

**HARVARD ELECTRICITY POLICY GROUP  
FIFTY-EIGHTH PLENARY SESSION**

Santa Monica, California  
February 25-26, 2010

**RAPPORTEUR'S SUMMARY \*****Session One.****Distribution Infrastructure and Electricity Transformation**

*The demands on distribution grids are certain to increase in the next few years. We are seeing more distributed generation, more and more sophisticated demand response programs, and the plug-in hybrid car (PEV's) is not far behind. Over the next decade, more customers will take advantage of these products and services. Distribution utilities, knowing that the existing system cannot accommodate such use, will find themselves with significant capital investment in the grid to meet customer demand. There is uncertainty over the timing and full scope of the demand for such system enhancements. Illustrating the degree of uncertainty, Southern California Edison, for example, projects the use of PEV's will increase, over the course of the next decade to a minimum of 220,000 to a maximum of 1,088,000 in its service territory, an extraordinarily wide range.*

*What are the technical challenges? How do we plan in the context of that level of uncertainty? How do we know exactly where to make the upgrades? How will distribution companies be compensated? How should those costs be allocated? Should distributed generators (e.g. solar panel owners or PEV owners wanting to sell back their excess storage) be put on special tariffs? How should such tariffs be designed? Does decoupling sales and profits help to address the question of who pays and how much? Will issues regarding the distribution grid come more to resemble the challenges of transmission investment?*

---

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

## Speaker 1.

This industry has lived through diversification and mergers and acquisitions. Of late, it's become smart grid, but there is not agreement about what smart grid means. About five years ago, it was focused on customer applications. We were going to have smart meters, smart thermostats, smart refrigerators, smart puppies, everything was going to be smart in your home. This was going to result in some windfall of benefits to consumers.

There wasn't a whole lot of thought, except by some of the utilities and some of the deeper thinkers in the industry about what the implications were for distribution transmission substation, and for markets, other than there was a lot of strong potential. The focus shifted a lot to transmission systems, particularly in California, where they were confronted with policy mandates, 20% by 2010, and 33% renewables by 2020. The focus was on transmission, both the importing of renewable power from the resource areas, and how do you integrate renewables in the system. There's problems with intermittency, with inertia, and so forth.

There is a shift in emphasis to smart grid in terms of distribution systems. California has 88,000 miles of distribution over 50,000 square miles. They expect widespread distributed generation, principally rooftop solar, to meet renewable goals. They hope to reduce some of the need for long lead time and very expensive transmission. California usually requires seven to eleven years to permit, license, and construct transmission. The hope is for much higher distributed generation.

There are also expectations and concerns for significant penetration of plug-in, hybrid, and battery electric vehicles. However no one has any idea how fast or how many. Consumer adoption is going to be driven largely by policy considerations outside of the technology of the vehicles. This will also include subsidies, gas prices, policy mandates, and, moral sentiment – these will all determine the speed of adoption speed and total amounts of electric vehicles.

It's very difficult to forecast where they'll cluster. Some of the early assumptions are that

rich green people will buy them all, the Santa Monica demographic. Santa Monica, for example, is an expected clustering area. It's going to depend on rate design and charging protocols as well, and there's no agreement on those.

What about the grid impacts? Distribution systems were never designed for large two-way flows. They were never designed to be bidirectional. So this whole notion of a two-way interactive distribution grid is quite radical. There are extensive studies being conducted to look at what happens when you suddenly burden a distribution grid with power flowing both ways that has varying characteristics.

One of the problems with DG [distributed generation] power is that the installations and the panels work, but the inverters tend to be junk. They're not very high quality. So suddenly if you have large clusters of solar photovoltaic producing power at varying frequencies and voltages all over the place it's very hard on the distribution grid? The presumption is that maintaining voltage infrequency remains the utility's job. It's expensive. It's difficult. The utilities are not exactly sure how you do it at very high levels.

EV charging and step changes are problematic. If you look at the Tesla electric vehicle, it's admittedly the most extreme, but when it's being charged, it consumes the power of about six typical homes. It is not the same as adding an air conditioner, although there are parallels obviously.

The utilities are trying to determine if they will charge hot, or charge slower? At very high levels, 480 volts? Or house current, 120? If there are high concentrations of EVs charging at very high consumption, the current distribution transformers will not accommodate them. These are questions facing major utilities that are looking at high levels of smart grid implementation. Many utilities are upsizing distribution transformers, scaling up distribution systems as they go forward, in part by retrofitting aging infrastructure so that they preempt some of the earliest problems.

These actions won't be adequate to handle the ultimate penetration of these vehicles and this

DG. Broader penetration will be both expensive and messy. One of the problems on the utility side, which is largely ignored in policy debates, is if they have to change large quantities of distribution infrastructure, they have the problem of the resources and the direct costs and also the problem of the outages to take to dig up streets and take down poles. So that's got to be considered in the debate, too.

There's wide variability in EV [electric vehicle] penetration forecasts. For 2020 the low case is down at 180,000 vehicles and the high case is at a million. For all the scenarios, the next three or four years are fairly mild, and then it ramps up steeply. Those first years are the prep time to get ready for the onslaught. It may be that this is too conservative a slide. By 2020, there might be as many as 10 million intelligent devices linked to the grid, providing sensing information. I think that's too low now. It's going to be twice that.

So what do we need to realize this smarter grid, particularly on the distribution level? There's nothing too surprising. It's the confluence of all these things needed that's a bit scary. They include communicating and intelligent plug-in electric vehicles, energy storage that's cost effective, both at bulk transmission and at the distribution level in order to smooth intermittency, re-architecting systems to enable a two-way interactive grid.

Right now we are herding cats, folks. There's no common understanding of standards for compatibility, both backward compatibility with trillions of dollars worldwide of invested architecture, or with going forward compatibility. Everybody right now is still in that early stage, as we saw with cell phones and computers. The mentality is "I have mine. It's better than yours. And I won't tell you about it." The result is that utilities end up being forced to commit to one particular vendor. That is a scary proposition as technology is evolving. Many folks are investing a tremendous amount of effort in the development of standards for plug and play compatibility for smart grid devices. If they don't get there, they don't solve this problem.

This is only enabled because of advances in both computing and communication. If there isn't ubiquitous high bandwidth communication,

none of it works. It's also got to be secure. Everyone is afraid of the bogeyman, which is cyber attack. There will be a relentless focus on security as we go forward. There is a concern for a workforce that is digitally competent. Currently it is an all male workforce that has basically been trained to climb wooden sticks in the ground with metal hooks on their feet. In the future they are going to be asked to be competent in a massively complex network of network applications. That's going to be a challenge.

The policy vision is that significant value can be achieved through this bidirectional flow of both information and electricity over a smart grid that enables customer participation. That's the Holy Grail. There are three key issues. One, the engineering economics: who pays and what are the priorities? Two, the grid as an increasingly complex network of networks, how is that all going to work? Three, how do you convert the grid from a simple and unidirectional system into something that can support what a trillion micro-transactions per day market, dynamic operations, with 20 million potential agents, all by 2020?

Finally, the big question is who pays? Energy, like much of the economy, is predicated on a massive network of policy driven cross subsidies, from progressive taxation all the way down to baseline rates, low income rates and conservation-driven rates. Ultimately, how much of this burden of creating this new interactive two-way distribution and broader grid will be borne through socialization of the costs? How much will be borne by causation? This is an enormous question.

In California, decoupling removed some of the significant barriers to DG because the utilities are not adversely affected by having people put distributed generation in. Rural electrification never would have happened without socializing of the costs. We would still have vast pockets of people without electricity. Socialization also occurred with the introduction of widespread air conditioning, which doubled the load of many homes when it went in, flat screen TVs, mansionization and home upgrades in neighborhoods. These things were gracefully integrated and socialized for the most part. This time, the scale may be very different and the

process may be significantly less graceful. Do the same rules ultimately work?

Smart Grid is certainly a trendy place to be but it will be a long journey. Personal computing, cell phones, and the internet all have 30, 25, and 20 year histories respectively now and they still have significant issues going forward. There's going to be evolution and there will be mistakes. We have to establish policy principles and technical principles that will maintain reliability and safety in the face of all these demands.

*Question:* During the presentation, you said that standards for plug and play are being developed. Is that one utility in California, the state or all the utilities working together?

*Speaker 1:* It's actually all of the above, which should scare you. If good collaboration doesn't emerge, then we'll have multiple sets of standards, and betamax will lose and VHS will win, and we'll do that all over again. The creation of national standards is critically important and utilities are certainly taking action there. They are doing the really unglamorous slog work of trying to come up with standards and fight through all the proprietary stuff that goes with multiple vendors. They want standards that are both backward compatible and forward looking.

*Question:* Quick question about socialization. My neighbor wants to get a Tesla [very high demand electric car], no one else has one in the surrounding four counties. The utility has to come out and put in a big transformer. Is that the kind of cost you're talking about?

*Speaker 1:* That is absolutely one of them. Changing the transformer can be a big deal. I don't mean to sound melodramatic but it's not just changing a pole because the transformer is larger, or upgrading the conductor. If 3-4 people have Tesla's it might imply changing protection equipment and even transformers back at the substation that supplies the neighborhood. The cost now is not 10 or 50 thousand but into several hundred thousand dollars in cost to accommodate those 1-4 customers. To what degree should that be socialized? Should someone say get a Prius, it doesn't cause those problems? That's a tough policy issue.

## **Speaker 2.**

I'm going to focus on the electric vehicle side of it, including some discussion of New York City. This is primarily Con Edison territory – about six hundred square miles, 3.2 million customers. It's a very dense service territory, about 235 megawatts per square miles. In Manhattan this is over 2,000 megawatts per square mile.

Most utilities agree that the smart grid is really the entire system looking from the supply side, generation, all the way down to the consumption. It's all three aspects, far more than the sexy smart meters. For utilities it includes a lot of technology like distribution automation, and much of it hidden in generation, transmission, and the substation boxes.

Smart meters are really a communication device, a little microprocessor. It can allow integration on the renewable energy front, whether it be storage, photovoltaics, integrating with customers' load management systems for demand response. However, there can be problems with this vision. Potentially one of the more disruptive issues could be plug-in electric vehicles. If the end goal is carbon reduction, electric vehicles make a whole lot of sense. U.S. households have a 90% vehicle ownership rate but in New York City it is 46%, about 23% in Manhattan. Electric Vehicle impact won't be as strong in the city.

The low, mid, and high curves get as high as 230,000 vehicles by 2018. They've attempted to assess the impact of electric vehicles charging on the standard daily demand curve on a system-wide level. Depending on when people charge, the peak load increases could be dramatically affected. A 10% increase to peak load is manageable, but other scenarios, based on expected commuter based charging times could be very problematic. People will charge when they arrive at work and they park. On their way home, after they reach home in the afternoons, they'll charge again. The utilities expect to see the worst impact on the grid in two separate peaks with peak increases of up to 25%. That's significant.

Obviously they'd love to be able to manage that such that the charging occurs completely off-peak when they've got capacity in the system.

However that is probably not practical. Somewhere in-between is more likely possible, i.e. with half of the charging occurring during commuter peaks and the other half occurring overnight. In the absence of smart charging, they have to relieve substations by either building new or adding new capacity to the substations. That's a significant cost to the company and the rate payers.

It is worrisome, and clearly the utilities would want to influence charging times at least to some significant degree. Con Edison has focused a lot of their efforts on working with the manufacturers now, on the ground floor. They want to influence the smart charging technology with the auto companies. They are working with charging manufacturers, a lot of companies are interested in building charging infrastructure in the city. There's an attempt to help create designs that will create smart charging incentives.

The Electric Power Research Institute has been doing a lot of work in this area. There's a lot of discussion, pilot programs, and studies to try to understand how the vehicles would behave and how the customers would behave as well. It's helped the utilities start to understand what the impacts could be under different scenarios.

There are several questions and concerns. One concern is that the technology is still not mature – that goes for the vehicles, distributed generation, and the battery technology. There still isn't a standard for the plug. How do you meter the vehicle charging? When you go from one location and you drive outside the service territory, how is that going to be metered? Right now, if you visit a relative in a different service territory, or even within the service territory, that bill is paid by your host. If you own a Tesla, that could be significant cost. And I'm not sure Aunt Sally would be too happy to invite you over the next time.

Another concern is vehicle to grid. The storage in the vehicle battery is storage. The ability to pump back into the grid when needed, like any other distributed generator, is theoretically possible. But that has to be fleshed out more and to see how it could be coordinated and better managed as well. Right now the battery technology is not there. It is not developed

enough to allow for this kind of sophisticated integration into the grid.

In New York City the grid itself is comprised of network protectors. These are switches or devices that are designed to prevent significant back feed up the system to the substation level. As they get more penetration of EVs and photovoltaics, wind, whatever the technology might be, they need to overcome that. It requires resetting a lot of the relays on the network protectors to accommodate that back feed. That compromises the protection system, because by its very design, it was designed not to allow significant back feeds. The technology is there to allow it to happen but there's a significant cost to do the retrofitting.

Another concern is that if charging time is spread to off-peaks then it reduces the amount of system maintenance. If the vehicles are charging during that time and the load curve now shoots up at that time, it impacts the ability to do work on the system. Further, the rating of the equipment – cables and underground transformers – is based on an assumption of what the cooling cycle would be. The equipment is designed for significant and regular cooling periods every 24 hours. If you no longer have that cooling cycle, one has to change the ratings of the equipment, or there's a significant loss of life now because it never cools down.

We need to influence off-peak charging by changing the rate design to go to time of use rates which we currently don't have in New York. EVs are here. They are coming. They aren't significant at this point. In the short-term, it's really going to be influenced by the type of rebates and subsidies one can get. Long-term, they will become more sustainable. The big question is the rate at which that occurs. I suspect it's going to be further down, beyond 2015 or so. There are challenges and opportunities in this but the key thing is to start addressing them proactively.

*Question:* Do the scenarios you discuss include an assessment of non New York City commuters coming into the city?

*Speaker 2:* Yes, they made some assumptions about commuters coming from out of state who would be charging in the city.

### Speaker 3.

I'll discuss these issues from a consumer perspective, residential consumers in particular. Distribution rates should be the sleepiest part of the business. They are the traditional natural monopoly that remains a monopoly and continues to be heavily regulated. Alternately, we have the ability as a society to use distribution rates as a tool for social policy, for economic policy, for environmental policy. Any region only has one distribution company and that means it provides one of the few universal tools that we still have as a society for accomplishing some goals.

Let me talk about Pennsylvania. They were one of the first states to go forward with smart meters on a universal basis. They passed a law last year in 2008 that made some changes regarding utility default service, energy efficiency, demand response, and also imposed a requirement on the utilities for smart meters in the next 15 years. This is all in the context of a deregulated market in Pennsylvania. Fifteen years was sort of a compromise. I think there were some people who wanted the utilities to do it tomorrow and some people who didn't want the utilities to do it at all. It's sooner for new construction or for consumers who request one.

The meters have to be capable of measuring customer usage on an hourly basis, communicating energy price information in real-time. The utilities must offer voluntary time of day and real-time pricing to all of their customers. The utilities are permitted to recover the cost of the smart meter programs, either through base rates or through a single issue reconcilable surcharge. Each has filed a smart meter plan and they vary a lot. Some of them take the full fifteen years. Some of them don't. Given the opportunity to recover the cost through an automatic adjustable surcharge, each has taken that option.

One company I want to talk about is Allegheny Power. Allegheny Power serves a large part of many fairly rural areas in southwestern Pennsylvania. They had very traditional hand-read meters up until now. They decided that under this law, they're going to replace all 725,000 of their meters between now and the end of 2014, and also install in-home display

devices in every single home of every customer, whether they ask for them or not. In addition, they want to redo their rudimentary information systems at a cost of \$580 million dollars to their Pennsylvania distribution customers. They're proposing a monthly customer surcharge that goes up about \$15 dollars a month by 2013. This means that they currently have a \$5 dollar a month customer charge that would go up by over 300%. Their current bill for a 500 kilowatt hour residential customer is about \$46 dollars a month. And yet they would add a \$15 dollar a month surcharge, raising those rates by 34%. Moreover, the monthly surcharge for individual residential customers would be as high as, or higher than the surcharge for large commercial and industrial customers. An old lady on welfare would pay the same \$15 per month increase as Penn State University.

Other utilities are not quite as dramatic, because they start off from a higher plane. They started off with smarter meters and smarter technology to begin with. Most of the companies are not proposing to do all this all at once like Allegheny. Still, 90% of the smart meter plans are being allocated on a per customer basis like this.

Consumer advocates have argued that while traditionally meter costs are allocated on a customer basis, these are not traditional meters. These are not traditional metering systems. The reason we're spending hundreds of millions of dollars to rip out perfectly usable meters that count kilowatt hours is because it will help customers reduce their energy, use energy more efficiently, and reduce their peak demands. A portion of the cost should be allocated on some sort of an energy and demand basis. This argument has been unsuccessful in Pennsylvania so far, it's pending before the commission. What about within a class? Some customers will use these meters; others won't. Most of the utilities are proposing that the cost be allocated universally to all customers through a monthly equal customer charge. An alternate proposal within the residential class is that the cost be allocated at least in part on a volumetric basis, because larger customers get much greater benefit than the smallest energy users. There's currently a bill, Act-129, that does allow for customers who want to get their meters sooner to call the utility for the meter. The question is,

what do they charge that customer? There are wildly different proposals. It ranges from \$16 to \$1300. Clearly, there's no rational way to deal with this yet.

Other costs can include the customer side of the meter. On the one hand, Allegheny wants to put in-home devices in every home. These could be smart thermostats or other types of devices that would indicate to the customer how much energy cost at any given point in time in addition to having the smart meter. Most are proposing that customer side of the meter costs should be the responsibility of the customer, with the hope that eventually a lot of these devices will be available at Radio Shack or Home Depot. You don't have to get those kind of devices from your utility. To the extent that improvements are made on the distribution network, at least so far, it appears that those costs are going to be allocated to all customers, even though some customers will benefit more than others. This is the opposite end of the question raised by speaker 1 where the utility side of the meter cost is hundreds of thousands of dollars because of 2 customers who have plug-in Teslas.

The goal in a traditional rate case is to make sure that the utility recovers its embedded costs in a fair and equitable manner. Rate design serves more purposes, including providing better pricing signals to customers, based more on marginal cost, not just embedded cost basis. The fixed cost versus variable cost has been occurring for 30 years. Now straight fixed variable costs are an issue again in the electric distribution side. The question is whether a utility recovers all its fixed costs through the customer charge, so the utility is never at risk. Obviously that's good for the utility. On the other hand, most consumer and conservation advocates would argue that that reduces the incentive for the individual customer to use energy more wisely.

Pennsylvania basically has rejected decoupling. Their Act-129 required utilities to implement energy efficiency and demand response programs and they are allowed to recover 100% of their cost through an automatic reconcilable clause. However, the legislature decided that cost does not include lost revenues from decreased revenues from conservation programs. Those costs can only be recovered in rate base

cases. Instead of providing incentives or decoupling, the Pennsylvania general assembly created penalties for companies that fail in these goals, \$1 million to \$20 million dollar penalties to utilities that don't meet their usage and peak demand reduction goals. This occurred because there was a strong backlash in Pennsylvania to a utility that tried to get decoupling a few years ago.

The Federal stimulus act includes a provision that in part gives Federal funding only for energy efficiency. That funding only goes to states that can assure the DOE that utility incentives are aligned with helping their customers use energy more efficiently. The question is, does the Federal stimulus act require decoupling in order to get this funding? Or would something like the penalty provision of Act-129 ensure that the Pennsylvania utilities' incentives are in line with those of their customers? Is it enough to have penalties for utilities that fail, rather than grant rewards to utilities who succeed?

Another policy concern is in the Waxman-Markey legislation on global warming. Under the law, the generators will effectively pay for allowances that they use. However, a large portion of funds go back to the distribution companies. Again, everyone has a regulated distribution company. So getting the money back to the regulated distribution company is a fairly logical way of making sure that benefits from those allowances go back to the rate payers. However, the legislation says they can't distribute the rebates solely on the quantity of electricity delivered to the rate payer. The rate rebates have to be provided via the fixed portion of rate payers' bills as a fixed credit. In other words, Waxman-Markey effectively rejects the concept of straight fixed variable rate design. It wants the variable rate to be the highest, and to include all the costs of carbon, so that the customer will see that. However the rebates will be returned via fixed cost. Is it more important to give conservation incentives to the utilities or to the customers?

One last point, does decoupling work in a restructured state like Pennsylvania, where the utilities, through their unregulated affiliates, make most of their money through sale of generation? One can take away the disincentive

to losing money based on distribution through decoupling. However, that doesn't take away the disincentive for a utility that sells a lot of energy at high market clearing prices through their affiliates.

Finally, how much do real customers really understand these issues? How much are we expecting from residential customers to respond to price signals, to respond to rate designs, to respond to smart metering? Customers know in Pennsylvania that when the rate caps come off, their rates are going way up. They understand that if they can conserve and use energy more efficiently, they can lower those bills. But very few customers are clear on other things that industry is expecting out of smart metering and rate design.

#### **Speaker 4.**

I'm going to try to anticipate some of the problems and challenges of the future, and some possible solutions. I'll focus in particular on the question of micro-grids. One future concern is the varying demands of customers for electricity quality and service. The quality of electricity can take on several different definitions. One is simply reliability. That is mundane but clearly important as the 2003 blackout demonstrated.

Another definition component would be resource adequacy, where we have a mix of resources to meet the demand fluctuations. An optimum mix of lowest cost and environmentally friendly generation.

A third would be power flow quality; certain types of power can be more refined and higher quality than other types of electricity. One aspect of power quality can include the micro-grid. It could be a potential solution to many things, but a lot of it is still speculation at this point. Some of the virtues include a generation mix that includes heat, where heat can be taken off for the purpose of industrial applications, or space heating. Storage is critically important. And I think it's far more palatable to think of it in terms of at the micro-grid level. It's also easier to calculate the marginal cost of power at the micro-grid level. Storage might make more sense at the micro-grid level than it would be at any larger level.

With a micro-grid, customers can be the owners. the extreme is a solar panel on top of a home, the investor is the customer. At a more general level, you could have joint investors that could use the generation within the micro-grid and the system. Or you could actually have a third party that comes in and provides the operational and physical nature of the grid. You could even have the EDU [Elec. distribution utility] operating the grid.

There's many variations. One can vary the load more simply within a micro-grid versus regular generation and delivered power. Micro-grids can vary depending upon the desired level of quality. For example, digital applications require high quality electricity. At the extreme, one could have a micro-grid that's completely direct current so that you don't have to rectify anything once it gets within the grid. For plug-in electric vehicles, the quality of electricity to charge a battery does not need to be high quality. A battery is in fact a rectifier to certain degrees.

The value of all this can be clearly demonstrated, and allows us to show the value of loss load. It shows that the value of loss load by different customer classes does exist. The value of loss load is clearly less to the residential customer than it would be to a very large manufacturer. It's possible to have micro-grids within a macro-grid. That's just your overall big distribution company, distribution grid. One micro-grid might be high quality, serving a large hospital, a university campus, or an industrial park. You could also have low quality micro-grid that serves a large parking areas where people can pull their cars into to get charged. In micro-grid number three, residential quality, it would be somewhere in-between, for appliances, televisions, washers, dryers, furnaces and so forth.

One could have more or less a breaker between each one of those. To some extent, an island, if the micro-grid wants to island itself from the macro-grid. That's one possibility. There are many variations by which the micro-grids would interact with the macro-grid. In part it depends on how much the micro-grids want to be isolated, and how much they want to rely upon the macro-grid. For example, the micro-grids could draw power from the macro-grid and refine it to some desired level. This could allow



for reduced quality power in the macro-grid. The macro-grids all have generally a uniform level of quality and there are certain tolerances with which they have to fit into with respect to voltages and frequency. By allowing slightly lowered tolerances in the macro-grid, because micro-grids could increase quality at a more local level, one could reduce the cost of the macro-grid in the long-run and impose those costs upon the micro-grids.

The micro-grids can either behave as a customer, and also generate. Clearly, this discussion on micro-grid is pretty broad and out there right now. There's not a whole lot of consensus. The most important one is whether the micro-grid is a public utility, or privately owned? Thus owned and operated by an investor group and their users? Or should it be regulated, and scrutinized by a commission?

There could be different issues with flows between the macro- and the micro-grids. Typically a micro-grid would be a low voltage system. And the overall macro-grid would be a high voltage system. Those issues would need to be addressed. Alternate suppliers. Will suppliers be able to enter a micro-grid and supply power? Of what quality? And how would that quality vary? And how would they get into the micro-grid itself? Could those within the grid opt in or opt out as the case may be?

The other issue would be investment dollars. What's it going to cost to do a micro-grid? If it's done by the EDU, I would expect the cost to capital to be somewhat less. If I was going to own and manage a micro-grid, I suspect the cost of capital would be very high. Whoever is operating these grids would have to have a certain level of managerial, technical, and financial expertise.

Clearly, if you're if you're an owner/operator or an investor/customer at the micro-grid level, you are at greater risk because of failure. If there is failure, the financial risk could be much, much higher. You may be dependent of course on the macro-grid. And that may be costly. There may be price implications, too.

At any rate, this does get us into the realm of the unknown right now. However, it's worthy of consideration, because a micro-grid does address

some of the problems and issues that we're going to have in the future. It will be both an engineering and economic problem to a great extent.

*Question:* For Speaker 3, was the specific additional charge to the Allegheny customers for their smart meter go on ad infinitum? Or is there a stopping point?

*Speaker 3:* Well it's still being fought. That charge was in place from 2010 to 2014. At the end of 2014, they don't know how much the rate will go down or whether it will stay the same.

*Question:* For Speaker 4, are there any serious discussions occurring regarding the micro-grid idea?

*Speaker 4:* No, it's really in its infancy.

*Question:* What are the associated costs with investing in this micro-grid system?

*Speaker 4:* No one knows yet because we don't have pilot projects. It will depend because there's so many variables built into this. What is the interaction with the entire distribution system, the nature of that? If the micro-grid is just purely a customer, that's one price. If they're an island onto themselves, then there'd be other pricing mechanisms.

*Question:* We heard that ACT-129 in Pennsylvania forbids revenue decoupling. Does the act specifically say that revenue decoupling is prohibited? Second, is there a prohibition against straight fixed variable rate design?

*Speaker 3:* The utilities are permitted to have a reconcilable, automatically recovered clause for all of their costs. However, it specifically excludes "decreased revenues of an electric distribution company, due to reduced energy consumption or changes in energy demand." It effectively bars decoupling between rate cases. Then the statute goes on to say that you can recover costs prospectively as part of your load forecast, as part of base rates. It does ban decoupling, but it does not ban straight fixed variable rate design.

*Question:* For speaker 1, we heard about the equivalence between a Tesla and six typical homes. What is that in kilowatts?

*Speaker 1:* About 19. So it's massive.

*Speaker 1:* Interestingly, a large utility has about 4,000 micro-grids. They're called distribution circuits. Because they each have unique characteristics, power quality demands. They tend to be sorted for sociological and economic reasons, into characteristic groups. One of the biggest problems as we look at this notion of micro-grids is that people don't aggregate together typically by the characteristics that we might need to make micro-grids efficient or useful. A typical circuit might have a hospital, a school, a thousand residences, and a tiny little electronics manufacturing plant. They could certainly be more efficiently organized.

*Speaker 4:* I don't doubt that at all.

*Question:* The micro-grid idea seems like it's going down a path that is inconsistent with where the rest of the country seems to be going right now. It seems inconsistent with more renewables and other intermittent resources that are remote that need to be accessed and brought into the system. How do micro-grids function in the 29 states with some form of an RPS mandate for renewables?

*Speaker 4:* I think they potentially could function quite well. The smaller and more contained your grid, the more you can arrive at a more optimum mix of resources, of inputs, of generation. Further, one would know at the margin what the cost of those inputs are so that you could vary them depending upon what your prospective loads are.

*Question:* This requires the micro-grid controller to make those decisions.

*Speaker 4:* That's correct.

*Question:* We can ask 4,000 distribution entities to do that, to make those decisions, as opposed to a single entity?

*Speaker 4:* It's up for grabs. The operator could be essentially operated from their central location, or more realistically, if it were built on

a greenfield site, each one could have his own operator. But again, that interaction can vary anywhere from a complete discrete owner/operator to one that's completely operated by the EDU. There are many possible models.

*Question:* In the New York city case studies do they look at sort of a half and half, half smart charge best case scenario, half worst case scenario?

*Speaker 2:* Yes. I didn't present all the different cases. This is just to kind of show the different extremes that one might get.

*Question:* In Pennsylvania, clearly there were lots of concerns or criticisms for Allegheny, the kind of \$15 dollar charge that we heard about. Are there better methods or best practices for cost allocation in smart metering?

*Speaker 3:* Yes. I presented the worst case scenario. The best case scenario was PPL [a Pennsylvania utility] which actually replaced their meters on their own initiative several years ago. They realized they could save a lot of money with smart meters on reading and outage management. They didn't ask for a surcharge. They just did it in the ordinary course of business and asked for it in their rate case. The net cost of improving their metering system was modest, I'd say in the tens of millions overall for the whole company. The rest of the companies are somewhere in-between. And they are gradually putting in meters. And the companies like PICO that got a \$200 million dollar ARRA bonus to put meters in are doing it more quickly.

*Question:* Clearly we don't want a tower of Babel, if you will, on smart grid standards. We've heard there are a bunch of different groups working on standards. Is there a leader out there propelling this? Can't a utility just say, well, we won't participate with a vendor unless they're going to be using some sort of open source standard out here? Or do we want the government doing this? Or is it better just to have a large group of stakeholders and let it emerge?

*Speaker 1:* Right now it's really sort of a public/private coalition of groups like NIST, DOE, EPRI, and IEEE. There are groups

representing the technical side and the public policy side all working fairly collaboratively with vendor groups on standards.

Now, many utilities do largely require open architecture on their smart metering. There were patents on some things which initially horrified the industry. Southern California Edison did this but then announced that the licenses to all their information would be available in perpetuity for no charge. One just had to send a request. They made it entirely open source. That's generally the way this should work to build that kind of architecture.

However, a utility requiring a particular standard will be unproductive if that standard isn't adopted by the other utilities in the region. At least on a regional basis, you've got to have sufficient standardization for interoperability, inter-communication. Now obviously one would like to have a national and a global basis to really get economies of scale and capture all the benefits.

*Question:* I have a couple of comments about the smart grid interoperability panel. It's a partnership that NIST created, and it includes almost 500 different organizations, some 1,400 individual volunteers working in a set of domain expert working groups and some 16 priority action plan working groups to coordinate the development of standards.

NIST published an interoperability roadmap that came out in January 2010. They've also published a draft strategy for cyber security that addresses privacy questions. They have formed an architecture committee, a testing and certification committee, a cyber security committee. There are lots of people working on this.

For folks in the room looking at these issues, are there gaps in that process that we're not doing today, number one? Number two, do you think that there is more that utilities should do? Only about ten percent of the organizations in the process are utilities. Three, what is the role of state regulators particularly given that the potential FERC jurisdiction under the energy independence and security act may be limited to transmission, and regional and wholesale power market related standards?

*Speaker 1:* Every utility of scale should play in this effort. As far as gaps go, and intervention, I hope this stays a public/private partnership. The worst thing that could happen here would be to have the imposition of the wrong standards through some sort of regional or Federal fiat. This has got to be driven by the best solutions. Utilities should be agnostic to vendors. The winning technologies have yet to be determined. We do need to keep an open mind and not lock in standards that will preclude potentially useful innovations in the near future. We want to let all of them flourish, and the winners will emerge.

I am concerned about backward compatibility. It's a lot easier to get it right going forward, than it is to get it right retrospectively. America's embedded electric infrastructure is so vast that we will effectively preclude smart grid from going into a lot of places for a lot of years if we don't thoroughly address the backward compatibility issue. It may mean that some of the new stuff will be clunkier than it could be on a going forward basis. That's just the price of admission to this dance.

*Question:* Would you give us an example of what you mean by backward compatibility?

*Speaker 1:* The industry has a design philosophy to create things that last a very long time, 40 years. There is a transformer right now at Bailey substation in California that has run essentially uninterrupted for 78 years. Our computer is obsolete in 3 years. There are electromechanical relays out there that are 40 years-old that operate just fine. Now, how do we interface those with the latest communicating and embedded sensing technologies instead of tearing them out? Because they're effective devices, and ultimately they should be replaced as part of their normal aging and replacement cycle. The industry cannot bear the monetary costs or the outage costs of broad scale replacement in order to upgrade that technology.

*Question:* I don't understand the underlying technology issues that give rise to this back feed and bilateral flow problem, except that they're there. How serious is this problem? We hear how we can draw power from the cars to go to the grid. Even simpler, one can vary the rate at which you're charging. So it's an increase in load, but you don't have to do it all this time. If

you reduce the charge rate, that's a substantial reduction in load, but it's not creating back feed or the bilateral flow problem. How much of the advantage of all of this smart grid stuff can we capture without having to confront the problem of the bilateral flow?

*Speaker 1:* Part of it depends on an underlying philosophical belief. This question came up in California with programmable remote thermostats, right? Is it OK to simply mandate charging protocols? Or do we send pricing signals and let rich people ignore them?

*Question:* What I was saying is that either way, one could implement that in a way where you've got a lot of the benefits and never had reverse flows. I think the industry could get a lot of benefits without having to deal with some of the more severe problems you've described.

*Speaker 1:* Some of your points are correct. For instance, vehicle to grid is much further down the road for a lot of technical reasons. Some of the reverse flow problems might be able to be addressed via rate design and consumer behavior. The problem here is distributed generation. As long as you're going to have significant penetration of rooftop solar cells, or neighborhood distributed generation, then you've got a reverse flow problem.

*Speaker 2:* Vehicle to grid is a separate problem, which may resolve itself eventually. How we coordinate distributed generation especially if it's clustered is a big problem. The network is designed to be unidirectional, right? Power flows from substations down to the customer. If we start pumping back into the system, it can compromise the protection in the system. It wasn't designed to accommodate reverse power flow. We can address these issues, but there's a cost to it. That's the concern.

*Question:* How does all of this impact real people? I have a mother-in-law who is an Allegheny rate payer, and she's 80 years-old on a low fixed income. There are three points that I'd like addressed. One is the obvious question of consumer education. What are either regulators or the companies doing on consumer education? The second and related point is, rather than rolling these things out to every home and every business, is there any thought of

doing it on a cost benefit basis, to get the greatest bang for the buck. My mother-in-law's very small home in the rural parts of the Allegheny Mountains isn't really going to save a whole lot of energy. Finally, has there been any consideration of a shared savings basis? Thus rather than have a charge, put the utility on the hook and allow them to share in the benefits. How do we ensure that real people accrue benefits, as opposed to this simply increasing costs?

*Speaker 3:* Consumer advocates struggle with this all the time. People compare the smart meter issues to the Internet. Oh, it's going to be like the Internet. However, the Internet changed all of our lives for the better. People want it. For people who are paying \$40 per month, paying a \$15 surcharge for this is really not going to add any benefit to their lives. It's not just consumer education. The value proposition for consumers is not always going to be there. The PPL replacement approach provided benefits to the company without significant costs to the customers. They got the meter reading and outage management benefits.

*Speaker 4:* I would say that consumer education is vital. Most people are clueless. They have enough decisions to make in a day without trying to decide how to set their meters and their thermostats. That's why the EDU should take over to some extent and do what it can. A beneficiary pay approach is unlikely, there's always going to be cross subsidies. I always thought straight fixed variable was excellent. It seems like Pennsylvania took a perverse approach to it.

*Question:* Are there any particular things that are critical path as opposed to a broader set of things that might evolve over a shorter timeframe? We've heard that broadband buildout is critical to the nation. Is there something similar here?

*Speaker 1:* On a Federal level there needs to be funding for a smart grid telecommunications infrastructure. For instance, a synchronous phasor measurement would have prevented the Northeast blackout had it been fully implemented. You need a lot of telecommunications power to do that. That is fundamental. Utilities are trying to keep options open, even with smart meters, so that they can

be changed or upgraded wherever possible to accommodate changing telecommunications infrastructure. No one knows if it will be 4G, WiMax, 5G? They just want the best infrastructure.

Important solutions are available in the market, but they're expensive. Imagine some sort of a centralized remedial action scheme, it's a big deal for maintaining the integrity of the system, particularly with intermittent power flows from renewable resources. It's got to be able to communicate hundreds of miles within cycles, and take action and receive confirmation. A utility can secure the necessary telecommunication infrastructure to do it, but it's time consuming and it's expensive. It's got to be easy and quick to ultimately enable the kind of robust control architecture that I described.

*Question:* So it's just the broad question of bandwidth and processing capacity for a variety of applications?

*Speaker 1:* Yeah, it's three legs to the stool. You're combining high power, easily available, low cost computing that can handle the volume of transactions we're talking about with ubiquitous high speed, high bandwidth communication. The third piece is advanced power electronics. You have to have all three of those working together to enable this.

*Question:* I'm amazed that Pennsylvania mandated meters. I'm concerned about cost effectiveness, and where the benefits are going to come from? Are we setting ourselves up for some kind of customer disaster backlash to spending all this money? All the studies that I've seen of the benefits show that 30-60 percent of the benefits have to come from innovation and rate design that's put in place with real customer response.

Second, the Pennsylvania law says every utility has to have a voluntary dynamic pricing. I would bet every major utility in the country has voluntary time of use rates and nobody's on them. Further, we don't need smart meters to implement time of use rates. If we're not willing to step up and say, we're going to change the way we price basic service, and it's all going to migrate to time of use. How do we ever make

these investments pay for themselves? How will it be a cost effective proposition if?

New York is putting progressively smaller and smaller customers on hourly pricing as a default service. It's a restructured state. Many states are doing this under regulation. Does the panel agree that a lot of the benefits have to come from doing more things with innovative pricing, but that if it's all going to be strictly voluntary participation for pricing then there's no way to get the benefits.

*Speaker 3:* It is a question for the regulators. The Pennsylvania law is pretty stunning, but it did give the utilities 15 years to do it. The idea was that over the course of the depreciation of the existing meters, they would gradually replace them with smart meters. Some of the companies have gotten too aggressive; how about tomorrow? Mandatory time of use pricing scares me to death, because it's very hard for people to understand, especially if it's really drastic, the kind of pricing one might think is necessary. The idea that we're telling an elderly person in north Philadelphia, turn off that air conditioner on the hottest day of the year; your health be damned. I'm not sure we're going to be able to get the kind of savings that might make these meters cost effective immediately.

*Speaker 4:* I think everything fails in the absence of time of day or dynamic pricing. It's got to be there. Electricity is one of those very few things you have no idea what you've spent and what your bill is going to be until you get it, a month later. It can be as simple as a meter that has a green, yellow, and red light. If it's red, don't do your wash. You can do it during your yellow light or a green light.

Duke in Ohio has a plan where If you accept a check for \$25 dollars, they'll install something a monitor on the air conditioner that will shut it down for a minute an hour during peaks. There are incredibly simple plans that can work with those uneducated consumers. It's interesting, I haven't seen time of use at the residential level, at any of the utilities I know of.

*Question:* I can give you some reports. An enormous number of them have voluntary rates. They're not marketed. Nobody's on them.

*Speaker 4:* Right. Well, they're not marketed. That's the key.

*Question:* Well, no, it's not just that. The worst is how they're designed. They are designed to be revenue neutral in such a way that it's really unattractive to the customer or really unattractive for the utility to market.

*Moderator:* There's several truths buried in all this. One, policymakers, regulators, and legislators are at peril if they get too far out in front of what the customer will accept. In Colorado they will adopt as appropriate, moving from today's two-part rate to inverted block rates, seasonal only. Whenever they are implemented the new tariffs will be basically aiming at the air conditioning load in the summer via inverted block rates. Their next step will be to use a fixed rate time of use for large residential customers. Presumably their usage is more elastic than the small users. It is folly to apply dynamic pricing to someone who uses 450 kilowatt hours a month.

Regulators can play this smart. There's interesting options that are developing for customer education. A new startup called OPOWER has a product where they mail a first class letter to customers quarterly. It gives them the analysis of their bill, comparing them to their neighbors. It's very popular. It's showing a pretty considerable reduction in energy use for the customers at a very low cost. This behavioral engineering is one of the least cost energy efficiency programs available to utilities right now. For a year before a rate change goes into effect, the same company will tell people what the rate impact is, they re-bill you essentially before and after the rate change. It sets up education on what the new rates will be, so customers can adjust usage.

Generally, I'm not a fan of dynamic pricing, per se. One can get a very large fraction of the benefit with fixed period time of use coupled with possibly critical peak pricing or something like that. These approaches are much more acceptable than pure exposure to the system for each customer at the residential level.

*Speaker 3:* Many non-regulated rural co-ops, for example, have had direct load control programs. These have been successful for years where they

just flip a switch and turn off your water heater. People don't even notice, and it's fine. There are a lot of things that can be done more simply where customers are not harmed, and they're willing to participate. Simply imposing mandatory dynamic pricing on customers today is scary.

*Speaker 4:* The political aspect overrides a lot of this stuff. Dynamic pricing would be a challenge in many respects. However, many folks have been getting in essence subsidized electricity. Those discounts began to go away last summer, which was no big deal until this winter hit. All of a sudden people's bills, all electric, go through the roof. The next thing is they're calling for hearings and resignations. These sorts of political issues convolute the process.

*Comment:* The politicians in New York have essentially eliminated time of use pricing for retail customers, by statute. We're getting help from the legislature on this key issue in the future.

*Question:* In a vacation home in central California the cost for electricity was \$470 dollars megawatt hour. The emergency generator, a ten to twelve thousand BTU unit, runs at \$130 or \$140 dollar power generation. These are not minor distortions in terms of getting the prices right. They are enormous. Collectively, there's enough people who respond to these kind of price signals – we have to face the pricing issues.

*Moderator:* Forty-seven cents a kilowatt hour, marginal rate?

*Question:* Yes.

*Comment:* Why aren't you home installing solar panels right now?

*Question:* Some people who discuss micro-grids take it a step further. They believe that with distributed generation, local windmills, solar, that they could disconnect from the grid and form a micro-market. They seem to think there's something valuable about that.

*Speaker 4:* Everything I've gathered about micro-grids is primarily about diesel generators

or natural gas-fired generators. That's the technology for immediate implementation.

*Speaker 1:* One to make that micro-grid seem really attractive is if they assume that the distribution utility will provide voltage, frequency, inertia, and backup power every time the micro-grid doesn't work, at no charge. Then the economics are phenomenal. I'm being a little sarcastic, but not too much because that is the assumption that some models have, and clearly it's unrealistic.

*Question:* I'm curious about what happens if the neighbor decides to buy a Tesla. The utility has to make some substantial neighborhood enhancements to accommodate that. How do they start assigning these costs? What does the utility do as a practical matter? Are they addressed on an individual customer basis?

*Speaker 1:* It's yet to be determined. Right now the utility obligation is to meet electrical demand, which means, de facto, they socialize the costs. It hasn't hit heavy yet. A good utility will set replacements to upsize and change the design standards to hopefully accommodate some sort of normal. Right now the answer is socialize, and a small group of consumers can impose extraordinary costs. In California, they have a regulatory proceeding going on to ask some of those questions. There's also studies going on currently to try to figure out what the costs are, and what the policy options could be.

*Moderator:* In Colorado they would welcome 19 kilowatt loads in the middle of the to take all the wind. So there's an impact way upstream with generation level. There are benefits there. They're cycling coal plants down to their lowest possible levels to accept two gigawatts of wind on the public service company, Colorado system. Having a load at night, which may be a battery during the day, that's actually icing on the cake. The real issue is what are the costs of doing it to get the benefits?

*Speaker 2:* On the supply level, there may be ample capacity at night. But again, as you drill down to the local level and you get clustering, then there could be significant impacts that have to be reviewed and planned for.

*Question:* There's some politicians who are saying don't do this, and other politicians who are going to mandates. At the same time, a lot of local utilities are not just distribution only; they're full service, vertically integrated utilities with an obligation to serve. How are they supposed to meet that obligation with all these uncertainties and all these different requirements?

*Speaker 4:* Normally, the politicians don't weigh in when it comes to things like time of day use. They're much more sensitive to environmental issues, like the renewables. Efficiency, they don't quite get that either. It's unlikely that we'll see much legislative action with direct orders.

*Question:* I'm concerned about socialization of costs. Has a big utility done a study of penetration of plug-ins or hybrids, and miles per gallon? At what point does the cost to the system for large penetration get to be too much?

*Speaker 1:* The question is how one sets the assumptions for the cost effectiveness study. It should show the true costs of serving that Tesla so that the decision a consumer makes is an economically rational one for them and for society. That is not happening now. In Europe they have a diesel SUV rental that gets 49 miles to the gallon and it is cheap. Here a hybrid is still not a cost effective choice.

*Question:* There are emerging claims by companies like Bloom Energy and others that technology is now arrived that would allow customers to disconnect entirely from the grid at a reasonable cost based on natural gas for fuel. Is this a real threat, especially if we're going to spend hundreds of billions or more bringing improvements to transmission and distribution with increased costs. Will new technology arrive and leave utility assets stranded?

*Speaker 1:* There's a lot of hype with fuel cells. It's not mature yet. Three or four breakthroughs are possible but they are down the road.

*Speaker 4:* If a Bloom Box comes to real fruition, there's your micro-grid right there. But I agree the technology needs more work.

*Question:* I don't want to underplay the concerns about having to upgrade the distribution

equipment. That's a really significant concern. However it seems like a utility could charge the Tesla customer for what it's going to cost. If there's such an obvious solution why can't we figure out how to do it? Much of this seems to come down to no longer socializing privatized capacity, and simply charging people the correct price for what they want. And I just don't get what the problem is in that respect.

*Speaker 4:* You're absolutely correct. You know, we've had low income programs for years. And all those are socialized. No one's ever blinked. A Tesla is \$140,000. For any regulator, any politician, it wouldn't be an issue whatsoever, correct?

*Speaker 1:* Well, one could have regulatory mechanisms to charge back based on causation, using sub-metering, which utilities will have for electric vehicles. That's something regulators could certainly do and it would be helpful.

*Moderator:* The theory of rate making is that customers in a class are more or less homogeneous in terms of the usage. Residential customers have more or less the same load factor and usage pattern. Charging on a kilowatt hour basis, while it may blur a lot of important economic distinctions, is seen to be relatively equitable. Now when you put somebody on the system who's got a 19 kilowatt load, and has the choice of charging the middle of the day or the middle of the night, that's qualitatively different, clearly.

Now, with dumb meters, nobody could measure instantaneous demand by residential customers. However, now it would be easy to say, anybody over 3,000 kilowatt hours a month goes on-demand energy. Averaging below that gets away from the grandmother problem, too, right?

*Question:* I'm puzzled by this conversation about mandatory dynamic pricing, optional dynamic pricing, and our decisions. Consider a different context. There's a lot of work in behavioral economics on default options and things like retirement programs. If you present people with a default which is not very good, and then they have to act to get something which is really good, most people take the default which is not very good.

Dynamic pricing plans should work. Some argue that people are too busy, and there's an opportunity cost associated with making these decisions that isn't worth the time. However, that just doesn't explain it. There's something psychological that's going on here, because this is really beneficial for consumers but they're not taking advantage of it. So I'm not sure where this all sits.

I want to separate those questions from the question of whether we subsidize residential, or we give them dynamic pricing. You either get the equivalent of New Jersey's basic energy service, or you're off the system and managing the pricing. Then the question is do you want to pay attention to dealing with the time variation or not, or just take the price on average without a subsidy? If the default price is like New Jersey, the constant price, and it's worth a lot to you to get off, you go to dynamic pricing.

*Comment:* I don't see where the subsidy comes in with respect to dynamic pricing.

*Question:* There is no subsidy in New Jersey. However, many people don't want to pay the \$15 subsidies in Allegheny. This is the average marginal cost debate, I'm trying to set that aside. But for people who are on marginal cost going forward, they can take the expected marginal cost and then stick to it for three years, or take the real marginal cost as it actually evolves and adapt on time of use rates. Let people choose.

*Speaker 3:* The New Jersey BGS rate is a flat rate though.

*Question:* Yes, but it's based on an auction where the people have to pay the future marginal cost going forward who are bidding in the auction.

*Speaker 3:* Right. Twenty-four hours a day and they don't have to go back and decide whether or not they can afford to turn an air conditioner. Based on how you set that rate, customers are no worse off, or they could be better off. I have no problem with that.

*Question:* So if that is the default and there is a dynamic pricing option, what have we lost?



*Speaker 3:* I think that could work.

*Question:* Well, what do we lose by doing it this way.

*Comment:* Do you not believe that customers on this flat rate will be making inefficient decisions in the heat of the day?

*Question:* Yes.

*Comment:* That's what you lose. The question is, how much of that efficiency could we obtain by having dynamic prices?

*Question:* Yes, what I'm trying to find out is there a huge benefit to be picked up, which is much larger than the cost of the meter? For instance, are the efficiency savings greater than \$15 per month? Or is there some psychological

barrier where people won't go and capture that benefit, even though it's a benefit for them? Which problem is it – a psychological behavioral problem? Or a problem that the economic benefit doesn't actually exist?

*Question:* Let me try to make an argument for partial socialization. The California Air Resources Board is trying to determine what the technologies are that can move us forward for greenhouse gases. The transportation sector is the single biggest nut to crack. It accounts for 40-45% of the GHG emissions in California. It's an integral part of the energy security issue, as well as greenhouse gas. Over time, these things have a tendency to pay themselves. There's a real and significant opportunity here that we need to move forward on – let the pricing issues work themselves out, but let's not lose the opportunity because of those concerns.

## **Session Two.**

### **Transmission Planning and Certain Surprises**

*The fate of proposed transmission projects has been a mixed story. The sponsors of projects would anticipate large benefits with great certainty. But some have been cancelled by their sponsors, or tied up in various controversies. Changing economic conditions can undermine the cost-benefit calculation. Differences in views about policy choices may drive differences in benefit definitions and calculations. Planning and approval protocols may be an obstacle for valuable projects and produce expensive delay that leads to cancellation. The allocation of costs and benefits may be driving disputes. Or traditional NIMBY objections may be the cause of project abandonment.*

*All these problems add to the uncertainty about the best or likely developments for investment in transmission infrastructure. What can be learned from recent cancellations or major delays? To what extent have these situations been the results of inherent uncertainty in deciding what is needed and when? How much follows from substantive policy disputes or systemic planning failures? How does, and how should, economic and regulatory uncertainty enter into the planning process?*

### **Speaker 1.**

FERC Order 2000 was really supposed to invigorate transmission planning and investment. But that doesn't seem to have really happened. Many transmissions projects, even those that are essentially perceived as good causes to further renewable resources, remain mired in controversy. I'll talk about issues I've seen in the New York Regional Interconnect project [NRI] and its proceeding before the New York Public Service Commission last year. I'll also look at projects in Virginia, and renewable generation projects and siting in the Southwest.

CAL-ISO's interconnection process is also worth examining.

I want to talk about some of the barriers to transmission development. The first is FERC itself. FERC provides incentives to develop independent transmission through higher rates of return, but then in some cases will penalize the same developers based on cost benefit tests. This is because a higher return obviously increases the revenue requirement. More recently, FERC cited with CAL-ISO regarding CAL-ISO's way of allocating transmission interconnection costs to Clipper Wind. Clipper Wind initially applied

for firm transmission capacity, which would mean they would be allocated more transmission costs. Then they changed their mind and said we're just energy only. CAL-ISO said they had committed to fixed transmission, and that's the rate they have to pay. So Clipper Wind withdrew its project in November.

FERC has decided not to deal with some of the super majority voting requirements in the NEISO governance structures. FERC doesn't seem able to address projects designed to increase access to renewables. Those projects really aren't needed for reliability purposes, per se and they're not going to lead to a lower cost of electricity if renewables are still higher cost generating resources. So somehow you have to justify the transmission based on other reasons.

The second barrier to transmission development are the existing transmission owners who control RTOs. And again, NEISO is a good example of the problem. Right now, they require a super majority vote of 80% of the load serving entities to approve a non-transmission owner proposal. It turns out the Con Ed, the largest load serving entity, has 21% of the vote. Con Ed really has effective veto power over non-LSE, non-transmission owner projects.

The other problem is it's almost impossible to justify a transmission line purely on economics alone, versus the energy benefits. Typically, the RTOs aren't pricing the value of reliability in their cost benefit calculations. They include reliability as a key issue, but they don't price it. Under NEISO's new congestion and resource integration study or CARIS plans, their process requires both passing a cost benefit test and a super majority vote. As NRI found out, that can be very difficult.

What was interesting about the NRI case is that to meet New York's renewable portfolio standard mandates, they have to have new transmission capacity. NRI was proposing to build transmission capacity from northern New York down to southeast New York where the load centers are. Same thing for the New York State energy plan. Yet oddly enough, the New York legislature voted to spend \$2 million dollars of taxpayer money to oppose the project. Also the New York PSC itself opposed building the project arguing that all one needed to do was

build new gas-fired combustion turbines in southeast New York. None of the opponents of the line even addressed the RPS requirements that were in fact one of the primary justifications for that line.

A third barrier is the RTO cost allocation processes. Cost allocation is typically based on one of two principles, either cost causation or beneficiary pays. There's nothing wrong with either approach in principle. However in practice, the generation queue process that most of the RTOs use can create winners and losers. The underlying problem is that transmission and interconnection costs are quite lumpy. So for example, CAL-ISO determined that two companies seeking to develop wind power in the La Rumorosa area of northern Mexico would have to pay over \$1 billion dollars in network upgrade costs. Essentially, CAL-ISO was saying you have to build a second sunrise power link. It's unlikely the first one will get built. Those projects have now been canceled.

Between October and December 2009, over 3,900 megawatts of wind power was withdrawn from CAL-ISO's generation queue. All but 125 megawatts of that had been listed as firm capacity. Another almost 16,000 megawatts of proposed solar generation, photovoltaic and solar thermal, was withdrawn from the queue in December alone. Two-thirds of that was firm capacity. The other was energy capacity. It seems if you're trying as a policy initiative to develop more renewable energy, then cost allocation policies like this are a very strong disincentive.

Another barrier is often the RTO transmission planning process itself. Essentially they have a one tool under their direct control and that is building new transmission capacity. The RTOs are charged with maintaining reliability, but they certainly cannot control development of any alternatives to transmission capacity. They can't own generation. They don't own demand response. They can certainly, they have markets for it. That was obviously a fundamental part of FERC's restructuring approach, which was to unbundle transmission and generation distribution. Unfortunately, in doing so, FERC introduced an inherent bias towards transmission solutions. And that bias necessarily drives RTO planning efforts, such as PJM's need for the trail

and the path projects. FERC has also made things worse by insisting that RTOs equate generation with demand response for capacity planning purposes, even though demand response does not actually have to meet the same requirements as generating resources.

What we have now is a renewables policy that is governed by a do-something approach, that isn't considering economics or engineering very well. Ideally one would want to analyze where the benefits of the RPS mandates themselves are cost effective. That would require identifying what RPS mandates are supposed to achieve. Are they supposed to achieve reductions in greenhouse gases? Are they supposed to reduce price volatility? Are they supposed to create green jobs or improve energy security? There's all sorts of things they could be identified as having those goals.

With clear goals, one could determine if an RPS is the best way of achieving those goals. Failing that, one can go about identifying the least cost ways of meeting the imposed RPS requirements. In doing so, one would have to treat RPS mandates like resource reliability and deliverability network upgrades as public goods and thus allocate all the costs of doing so to consumers within the RTO. It may also require that allowing RTOs to bid out construction and operation of generating plants so they can control generating resources as an alternative to just having the hammer of transmission.

*Question:* Why is it that if you build a line, and it decreases the price differential between the two points, why then is that no longer a financeable benefit?

*Speaker 1:* Once that price differential is gone, it's very hard for the transmission owner to essentially recover that cost – it's no longer there, it's no longer measurable.

*Question:* If it is based on private property rights like FTRs, that value is clear. If it is rate-based in some fashion, then it could be done by a before and after differential of the benefits to the consumers. So it's a question of which paradigm you're under.

*Moderator:* We can return to this question in the general question session.

## **Speaker 2.**

I'm going to talk about the regional transmission expansion planning process, RTEP, at PJM. The regional planning process is an ongoing process. It's done every year. It's a 15-year planning horizon. The concept of the planning process begins each year with a baseline reliability analysis. It considers both demand and generation resources that have committed as capacity in the footprint, the expected load forecast, the base set of transmission that's there and expected to be there for future years. That analysis then looks forward in time over the 15 years and determines if there is a reliability violation in that base system. These could be thermal, a voltage reactive problem or a stability problem. Once they've established that baseline, they look at the other items coming into the planning process, for instance generation interconnection requests. Obviously generation retirement can occur too. This sets the baseline for those evaluations.

Once those are set, if somebody wants to build a merchant transmission upgrade for instance, do a generation interconnection, look at a long-term transmission right request there is information for them. What would it take? What upgrade would I need pay for in order to get that right? That type of thing can be done once they've established a baseline.

Upgrades happen primarily because of the reliability trigger. There are two other triggers that could trigger an upgrade. One is a market efficiency analysis. This is a cost benefit overview to determine if there is a constraint that causes so much separation of locational prices, including separation in capacity prices? The difference in the cost of reliability between areas also contributes to that. A market efficiency upgrade could be triggered if the price of the upgrade is projected to be less over time than what it's costing to operate. It is a fairly high hurdle. It's fairly difficult to trigger. They just had a substantial market efficiency upgrade for the first time. Lastly, an upgrade can be required because of an operational problem. Even if they haven't triggered the bright line reliability upgrade or the market efficiency, if there is something that causes operational problems and makes it difficult to operate in a

certain area, they can request an upgrade for that. Those are the basics of the RTEP process.

Let's discuss some of their approved backbone projects and some of the uncertainties that they're facing. Essentially they had four recent major transmission upgrades that were approved by the board. They have TrAIL [Trans-Allegheny Interstate Line], which is already under construction, and will come into service in the Spring of 2011. It runs into the D.C. area. Then they have PATH [Potomac-Appalachian Transmission Highline], which is the longer line, coming from John Amos substation up into north of the Washington area. There's been some recent announcements on that one as far as the need may be deferred for a few years. Then the MAPP [Mid-Atlantic Power Pathway] line essentially goes across the Chesapeake Bay and up into the Delmarva Peninsula. That's another line that was approved. And again, there's been some issues with potential delay on that line, in terms of need. Then there's Susquehanna-Roseland which is in the northern part of Pennsylvania, going over into New Jersey. That line, again, is not being deferred. The need for that line continues. The reliability need has not moved. There are some challenges getting that line across the Delaware Water Gap that you may have read about.

They get as many as 125 interconnection requests in a year. They have to do studies for each of these. About 88% of them drop out after they come in. There's a lot of wind, just like everybody else but their wind is a little slower than others, as far as it getting interconnected.

Merchant transmission has been mostly focused up in the New Jersey into New York area. It caused tremendous uncertainty in some cases, where they would lock up the planning queue for some period of time and cause uncertainty because those projects had potentially big impacts. Big projects create a ripple effect through the entire analysis, similarly if and when they drop out. It changes the sequential nature, of the planning process. Further, they've had the reduction in load forecast because of the economic downturn although that's rebounding.

Penetration of demand response has increased dramatically. A lot locked in on a three-year forward basis in the last auction. There's also

concerns for at-risk generation. Most of this is because of concerns for environmental mitigation. Hopefully all this just demonstrates how much uncertainty they are dealing with in this process.

Demand response has been somewhat interesting. Prior to the 2012/2013 year, demand response did not have to lock in on a forward basis. It didn't have to commit three years forward and let us know that it would be there as a capacity resource. As of '12/'13, it was required to come in and commit forward. Once it committed forward, then it would be reflected in the planning process. That created a substantial change in the planning assumptions coming in.

Demand response as capacity is defined, the contract that they sign when they come into commit to this says they will be available to curtail up to ten times per year for a six-hour duration. So ten days a year, six-hour duration is their commitment. That means PJM couldn't call them eleven times. I guess they could, but it would be a favor. They would do it, not because of requirement but for reliability. The challenge is that as they get more and more demand response, the load shape would flatten, because DR looks like a peaking plant. At some point in the future, with enough committed DR, ten interruptions per year will not be sufficient for reliability. This will become a bigger uncertainty every year as they go forward. DR is going to have to evolve at some point. Future contracts may be based not on interruptions but rather on price.

I'll talk about specific challenges via two case study examples. The primary concern is uncertainty – there are sometimes big changes even within a year. Reliability criteria violations are a bright line, if you have a thermal overload you're projecting, and it's 99.9% of its rating, it is not a violation. If it's 100% or above, it is. And as you can imagine, if you see changes in load forecasts over years, the triggering event there could change just with a fairly small change in load forecast assumption or in demand response or in generation. You could have the need for a transmission line move year over year substantially. This is a problem. They need to deal with that issue of the bright line criteria.

They also have very stringent rules on when a generator wants to retire. They actually can't assume they're retired in the modelling until they actually give PJM paperwork that says they want to retire. At this point it's ninety days notice – it's not nearly enough.

Another piece are state siting proceedings, especially for transmission. Determining need and providing strong evidence for it is critical. The information is very transparent; everything in the analysis is out there for everybody to see. The fact that they have bright line criteria tests helps. Oftentimes, the in-service date has oscillated year over year. One year they need it in 2013. The next year they need it in 2016. They know they need it, but the exact commissioning date is not clear.

Let's discuss PATH. It was set up to resolve a fairly substantial number of overloads across the central Pennsylvania, Allegheny mountain region. The project already assumed the Trail line would be in place. That happened to be one of the better assumptions because Trail will actually be built. They needed this line based on the thermal problems coming by 2014. The line is designed to address significant and widespread thermal problems. A big line can come in and solve a multitude of problems that a few small lines can't.

Recent analysis that incorporated new demand response from the last capacity auction and the reduction in the load forecast. The line requirements moved by two years from 2014 to 2016. This meant that the developer had to withdraw the line and it will probably come back. One problem is that a line that is needed, then not needed, then needed again makes it even more unpopular. It will have to be built at some point to maintain reliability. The delays in implementation just make it more frustrating for everyone involved. The FERC bright line tests and no discretion make it difficult. Having a way to exercise judgment would improve the process extensively.

Similarly, the MAPP project had thermal and some reactive criteria violations, and originally was projected in service by 2013. It started as an AC line all the way through. Now it is actually DC light, and more controllable. Doing this meant that they could drop the part that goes

north out of Indian River up to Salem. The extra controllability helped them resolve the violations without building a second segment of the line. So that was all good stuff but now new demand response scenarios mean it will be delayed. Again, there's extensive uncertainty.

So clearly RTOs are dealing with a lot of challenges and a lot of uncertainty in the future. They probably need a zone of reasonableness or some type of test that isn't quite so bright, that allows them as a stakeholder body to exercise some judgment.

*Question:* Would you explain the notion of the interaction between your hypothetical zone of reasonableness and timing window, and how they work the capacity markets, and how it would all work together? There's an interaction.

*Speaker 2:* The way the capacity market structure works, given that it's a three-year forward, and most of these transmission lines are longer term than that. The capacity market depends heavily on having certainty about the major transmission topology that will be in place. It tells everyone how things will be addressed via transmission or via generation. Demand response being cleared in the capacity market is truly a success story. It is highly economic and it's great. However, it won't cancel the need for the line. It will defer it.

Having a dependable in-service date for transmission strengthens the capacity market signal. Transmission facility uncertainty simply creates uncertainty on the capacity side, so there are less dependable market signals. It's more than just a siting problem. It produces substantial uncertainty on the generation investment.

*Question:* Can you discuss the decision to make part of the Mapp line DC, what the advantages and disadvantages of that were?

*Speaker 2:* Well, the biggest advantage was that the environmental footprint in wetlands around that area was substantially reduced. Going underground was less intrusive also. Once they started looking at the controllability of the thing, when they have more control of what could flow into the peninsula, that also allowed other upgrades to be moderated, which helped justify

the extra cost of the DC. So in a nutshell, that was what drove it.

*Question:* You showed there's 18,000 megawatts at risk of retirement for environmental reasons. Is that 18,000 megawatts of people that have told the RTO that they are formally going to retire? Or that's just your sense of what's coming down the road?

*Speaker 2:* RTOs see a lot of data. That's based on PJM's assessment of what kind of megawatt amount is at risk. They are certainly talking to various stakeholders. NERC is also thinking of doing this more formally. There could be substantial numbers of units that can't make it.

*Moderator:* For unit retirements, PJM does not have the authority to make the units stay on. A retirement can put them into a significant reliability risk for a number of years until they get the upgrades in service.

*Speaker 2:* Having these units go away is not a bad thing but the uncertainty is. The demand response coming in can displace some of these units.

### **Speaker 3.**

I'm going to focus on the system in California. Much of that can be tied to renewable standards. They have the twenty percent by 2010, the 33% by 2020. Southern California Edison [SCE] is at 17% renewables as of last year.

The renewables will require a lot of large-scale transmission. The PUC study said that it would take about \$115 billion dollar in total investment across renewable generation, conventional backup generation, and transmission to get to 33%. Twelve billion of that is for transmission, and that means seven to eleven major transmission lines, of which there are actually two in development right now. SCE is targeting about \$5 billion dollars in transmission investment over the next five years, very extensive. About 3.3 billion can be tied in a direct way to renewables needs, with the balance being for reliability.

Let's get an overview of how transmission gets justified in California today, and a couple of

case studies. While constructing only takes about two to four years, the whole process in California takes seven to eleven years, with a lot of it being the siting and licensing piece. Siting and licensing is arguably the hardest part.

The transmission planning process considers upgrades in a variety of categories. One big category is anything that maintains system reliability. There are categories for economic efficiency. Another is for locational constrained resource interconnection facility which is renewables by a different name, and then a category for maintaining the feasibility of long-term CRRs [congestion revenue rights]. That's one big bucket for the transmission planning process that's run by the ISO.

A second big bucket is the large generation interconnection process. Here, generators show up and say, I want to be connected. Please identify what infrastructure is needed.

Note that it is sometimes hard to fit renewables into one of these categories in the first bucket. The ISO has recognized that there may be the need for yet another category, it's not quite economic, it's not quite reliability, but it's about interconnecting renewables in a sensible way. So the ISO put out a couple drafts that they're still revising.

There are two other things that are worth mentioning. One is the renewable energy transmission initiative, which works with a group of stakeholders who have broad market representation. It identifies areas with potential deep renewable resource potential, and what kind of transmission might be needed to serve and access those. There's also a relatively newer process, the California transmission planning group, which is a collection of system planners. They are putting together a more detailed plan of what transmission network improvements will be needed across California to meet renewables needs. That one's evolving right now.

I'll skip discussion of reliability because those needs are fairly clearly defined for everyone. With economics, I'll discuss the Devers-Palo Verde 2 line that started out as an economic project and then changed to an interconnection project with renewables driving a lot of its need.

A separate topic that's coming up in California right now and I think FERC has a proceeding to take a look at this question, is, what is the role of various transmission players as a new investment is considered? Take the ISO as an example, the transmission owners are the historical owners of that capacity. They are obligated to construct, own, finance, and maintain reliability projects. This ensures there is a group of players that are on the hook to build needed capacity.

In the case of economically driven projects, if it's a project that's approved by the CAL-ISO, there is the same PTO responsibility as project sponsor. There's also a separate track for merchant transmission facilities. There's now a growing number of independent players. However, they're not seeing too much merchant activity. By merchant, I mean a project that is willing to get its cost recovery from the market, through CRR value. Instead, California is seeing independently proposed projects that are looking for cost recovery through the transmission access charge. The utilities argue that as long as they continue to have an obligation to build whatever the ISO needs, then they should have right of first refusal, so they have a consistent portfolio of projects.

Now locationally constrained resource interconnection facility [LCRIF] projects are interesting. The ISO was able to acknowledge that there are cases that don't fit in the traditional types of transmission. There are two broad categories. First, network lines whose costs are recovered through the transmission access charge, and there are generation interconnection lines which are typically paid for upfront by the generator with refunding over the first five years of operations of the generation project. That works fine when the network is the big network, and the generation interconnection is typically a fairly short line that's pretty close to the network. When you're talking about a project like Tehachapi, a large wind area more than a hundred miles away, that is a really big gen-tie. The first generator that triggers the need for that \$2 billion dollar line is going to have one big upfront payment and there's no way they can finance it. So FERC here acknowledged that problem and approved the CAISO proposal. In this case at least FERC has acted to address the renewables and

transmission concern. The other category is CRRs which I'll skip because they are rare, and the process should be clear.

Let's discuss generation interconnection driven projects. Originally it was a serial process. Projects would enter the queue, studies would be conducted, and the project would be early in its development. It might or might not have a commitment, might not have a PPA with somebody to actually get it financed. If it didn't get built, then the next set of projects that were studied after it would need to get re-studied. This created a horrendous loop of analysis paralysis in the state.

The ISO made some reforms to create parallel processes to study projects in clusters. It also acknowledged that the the cost of entry into that queue was essentially zero. A developer could enter that queue and in some cases could clog that queue. The ISO also stepped up the amount of security postings needed to be put upfront in order to increase the hurdle rate for actually entering the queue. There was a drop in the number of queue requests in California for a reason – the rules changed, and for the good. The remaining projects are with players that are more committed to the process, that have stepped up their security, and that have indicated that they're there to stay. Literally there were hundreds of thousands of megawatts in projects in the queue that all required studies. They were triggering work for the ISO and others. It's approximately 40% of the prior amount now in the queue and that is much easier for planning. It's plenty enough for future generation, but not so much that it's overwhelming the system.

The Devers-Palo Verde 2 started, with SCE as the developer, as an economic project example, but morphed. It was a very economic project. In 2005, it had about \$460 million dollars in net benefit. And it would have been in service before the summer of last year. And you had the original project route, pretty picture, you know, basically got to Palo Verde. They went through approvals at the CAL-ISO, at the PUC, and through a number of Arizona siting bodies. The brakes came on in June of 2007 when the Arizona Corporation Commission denied approval, overturning the recommendation of the siting committee. They started working with Arizona stakeholders on different structures that

might increase the value to Arizona, but not unduly diminish the value to the California ratepayers who would have been the ones putting up the money for the project. They initiated a FERC backstop siting pre-filing process as well. However, this is a great example of where time is the enemy of projects, particularly economic projects. When they had come up with an approach that had a pretty reasonable chance of working for Arizona, circumstances had changed. The fundamental economic value of the line had changed significantly by 2009.

They could no longer support it in its original form as an economic project. There were four drivers. More renewable generation that was coming into the WEC for the high RPS targets in California. They had reduced load growth forecasts because of the economic downturn. There were a greater number of generator interconnection requests on the California side of the line, lessening the need for southwestern imports. Finally, they had a lower projected fuel differential between the prices at Palo Verde and the prices inside the CAL-ISO. The economics had been sucked out by time.

Now that doesn't mean that the project in Arizona is gone. They certainly will go through with this if the need for an Arizona portion of the project is established through a different mechanism, and also through the ISO's large generator interconnection process, given that there are still a couple thousand megawatts worth of interconnection requests on the Arizona side to connect into the CAL-ISO system. If the CAL-ISO determines that that Arizona portion or some part of it is needed for interconnection purposes, they can complete the Arizona portion but for right now it is suspended.

They have a revised plan at this point. It's the Devers to Colorado River project, which basically takes the California portion of the project, moves it forward, driven by interconnection requests. Many of those are renewable interconnection requests, which is why they shifted this project from the economic category to the renewable-driven category. However, this is not an LCRIF project which I'll describe with Tehachapi. It is an interconnection-driven project. The DPV 2

extension to Palo Verde, again, is on-hold until they see what happens with the LGIA process.

Let's consider the renewable process, known as the LCRIF process. The Tehachapi area has almost 5,000 megawatts of potential wind resources. There's also potential solar resources as well. The project is a \$2.1 billion dollar project, with eleven different segments to it. Three are done and the whole thing will be finished around 2015 and bringing the line up to 4,500 megawatts. There's a lot of activity in highly populated areas with neighbors and protests.

The case at the PUC was very heavily contested. The city of Chino Hills was the most active in their opposition to the project which requires putting in 220 towers in a currently unused right of way. FERC's support was developed via CAL-ISO – it's something like a trunk line so that the costs can be allocated pro rata amongst all the generators. This is a new approach and got the line built when in the past it would not have.

Let me close with some of the lessons. The hardest part of this is getting the licensing done and particularly the interaction with local communities. One has to make sure that the interests are aligned. In the case of Tehachapi, this is all about renewables. It's about the state meeting its ultimate 33% renewables target. One has to partner with regulators and the agencies. They are still independent bodies that will have to provide a thumbs up or thumbs down at the end of the day.

An example of what partnership means here includes environmental studies. The historical practice has been that a utility would do the environmental work, then the CPUC would redo it and waste 16 months of work. Now they combine that, while still preserving the control function that the regulators have.

Engaging the public early and often, is critical for support. On-ramps and off-ramps are really important. And so in the case of DPV 2, when they were working with Arizona, they worked out some benefits that could help them, though still paid for by California consumers and driven by benefits to California. It now provided benefits to Arizona as well. It helped, for



example, the state water project, and other access and resources they needed. Those on-ramps and off-ramps were critical to developing better in-state support.

*Question:* The characterization of the Devers line under the LCRIF is contingent on getting some number of megawatts approved. What are the distinguishing factors?

*Speaker 3:* DPV 2 is still clearly a network facility. That's the key distinction there. It falls neatly under the interconnection process. LCRIF is generally for resources whose field can't be moved, they are locationally constrained, and require a radial extension that normally would not be upfront funded under the transmission access charge.

With DPV 2, there's no issue here about whether it goes neatly into network. It's just the circumstances that determine that the line is clearly needed by the ISO. and we upfront fund it, you know, and generators don't have to do upfront funding on their side. That's not the issue. The issue now is just making sure that we've cleared a sufficient hurdle for the ISO to say, yup, the line is clearly needed, and the bar they've established is, once there's a sufficient number of megawatts with signed LGIAs, that's when the need gets triggered.

*Question:* Is the distinction then that the signed LGIAs [large generation interconnection agreement] on the Devers facility don't get prorated in the same way as the LCRIF?

*Speaker 3:* The ISO is shooting for about 1,030 megawatts of signed LGIAs on a line that has a 1,200 megawatt capacity increment. That is one way to get it justified at the ISO.

*Question:* But it winds up in the transmission access charge [TAC] as opposed to with the generator?

*Speaker 3:* Yes, directly in the TAC.

*Question:* What is it about DPV 2 that makes it so hard to get it done? Is it the interstate nature? And if so, how RTOs like PJM get it working? Is it about a multi-state RTO?

*Speaker 3:* At the end of the day they had interstate issues. The Arizona Corporation Commission was concerned that there was some negative impact to their customers. They chose to withhold approval in spite of all the supporting approvals that the structure had received. They were looking at it through one lens. Overall, including the benefits to generators in the state, I thought there was a strong case for Arizona benefits. Getting some more clear benefits for Arizona into the picture would have been helpful. Once they started working on that, it was clear they could not continue to pursue it given the economic changes that had occurred.

*Speaker 2:* PJM has had fairly dramatic reliability needs that drive multi-state cooperation. It doesn't hurt to have their more inter-regional look. However, mostly the reliability need was so dire. Extensive information and transparency is clearly critical, and the states were involved along the way. However, all those things are possible in the California case.

#### **Speaker 4.**

At a NARUC forum recently there was discussion of an 85% carbon reduction by 2050. The question from the audience was why don't you do planning out to 2050? The correct answers were that that's just too far out. You don't know the technologies. There's a lot of uncertainties. It's hard to go ten years out.

In 1970, if you tried to do a forty-year plan, what would it include? It would include of course a lot of load growth that would be met primarily by coal and nuclear generation. There wouldn't be any renewables or natural gas combined cycles. Even the ten- to twenty-year plans in 1970 turned out not to be very accurate. There were a lot of over-builds and other snafus.

Because of all the uncertainty in planning, the best low cost/low risk plan is to have a lot of fuel diversity. That is a useful underlying principle. With that, I'll talk about three transmission projects, from the perspective of planning, permitting, and cost allocation.

The first is the Southwest Intertie project [SWIP]. It's been around since the late 1980s. It's a single circuit, 500 KV, 500-mile line from Midpoint to El Dorado. The permits for 250 miles from the Ely area to Las Vegas are all in-hand and the planning's done. The last approval outstanding before construction is the cost allocation for that portion of the line.

Second, the Wyoming-Colorado Intertie project is a project that's also been around for a few years. It arose from the Rocky Mountain Area Transmission studies [RMAT]. It's a 180-mile, single circuit 345 KV line. There have been a variety of developers. It originated to bring low cost Wyoming wind resources to Colorado, to further the renewable goals there, and help diversify the portfolio. They worked with the local utility to coordinate the utility procurement with the transmission line subscription. It allowed generators in Wyoming to subscribe the capacity of the line, bid into the public service of Colorado RFP, and then if the bids were successful, secure the long-term transmission service agreement to deliver on that proposal. As it turns out, none of the Wyoming bids were selected in the RFP. And so currently, we're entertaining other offers. The current subscribers have not exercised their rights, because they weren't selected. It's still in the planning stages, but not moving forward with permitting until the cost recovery is more certain.

The third project is the Cross-Texas Transmission project. There's important lessons to be learned from what's happened in Texas for transmission planning in the Competitive Renewable Energy Zone [CREZ] process. It's still three years before the project's placed in service. Texas has the luxury of a single jurisdiction, and political support from the legislature to move forward with transmission to support renewables. The planning was an open stakeholder process. They identified candidate for competitive renewable energy zones, and ran studies to deliver varying amounts of generation, 12,000, 18,000, 21,000, and even 24,000 megawatts from the CREZs to load in Texas. They looked at 345 KV, 765 KV, and DC options. And also along with the transmission studies that were done by ERCOT, there were production cost studies that showed the different levels of wind provided as a benefit in each scenario. So there was a high benefit to cost

ratio, primarily from diversifying the Texas fuel mix, which is very natural gas heavy. Their commission in 2008 approved scenario two, a \$5 billion dollar transmission project. A second proceeding was the transmission service provider selection docket, where competitive bids were submitted. And ultimately, a number of transmission service developers and providers were selected. There are also dockets to make sure it's permitted and constructed in an orderly manner, and a financial commitment docket, where the commission was looking for assurances that the wind generation would actually get built and use the line.

The planning was done by ERCOT and the public utility commission. The permitting is still to come. The cost recovery is certain, with cost of service-based transmission rates.

The SWIP project I mentioned first, the planning and permitting is done. The cost recovery is the last remaining step. For the Wyoming-Colorado Intertie, the planning is done, but the permitting and cost recovery are both something that comes in the future. There's not any one size fits all approach for independent transmission development.

*Question:* Are these merchant transmission projects? Or are they trying to get some sort of a FERC-approved rate of return?

*Speaker 4:* There's a different approach for each. Cross-Texas is a regulated cost of service transmission service provider that will have rate base in Texas. Revenues will be collected through ERCOT. The Southwest Intertie project has a utility agreement, relatively complicated. There's two phases. And in the first phase, the utility will take all of the capacity in their state rate base. In the second phase, the developer and the utility will share capacity. The Wyoming-Colorado Intertie is currently strictly an open season approach.

*Question:* The question of the right of first refusal, whether or not transmission owners should have the right of first refusal was discussed. The reason why was so that the PTO [participating transmission operator] had a consistent portfolio of projects, as well as the fact that under certain circumstances the PTO is required to be the project sponsor. Can we hear

comments on that? I'm not entirely sure why that's a reason that gives the PTO an advantage over others.

*Speaker 3:* An independent that is not looking for recovery through the transmission access charge or a regulated rate of return. That's really a merchant project. However, a PTO has a different role in transmission. Under most ISO's FERC-approved tariffs, they have an outright obligation to build whatever the ISO deems needed in certain of the tariff categories, like reliability and some ISO-approved economic projects.

Thus, they have an obligation to reserve part of their balance sheet for building those projects. In California, the ISO has observed this historically as an associated right of first refusal. In essence, because the PTO is on the hook and reserving space on their balance sheets for investments it adds considerably to their uncertainty if they can have pieces of that taken away through separately proposed projects. Yet they are maintaining all sorts of ability and preparedness to address the projects if they are mandated by the ISO. It's not fair for the PTO to end up with the portfolio with all the high risk or difficult to permit projects, and all the less risky projects are cherry-picked by independents. I'm not sure how they would ever get a compensatory ROE to cover that structure.

If a PTO has an obligation to build whatever the ISO is deeming needed then they should have that right of first refusal. In one of the cycles of the CAL-ISO's proposed renewable energy transmission planning process, they said that the PTO gets that first refusal right but they also can't sit on it. They recognized that there has been a problem with the PTOs effectively blocking generation's access to market by using the right of first refusal to have veto power over transmission projects. In that CAL-ISO proposal, the PTO has about a 90-day period to exercise the right of first refusal, or get out of the way.

Then, if they get out of the way and no independent transmission arose to fill those shoes, the ISO could still come back and compel the PTO to exercise the obligation. At the end of the day, an ISO wants to have somebody on that hook. Again, if you're talking about a merchant

project, that's a different ballgame. There's been no independent proposals in California that have been truly merchant. They've all been looking for cost recovery through the access charge, and also cost recovery with additional benefits not available to utilities. For example, the PTOs have to maintain a 50/50 capitalization structure but an independent is allowed a cap structure with a much reduced equity contribution. There is still fundamental development risk on those projects but that risk is now being shifted over to customers implicitly, right? The independent transmission operator only has 20% equity. It's a fundamental risk transfer there.

A utility just doesn't want to be reserving \$5 billion dollars worth of balance sheet capacity when they may only need \$2 billion. And that \$2 billion is for portfolios with fundamentally higher risk.

*Speaker 4:* Independents would love to have the obligation to build. However, the merchant projects I discussed are outside an RTO area. In the RTO markets, I don't think a merchant transmission line makes sense when the competing line is going to be rate-based. To use the Sunrise line in southern California as an example, if SDG&E is rate-basing a line that's \$10 billion dollars from the Imperial Valley to bring in renewables, and a merchant were to propose a competing transmission line, generators would never subscribe to the merchant's capacity. It would never be successful.

In the RTO regions, an independent developer can demonstrate a project to be beneficial, construct it, and recover the cost the TAC. If there is a project that wasn't being sponsored by anyone, that the ISO would identify as a reliability project that hasn't been proposed by an independent, it makes sense for the incumbents to be the party to build that line. The one concern I have is for an independent to propose a line, it gets approved, and then taken away.

*Speaker 3:* California has a transition issue. They have a number of independent projects that have been proposed, and you have the ISO in the middle of clarifying rules and whatnot. To the extent that an independent project is selected under the ISO planning process, and it was won

under the existing tariff, and the utility had the right of first refusal, there are legitimate concerns. The proposal is developed with intellectual capital and value investment. There should not be some sort of taking by the PTO. There would need to be fair compensation.

The ISO has suggested partnering, looking at buyouts, and other opportunities. More than anything they need clarity in California. This is a hard problem to solve, right? FERC has acknowledged a role for independents. How this all gets reconciled is unknown but there's a lot more of this debate in the filings.

*Question:* We heard that renewable policies governed by a do-something approach and economic engineering are ill considered. CAL-ISO is considering new renewable energy transmission planning processes. How are they reconciling these issues.

*Speaker 3:* The fundamental issue is that you might have some transmission lines that are being driven by the need to interconnect renewables in order to satisfy a state renewable standard that don't fall neatly inside either a reliability line designation or an economic line designation. This is still an open question that the ISO is working on. They might end up with a planning process that starts with renewable need, identifies renewable areas, creates coherent kinds of responses for those renewable goals, and set up a tariff. They have to satisfy state standards. It has some analogies to the CREZ process in Texas, because they're identifying the generation areas. It's probably a bit more of a centralized planning approach in terms of the engineering side to how they draw the transmission lines required.

*Question:* Did I understand that PJM is going to forecast retirement of coal plants and take that into consideration in transmission planning? Is this appropriate for the RTO? It requires forecasting the price of electricity, coal, gas, as well as capacity prices and other policy outputs.

*Speaker 2:* I think you misunderstood. It would be inappropriate for the RTO to make such a firm decision. They do have to address bright line tests which say things will happen a certain way based on what has cleared in the markets and what the load forecasts are. The baseline

reliability analysis has to look at a family of scenarios. One of those should include what could happen on the generation retirement side. It's scenario planning. It is not something they could do a definitive analysis with.

*Question:* To clarify, they do baseline planning, and then a scenario that says, OK, there's a chance that generation will retire because of environmental issues, and that might accelerate the transmission line by a year?

*Speaker 2:* This approach may help soften the bright line. In other words, they could say, "OK, the bright line says the line now is delayed two years. But we looked at a family of scenarios, and more than fifty percent of the scenarios say it would come right back just two years later." It's a way to help moderate the volatility of the bright line test, not a way for the RTO to become the all-knowing forecaster of events.

*Question:* Had the Devers Palo Verde project been built, how would it have changed the approaches that the utilities are taking to events today? Would it have advantaged their rate base, disadvantaged their rate base? How is it in retrospect? Did it simply get torpedoed by political considerations in Arizona? What are the lessons learned from that very difficult exercise?

*Speaker 3:* The answer is a resounding yes, that line would have benefited the customers significantly had it been built as proposed on the timeline that it was proposed. The economics of that line were very front loaded. Most of the benefits accrued in the early years because of forecasts for excess capacity in Arizona, a large price differential between the Palo Verde and ISO markets. There were 4-5 years of those benefits. Some of the underlying forecasts changed prospectively. Load softened in California, was more generation built, etc. The delay introduced by the lack of regulatory approval shifted the online date by 2-4 years. The delays sucked out the highest benefit years of the line. There would have been no regrets if it had been put in place on the timeline. As a general rule, I don't know of any transmission lines built where anybody has regretted having them built. There's an inherent option value in them that probably doesn't get adequately captured, nor should it, in the regulatory process. You don't want to be gambling here. However,

there's an optionality to the lines that somehow always seems to pay off.

*Question:* There's a tremendous impetus to build transmission. The historical criteria don't necessarily allow some of the transmission that everyone feels should be built, especially with regard to renewables. Do we truly need this build-out of transmission? We've heard that demand response has delayed implementation of lines. There's the changing paradigm of smart grid and distributed generation. Should the planning process be adjusted?

*Speaker 2:* Lines that are merely delayed, get delayed. I'm hesitant to say, go ahead and wait another couple years because of the difficulty in actually getting them done. I'm talking about lines that have clear implications for reliability. Other lines would likely have moved forward had we not had the major shifts that we've seen

in the economy and other market responses. Some lines in PJM are now gone from the planning horizon. The need to build as much as we thought we would have needed two, three years ago, has definitely relaxed.

*Speaker 3:* The uncertainty in building the lines does create real challenge in terms of saying, if the need is deferred, can we plan so that it lands right on the month and the week that we think we'll need it? There's just so much uncertainty in the planning and the criteria that it's a dangerous game to play, both for transmission and for generation capacity.

Second, a robust planning process that creates good scenarios around load forecast, impact of demand response, impact of energy efficiency, can provide the confidence that you're not over-building. The beneficial or deferral impacts of some of these tools have to be addressed.

### **Session Three. Copenhagen Challenges for Climate Change Policy**

*The UN Climate Change Conference 2009 (COP 15) in Copenhagen produced less than the intended post-Kyoto framework. China and India offered up less than was hoped, but more than nothing. While the House of Representatives passed the Waxman-Markey bill last year, Copenhagen did nothing to move the Senate further along. The EPA is moving on its agenda. This may motivate some Congressional action, if only for fear of what EPA might do. In addition, a number of states have their own carbon reduction efforts. Will they now move forward more aggressively either out of principle, or out of a desire to stimulate action at the federal level? Conversely, given current economic circumstances, the meager results coming out of Copenhagen, and attacks on the works of some prominent proponents of carbon control, has the momentum on carbon controls been reduced? How does the added uncertainty play out in policy planning and investment decisions?*

#### **Moderator.**

The spectrum of views concerning Copenhagen ranges from the view that it was basically a train-wreck and the failure to get a comprehensive treaty was a serious blow to this whole process. That's one perspective. Of course, there were many who recognized ahead of time that getting a treaty out of Copenhagen was extremely unlikely and the question was what was really going to happen.

Bo Lidegaard, the Danish deputy minister for climate activities has argued that a lot more happened at Copenhagen than many people recognize, and maybe some very important

things, particularly in terms of getting the developing countries, particularly China, involved in the conversation, and recognizing the need for transparency. We'll hear from the speakers concerning their assessment of where Copenhagen takes us now.

#### **Speaker 1.**

I'm going to discuss practical consequences that emerged from Copenhagen. The last eight years have been solely about binding commitments, not just only what you do at home, but also a binding commitment globally. It was clear at Copenhagen that there is a strong awareness of

weakness in global governance. As an institution, the U.N. framework convention on climate change, as we've witnessed with Kyoto, has a fundamental question of enforcement. There are countries that have not been able to live up to targets. This was a big topic of conversation in Copenhagen. It's the question of metrics, and literally looking at enforcement. The discussion was focused on verifiability. To-date, that really hasn't been part of this process.

It's clear that climate change has become a top tier political issue. The President of the United States was there. There were heads of state from other countries, negotiating and talking about these issues. That was very different from many of the past meetings.

In terms of political trends in Congress, there were not really changes coming out of Copenhagen. The evaluation was fundamentally looking at what kind of commitments that China would be making. Both Republicans, Democrats, both sides of the aisle have concerns that they're not seeing this as a partnership. In order to have an effective global agreement, you can't only have some countries make commitments. A holistic approach is needed. Congress clearly felt that China is not doing enough.

Let me talk about process. There was a deficiency in the process. Many folks argue that the U.N. framework convention on climate change is just too unwieldy. They are looking for alternatives and two have emerged. One is the G20 forum, and the second is the major economies forum. That was an instrument that was used in the Bush Administration, and has been sustained in the Obama Administration.

In both cases, a core underpinning is to look at issues in a targeted way with countries that comprise the largest percentage of greenhouse gases. The resignation of Connie Hedegaard does send a signal that people are concerned about. Is it an abandonment of the process? It correlates with a frustration over the U.N. framework convention process. However, that is different from an unwillingness to address the issue.

It was significant that India recently stated their concern over G20, saying that negotiations

should always be in the U.N. framework convention. It must be global. They don't like the G20 as a forum. They are already laying a marker down.

Domestic politics are also a concern Washington is focused on health care, finance regulation and reform, and third, climate change. Even if there are those of us who would like to see this advance, I don't think that it's going to be as fast as originally anticipated. There are a lot of questions about cap and trade.

A few words about China and India, and specifically how they've evolved and where they're going. The good news about China and India is that they have evolved significantly. They are now significant players. During the U.N. framework convention meeting in Bali, both China and India emerged as big players. They played a major role in the language that emerged like measurable, verifiable, reportable. China had a lot to do with Yvo de Boer's literally walking off from the stage because they were protesting aspects of the procedures. India was a major push for hard verification. As major economies, they're key players in this issue. They finally have important and significant national plans.

The challenge going forward is how to really engage with them. India laid down the marker about the G20. China has laid down the marker about its sovereignty. These are going to be problems in moving forward and breaking down these barriers.

Let me end with a note of optimism. There is one trend from countries that are looking at themselves with bottom-up approaches, and national plans. That will help to bridge us with India and China and help us move forward.

## **Speaker 2.**

I'll be making some comments on the domestic climate change legislation, the bill that passed out of the House, the state of play with EPA efforts to regulate greenhouse gas emissions through the Clean Air Act, ongoing regional and state level efforts, comments on the Copenhagen accord and how it was received on Capitol Hill, and prospects for Senate action in 2010.

Let's discuss the major provisions in the comprehensive energy and climate bill that passed through the House. There are a renewable electricity standard, efficiency standards for buildings and appliances, transmission provisions, and a number of other complementary energy policies. For greenhouse gas regulation, there's a target of 17% below 2005 levels by 2020, and 83% by 2050. This is an economy-wide cap covering 86% of U.S. emissions. It is a very comprehensive climate cap and trade program.

The points of regulation for emissions through the supply chain in the U.S. phase in over time. In 2012, they capture about 66% of emissions by regulating petroleum at the refinery for all downstream and point source emissions at the refineries, and also electricity generation. In 2014, they add in major industrial sources, increasing coverage to 76%. And then in 2016, the coverage increases to 85% of the economy.

The auctioned allowances have revenues going back to low income folks, targeting the lowest quintile of earners in the U.S. in the early years. After 2025, a dividend check goes to the broader part of the economy. There's also proceeds to agencies for public benefit. This is largely deficit reduction, but also some transition assistance for workers and communities, all from auction proceeds. It includes domestic/international adaptation, allowances for heating assistance, and state allocations for efficiency and renewable energy. Another large portion of the pool is to prevent rate increases for electricity consumers, but also natural gas consumers.

For regulated entities, there are bonus allowances for carbon capture and storage, electric vehicle deployment, and R&D. There are also allowances to industry with no strings attached. It is for energy intensive trade exposed industries, steel, paper pulp, aluminum, merchant coal, long-term contract generators, and refineries.

There are a variety of pieces of legislation going through the Senate. The Cantwell-Collins bill is getting a growing amount of interest, but the targets are certainly insufficient to meet the 17% reduction that the President pledged the U.S. to in the Copenhagen accord.

Let's examine the Clean Air Act and what EPA is doing right now. In *Massachusetts versus EPA*, the Supreme Court ruled that greenhouse gas is an air pollutant under the Clean Air Act, and the EPA must determine if greenhouse gas is in fact a threat to public health and welfare. In December they finalized the endangerment finding. This has been challenged in court by the U.S. Chamber of Commerce, among others, although there are states of course on the other side in support.

This triggers regulatory measures under the Clean Air Act, the first of which is expected to be finalized in March, the auto standards, greenhouse gas emissions for vehicles. It also triggers regulations for stationary sources, and a range of other things. There could be other mobile sources, new source review, or a new source performance standard. These are the most likely route for stationary sources. National ambient air quality standards are less likely route, and so is the prevention of significant deterioration, PSD.

There is also a prospective tailoring rule which essentially would change the thresholds in the Clean Air Act to be better tailored for the greenhouse gas emissions. These are the thresholds from major sources. The tailoring rule is also likely to be challenged in court.

New source performance standards and PSD could regulate existing sources if there are major upgrades or any new sources. There are congressional efforts to prevent EPA from moving forward, and Murkowski's disapproval resolution with a large amount of bipartisan support. That number's higher than 40 now, and should get close to 50. It's part of a congressional review act which only requires 51 votes and there's bipartisan support, from some moderate Democrats.

In the House, there's some parallel bipartisan efforts to prevent the endangerment finding from triggering regulation. Much of this is political because it's an election year. The President would almost certainly veto anything that passed through the House and the Senate in this regard but that has political costs.

The Waxman-Markey bill has provisions that would have a similar effect, essentially taking

away the Clean Air Act authority but moving it to command and control regulations on existing sources, particularly covered sources. It would preserve some ability to regulate smaller sources that are outside the cap.

Recently, Senator Rockefeller and eight Democrats sent a letter to EPA asking for a delay in the endangerment finding. The EPA is open to raising the 25,000 ton threshold to some higher level, and delaying the coverage of stationary sources until the latter half of 2011. This is a significant development and suggests that the Murkowski's resolution is unlikely to pass. It provides some political cover for those who support Rockefeller's track.

Some thoughts on state and regional actions. There are several with climate action plans, and some states with climate action plans in progress. There's of course the regional greenhouse gas initiative in the northeast which took effect in January, 2009. The Western Climate initiative includes several Canadian provinces as well. This effort is on-track start in 2012. The Midwest greenhouse gas accord released a draft version of a model rule in 2009. All three regions are looking at ways to harmonize and possibly link the programs.

A couple of comments on the Copenhagen accord. The overriding objectives from the State Department was to respond to concerns on Capitol Hill regarding China. Is China going to also take action if we're going to take action? Will there be a way to check up on them? There are some provisions in the accord, paragraph five, for transparency. There is a requirement to report and review every two years – all supported actions but also pledges. They also wanted to avoid doing anything that would create a backlash and prevent the Senate from doing its work. These objectives were achieved sufficiently to the point that the ball is in the Senate's court. The UN process is still quite uncertain.

The Kerry-Boxer bill passed through the Senate Environmental and Public Works committee, with no Republicans present, and really the process stalled. This was not going anywhere for a number of reasons. Mostly it was very similar to the Waxman-Markey bill of course. The new opportunities for action comes first because the

President has indicated a renewed commitment to Senate action in the State of the Union. His 2011 budget reflects the commitment. There continues to be significant business engagement among USCAP and other business coalitions who are supporting taking action in a new advertising push. Senate action will come from Kerry, Graham, and Lieberman and doing everything they can to pull together a compromise package that can get to sixty votes. They've made a commitment in the framework that they outlined to achieve the 17% target by 2020, which is certainly important in terms of our international commitments. There are other energy measures, including offshore drilling, encouraging nuclear development, including a clean energy standard, which would be like a renewable energy standard, but nuclear could qualify. Other options include interest in a utility-only bill.

Here are some conclusions. Passing the House bill this summer was a major milestone. EPA regulations under the Clean Air Act are being developed. The states and regions are moving forward. Senate action is looking likely to spring but it's the big question mark. No matter what, we're going to see at least some regulations.

*Speaker 1:* Just to clarify, it is clear that there has been a commitment to transparency within Copenhagen and also with Bali.

### **Speaker 3.**

I'm going to talk a little bit about the politics, and public opinion. Those two things lead inevitably to the word challenges, and obstacles. The current state of the economy has really presented a ubiquitous challenge to policymakers in every sector of policymaking, but especially in environment and energy policy, where there tends to be a traditional give and take between what makes sense economically and what's good for the environment. Environmental groups are trying to come to the table with solutions that deliver the win/win of environmental protection and economic growth. U.S. CAP is a good example of that.

However, recently a couple of oil companies pulled out of U.S. CAP. A big reason for this is the fairly public discussion of bifurcating the



electricity sector and the oil sector in the regulation. As the rubber has hit the road, we're starting to see the fissures develop, in the business and the environmental community. There's a lot of different paths that we can go on from here. In terms of the state level action, even in California, things are tenuous. The Western Climate initiative market is not going to start in 2012 with the entire group of participants. It will probably be just California, New Mexico and a few of the Canadian provinces – that's still large. The roadblocks are the same at the national and the regional levels. There's a different level of capacity among these states and provinces to really start playing right away.

There's also an erosion of public support for and confidence in the scientific community. There have been controversies with Climategate at East Anglia and smaller ones with the California Air Resources Board. Very few people think that there's any question about whether climate change is real and manmade but there are doubts forming. There have been real hiccups in terms of their ability to deliver really iron-clad, scientific, and economic reports. A lot of that criticism is not particularly well-based in fact but it creates a fear factor and suspicion.

A good example was gentlemen who worked on the economic report on the air resources board rule on diesel trucks. One person really didn't get the degree that he said he got. Then the question becomes did he get the degree, not is the data good. One little thing that may not even be germane to the central issue serves as a tipping point to get things off in the wrong direction. There's been similar concerns for integrity with the emails in Britain. The UNFCCC has selected an independent panel to review the IPCC findings going forward, to try and improve perceived credibility.

With public opinion, there's a reduction in support for taking strong environmental action if it means job loss and increases in electricity bills and fuel costs. The challenge is that it needs to be framed as a transition, rather than a revolution. EDF, a significant environmental group, hired Frank Luntz, a Republican conservative message maker. He has done some polling for them and has basically said, stop talking about science and polar bears. Instead talk about a healthy future. Talk about the

outcomes. Talk about the vision for the future instead of the process for getting there. We've heard that cap and trade has started to arouse greater suspicion and uncertainty. First, it has the worst name of any policy ever. Particularly in an atmosphere where markets are not trusted and the economy is tenuous. If people don't trust wall Street and you introduce a complicated market-based policy there's some challenges.

We know that cap and trade programs have been successful with acid rain and getting lead out of gasoline. However, it was never talked about, they just did it. Now, we're so mired in the details of the process that people are forgetting about the outcomes. Cap and trade gets reductions quickly and at the least cost but we don't hear about that.

Without binding targets and without certainty, the Copenhagen accord dynamics, but also the EUETS, the European trading system all seem to have multiple potential paths forward for the future. The European carbon market had a pretty good allowance price for carbon a few years ago. But there were steady declines in 2008 and 2009. Now it's not clear whether EUETS is actually going to be able to link with other programs. This is a problem because the broader and more comprehensive they are, the better they work. That means the EU system may go solo and that has introduced multiple layers of uncertainty for investors and project developers.

Clearly the Administration feels like they have to really occupy middle ground and a very cautious approach. Skeptics in Washington about the Clean Air Act and way that EPA is moving forward have effectively framed this issue as, EPA wants to regulate your house. They've talked to farmers about EPA regulating each individual livestock that they own. That is sometimes known as cap and trade [Laughter].

The perception is that this is going to be an intrusive program, instead of something that acknowledges that greenhouse gases have a public health impact, and that they needed to be regulated under the Clean Air Act. It's about scaring people, and giving people the impression that this is another big government program.

In California the real political challenges are the low carbon fuel standard. It is the world's first

comprehensive low carbon fuel standard, part of AB-32, an early action item in the Global Warming Solutions Act. There's several lawsuits trying to derail that standard. They are similar to the lawsuits against the clean cars program, to question whether California has any right to regulate fuels at the state level.

Second, there is a potential initiative on the California State ballot in November that would suspend the Global Warming Solutions Act. All of the policies that California is developing to drive greenhouse gas reductions down to 1990 levels by 2020. It is serious and is probably based on public opinion research about how the public feels about clean energy policies and investment and healthy communities. Environmental groups believe they have a pretty good argument to defeat that initiative. However, the Wall Street Journal endorsed it for economic reasons. I would argue the key to economic growth is to put in place an innovative green economy that is stimulated by smart and strategic policies.

*Question:* On the Clean Air Act and the EPA moving forward, besides the scare tactics, is the Clean Air Act the appropriate tool to regulate greenhouse gas?

*Speaker 3:* That's a really complicated question. From a political perspective, it's necessary to pressure Congress to act. It is certainly appropriate given the endangerment finding to have EPA writing regulations that control greenhouse gas emissions, because they're a public health and endangerment threat. But it's not sufficient. For right now it's the appropriate tool.

#### **Speaker 4.**

I will focus on California. There is strong political will to continue with California's global climate change legislation. The governor is signing a bill on net energy metering on the rooftop of a Macy's store in Culver City today. This would raise the ceiling to five percent that utilities will have to pay a customer for their excess electricity on their solar. The utilities are enthusiastic about this.

In significant part due to Governor Schwarzenegger, who also was in Copenhagen, the state is undeterred in its pursuit of a more rational energy and environmental policy.

I believe there are a lot of positives that came out of Copenhagen. Certainly China made a bigger commitment than in the past to do things. Every day in China, not burdened by any CEQA or NEPA requirements, they're building high speed rail to Tibet at 16,000 feet or to Chengdu province from Shanghai. They will become the number one wind producer in the world, and soon probably the number one solar producer in the world, and they're making a renewed commitment to nuclear, they're going right ahead. They are moving faster than us in many ways.

California can serve as a model and help drive the debate by showing the viability of transitioning to a low carbon economy, and fostering next generation technologies. Energy efficiency is their number one priority, followed by demand response programs and renewables. The Governor has been a strong leader in this regard, ever since he signed an executive order on climate change in 2005. That set the stage for the adoption of the Global Warming Solutions Act, AB-32. They have to reduce to 1990 levels by 2020, and eighty percent below 1990 levels by 2050. They are ambitious goals.

They are developing a cap and trade program in California. The final regulations will be adopted later this year, to go into effect in 2012. It will happen regardless of whether the Western states do it or not. Some of those are less enthusiastic often because they are exporters. The Western Climate Initiative is not easy. Nonetheless, California's 80% reductions are not dependent at all on cap and trade. They're basically command and control programs. It's energy efficiency, renewable portfolio, standards. The low carbon fuel standard. It's light duty truck standards. It's sustainable forests. They expect to get their 80% reductions regardless of whether there is a national program as well. Even if AB-32 were repealed, and that's extremely unlikely, you would see many of these types of programs continue regardless. Similarly, we could see a lot of these achievements at a national level without a cap and trade regime. California does function as a leading regulatory trend-setter. Since the

mid-'70s it has been able to hold per capita electricity consumption stable per capita, while the nation has gone up 50%. If the nation had done what California's done over the past 30 years, we would have met the goals of Kyoto without ever having to build all these new coal plants. Further, they can bend the demand curve down and actually reduce per capita consumption. This will take aggressive leadership, and command and control programs.

There are Herculean challenges in climate change but there is spasmodic progress, all over the world. It's not coordinated enough. It's extremely frustrating when I look at DOE and some programs. A year ago, the President said we were going to weatherize 500,000 plus homes in the United States. GAO said last week that the program did about 4,000 in its first year. DOE sent out a press release, and corrected it to 22,000 – that's just not enough.

They have virtually no coal in the state. They do import some coal. Los Angeles is nearly 50% dependent on coal generation for its electricity, but it comes from Utah. They have a lot of petroleum coke that they export to Japan. It's used in steel mills in Japan, and comes back here in terms of air pollution in the Sierras. So they're very interested in carbon capture and sequestration nonetheless, because petroleum coke has the same chemical characteristics as coal. They hope to go forward in a project by turning that petroleum coke into hydrogen, using that in a power plant and sequestering the CO<sub>2</sub> in the ground in Kern County. The downside is that they're getting opposition and reluctance and bureaucratic foot-dragging from many of the same state agencies that nominally are supposed to be environmental leaders.

As one of the biggest economies in the world, with 38 million people here, it's clear that leaders in the state plan to move forward. This is regardless of the fits and starts on cap and trade, on climate legislation in Washington, and regardless of how one reads the outcome of Copenhagen and what succeeds it. It's a steady-as-you-go program that will de-carbonize the state. It's the future.

*Question:* There is a vehicle charging LIR coming out of the state. What's the relationship of that to the priority action plan on vehicles in

the NIST smart grid interoperability panel? Are they ahead of where NIST is?

*Speaker 4:* I don't know.

*Speaker 1:* From the international perspective, there have been California delegations at the different U.N. framework convention meetings. Other countries are looking very closely at what's happening on a state by state basis here, not just a national basis. It's part of an active discourse about the best models and test cases. State examples can be very helpful. Hawaii was a model for the countries of the Caribbean. The governor of Hawaii went to the Caribbean to discuss their efforts on renewable. Hawaii has the highest dependence on importing oil. There is a lot of useful things happening in the states.

*Question:* In your base reduction in carbon, did the state include that which is produced out of state but which they import?

*Speaker 4:* Yes. California adopted a low carbon standard; no long-term importation of coal in the future in or out of state. It's had some real impact. It may have had some impacts on the Western climate initiative.

*Question:* We've hear that the EPA endangerment finding is not the optimal way of regulating greenhouse gas emissions. However, it has this tremendous political advantage of being a political pressure tool in order to force the Congress to act. However, I'm worried that opponents will use the EPA process to delay serious regulation ad infinitum. Challenge and lawsuit and delay, delay, delay, delay, delay. It could become the excuse for Congress not to do anything. Any comments?

*Speaker 3:* Almost any policy is liable to go in the wrong direction if it's done badly. There is no substitute for an act of Congress that would mandate a cap on greenhouse gas emissions, no substitute. That is the preference. Politics is not the endpoint. It's the means to the end. The environmental groups are certainly paying attention to this concern.

*Speaker 2:* One way that this delay is playing out is the legislative process. On Capitol Hill, there's a huge amount of attention and time spent on the Murkowski amendment and the

Rockefeller proposal. The staff are working and trying to fend off very heavy lobbying pressure and political liabilities. There's defying the President on one side, or having constituents who are upset with you on the other. Those offices, as opposed to working constructively towards a bipartisan compromise with Kerry, Graham, and Lieberman, are spending most of their time, trying to fend off these other efforts. This could go for years.

The EPA has decades of experience and a history of protecting the public health and the environment, the air and water, using the Clean Air Act, and in a way that is mindful of business interests and the concerns of industry. That's what the tailoring rule is about, so that they aren't regulating hot dog stands instead of larger sources. There's talk of expanding the regulatory threshold to 100,000 tons of emissions per year. The EPA could end up doing an effective job if they ever get the chance.

*Question:* There was a discussion yesterday that the right decisions in this kind of environment tend to be maybe smaller scale, shorter-term, lower capital intensive, reflecting that kind of high risk. My impression is that's exactly the right conclusion. How do we meld this back into the decision processes that we've been talking about last couple days, and particularly transmission?

*Moderator:* The discussion yesterday was that if you knew what to do, you would build a really big transmission line between A and B because that's what you wanted to do. However, the problem is, we don't actually know. There's a lot of uncertainty about what's going to actually happen, and what the right technologies are going to be. The lesson from other contexts where you're making decisions with uncertainty is that when you have to make those decisions, small bites, try it and learn and adjust and recognizing that you're adjusting those.

Then when you get out there a few years later and you look back at what you did, well, you did the wrong thing. What you should have done is picked the winner. Right? But the problem is, that's ex-post thinking. No one can ever know what the winner is. The right thing to do is to have a series of things which are hedges.

So there's not uncertainty about whether or not there's a big problem with the climate, but uncertainty about what the technology should be that's going to meet it. As an example the conventional wisdom is that means much heavier weight on things like energy efficiency investments. They are incremental, inherently small-scale. Individually, collectively they could be a lot. One can expand them or contract them much more easily. This kind of approach would be biased against a massive transmission infrastructure buildout to link Midwest wind energy to the east coast. That might be a very good idea. But given the uncertainty, we just don't know and it could be a monumental waste of time.

*Question:* Yes. For the panel how does that come back into the discussion of transmission planning strategy in California for renewables. All these things feed back into the uncertainty. In the global climate change debate, how much of this incrementalism and hedging is going on in people's mind as they're negotiating strategies, putting in regulatory pieces, or setting time tables? Alternately, how much is about big projects and go ahead because we have to do certain things?

*Speaker 4:* California is pursuing a dual track policy. Their endorsement of energy efficiency and the billions of dollars for it is an example of that very point. They had decoupling 25 years ago and economic incentives to utilities to invest in energy efficiency.

They also have a loading order, a priority list. Energy efficiency is first and renewables and demand response follow that. Within the renewables category, they're also on a dual track. They're pursuing distributed generation as well as central station generation. There is greater certainty about the distributed generation in the short-term than central station. Let me juxtapose the two. They California solar initiative, which is 3,000 megawatts by 2017 of solar PV on rooftops, came in 2007. They have 500 megawatts already installed or contracted. They provide incentives to residential and commercial rate payers.

One of the utilities proposed a 500 megawatt project in addition to the CSI rooftop solar program on warehouse space in Riverside and

San Bernardino County. There's similar programs, and these are larger installations.

At the same time, they are approving transmission. The Sunrise line in 2008 for both geothermal and solar. The approval holdup is the U.S. Forest Service. The Tehachapi region line is moving forward. So is Devers. So it's a dual track approach.

*Question:* We've heard about charging stations for EVs. Better Place certainly envisages this as battery swapping. However, the initial implementations of this will be parking lots, perhaps in urban areas. Yesterday, there was a lot of discussion about the infrastructure issues of charging on-peak. My concern is low coal state charging on-peak versus off-peak is setting the state up to have higher greenhouse emissions than you would otherwise have to because folks will charge during the day in the parking lots. How do you reconcile that with the other natural policy, off-peak charging using wind? So how do you fit those together?

*Speaker 4:* The idea is to have options. There is a time-of-use that is much cheaper off-peak than it is on-peak. On-peak is 17 cents kilowatt hour and off-peak is six cents. Off-peak begins at 9:00 PM. They are looking at a lot more options as well to determine what will work best. Clearly we want to use cheap electricity off-peak.

*Question:* We heard that the Europeans' voice was muted somewhat in this last round. I know after Kyoto, they made some major structural changes in renewable energy structures. I was wondering if you could elaborate.

*Speaker 1:* In fairness, the Europeans have been doing a lot. The trading system works well now. Rather, the spotlight was on the United States and China for all the obvious reasons.

Second, although China has done a lot, it is still part of the G77 in the U.N. framework. There were small island states complaining, why is China still in this pool with us when it's not a Vanuatu or a Tuvalu.

The Europeans became somewhat marginalized in this context. In the past they've been very active and aggressive players. It's just more that

the onus was on the U.S. and China for leadership. If nothing is happening there, then Europe is slightly less important. Nonetheless, they are incredibly important players in this, and are arguably doing more than most.

*Question:* We've heard that people are taking seriously the idea of a utility-only bill for greenhouse gas emissions. This creates perverse economic results with plug-in electric vehicles. It creates a \$20 or \$30 dollar a ton penalty on electric vehicles. It would allow someone to drive a gasoline-powered SUV but have a penalty for driving a Prius.

*Speaker 2:* It's a serious concern. One idea is that the transportation fuels would be outside of the cap. Other major oil companies are proposing a linked fee, but it would be inside the cap. The market price for carbon that's determined through trading within the utility sector would be applied to fuels downstream. So if it's \$20 dollars a ton in electricity, it would be \$20 dollars a ton for emissions from your tailpipe reflected in the gas. That'd be about twenty cents a gallon or so. That's one way to solve the problem – it has to be addressed.

*Question:* What are the new source performance standards? Or more appropriately, what is the best available control technology [BACT]? There doesn't seem to be any commercially available control technology like we have for sulfur dioxide or nitrogen oxide emissions. The only thing that comes to my mind is either retiring a unit or re-powering a unit. If that's the approach, what happens to the existing units? If they're afraid to do maintenance because they might trigger new source review, they're going to run them into the ground. Forced outage rates go up because of non-maintenance. What will the EPA do with this, and how will they go forward if Congress doesn't act?

*Speaker 2:* These are great questions and the answers are not clear. I have no information on these issues.

*Question:* The environmental groups are pushing for the EPA rulemaking because it would put pressure on Congress to act. However opponents are getting very clever lawyers who are figuring out clever ways to legally attack any action by EPA to go down that path. Using the EPA

approach creates more opportunities for delay and litigation. Is this really a strategy?

*Speaker 2:* The environmental groups have pretty clever lawyers as well.

*Speaker 3:* The EPA strategy will not get us the reductions we need to stabilize our atmospheric amount of GHGs. However, in the absence of Congressional action, EPA moving forward and putting rules into place is a necessary complementary effort. It can provide an imperative.

Most of the things that have happened in this arena have already been litigated. California has faced lots of litigation and made lots of progress.

*Speaker 1:* These actions also add to the international context. The EPA administrator went to Copenhagen and spoke about this. A lot of countries were interested in it because it shows concrete steps. They they were very interested in the fact that the Administration took that path.

*Speaker 2:* This is a very tricky place to be for the Administration. Environmental groups view it as potentially risky. Their perspective is that the Administration is following the law. The Supreme Court handed them a ruling.

*Question:* Public opinion, at least nominally, drives Congressional action. On the one hand, we have Climate-gate. This has provoked increasing skepticism of global warming. On the other hand, there's emerging science that says, 450 parts per million isn't even going to be enough, we need 350 for real mitigation. That argument is not as strong as the general global warming science. However, there's no such thing as ironclad science. Scientific inquiry always involves uncertainty. We have to make public policy decisions with a certain level of uncertainty, and make the best decisions we can. Has there been a failure in coordination, in influence, and persuasion in creating positive approaches to global climate change? Can it be improved, rather than looking to the EPA?

*Speaker 3:* The uncertainty issue is an extremely good point. We can do a better job insisting that some action needs to be taken to stabilize the climate system. We need to make some

analogies about other areas in policymaking where we take dramatic action based on far less certainty that we have with climate change. Even if the range of impacts is in a lower tier of severity than what's generally anticipated, there's still a tremendous impetus to take action.

Ironclad in the context I used it was meant only in the eyes of the public, right? Ultimately you have to reach a certain threshold with the public before the science that underlies what you're doing becomes totally disreputable. We have to be mindful that the general public is concerned even if the scientific community doesn't feel that way, and most of the policymaking community doesn't feel that way.

*Question:* As follow-up, there's really strong survey data on climate scientists that show 87-93% of climate scientists are quite sure that anthropogenic global warming is occurring. There's no discussion of that particular issue, of that degree of certainty. So instead we see skeptics cherry picking certain problems with the data in a wide bank of material that the IPCC has looked at without discussing the fact that we're looking at an overall picture. The experts certainly seem to feel quite strongly that there's a lot of certainty there but that message hasn't gone out to the public. I'm not sure why.

*Speaker 3:* The media is strangely committed to balanced reporting on this particular issue, meaning that even if there are 99 who feel one way, and one who feels the other way, that most media leaves the impression that there is still a great degree of debate on that issue. It's clear that the media has played a big role in fomenting the uncertainty back to more like a 50/50, rather than 95 and 5.

*Speaker 1:* There was the question of whether ClimateGate would have an impact on Copenhagen. Was there going to be a debate or a discussion during the proceedings? It did not happen. There was only one country that raised it, and it was Saudi Arabia during the proceedings. So it didn't affect Copenhagen.

*Speaker 2:* The Climate-gate emails, and god help me if anybody ever got a hold of the past fifteen years of my own emails, are clearly political. For the scientists, the question is really not whether or not humans are causing climate

change, but how much. The other big question is what's going to happen in the future? Obviously we can't answer the future question. Clearly it's an incredibly complex system.

*Moderator:* There's another issue here that comes up in dealing with the uncertainty of impacts. There's an enormous debate that's been going on, particularly led by the work of Marty Weitzman at Harvard. If you think about policies when we're uncertain about the outcomes. It depends on how you characterize that uncertainty. If you characterize it using standard, normal distributions, then the implication for policy is not that you should do nothing when you're confronted with uncertainty, but do a little bit less than you would do otherwise. But you should definitely do something and get started soon, because you want to collect the information.

If you characterize uncertainty as having fat distribution tails. In other words unusual events have higher probability than they're supposed to. This is the one in a thousand year financial meltdown that we have every 50 years, then there's something going on that we don't fully understand. We haven't characterized it, mostly because of the things we haven't thought of. That has the opposite direction because of the asymmetry of the effects. If you have a really bad thing and it has dramatic effects on sea levels, it's much worse than the benefits that you would end up with if a miracle works. The miracle is a technology which is cheaper than coal that doesn't produce CO<sub>2</sub>. That would be a terrific outcome. You know, it's on the other end of the spectrum. Weitzman shows there's an asymmetry in terms of the benefits and cost of this. The implication is that a quite significant increase in the caution that you take should occur. You should take far greater precautions than you would otherwise. His analysis is very robust, and it has not seeped into the policy discussions.

*Question:* I am intrigued by the suggestion that you re-brand the issue. Do environmentalists have a plan to re-brand it and focus less on the science and the facts, which are so debated, and most citizens are very confused about, and more on the future?

Second, we heard about a lack of alignment on incremental steps at the Federal government level, whether it's a transmission line or a solar project. There is a lack of coordination between Federal agencies. Is there any fix for this?

*Speaker 2:* In terms of branding, groups win a lot of these battles on the brand that they create. That's why I try to get my colleagues to think from that perspective. It's about leading with what the outcome of the policy is, not leading with what the policy instrument is. It's not about creating a cap and trade program; it's about creating healthier communities. No one understands cap and trade, and no one opposes healthy communities. Why would someone ever say cap and trade if you could say healthy communities?

It has more to do with the 30-second elevator speech about why you're doing it. The way to bring people into the conversation is to talk about their air and water, is to talk about their children, it's to talk about how easy it is to live their life – things like how much mass transit access they have, how inexpensive the bills that they pay are. Those are all non-process but rather outcome-oriented things.

They have started it but it's slow going. This is why framing in the public domain is so complicated, right? People that don't want to do stuff want to frame it around the complex, contentious issues. Sometimes it's about who is yelling the loudest. It's public information to look at Frank Luntz's analysis on the new language. It's called the language of the new energy economy. It's about this type of framing about outcomes.

*Speaker 4:* California started out with the air resources board and strict emission controls before anyone ever talked about climate change. It was a public health issue and that was enough to compel very serious action. As a general rule it hasn't been about partisanship, rather it's been about industry sector. The auto industry and others have fought every single one of these things. And yet California has done it and now they've become national standards.

In Beijing today the air is basically unbreathable, almost. As they create a middle class, and there's couple hundred million out of

a 1.3 billion Chinese now live in the coastal zone and the strip up to Beijing. Their affluence is increasing. They will come to appreciate the other values, clean water, clean air, and so forth. That is as compelling an argument for the Chinese to reduce their emissions, because it's internal. The question is whether it happens at the pace necessary before we get to 450 or 500 or 550 parts per million.

The problem of silos and coordination in government is very difficult. One thing I do believe is that we need a Cabinet Secretary of Energy. We need fifty people whose only job is to make sure permits get done. It's a managerial challenge of the first order.

*Speaker 2:* On messaging, the Kerry Graham Lieberman effort was kicked off with an op-ed by Graham and Kerry. That was followed up during the Copenhagen talks with a four-page framework which was slightly more heavy on policy than the op-ed, but really just more framing and messaging. Here they wrote down the titles of each of the sections. Better jobs, cleaner air, securing energy independence, protecting consumers, ensuring a future for coal. All of these things are really what a good bill should be able to accomplish. We need to focus on those and try to re-message and reframe the debate and the discussion.

*Question:* Is it a good idea to do a sector-specific cap program? It can get done earlier than 2014 or 2015, which is cap and trade date. There is leakage or friction with the other regulated bubbles. One is electric vehicles as we heard, especially since carbon intensity is 25% that of gasoline. It's less even if coal is being used to generate the electricity.

The other area is space conditioning water heating. There's a long standing competition between natural gas and fuel oil and electricity for those purposes. If we could patch those holes, we could feasibly do electric sector only. Is this a feasible approach?

*Speaker 2:* On the positive side, we need to get started. If this is what it takes to get started, so be it. With that said, utility only captures only about 40% of emissions. It won't get to the 17% target that the President has signed in Copenhagen. Second, it doesn't solve all of the

political or economic problems. Energy consumers range from residents to commercial to farming community to industry and trade exposed industries who use a lot of electricity and still will have the carbon cost reflected in their rates. There won't be just leakage between sectors in the U.S., but international carbon leakage and loss of jobs from those sectors potentially. In Waxman-Markey, there was a large number of allowances set aside specifically for those trade exposed energy intensive industries to insulate them from that concern.

*Speaker 3:* An economy-wide cap is much better. There is a lot of value in programs at the sectoral level to drive down emissions and to inspire technology deployments. In order to really make a cap work to drive down global emissions, it needs to be economy-wide.

*Question:* My thinking is to have the electric sector as the start point, and we would expect transportation and other fixed and mobile sources to follow. Having electricity start would remove much of the policy uncertainty for transmission lines, a gas plant, solar plant, or long-term investments. It would help the industry a lot ironically.

*Speaker 1:* Internationally, sectoral approaches was a very hot topic. It was on the table two years ago. It is a way forward but it has a lot of tradeoffs and it hasn't been formally pursued yet.

*Speaker 4:* If we choose one sector it may stop there. There are rate impacts. Some of the biggest reductions in greenhouse gases come from vehicle and building standards. We need a more integrated approach, even if it takes another year or two.

*Question:* Do concerns over budget deficits have any bearing on climate change proposals. We heard the cap and dividend proposal by Collins-Cantwell was gaining steam. It is most if not a hundred percent auction. It is a double-edged sword in that it could lead to deficit reductions, but at the same time, could be construed as a tax. What is the impact of these proposals?

*Speaker 2:* Cantwell-Collins is a hundred percent auction and 75% of the auction revenue would go for dividend checks back to individual



citizens. If you have a large family, you get more checks. I'm not sure that's the most efficient way of sending the revenue back to the population but it's popular and simple. The 25% of allowances that are not given back are subject to annual appropriations. It would be deficit neutral, and that is appropriate. They'll have a big problem getting coal state and manufacturing state Democrats to support something like that.

*Speaker 3:* Well, on the branding issue, there's tremendous irony, because cap and trade is an economically efficient policy. It provides much more flexibility than direct command and control regulations in terms of what businesses are able to do under that sort of a program. People forget that at the end of the day, the American public is paying for this program, regardless of how you slice up the pie, and it would be better to have a more efficient, flexible program. A lot of people would prefer a big auction, because the eyes light up when they think about the pet projects that could be funded. The allocation of allowances to LDCs is better because they're in the best position to return value to their customers, rate payers.

It's funny because people complain that cap and trade is too expensive but full command and control program costs more. Doing nothing costs infinitely more.

*Question:* The problem with cap and trade is it's too complex and it's easy to become suspicious of things that are too complicated, because things go wrong that we don't foresee. We have all kinds of interesting technologies out there, and there are opportunities to invest in infrastructure and jobs. If cap and trade goes away, what can we do with other programs?

*Speaker 3:* Well, we need that cap to be in place. If we do policies in a siloed approach then we're not achieving the ultimate outcome. Consider an example. If there's a Federal transmission policy before a cap on emissions, then there's serious problems about resource access to the grid. With a cap the whole process is much more logical. Alternate types of Federal policy intervention

would not have the kind of robustness and certainty associated with them that cap and trade provides.

Complexity is a problem. Waxman-Markey is the Christmas tree approach to governance. A simpler approach would be to have a good component of it as a straight dividend. That would be better and less complex.

*Speaker 4:* The best investment anybody could make is in energy efficiency. The return is greater than its cost. A Federal program, much greater than what's been contemplated, on energy efficiency is a no-brainer. In California the energy commission is sitting on over \$200 million dollars for energy efficiency programs that it got last year and hasn't spent a penny yet. Government agencies have to be more proactive in this regard. We should use utilities if we have to. At least they know how to employ people in the community for an energy efficiency program. They can go door to door, and put in weatherization programs and they all save money. Ultimately they reduce CO2 emissions. They're efficient. They reduce customers' bills. It can be a win/win/win/win/win. We need much much more of that. That's number one.

Number two, a big commitment to renewables. They have the appearance of a higher cost. However, if price increases are more or less in line with CPI, people could tolerate it without rebellion. Both of these will also create jobs effectively.

*Speaker 2:* Waxman-Markey is way more complex in the levels, as you drill down. It was put together as part of a political process. However, there really were and are good public purposes and good policy justifications for a lot of the way that was structured and designed. Nothing like this has ever been done and that's part of what's going on. Ultimately a big cap on carbon economy wide is the key.

*Speaker 1:* From the international side energy efficiency is just as important. It's economically beneficial, provides jobs, and helps the environment.