to address many of the local issues, not just the big national policy goals like climate change and national security. These include state level renewable portfolio standards, energy efficiency requirements, local economic development objectives, and demand resources. National legislation should take account of all the commitments that have already been made at the local level and incorporate them into the planning process.

Question: How would they plan to harmonize inconsistent state objectives in the multi-state process? That is why multi-state transmission planning has been so problematic.

Speaker 3: FERC would be the final authority approving the plan. FERC would be the final word to adjudicate those disputes in the planning process. No one wants FERC to take everything over from the get-go, but we all recognize that some authorities are needed to settle these problems.

Question: On the balance between state and federal authorities, can you discuss how states might not feel utterly preempted in siting issues?

Speaker 3: The EFC proposal is to allow the states to site the facilities once they are identified. Leave the detailed routing and siting decisions to the states. If there are problems that arose in siting that fundamentally contradict the purpose of the overall plan then FERC would step in and resolve those disputes. The process

tries to leave in place the processes and expertise that exist already. The difference is there is a closed end to the process and FERC would step in and make a decision if the states cannot.

Speaker 4.

I'm going to discuss planning in New York compared to results in New England, and then take it up to the Eastern interconnection level and talk about the interconnection planning.

There are many levels of planning. Local transmission owners are responsible for their local needs, and that rolls up into regional planning where the RTOs and ISOs have reliability criteria and future needs to evaluate. Coordination is done between ISOs and RTOs to integrate those plans and determine interconnection-wide needs. There are a variety of interconnection-wide projects built since the ISOs were formed. There's a 345 KV connection with Maine and New Brunswick. In New York, there are two HVDC ties in Long Island, between LIPA [Long Island Power Authority] and New England and between LIPA and PJM. Each interconnection is unique, depending on when the markets were originally put in and their characteristics.

There's some common principles that are used by the ISO RTOs to do planning. Open transparent processes are fundamental. Everyone has access to all the information and knows what the assumptions are, and can see the results. The ISOs have designed their markets to attract the right kind of resources to the load, including generation. demand response, and transmission. In New York, the tariff requires that all resources get evaluated and considered.

The ISOs also have the authority to protect reliability if the market doesn't. In New England they had diesel generators on trailers in southwest Connecticut because the transmission could not be built fast enough.

The independence of the ISOs is very important. The projects are brought to the ISO boards for approval and they make independent decisions on the projects. That independence is important in the siting process, because the ISOs are perceived as objective when they discuss the need for a project and demonstrating the alternative options considered for a siting board. The vast majority of projects have been reliability projects. None of the ISOs have had the authority to do economic planning until recently. FERC has just approved the new tariff in New York that will allow for economic planning.

In New York, they put in locational energy markets, ancillary service markets, and capacity markets right at the beginning. Those sent strong locational signals for investors and developers to put generation close to the load. If one compares that to New England, they started with a single price market for the whole pool for several years, and no locational capacity market either. There was a land rush in conjunction with new power plants during the early years and about 10,000 megawatts went toward the intersection of the pipelines and other easy to build locations. They are located in Maine, Rhode Island, and other places that are not efficient to the load.

In New York, the market signals meant that the generation went to the load centers. It set up a different construct for planning in New York versus New England. In New England they knew where the generation was but it couldn't serve the system reliably and meet criteria. A lot of transmission had to be built, about five billion dollars worth of transmission is close to being completed.

There's similar issues nationwide. There's 15,000 miles in NERC's ten-year plan now. That's more than has been in that plan in 30 years. It's a myth that transmission isn't getting built or planned, it is. Certainly the environmental initiatives will change that paradigm even more.

In New York, the markets have been working very well. They are protecting reliability, getting generation located close to the load with a combination of public and private investment. A lot of this investment has been public/private partnerships. A lot of demand response has come into play at the right locations, unit availability has increased, the heat rate of the whole system has increased, and the efficiency is much greater. Most of the new generation, over 80%, has come below the Central East bottleneck to serve New York City. The other

new generation is renewable, in the north and western sections of the state. There are now 1250 megawatts of wind operating in New York. Very little transmission has been built to upstate New York because the generation got put in the right spots. The two new HVDC lines for LIPA are the exception and they bring power into Long Island's load pocket.

Let's look at New York's planning process itself. The ISO does a needs assessment looking out in the future, identifies reliability problems and calls for market solutions in a formal process. They can be generation, transmission, or demand response. New York does not need additional generating capacity for reliability for ten years. The new charge is to integrate economic planning, examining the costs and benefits of new facilities and infrastructure. This starts with a reliability base case of ten years, and looks at a number of future assumptions on what the future looks like.

The eastern ISO/RTOs are trying to develop a better interconnection-wide planning process. This includes all of the planning authorities that are 890 approved within the U.S. and the Canadian planning authorities that are NERC approved. It includes the New Brunswick ISO, the IESO in Ontario. New York PJM, ISO New England, MISO, SPP, TVA, Southern Company, Duke Energy, Alabama Electric Co-op, all the Carolina companies, all the Florida companies, Georgia Transmission, and Progress Energy. It's called the Eastern Interconnection Planning Collaborative.

This starts with the ten year plans that all the regions have, and rolls those together to come up with a base case for the Eastern Interconnection. Then they conduct a variety of studies. The states have input as well. The analysis would be based on reliability but also economics and environmental goals. The expectation is that the national policymakers would give us some metrics to evaluate. Right now we don't have those metrics, and that's why a lot of planning isn't being done.

New York has aggressive environmental and efficiency goals. The process would put all of those goals together for the states and run scenarios to determine the system needs to achieve those metrics in future years. It's not just one or two cases. It could include cases that run all the wind in North Dakota and Minnesota, or cases that include local wind and renewables. An enormous variety of different needs and possible solutions would be evaluated. The resulting report would be given to FERC, DOE, and the Canadians who may ask for additional information or different cases to be run. This would not be a decision making body but rather bottom up planning. Running load flow cases, production costing cases, simulations, economic analysis and so forth to demonstrate whether or how the various goals could be met.

There is support from all of these planning coordinators to do this. DOE will issue an RFP for stakeholders to respond to, in the east, in the west, and in ERCOT. In the east these planning entities plan to form an organization to respond to this RFP. Even if the legislation doesn't go through to require this, there's enough support to do it anyway because it's the right thing to do.

Let me just talk about economic projects that are possible in New York to finish. They have a comprehensive transmission study looking at the condition of the infrastructure, and the long range needs of the system. It's being done by all the transmission owners and the ISO is participating. It will be interesting to see how the new economic 890 process will identify what projects might be cost justified to remove some of the bottlenecks in New York.

Second, there's a lot of new wind, and most of it is on the other side of Central East so that barrier will be examined in a new light. While there's a lot of studies going on in New York looking at transmission, they all need to flow together so that they can be evaluated on a level playing field. If an entity is asking for recovery through the tariff they need to be evaluated in the 890 process, and the ISO's technical studies to determine if they can be hooked up reliably. That's the next level of challenge in New York for transmission planning.

Question: You mentioned having metrics in the planning process to achieve environmental goals. How would that work, in particular do you foresee the planning process reaching in and making determinations to where environmental generation would be?

Speaker 4: The metrics would be defined by New York's policymakers. A number of scenarios would be run to show how these different targets could be met. All the states would have say in that. A lot of states have robust planning processes themselves for energy efficiency and renewables.

Presumably it would include alternatives such as demand response and energy efficiency. Renewables from long distances would also be considered; offshore and onshore. There are an infinite number of combinations. These would be used to inform policymakers on what direction people can go in. That's why the role of the states is so important here. If they're not at the table helping define the cases that are run, it won't work.

Question: You discussed the voluntary nature of the collaborative process for the interconnection. How do you anticipate dealing with the inherent conflicts that will arise among the various parties?

Speaker 4: On the technical side, there's not going to be many difficulties in setting up cases and models. They already have processes to get that done. Any time you set down to do an economic study for the next 20 to 30 years you're going to get 15 different economists with different answers. They'll have to run scenarios, and different sensitivity analyses based on different assumptions. That's a good way to bring in everybody's perspective. I expect this process will show some obvious winners that make sense no matter which way you go. It may not be that simple but I'm hopeful that it will.

Question: Even the obvious good projects will have parties that view those projects as not as positive. Ultimately there needs to be an arbiter that says, yes, we need to do this project. How do you resolve that conflict if it's a voluntary collaborative process?

Speaker 4: Well one has to get the parties to agree to it. There's a way to do the cost sharing. The one in Maine between New England and New Brunswick had benefits for folks in both territories, and they agreed to each share the cost, 50/50. That got it done and that will happen here. A study by itself will not do it. Imagine going to testify in front of a siting council for a project that was based solely on economics and you're having to condemn somebody's land, and they have five economists on the other side saying those assumptions are wrong. There has to be strong buy-in to the project. This process is bottoms up, all the information's revealed and find projects with reliability, economic, and environmental benefits. There's many different ways to achieve those goals, not just one way. That's where the states are going to have a major role in it.

Question: What classes of stakeholders would occur in the planning process, and how would it be structured? A steering committee, limited representation, how many per class?

Speaker 4: They're just beginning to formulate structure, governance, and cost sharing. They would try to emulate good practices in some of the RTO footprints. New England has a participant advisory committee that's open to everybody. The transmission owners, the generators, the environmental folks, government agencies, local towns. I think their principle will be openness and transparency, and allow people to ask for alternate cases to be run. Once they set up these models it's going to be easy to run different cases. Allowing people to consider a variety of cases will improve their credibility.

Question: We heard that the NERC five year plan has 15,000 miles of construction planned which is more than the past 30 years. In the past few years how much have New York and the Eastern Interconnect built compared to historical levels?

Speaker 4: It's catching up. In New England there have been two 345 KV lines built in southwest Connecticut, probably the most difficult place to build anything in the country. There are new lines in Vermont, Massachusetts, and Maine. PJM has a number of projects that are under way and approved by their board. It's almost $15 billion in projects under way at PJM. In New York there's not a lot of internal AC projects have been actually planned just those two DC projects. However, they now have the 890 process for economic planning.

There is a lot of transmission coming in because the planning process got started in the ISO footprints a few years ago. What's happening

fast though is they're getting wind generators in their interconnection queues. Some are real, some aren't. But that's going to be the major focus going forward.

Speaker: There's a lot of statistics out there, and one can spin them any way you want. There's a perception out there that nothing is happening, that's just not true. Many are bigger projects and they don't instantly come overnight. Dominion has the trail project, they're putting up two towers a day. It's a major multistate project that got all the states siting approval. Perhaps the threat of FERC coming in incented four states with very diverse interests to move forward.

That being said, the bigger change is the paradigm shift in what we're building for. That should be the focus. An interesting problem is that when you get multiple projects, how do you decide the best project? Who decides that issue, do we just say let them all build and race to the siting board? Does the RTO have a role in that, what are the criteria in measuring projects?

Moderator: EEI published some months ago a compendium of all the transmission projects that its members were doing. It might be of interest to folks because it shows that there is a lot happening.

Question: If the new paradigm is adopted by policymakers, are the existing institutions up to the job of planning this new broader overlay transmission system? How would they come together? How does this get done?

Speaker 2: That's a really hard question, which is why we should be talking about it here. We couldn't make up a new institution tomorrow even if you want to. Further, the RTOs that exist and operate know a great deal about transmission, and how to operate effectively within the paradigm that exists. The question is who can lead the shift that's required. We have to assume it will be a federal entity with a broad federal vision, like the NERC reliability paradigm shift. Ultimately, the question is what is the right way to define the role of FERC. Second, how do you deal with cross border issues, and third, how do you deal effectively with organizations that are not operating in RTOs.

The planning process discussed earlier is a very noble attempt to bring all that together, but I confess to some skepticism. I'm concerned about combining RTOs with organizations that effectively are not in RTOs because they never wanted to be. I'm not sure they have that kind of vision.

We probably need a higher level of FERC intervention, and a clearer definition of the policy parameters to be achieved. There's a lot of cultural subtexts to move in order for us to be able to get this done.

Question: If we could find infrastructure projects that work no matter which way we go, that would be terrific. However, we heard about the line to Arizona and deep concerns about uncertainty from at least two of the speakers. If we consider first principles, the more uncertainty with a problem the more one is driven towards investing in projects which are not good no matter what happens. It is rare that a dominant perfect solution occurs. Instead the solution is not so bad but almost always after the fact turns out to have been the wrong decision.

The planning paradigm we've been hearing about is sidestepping that fundamental problem. One way is to have an incremental "try, learn, experiment" optionality, a gradual organic process to address uncertainty. Alternately, we've heard a strategic vision of, "it's not economic but it's a really good idea." This sounds like a problematic approach for a 30-year planning horizon on a gigantic project. I think this approach is the wrong one for the problems we're facing.

Speaker 2: I'll let the other speakers address parts of this as well. Here's an example of something that can work. The Southwest Power Pool is evaluating a 765 overlay to move vast wind resources in their area. They don't know all the directions it's going to go, it's probably mostly east, although going west isn't an impossibility. They hired Quanta to determine if the overlay would be cost effective. Quanta run several scenarios and concluded there were net economic benefits from a production cost perspective for every state in the Pool.

That project has a lot of the uncertainty you describe. They don't know every resource that's

going to be connected to it. They don't know which specific projects are going to be built or in what order. Rigorous reliability tests for every single increment of the project will certainly move around, because the underlying data move around. So they don't have unbounded faith, but they have a willingness to recognize that there is an artificiality to the way in which the industry does modeling. Especially if what you're planning for is a host of objectives, and not just the next reliability spend. Many of the objectives are known. Their process is a broadening of the horizons of the things you're willing to talk about. They can make a generalized commitment to the overall plan and new system without having to have every last dollar and load variability accounted. That's a respectable intellectual planning discussion that ought to go on, and a new paradigm for the process.

Moderator: One is trying to balance multiple elements into a process. There's overall economic considerations, there is the rigor of the process, the stakeholders, etc. A project probably has a 40 or 50 year life, with an initial 7 to 11 year process before electrons are flowing. It could be a 60-year time window.

So how do you balance all this stuff? Just take the Arizona example. The economics had changed in the near term to midterm. I don't think this changes the value of the line in the long run. Many stakeholders want to see Arizona become the Saudi Arabia of solar with a line to the western markets. There is a need for the line, however it's not the same need in the original application for the project.

Then it's about the process. One has to respect the policymakers because they have tariffs, they have rules. Those do not take into account a broad horizon planning perspective. Sometimes there are no-brainer projects that have to go through a process that is very narrow, with careful studies. We really need to make sure that the process can accommodate that uncertainty, and can play some smart bets.

There's a couple of key elements to that. One is accepting that uncertainty. This comes from a view that transmission is not just an alternative but also an enabler of the market. It is similar to the highway or railway system. In California 20 years ago, there was the 605 Freeway, and it was an empty corridor. An enormous amount of development took place about a decade later and enabled extensive economic development. Transmission is a market enabler especially with the challenge of changing the resource mix. There is an inherent disconnect between the long lead transmission cycle, and the shorter lead cycle for generation. There is a chicken and egg problem and the way to solve it is to look at transmission as the enabler.

Speaker 3: I agree and let me add to that. A 40-year life of a transmission facility will have many changes. Back at TVA they built three nuclear plants on the eastern side of the system, with a 4,000 megawatt load over in Memphis, several hundred miles away. They could keep putting in peakers in Memphis and burn oil to keep the lights on, but that didn't make any sense, and the transmission got built.

A lot of transmission got built to connect the nuclear plants. In 1985 the NRC walked in and shut down those nuclear plants for five years. The transmission system that had been built to enable the nuclear system now ended up functioning as the interconnection for everything else to keep the power flowing in the region for the next five years. That wasn't a core planning scenario at all.

A broader look at scenarios is extremely useful. In New England, in January 2004 on a very cold day there were 10,000 megawatts of gas plants, and 7,000 megawatts of them called in and said they could not run. The transmission system and also ties to New York helped ISO New England get through that crisis. Long range planning needs to incorporate studies that look at a lot of scenarios and conditions within the system, recognizing that things change.

Speaker: I heard your question as asking who bears the risk in that situation. The answer to that would be a true merchant transmission model as opposed to a regulated rate base model. Merchant transmission hasn't particularly worked in this country, particularly for AC. Currently the risk of overbuild or under-build is totally on the customer. The risk allocation question will need to be addressed at some point.

Speaker 3: We have to weight the risks of mistakes in the planning process against the

risks of not moving quickly enough for many of these larger issues that we're trying to address. The industry has to look at all the risks in the picture, and not just the ones inside the electric system.

Moderator: We also need to think about what's the test we're meeting, what does economic mean? Economic currently is based on the price signals we have available today. However, economic to customers should mean the lowest cost to achieve all the different policy objectives including renewables. That's a different test. There's a lot of focus on getting it right, and getting the timing right. This is not Wal-Mart negotiating with Proctor and Gambol to get just-in-time deliveries of toilet paper. This is an enormously complex product with timing problems that will be ongoing.

Speaker 2: There is not simple solution set to these problems unless something gives. There are a set of economic, engineering, political, and legal facts that constrain decision-making, and that is why they are stuck in Congress.

First, we rely on private investment for these things. The road system was a public investment. Do we still want to keep on that paradigm? Generally the answer is yes, we want to stay on a private investment paradigm. However, that makes things difficult where we can get the wrong decisions for the right reasons.

Number two, from a markets and engineering perspective, we never can forecast correctly, and there's always going to be unintended consequences. Although oftentimes there may be good unintended consequences.

Third, different stakeholders define things differently. John McCain's definition of clean generation is not the same as the Sierra Club's definition, nuclear or not nuclear. "Clean" is going to be a legal/political definition at the end of the day. I'm still not clear how we will keep dirty generation off of the wires, I've never had anybody tell me how that works specifically.

We will have to address economic development of the plains states versus the Northeast states when we're looking at a transmission line and it is not clear to me how that would be adjudicated. And agencies generally like to adjudicate things.

Finally, we have political environments which are determined every two years, not every 50. Something has to give, how do we do that? These constraints are very difficult.

Speaker 4: The key is metrics to start with. If there are metrics on the goals, planners can plan. The NERC reliability criteria has good metrics that we can use. Production cost analysis and other economic tools can assess cost metrics and pollution metrics. If there are metrics from the states and the federal government, it would allow for improved scenarios and far better assessments.

If legislation doesn't happen to define what the metrics are then we will be stuck. Currently, this issue is not being addressed in Washington, despite a recent Academy of Sciences conference that characterized this as the first priority.

Speaker: I'll address the question of how to accommodate state concerns. The planning process needs transparency, robust analysis, and more scenarios than the past. Especially for interconnection-wide planning there's been very little done. There'll be conflicts among states and between the federal policies and the states that will have to be sorted out. We need a good process in place, with resources and the authority to get it done. We certainly need strong policy direction. It's not clear the climate and energy bill will have strong enough policy direction, particularly for transmission.

Next, how to keep dirty generation off the wires. The laws of physics certainly can't be ignored. Actually that was heavily negotiated. There were a lot of people who were against that. While one can't tell the difference between green and brown electrons, they can tell the difference between a coal plant and a wind turbine. If there are resources specifically built with the planning cost allocation and siting authority in the legislation, there would be an interconnection standard for new resources connecting to those lines. This doesn't deal with increased utilization of existing facilities, currently there's no answer for that.

Speaker 2: First, with respect to who should build. The interstate highway system was built with public funds. Transmission obviously has been publicly owned as well as privately owned. One could say these questions are so hard, rather than have a transparent process where everybody tries to work it out, let's just let the feds figure it out. However, the reality is that transmission is financeable. Some gets justified based on RFPs, and long term contracts. It's also a perfectly respectable model to rely upon cost allocation based on utility regulation. I expect these multistate projects will get done with utilities or independent transmission companies that are FERC regulated. That kind of tariff is imminently financeable particularly given the work that FERC has done over the last several years. One still has to address development risks but that is certainly possible.

On carbon, we ought to enact a reasonable carbon regime, but the whole principle of a cap and trade regime is that rational choices get to be made based upon economic decisions, and not based upon discrete pieces of regulation. That's precisely what this carbon limitation would be. What if someone builds an ultra supercritical coal power plant that can be connected, and provides stability to a system that's substantially wind? It is makes no sense to prohibit that interconnection. We need to provide flexibility within a carbon constrained future.

Question: One speaker argued that "just in time" doesn't make sense here. I want to challenge that to some extent while acknowledging that transmission lines are certainly not toilet paper. Second, I'd like to challenge the notion that we can't get there without major change.

In discussing these two elements, I wanted to set some background. An energy company in the ISO markets might initially see the world as painted in one particular set of congestion patterns. However it changes. In a year or two, totally different patterns. Another year or two, totally different ones. Consider the process in PJM. They went from the east and west, the eastern interface paradigms, then came Branchburg, then Beddington-Black Oak, then AP South, and a dozen other major issues since then. These have all been largely addressed through transmission upgrades, and quickly. That environment has a rapid cycle time perspective. This is true even in New England and New York as well. New York total east was the big thing, now central east is back after a hiatus. Again, these things are being addressed fairly quickly. In PJM there is a process where people pay to accelerate transmission upgrades. There is merchant activity to build upgrades. The increased precision around planning has reduced cycle times, made it more efficient, and reduced uncertainty. We've heard that Cal ISO has increased precision in their planning. With all these improvements, and processes that are now working well, do we impose a different regime? Larger scale overbuilds, longer horizons, and reduced precision? Do we move it back to the federal government, who will probably be slower?

Changing load forecasts are occurring in breathtaking patters today. Infrastructure is being removed from some locations because they're going out of business. Growth and patterns of flow are not predictable. Climate change and fuel markets; low gas prices, high gas prices – they all contribute to unpredictability. Obviously, this picture challenges the notion that incremental change is not working and also challenges the need for a paradigm change. Any comments? Do we run the risk of throwing out the paper with the bathwater.

Moderator: Let me respond, since you mentioned my comment. The organized markets are getting enhancements through market signals, but there are two different worlds here. One is shorter distances, and congestion driven need. This is different from transmission needed to satisfy societal policy objectives like renewables in remote places, or new kinds of economic tests. Certainly a shorter cycle is great, but the enhancements are needed with a cycle as short as possible. Many of these important projects are not going to come in with a short cycle. These changes are unavoidable considering the distances that we're talking about here.

Question: Well in PJM for example, a 230 kV line, brand new 200 mile line from start to finish in eastern New Jersey, was done in less than two years. 345 kV lines, can't be built a thousand miles all at one jump, but maybe in pieces like

the 500 kV line through PJM. Breaking it up like that can get a fast cycle time.

Moderator: Well there's bigger challenges. If California only goes to 33%, they estimate they'll need 527 new 500 kV lines just inside the state to get to renewable. Many are long distances.

Speaker 1: Theoretically you could do this under today's paradigm. This is about wind integration more than anything. The existing paradigm is that the generator pays. One could hook up wind units, and give them a very large transmission bill. It may be unfair but they're going to get a huge bonanza in the energy market because their fuel costs are essentially zero. Under the single clearing price market they will do very well when they run. The difficulties are the upfront costs and capital which may not be workable for diverse wind projects? When a border is crossed with many states and multiple RTOs, can these things actually get built? This is a question of who pays, to be honest. This is a question of whether that should shift. It's not impossible to do it today and these proposals would probably make it possible.

Question: Is a production cost saving as the benefit indicator applicable for robust transmission planning? In New York, what really stopped NYRI [New York Regional Interconnect] was the decision that the benefits should be measured at the production cost level, and the application was dropped. Second, what is the role of independent transmission companies in the development of a transmission plan and its implementation?

Speaker: Almost every RTO has the production cost threshold in their 890 process to be considered an economic project. It's the right answer by an economist's standard. In New York after you get through that barrier then the ISO calculates if the project is good for the whole pool, and who are the beneficiaries are. That's based on the LMPs, and load. It's modeled the same way interconnections have been done. Two parties do a study, assess the long range benefits of a project and a variety of cases and sensitivity analysis. If they're going to pay for it they have a say in it. New York's new 890 process is just coming into play now and we'll have to see if that threshold is too high. If clear winners jump up the beneficiaries would presumably want it.

Independent transmission companies have done well, both in the east and in the Midwest. They do have a role.

Speaker: There is a question of what is robust. One speaker described a reliability screen, then an economic screen, and a new third policy screen which is essentially wind integration. We heard about scenario planning, and then consensus. That seems like the vehicle for the third screen. The only way to get things built is to have parties who will ultimately pay perceive it to benefit them. Scenario planning is being adopted by several of the RTOs. Metrics will be critical as well. Then the information is complete so that the policymakers can gain that consensus.

Speaker: There is a tension between paralysis by analysis versus some reasonable level of scenario analysis. Can it complicate the process where you're studying endless things especially in a longer timeframe? Who decides that? Metrics and policy direction will be needed to circumvent that problem, otherwise this could be a modeling exercise till the cows come home.

Speaker: The New England scenario analysis went through in a fixed period of time. The stakeholders were involved on all the assumptions, the full ranges of highs and lows. The stakeholders brainstormed and came up with a set of metrics. They had 20 pieces of data in these models to show how each scenario performed for New England. They ended up with ten scenarios, and some wanted hundreds so that has to be controlled a bit. However, once you get these models set up a lot of work can be done. New projects are occurring in New England as a result of all that analysis, including the NStar project with Quebec. It's value emerged out of that process.

Question: How should the RTO include demand response in the transmission planning? Do they count on it five years from now, or three years from now? In the recent PJM capacity markets there was no hesitation for the RTO to plug in 7,000 megawatts of demand response. That's seven nuclear plants of demand response. Will it materialize in three years? One could argue that

it serves the purpose of the RTO to have lots of demand response in the capacity markets, because it leads to low prices, and then consumers and regulators are happy. However, transmission planning occurs using far less loose assumptions.

Speaker: PJM created a forward capacity market to create a level of certainty in resources. They don't say that demand response is inherently less reliable than generation. There's also a hefty reserve margin. There's no pay hefty penalties, and there's no real threat to reliability. The impact of both demand response and intermittent wind generation on the reserve margin is going to be an issue. They will have to adjust the reserve margin.

Ultimately they depend on demand response the same as relying upon a generator that's under construction but may not be completed in time. They have bid in, and the RTO is relying upon the obligations to be met. If we go out 15 or 20 years, does the planner make some assumption as to how much demand response there may be in 15 years for reliability purposes? That exercise is riskier in terms of what will really happen.

Speaker: That question has come up for transmission planning in New England. These transmission projects were reliability based projects with N minus one contingencies, where voltage collapse could occur in cycles. Demand response is not cycles. It's in multiple minutes, 15 to 30 most of the time. One has to assess the characteristics of all the resources in the mix.

Question/Comment: Just a quick follow-up. I would accept that answer if one doesn't treat them exactly the same with payments. So if the generator provides added reliability because it can respond to voltage collapse then it should be paid differently. They are paid exactly the same in the capacity markets.

Question: On the eastern confederation that you discussed, it will look at gaps. We've also heard about a stronger FERC. Consider MISO and SPP, and each of them creates wonderful plans that meet all their criteria and they firmly believe in. However, the new interregional criteria gets decided and they run scenarios and each of the plans is suboptimal. Who gets to take the stick and tell them both they're wrong?

Moderator: It wouldn't be the collaborative or confederation that decides. That's not their purpose. They do basic planning, get the studies done, and information to the FERC. Does the rolled up plan address the gaps? FERC and DOE will have a lot of play in what other alternatives they want to be addressed.

Speaker 2: There's no perfect answer about who gets to decide. FERC seems fairly obvious but they're not perfect. Ultimately, we just need a decider. The stakeholders need a program, a set of analyses, some discipline on the process, metrics and goals. Then we need someone to make the decision in a timeframe, without ten years of litigation. Certainly mistakes will be made but at least the process can move forward.