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ADVANCED COAL WORKSHOP FOR WEST COAST COMMISSIONS:

IGCC Technology, CO2 Sequestration
and Policy Directions

May 24, 2006
Sheraton Portland Airport Hotel

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MR. BEYER: Good morning, I'm Lee Beyer. I'm the chairman of the Oregon Public Utility Commission, and I'd like to welcome you to Oregon -- those of you who don't live here. I hope you enjoy your stay with us. This is the first of what we hope will be a number of joint meetings between the West Coast commissions.

This event was put together by the Oregon, Washington, and California commissions because we share a common goal of developing clean energy resources to meet our electricity needs for the future. We welcome our colleagues from the other western commissions that are here with us today and hope that -- and these -- excuse me -- they've been working with us in forums like this and with the Western Governors Association to develop policies that will accelerate the adoption of clean energy resources. I think we have 11 commissioners here, and I think I'd like to let each of them introduce themselves so that the audience knows who they are. I'll start with my colleague, John Savage.

MR. SAVAGE: John Savage, Oregon Commission.

MS. BYRNES: Mary Byrnes, Wyoming Commission.

MR. BAUM: Ray Baum, Oregon Commission.

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MS. GRUENEICH: Dian Grueneich, California Commission.

MR. JONES: Phillip Jones, Washington Utilities and Transportation Commission.

MS. CHONG: Rachelle Chong, California Commission.
MR. MARKS: Jason Marks, New Mexico Public Regulations Commission.
MR. PEEVEY: Michael Peevey, California Commission.
MR. OSHIE: Pat Oshie, Washington Commission.
MR. BEYER: Okay. The purpose of our workshop today is to better understand the policies and the technologies that can make coal a clean energy choice, with the inclusion of carbon capture and sequestration -- and I even said that word right.
This workshop came about as a result of the West Coast Governors Global Warming Initiative. The governors of our three states began this work in 2003 because of a serious concern about the consequences of greenhouse gas emissions for our economy and for the environment.
Through their initiative, the governors directed the states to do three things: (1) To develop joint policy recommendations for activities

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that require regional cooperation in action; (2) to develop strategies to reduce greenhouse gas emissions and adapt to a changing climate; and (3) to work together to achieve greenhouse gas reductions that are greater than any state could achieve on its own.
Among these achievements so far, all three states have adopted greenhouse gas standards for new cars and trucks, and they've also adopted appliance energy standards for products not covered by federal rules.
I want to thank my fellow commissioners and their staffs for helping us put this workshop together today. Special thanks to commissioners Dian Grueneich and Pat Oshie -- Dian of California PUC and Pat of the Washington Utilities & Transportation Commission -- and Commissioner John Savage on the Oregon Commission. They really were the ones who conceived the workshop and did the real thoughtful work to put the thing together.
And, of course, behind all policy folks there's a team of staff who really do the hard work and hard lifting to do the logistics, and I want to recognize them, too. Lainie Motamedi -- I'm going to say this -- Motamedi -- thank you, Dian -- of

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the California Commission; Nicholas Garcia of the Washington Commission; and Lisa Schwartz and Cherie Zastoupil of the Oregon Commission.
And we need to pay a special thanks to the Energy Foundation for providing financial support for this event today and, of course, to the speakers who you'll hear from as we go through the day.
Again, the intent is to make us all a whole lot

smarter about coal and effective use and clean use of that.

Okay. A few details before we get into the nuts and bolts of the panel. If you haven't availed yourself of the breakfast that's outside, it's there, and it will be there through the first break. Our intent is to break for lunch at about 11:45 this morning. We'll also have a refreshment break in the afternoon.

More nuts and bolts -- if you haven't found them yet, the restrooms are sort of out the door to the right. Lunch is out that way in a room down the hallway a little bit. Most importantly, if you haven't turned off or silenced your cell phones, now would be a really good time to do that.

Okay. If you review the agenda, we actually

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have set this up into three particular panels. The first panel we're going to do this morning is to hear from the three western states and Bill Keese from the Governors Association about policy options that the states already have underway. I'm going to moderate that panel.

This afternoon we're going to have -- the first one will be on IGCC Technology and Commercialization, which Commissioner Oshie will moderate.

And, finally, the panel on CO2 Capture and Sequestration Opportunities, Commissioner Grueneich will moderate.

Our intent is we'll let the panelists go straight through and do that, and at the end of each panel, we'll then provide an opportunity for questions and some moderate discussion on the panels.

At the end of the panels or at the end of the day -- about 3:45 today -- we can open it up for public comments for those who feel a need to make a public statement about our discussion today.

So, as we go through these, I'd encourage you to jot down your questions so that we don't lose any of them as we get to the end.

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Okay. I'm going to turn it over now to my two fellow commissioners for a couple of short opening remarks. President Michael Peevey will be the first to comment. Michael has served on the California Commission since 2002 and was appointed president of the Commission shortly after his arrival there. Before coming to the Commission, Mr. Peevey was President of the New Energies, which was then the nation's largest energy service provider. Before that he was the president of Edison International and Southern California Edison. He also serves on a number of boards for corporations and nonprofits.

Commissioner Pat Oshie has served on the

Washington Commission since 2001. Before that Mr. Oshie was a partner in his Yakima law firm, specializing in federal Indian and environmental law. In the late 1980s, Pat served as the Assistant Seattle City Attorney and before that as Assistant Attorney General in Utah, representing the Division of Public Utilities and the Committee for Consumer Services and for the Utah Commission.

And, as I said, after the introductory comments, we'll get back and get into the policy debates. So now I'll turn it over to President Peevey.

MR. PEEVEY: Good morning, everybody. Greetings from California. It looks like there are plenty of Californians here -- even people as far away as Houston and elsewhere.

I think today is the beginning of an important conversation for our region in these three western states -- the three so-called Left Coast States. I'm glad we have representatives from not only there, but from many other -- several other states here in the West so we can have a worthwhile discussion about advanced coal and its place in the energy futures of California, Oregon, and Washington -- and throughout the West, for that matter.

As I'm sure all of you know, with the exception of a few small coal generators, we don't have any coal-fired plants in California. We do import plenty from other states. Upwards of 20 percent of our energy supply is coal by wire.

So our perspective on this -- which I'll amplify in a moment -- bringing new coal-fired power -- if we're going to do that in California, we want it as clean as possible, both in terms of conventional pollutants and CO2 emissions.

Why? Because we take the global warning issue extremely seriously. Our governor has been a leader of this -- Governor Schwarzenegger -- and he set very ambitious goals for reductions in greenhouse gas emissions. By the year 2010 it's supposed to be back to the year 2000 level emissions. By 2020 he set the goal of being at the 1990 level, and by 2050 he set the goal of 80 percent reduction, which is very, very significant.

Now, not all of us in this room will be around in 2050 to see if we'll achieve that goal, but there's a few of you that will. So keep that in mind.

My agency, the PUC, is looking forward to limiting greenhouse gas emissions resulting from putting limits on the companies we regulate. With actions occurring not only here in California and in the Western states -- the coastal states here -- but also the Northeast states, the RGI states. I

think it's only a matter of time -- in fact, I'm sure it's only a matter of time before we have federal standards limiting greenhouse gas emissions.

As utilities and independent power producers start thinking about the next generation of coal

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plants, they need to be thinking about the types of technology we will be talking about today. It's proven from both an investor's standpoint and from a rate-payer perspective.

So now let me give you just a little bit of background on the California Energy Policy. Many of you in the room know it already, but in 2003 the California Energy Commission, the Public Utilities Commission, and other major state agencies got together -- something called the California Power Authority in existence at that time -- and we created something called the Energy Action Plan for California, and that plan was updated again in the fall of last year -- Energy Action Plan 2, which is a document which will be made available to you today here for those that are not familiar with it.

What it does is set forth what we call in the document a loading order, but which is simply a priority list of how we want to go about developing resources in the future. No. 1 on our list is energy efficiency. We strongly believe that the best investment one can make -- and I am speaking as an economist and feel very close to this -- that is, investing as much as you can in energy efficiency.

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Last year we approved a $2 billion expansion in the utility energy efficiency programs for this year and the next two years. California has been very successful in energy efficiency programs over the past 30 years. We have held per capita electricity consumption stable -- stable -- while the nation has gone up 50 percent. That's a rather dramatic statistic in and of itself, and if the nation, as a whole, had met the kind of California standards over the last 30 years, we would be consuming a heck of a lot less of a lot of different things and a lot less pollution into the air.

Energy efficiency is No. 1. No. 2 is our renewable portfolio standard. Statute by statute, the electric utilities, the investor-run electric utilities are supposed to get 20 percent of their electricity from renewables by 2017, but we, as policy in the Energy Action Plan 1 and 2 moved that up to 2010. And the governor has asked us to set an additional goal of 33 percent by 2020, an extremely ambitious goal. I'm not sure it can be attained, but we will do our best to try. We have had commission studies that suggest it can be

done -- one third in California -- without any consequential harm and, as a matter of fact, economic benefits.

As part of that effort, some of you are probably quite familiar -- we adopted earlier this year the California Solar Initiative. This started out as the Governor's One Million Solar Homes Program. Two years in a row we tried to get it through the state legislature and was unable to do so. It came to the Public Utilities Commission. They asked if we would do it. We did. This is a solar photovoltaics program that spends about what -- we'll spend about $3 billion on solar projects and solar photovoltaics over the next ten years, and we hope that that will produce 3,000 megawatts of decentralized power generation. We include performance standards in that.

The Energy Commission will do the new-home-construction requirement part of that, and the PUC will run the rest of the program and retrofit some existing facilities and programs for schools and everything else.

Let me say a little bit about our procurement policies that we have developed at the PUC going forward that is particularly germane for coal. In 2004 we adopted as policy, what we call a greenhouse gas adder. It currently applies to long-term procurement by our state electric utilities at $8 a ton CO2. The purpose of that is to account for the financial risk that we think ratepayers in the future will bear due to future regulation nationwide of greenhouse gases.

We also set a greenhouse gas performance standard in 2005. We established our intent to implement, and now we're moving forward. We're doing that consistent with the policy of our sister agency. It applies to new sources of base load energy purchase for at least three years, and those greenhouse gas emissions are not to exceed those for a gas-fired combined cycle power plant.

We're now in the process of adopting a greenhouse gas cap, which will establish a load-base cap for the IOUs and other load serving entities operating in their service territories. We're now in the process and will spend the next 21 months exploring flexible compliance measures, including banking, offsets, and trade.

So that's the kind of backdrop for California Energy Policy, and there's a lot more I can say, but in the interest of time and the program this morning, I won't, other than to say that we are strong supporters of what we have in California -- the California Climate Action Registry. The purpose of that registry is all the major utilities

and other large users -- many other large users are members of California Climate Action Registry. These members -- their greenhouse gas emissions are registered, using standardized protocols, and they're certified and so forth, and it's a benchmark for going ahead in compliance here. We think it's particularly important.

Let me conclude by saying I see all this against a backdrop of a truly serious, serious thing that we face here in the United States. President Clinton -- Former-President Clinton said that -- and this is a little hyperbole, perhaps -- but he says that greenhouse gases and global warming are a more serious threat to this country and its well-being than is terrorism. I said that might be a little hyperbole -- certainly in the short term -- but it gives you a sense of the magnitude of it.

I assume that eventually -- if for no other reason than you'll be interested in seeing Al Gore on the screen -- you'll all go to see "An Inconvenient Truth." It's intriguing movie making,

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which I think opens tomorrow -- or it's about to debut. But the whole purpose of the film is to try to implore and beseech policymakers to do something now while we have a little bit of time and truly head off a very, very consequential impact of a very, very serious challenge.

We believe that in California -- there is a political consensus, I would say, in California that believes that greenhouse gases are an incredible challenge. It's led by the Governor, but it's shared by the leadership and others in the state legislature. We have to get on with it. We have to see coal's future in that context. Thank you very much.

(Applause)

MR. OSHIE: Well, like Lee and Michael, I'd like to welcome all of you to this workshop on coal, on integrated identification of the combined cycle technologies. I think it's going to be a very good meeting. We have had an opportunity over the past few months to put this together. We've got some very good speakers, and it should provide some information from which all of us can help make decisions.

I'd also like to thank the staff that have

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been -- as Lee did -- who helped put this together. They did a great job, and he named them -- and I'm not going to try to do that, because I'm sure I would miss somebody -- but they made a very significant contribution of pulling this together. And also to David Wooley and the Energy Foundation, who really pulled the three commissions together and had an idea, and I think it's come to fruition.

So thank you very much.

I'd like to start off my presentation with a quote from one of our Orders of the Commission, and the quote goes like this: "Future energy supply to provide even modest growth is going to be much more costly. The high growth potential of the region is almost totally utilized. All of the utilities are participants in a regional plan to provide fossil fuel facilities to meet future demand. The Pacific Northwest region will require substantially increased generating capacity over the next few years, even if the most optimistic conservation measures are effectuated."

That's the quote. I will ask the audience at the end of my presentation what year they think the Commission Order was issued.

We'll go ahead and get started. I'll start

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with talking about electricity demand. This illustrates the regional demand. I think what's important here is you can see that the energy demand will remain relatively flat regionally through 2015, and this is based on the Northwest Power and Conservation Council's projections in their fifth power plan. 22,105 average megawatts represents the median case growth scenario. That assumes no growth in the aluminum industry, increased energy efficiency, and increased renewable resource development.

However, while regional demand is projected to be flat, the demand in Washington State is expected to rise. Our utilities -- the three publicly owned utilities -- Vista, Puget Sound Energy, and PacifiCorp -- are projecting 760 average megawatts of increased demand, going forward to 2015. Our 60 -- the rest -- they serve about 40 percent of the population in the state. The remaining 60 percent is served by public utilities. A BPA white paper projects that those public agencies will require 840 average megawatts of new generation going forward to 2015. I'm not sure how the Washington public agencies fit within that number, but I'm sure it's significant because they're large takers

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of power from Bonneville.

So there's new demand in Washington that needs to be met, and how are we going to do that? Well, right now -- that's a three clicker -- right now -- and I think all of us in the region know there's a terrific reliance on hydrogeneration that provides 50 percent of our electricity energy and -- energy -- and it provides two-thirds of our peaking compacity.

And as we're not building any new hydro, we have to ask the question, "What are we going to do to meet our projected demand with our current resource mix -- energy, efficiency, and

renewables?" And this is where the answer, of course, is dependent on many factors which we have little or no control. Snowpack and rainfall fuel our hydro facilities, and a good water year can produce over 20,000 megawatts. In a bad water year, 12,000. We have a system demand elasticity, which is affected by fossil fuel prices, increased cost, consumer education, and consumer acceptance and adoption of conservation measures.

To the risk of not rolling the hydro dice and facing another critical period like 2000 and 2001, if we need to build new fossil fuel resources, what

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will those resources be? Well, utilities are all looking at more fossil fuel resources in their portfolio. And I think what's interesting here is that Washington's carbon footprint is the third smallest in the nation. To be exact, it's 0.123 tons of carbon emissions per megawatt hour.

We are right behind Idaho and Vermont. I don't believe there's any generation in Vermont that can take all their resources from generating facilities outside of Vermont. They're all coal and natural gas, but still, based on the way the study was done, I believe they are second. Idaho was first. Oregon was not far behind.

So even though we're one of the lowest carbon outputs in the nation, we have still been engaged in reducing our carbon emissions. So what I am going to do now is walk through what we've done directly to mitigate or address carbon output and then also actions that we've taken -- as I think Commissioner Peevey pointed out -- other actions taken to mitigate carbon output from our generated resources.

In 2004 the legislature took action to mitigate greenhouse gases for all fossil fuel projects. The Energy Facility Site Evaluation Council has

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permitting authority for projects over 350 megawatts. The Department of Ecology has permitting authority for projects between 25 and 350 megawatts.

The law requires all project owners to mitigate 20 percent of carbon emissions from all fossil fuel projects. Those emissions are priced at $1.60 per ton. They assume a 60-percent capacity factor for each generator permitted, and they assume a 30-year life of the project. The mitigation dollars are paid up front to EFSEC, and EFSEC would then contract the mitigation, as I understand it.

The project owners can also provide for their own mitigation measures, and that I don't -- I guess the question there is who owns the renewable energy credits or the regs, if that were the case.

I think under the rulemakers, as pointed out here, the carbon dollars can go up 50 percent each

year through agency action and rulemaking. Jim Luce, the executive director of EFSEC, is here today, and if you have any questions about the process, I'm sure he can answer them.

The projects that are listed there on my slide -- only Chehalis -- Cherry Point was not built; (Inaudible) was not built; (Inaudible) was

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not built; Cherry Point was in operation. The credits are in place, but they haven't reached the generation thresholds to where they have to pay.

Also what we've done -- this is something that the UTC has done -- is explicitly require the utility to examine the uncertainty associated with climate change, including carbon regulation in their integrated resource plans. We've called out climate change and carbon control to better understand the long-term cost of fossil fuel projects.

The real possibility of federal and/or state carbon control legislation heightens the level of uncertainty associated with new thermal resource development and cost recovery. We need accurate cost projections for new fossil fuel resources over the life of the project in order to compare their cost effectiveness with other resource possibilities.

Now, as an example, PacifiCorp modeled conditional coal with the carbon gas adder of $35, and found that at that $35 penalty, IGCC would be cost competitive with conventional coal.

Now, the environmental issues -- and they have to be dealt with in an integrated resource plan --

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reach much further than carbon control. For example, the future of hydrogeneration is significantly affected by climate change and weather volatility.

There is a study done by Pacific Northwest Labs. They projected that with warmer temperatures there would be reduced snowpack in the Cascades; there would be alteration, if you will, of the natural hydrograph; the runoff period would begin earlier; there would be less reservoir storage available; and, of course, in the late summer and fall, there would be a significant decrease in the water available for hydrogeneration.

We would like you to take a look at these things. Of course, there's a significant uncertainty here, but it's an issue that needs to be examined. It's perhaps impossible to forecast the impact of climate change with precision, but they need to take a look at how climate change is affecting their generation and also affecting their changes in demand as temperatures warm and also resource availability for wind projects, as an example.

I'd also like to discuss the other actions that we have taken. We have -- they're on this slide and identified -- conservation efforts, renewable resource development, and interconnection standards. While not designed to deal with carbon emissions directly, all of the above have the effect of reducing Washington's carbon footprint.

Starting with conservation, the Northwest Power Plan, which is looked to as a (Inaudible) in the region as of the (Inaudible) utilities for direction with regard to energy efficiency and as a comparator for performance of utility, their fifth power plan indicates that they believe the region can meet its resource demand through 2010 through conservation. We're looking at approximately 700 megawatts of cost-efficient conservation would be available to the region.

Also we are -- I'd like to speak very briefly about how our utilities stack up. We have approximately 40 megawatts of average savings that Puget has in place and saved in 2004-2005 6.6 average megawatts for Avista -- which is a smaller utility -- and PacifiCorp, which has an even smaller footprint in Washington, had 3.3 average megawatts.

But what's important here is what they are projecting. PSD is projecting 282 average megawatts of savings from conservation alone through 2016. Avista is projecting 69 megawatts of average savings in that same time period, and PacifiCorp is also projecting more significant savings in that period.

Now, how can we make the -- how can we make energy efficiency measures more attractive to the utilities? What we have here on this slide are just some ideas. They're not -- I wouldn't call them policies yet of the Commission, but they're ideas that we are -- that are in discussion, ideas that we know are -- have some merit, and let's go through them very briefly.

Financial incentives for energy-efficient appliances and project development. Financial incentives could be rated at a rate of return adder for conservation measures, or there could be some type of incentive mechanism that rewards the utility for meeting or exceeding conservation targets.

The reference to a disincentive on that slide -- that's code word for decoupling, and it's a matter that's in adjudication before the Commission right now, and it's a matter that's been before us, and we are looking at it very seriously.

Integrated conservation only RFPs -- we've allowed those in the past, and I think we could do that

again in the future. Enhanced energy appliance standards -- we don't have control over that, but that would certainly be a great policy that would be better on a national level, but it could be done by the state.

And also one other factor is integrated resource planning for public utilities for those with 25,000 customers or more. This was a new law that was enacted in the last year, and I'm very interested to see the effect of integrated resource planning for the smaller utilities. I think it's going to be a real benefit.

This slide just talks about some of the available conservation resources (Inaudible) power plant. The really big numbers here are -- you can see No. 1, commercial new and replacement lighting. 245 average megawatts by 2025 at a cost of -- at a high cost of 1.51 cents a kilowatt hour. And some of the other big numbers are industrial nonaluminum, 350 megawatts, 2 cents a kilowatt hour; residential compact flourescent lights, 2 cents a kilowatt hour, 535 available average megawatt hours.

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I'd like to speak briefly about our existing renewable resources that we have in play right now. We have Puget Sound Energy's Hopkin Ridge facility that's been built -- it's 150 megawatts, and in the process of building Wild Horse -- that's 230 megawatts. We have the Kettle Falls facility, which is Avista -- I believe about a 50-megawatt wood-waste plant, and Avista has contracted with -- statewide for 50 megawatts of wind.

The next slide is what may be available in the future. Avista is looking at more wind. We have a co-gen with BP, and Puget Sound Energy is looking at tidal power, which I think is a very interesting concept, and exploring geothermal, solar, and biodiesel alternatives.

I'll kind of quickly run through this. This is just some stats on the Hopkin Ridge and Wild Horse facilities, and they're there for your information only.

I think this is very interesting slide. The Hopkin Ridge capacity factor they project at 36.7. They're getting 38 percent. I think what's really interesting here is you can see the projected and actual production from the plant is very volatile. While they're averaging above what they projected

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as a capacity factor, it's been a very volatile facility in terms of understanding the actual output and being able to integrate that into the system.

Potential resources are here. There's a number of them. Again, this is for your information only. These are -- these are projections made, I believe,

by the Power Council as to what might be available in this region. You can see most of their benchmark costs are below what it would now cost to generate at least natural gas and probably most coal facilities.

Now, what can we do to support our renewables? Again, financial incentives, some rate of return adder to be considered, or, again, some type of incentive mechanism for the utility that meets or exceeds its renewable resource development goals.

Renewable portfolio standards -- that's in play in Washingtoon. We may see that as an initiative, I believe, and we may see that law in effect at the end of the election year.

I think, very quickly here, I'd like to ask the audience now what year they believe that the quote that I read earlier in this presentation -- what was the year of that order? Anybody have any

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guesses?

AUDIENCE MEMBER: '79.

AUDIENCE MEMBER: '75.

MR. OSHIE: That's a pretty good one. There we go. I would have guessed probably somewhere in the mid '80s, because that's when they started in regulation, and at the time there was terrific inflation and increased demand and, of course, increased cost, and, you know, the companies were coming in all the time for rate cases because of that. But whoever guessed '75 was really close, because that order was written in 1974.

And we are faced with the same issues today, only more. We have increased demand, increased cost, significant uncertainty as to how we're going to meet the demand at the lowest cost possible.

Now, unlike the commissioners in 1974 or those in the mid '80s -- and we could probably stack a few more dates on top of that -- we have added climate change to our stack of uncertainty and risk.

Now, how disruptive will the effects of climate change be on the industry? We don't know exactly, because we don't know precisely the impact. We can only guess. But what we do know is that utility

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planners in Washington have called for coal plants in their resource stack, and utility management has to make a decision. "If we build it, what's it going to be? Is it going to be a conventional coal plant? Will it be an IGCC? Will it be IGCC with or without sequestration?"

I think utilities -- the boards of directors for our utilities have to be asking, "If we build an IGCC plant, will the regulators allow cost recovery? Or, in the alternative, if we build a conventional plant and carbon controls are imposed, then who is going to bear the cost of the controls?

Is it going to be the ratepayers, or will it be the utility that built the conventional coal plant in the face of climate change and carbon uncertainty?"

Well, these are really difficult questions -- questions that our utilities are wrestling with, questions that the Commission is wrestling with, and we don't have a definite answer -- I'm not sure any of us do -- and perhaps today's discussion will inform our decision-making. Thank you very much.

(Applause)

MR. BEYER: I'd like to turn now to the Oregon perspective. To borrow liberally from Dorothy, when it comes to generating electricity, we're not

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in Kansas anymore.

I think it's an accepted fact that fossil fuel generation of electricity is second only to pollution from cars in contributing to global warming. Clearly, we have a problem. Emissions from fossil fuel power plants are changing our climate, and there's mounting evidence that the effects will be serious, widespread, and if we simply continue to burn coal the way we do today, we're going to have a problem. Our energy policies must change, and they must be directed as to preventing future damage to the environment.

Our governor, Governor Ted Kulongoski, takes this situation very seriously, and he's adopted three clear goals for addressing that in Oregon. First, he's directed that we arrest the growth of greenhouse gas emissions by 2010. Second, that we achieve a 10 percent reduction below 1990 emission levels by 2020. And, third, by 2050 achieve a climate stabilization level at least 75 percent below 1990 levels.

These goals form the basis of recommendations from the Governor's Advisory Group on Global Warming. The Governor recently appointed a Climate Change Integration Group to oversee the

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implementation of the goals and to develop strategies for adapting to climate change that we cannot avoid.

The Oregon Commission takes this challenge seriously. If we're to meet our energy needs reliably, affordably, and with minimum harm to the environment, as we face the changing climate, we have to do things differently.

We've adopted four strategies to get there. First, recognizing and signaling the full cost of energy production in our resource planning. Second, to capture all cost-effective conservation. Third, to develop renewable and distributed energy resources. And, fourth, to promote advanced technologies that hold promise at meeting our energy needs at lower cost and with less impact on the environment.

Let me touch on each of those just briefly. First, the accounting for the full cost of energy production and decision-making. This isn't new to the Oregon Commission. This is something in planning that we've been doing now -- for a long time now. Since 1989 we've required the use of environmental adders and resource planning. For carbon we've required analysis of adders up to $40

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a ton since 1993. I have to say that there's a point where I kind of wondered about that -- whether we'd ever get to that. My good friend, Phil Carver, with the Oregon Department of Energy has been telling the Commisison for, I think, almost 20 years, John, that there's an imminent national carbon tax that's going to happen.

Well, you know, when the Bush Administration started talking about a carbon tax in the last year, I think he may have something there -- something we need to pay more attention to -- and should, anyway.

All three of our private electric utilities recognize increasing likelihood of carbon allowance. They've already chosen resources -- assuming carbon emissions will be regulated. In orders that the commission will soon release, we'll be updating our carbon adders and require our resource planning analysis establishing what carbon costs to assign to resources in the competitive bidding process.

Back in 1987 Oregon passed the first law in the country to require developers of new power plants to meet carbon emission standards. Developers must invest in projects that offset portions of their

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emissions.

Today a governor's task force is exploring a load-based carbon emissions cap for Oregon electricity suppliers. The recommendations from that task force will be forthcoming early this fall.

The Commission's second strategy and perhaps the most important for meeting our electricity needs is conservation. Efficient energy use is the foundation of the Commission's energy policy -- for a simple reason. That's because conservation is by far the cheapest and cleanest resource available to meet growth. Oregon has long been a conservation leader, but there's a lot of savings that we leave on the table.

As Pat was talking about, the Northwest Power and Conservation Council's latest plan for the region sets a required -- a regional conservation target of 130 average megawatts per year. Oregon's share of that is about a third, and the utilities we regulate account for most of that.

The Energy Trust of Oregon, which is a

nonprofit that this Commission created in 2001, runs our conservation and renewable resource programs for the two largest utilities, Portland

General and Pacific Power. Customers fund the trust through a 3 percent charge on their electricity bills. Last year the Energy Trust Conservation Program saved almost 40 average megawatts. I'll note to my friends in California, we're about a tenth of the size of California. So that's a significant number to us.

A new study by the Trust found that there was 350 average megawatts of conservation available by 2012 at a cost of less than 6 cents -- less -- 6 cents or less of killowatt hours. So far the average costs for our conservation effort has been just a little over a 1-cent kilowatt hour, and that's, obviously, if you looked at the prices at the trading hubs, that's a pretty good deal for customers.

Unfortunately, with the funding that we currently have, we're not going to be able to achieve most of that. But, to address that, the Commission has proposed or will be proposing a bill in the next legislative session to increase the funding so that we can get at more of that resource.

The Northwest Council's plan also calls for reducing peak demand by 500 megawatts regionally.

To get there, we need to look beyond programs for our largest customers and look more at empowering residential and smaller commercial customers to participate in the program.

Towards that goal, the Oregon Commission recently adopted a new rule to promote advanced metering. We will be reviewing Portland General's application to install advanced metering throughout their system in their current rate case.

Our third strategy to meet our energy needs is developing renewable resources. As Pat said, the Northwest Power Plan calls for 600 -- excuse me -- 6,000 megawatts of wind by 2015. All of our electric utilities are in the wind business now and have aggressive wind acquisition in their resource plans, and we have the Energy Trust available to help them with subsidies, where necessary, to achieve those goals.

Most recently, PGE has announced plans to develop a 350-megawatt wind farm in Sherman County, Oregon. Those of you not familiar, it's just over the mountains.

And Pacific already has acquired a wind farm -- that and a geothermal plan toward their commitment of 480 megawatts of new renewable resources by

March. The company also plans to announce an

additional wind project in the next month.

We've also developed a strong consumer demand for renewable energy through our Green Power Options or Green Tariffs, if you will. Portland General is ranked proportionally second in the nation in customer's acquisition of green power. Pacific is ranked No. 3. We're also encouraging our customers to generate energy at their homes and businesses with our new standard rates and contracts for small renewables and cogeneration.

Our staff has started work on rules to expand (Inaudible) and develop uniform standards, procedures, and agreements across all utilities for interconnecting independently owned generations.

Recently Governor Kulongoski called for the enactment of an Oregon renewable portfolio standard, and, frankly, it's pretty aggressive. His goal is to supply 25 percent of Oregon's needs with renewable resources by 2025.

While our utility planning projects are almost enough to meet the governor's target by 2015, the new (Inaudible) would likely increase the amount of renewable resources available over the long run.

Finally, we get to our strategy for promoting

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new advanced technologies. That's where IGCC technology and carbon capture and sequestration fits in. For many years now, we've been including in our decision-making the financial risk of these resources that are harmful to the environment. Given the mounting concerns about climate change, we're at the point today where we should not be making any long-term bets on coal plants unless they're designed to capture and sequester carbon emissions in the future. I think this afternoon will be very interesting, as we look forward to hearing more about how we can do that and where the technologies are today.

So that's the Oregon perspective. With that, we have one more speaker on our policy panel, and after that I'll turn to other commissioners to get their comments and open the floor to discussions on this.

So our next speaker, then, is Bill Keese. Bill is co-chair of the Western Governors Clean and Diversified Energy Advisory Committee. This group is assisting the governors to achieve their goal of developing 30,000 megawatts of clean and diversified electricity generation in the West by 2015 -- an aggressive goal.

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Bill is also co-chair of the group's Advanced Coal Task Force. He served eight years as the chair of the California Energy Commission, and Governor Schwarzenegger recently appointed Bill as his advisor -- to his advisory panel that is reviewing the California public goods program.

Bill also serves on the boards of Alliance to Save Energy, Cal-Plan Corporation, and he's a strategic advisor to the North American Insulation Manufacturers. In short, Bill has got a lot of experience in this subject.

Bill, it's all yours.

MR. KEESE: Thank you, and I do note that there are representatives of three of the governors who were at the energy summit. There are six participants in our task force in the CDS itself, and there are four people here who can tell you on almost all of the 3500 pages of work product how the "I"s were dotted and the "T"s were crossed. So I'm going to be a little careful in making this presentation, I guess.

We started this activity -- it was started by Governors Richardson and Schwarzenegger in June of 2004 -- 700 participants -- and they came up with a resolution. Protect against shortages and spikes.

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Regional energy policy that is diverse and contains both conventional and alternative energy resource development, energy efficiency, and conservation. No. 3, meet the energy needs of the West. No. 4, respond to environmental challenges, and, No. 5, take advantage of new technologies that lower the cost of renewable energy and reduce emissions.

Now, I have to -- I'm going to try to tie this in to what you're doing -- what we're talking about here. So let me explain how the Western Governors operate. They have adopted a policy in libra. In libra is the way that the Western Governors, operating as an entity, can bring together the group's interest.

I'll read you a couple of the -- their bulleted items: National Standards, Neighborhood Solutions. Collaboration, Not Polarization. Markets Before Mandates. Recognize the Costs and the Benefits, and Solutions Transcend Political Boundaries. Use the Appropriate Geographic Boundaries For Environmental Problems.

The resolution called for a number of things. Add 30,000 megawatts of clean energy by 2015. Increase energy efficiency in the West by 20

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percent by 2020, and meet the transmission needs of the West over the next 25 years.

A task force, an advisory committee, CDS, was formed to promote those recommendations. There are 29 members of that body. All my previous presentations have been on what the CDS was. The CDS report has been prepared, is out with those 29 members. I wish I could report to you day-to-day that we had 29 signatures. We're real close. But in the in libra principle, we do believe now that we have everybody signed up. There might be no

objection to the report. The report will go to the governors.

Let me give you a little sketch of what we did. We set up some task forces: Wind, clean coal, biomass, geothermal, solar, energy efficiency. We also had a paper on natural gas and a paper on hydropower and a paper on combined heat and power.

We set up a separate transmission task force. We set up -- the energy efficiency group operated somewhat separately, but extremely well.

We had an integration group that tried to make sure we were always talking about apples or oranges, that we did not get different reports on different bases and bring unity to it. We had a

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qualitative working group. We had a steering committee.

The report was to illustrate the potential for clean and diversified energy and energy efficiency if the right incentives are provided, and our conclusion is going to be that, as a result of the incentives and renewable portfolio standards, we should exceed the 30,000 megawatt goal. But, ultimately, the market will determine what gets built and where it gets built.

The CDS policy, we hope, implemented by the governor, will allow companies to invest on this plan that we see going forward.

Let me talk about numbers a little bit. We had hundreds of participants. In the solar area, for instance, we had 65 stakeholders participate. In the coal we had 40 to 45 participate. We had extremely good support from the Human Foundation. We had expertise from the Department of Energy, the USCPA, the national labs.

Geothermal -- the potential is 5600 megawatts. Solar -- the potential is 8,000 megawatts. Biomass, 10 to 15. Energy efficiency, 48,000 megawatts. Wind, 9,000 to 54,000, depending on accessibility of the transmission. And coal --

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5,000 new megawatts from highly advanced technologies and 9 to 17,000 megawatts from other advanced technologies.

I want to mention -- I'm going to ignore everything but coal, but I do want to mention that there's some very important aspects of transmission in this that I think are related -- that recommendations will be that we should promote the efficient use of existing transmission systems, improve transmission planning. Cost allocation and cost recovery for transmission investment is very important, and we need to coordinate siting and permitting.

As I said, all the task force reports are completed. They are on our website. They were each adopted by consensus of their participants.

So those who participated in each of the task forces and in each of the work groups came to a consensus on their report. We then, of course, moved up the ladder.

Coal was a problem. At the front end, it's fair to say that we had some interests in coal, who suggested that the report should be written without the use of the word "carbon." On the other hand, we had some who suggested that the report should be

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written without the use of the word "coal." That did present us with a big problem.

We had three work groups. We had technology, carbon management -- you can sort of read that in sequestration -- and policy. The policy work group report focuses on the barriers that have inhibited the development of new, cleaner, advanced coal technologies and presents recommendations to overcome those barriers. I am reading a couple things, because they were negotiated to be read as I am presenting them.

This is a very important thing I will read. "This task force supports continuing efforts to improve the operational and environmental performance of all the advanced coal technologies listed in the technology report, beyond performance levels, with the ultimate goal of achieving near zero emissions of all emissions at a competitive cost of electricity."

Now, I want to mention that the group called for two specific groupings of coal projects. Understand, we're trying to make 2015. 2015 is a stretch goal for advanced coal technologies.

Tier 1: We recommend that the Western Governors and the Western states place the highest

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priority on providing incentives to facilitate the development of four to five electricity-generating plants, approximately 2,000 megawatt totals that use coal for fuel and that capture and sequester at least 60 percent of the CO2 emissions. We recommend that a full set of state level incentives be provided to Tier 1 projects. 2,000 megawatts, new plant, that sequester at least 60 percent.

Tier 2: In addition, we recommend that a subset of state incentives be provided to projects of approximately 3,000 megawatts, employing technologies not yet commercially deployed in the West that most cost effectively and rapidly move toward zero-emissions and carbon capture and sequestration. These are not limited to, but include, gasification, ultrasuper critical coal, and oxycombustion.

As I mentioned, the report is being signed off as we speak. Perhaps by the end of this conference I'll be able to say it's been signed off and going to the governors. It's not going to be made public

until the governors receive it on Sunday, June 11th, and decide on an action plan.

I will mention one of the recommendations, because we have many recommendations. Until cost

recovery for Tier 1 and Tier 2 project development, we're going to ask the governors to request the public utility commissions encourage utility cost recovery for Tier 1 and Tier 2 project development studies and for sequestration studies at current and proposed generation sites.

I am very enthusiastic about this project, but it's the result of all this technical work which basically shows the potential for wind in the whole west and the potential for solar and the potential for coal. If it sits on the shelf, it does nothing. It takes action plans.

I'm pleased to see this conference, because I think this is the way we're going to get the action plan moving forward. The recommendations will be recommendations as to what the federal government can do to help us overcome these barriers to reach the potential.

What states can do to overcome the barriers to reach the potential and what we have to do as regions on different -- in different areas of this -- whether it's transmission or energy efficiency -- to overcome the barriers and reach the potential. Thank you.

(Applause)

MR. BEYER: Thank you, Bill.

Okay. We have provided about a half an hour for additional comments by the others and questions and discussions on this topic, and I'm going to turn first to my fellow commissioners and ask if any of you would like to comment. Can you do it from up there?

MR. SAVAGE: Can I ask a question?

MR. BEYER: Huh?

MR. SAVAGE: Can I ask a question?

MR. BEYER: I was hoping there would be comments first. John, you talk a lot.

MR. SAVAGE: I have a question for Bill. Can you explain Tier 2 again. I understand Tier 1. Can you explain the Tier 2 plans again, what you are trying to accomplish.

MR. KEESE: Well, I think probably the easiest way to explain it is Tier 1 is plants that will be built and will be sequestered, and Tier 2 is plants that will not be business as usual, but advance forward and capable of sequestration.

MR. SAVAGE: Okay.

MR. KEESE: I'll just ask any of my experts sitting in the middle of the room in the third or the back row if that's correct.

MR. BEYER: I think he got it right. Okay. Any other comments?

Mary, did you want to comment on anything on the Wyoming perspective?

MS. BYRNES: Thank you. Not speaking exactly for the policymakers of Wyoming throughout the system, but I think we talked earlier about the political consensus about that global change is happening. I don't know if you would find that explicitly articulated in Wyoming, given the culture of Wyoming, and it's deeply embedded in harvesting coal and hopefully will be transmitting energy. That's a great gain for the state.

It's encouraging to hear the discussion today regarding cost recovery is an issue both for the consumers, as well as for assurances to the companies, and in Wyoming I think some of our concerns are that the cost would be pretty much burdened on the citizens of Wyoming -- and there's very few of those -- as well as the sequestration issues, perhaps for long-term safety and liability and viability of those. I'm looking forward for the rest of the day to hear more about this.

Additionally, I did have a question for Bill. If you could articulate what the Western Governors

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Association are requesting of the PUCs in Tier 1 and Tier 2. I'm not sure I understood.

MR. KEESE: I'm presenting the Western Governors and not adopting our presentation. Our recommendation to the Western Governors in a consensus document is that all the western states support 5,000 megawatts in the Tier 1 and Tier 2 group. There is no suggestion whatsoever that Montana, Wyoming, and North Dakota have to bear the cost of it.

I should put a little asterisk here. Those of us who work in the West and worked on this for a long time think of the West electrically as west of the Rockies. The Western Governors includes Hawaii, Alaska, Texas, Nebraska, North Dakota, and South Dakota. So there's a little bit more to this politically than meets the eye. But the suggestion of the group is not that the states where the generation takes place should be the sole supporters of it, that there has to be some regional take to it.

MS. BYRNES: Thank you. Thank you.

MR. KEESE: Until they've adopted it, I really can't make the recommendation specifically.

MR. BEYER: Somehow I think that will all find

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its way into rates.

Commissioner?

MS. GRUENEICH: Yes, I guess I have basically two comments. First of all, I am very, very pleased that we've been able to gather here

together. After I was appointed early last year and was discussing energy matters and various aspects in the West with President Peevey, he asked me to basically be taking the lead among the California commissioners of thinking what more we can or should be doing in terms of reaching out to our fellow commissioners -- not just on the West Coast, but in the West generally -- and in the approximate year since President Peevey and I spoke on this issue, it really has become increasingly apparent to me that we in California -- both at my Commission and other entities -- need to be part of the broader discussion going on in the West. And so I wanted to say that I very much enthusiastically support the efforts of CDS and Western Governors Association to be bringing together the stakeholders to be looking at the West in some sort of an integrated fashion where hopefully we can have some consensus on what we see going forward as some of the rock-bed foundations

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of the policies.

Certainly, by our presence today of three of our commissioners, I hope that we're sending the clear message that we do want to be part of the discussion and dialogue.

One of the areas that -- I know it's not the topic for today, but I'm hopeful that, as we have these continuing meetings and discussions, we can talk about energy efficiency, in particular, since that among the three West Coast states -- and I know many of the other states -- it's really the foundation of saying that's something that still is left largely untapped. It doesn't require these massive new transmission lines, which, believe me, I'm spending a lot of time thinking about how you -- you know, look at the permitting and planning, and its costs are really at the low level. And so I'm just going to put in a plug that I think that's an area when we're talking about regional discussions.

The second thing, though, I wanted to just address briefly today is the topic of this panel that when John and Pat and I first met to think about it, we really concluded that this is the first thing to take on, because, as the regulators

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in the western states, where we are in the West Coast states, from what I'm hearing today and have heard before, that, while we have variations on it, all three states are really saying that we are committed to addressing climate change and that, as part of that, we need to think about how coal will be part of the mix in the future.

And so I felt that it was extremely important for me to get educated on what is the state of the technology of advanced coal -- whether we're

talking about supercritical peak or IGCC -- and what's the state of the research and development on carbon sequestration. Because, as regulators, we can only make intelligent decisions if we understand what is the state of that technology? What are the risks out there? What is the time line? And also in my mind, very importantly, what signals does the investment community need to have in order to be willing to put investment in carbon sequestration and the advanced coal.

So I just wanted to take a moment to share my perspective that this is really about educating all of us, of understanding what is this new technology that we're really saying is so critical to meeting our policies? What are the issues? What are the

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risks? And then hopefully how we, as the regulators, can respond intelligently as we are presented with these issues in terms of utility resource plans or proposals for generation or loading orders or whatever.

So thank you very much, and I look forward to the discussion.

MR. BEYER: Thank you, Commissioner.

Commissioner, is there anything from New Mexico?

MR. MARKS: It's great to be back here. Well, I wanted to start off by thanking the Oregon, California, and Washington commissions for organizing this and holding it. I'm here to learn.

New Mexico is, I guess -- and certainly compared to California -- a drop in the bucket. Our retail market -- our peak load is, I think, a little bit under 3,000 megawatts. But, you know, to me, it's very near and dear to my heart.

Right now New Mexico -- our retail electrical supply is about 80 percent coal based with, oh, I don't know, 5, 6, 7 percent nuclear and then some gas. And then we have a fair amount of wind. Right about now about 8 percent of our electricity is coming from wind. We have our Renewable

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Portfolio Standard that's been around for a couple years -- actually, just took effect in 2006 -- but our utilities built towards it, and certainly we're having the same discussions that other states are in terms of raising the bar to something in the 20 percent or higher range in the next decade as a target.

With our RPS -- and we've got some solar projects that are on the table -- biomass on the table -- I would like to say -- I would really like to say I hope we never have to build another coal plant in New Mexico to serve our retail load.

Unlike my colleagues up here, I'm an elected commissioner, and my constituents -- they're not too excited about coal. They certainly aren't

excited about expensive power either. But, you know, natural gas is the deed at the moment, and the renewables are actually cheap. We all know wind is 3 cents a kilowatt hour with the PTC. Solar is coming and (Inaudible) in natural gas. It would be great -- and biomass is probably cheaper than natural gas and getting competitive with these advance coal technologies -- they're not that far apart.

Nevertheless, I think it's -- while it would be

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my wish that we could avoid it, I don't know that we can avoid it. I think there likely is a place or role in our integrated resource planning for new coal plants, and if we're going to go down that path, I think it behooves us to do it right.

And I would hope that we can -- New Mexico will be part of -- if we do go down -- building more jurisdictional coal -- that it will be advanced technology, not pulverized coal.

And my other interest is less acute, but New Mexico is also an energy-producing state, and it's likely -- right now we export electricity. We export -- we're an oil and gas state, as well -- and we're a coal-producing state, and there are -- some of my colleagues here in California are some of our customers, we'd like them to be bigger customers, and that involves -- that involves exploiting our coal resources in a way that doesn't place an environmental burden on the citizens of New Mexico, and, in particular, the citizens in the coal-producing areas of Four Corners, who have had to suffer from environmental deprivations with uranium mining and now with the location of thousands of megawatts of coal out there -- they say, "No mas."

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So if we're going to go forward with this, we need to do it in a way that respects those who happen to live above that coal. And so I'm here to learn and find out what options we have of going forward and to continue the dialogue that's developing in the western states. Thanks again for having me.

MR. BEYER: Thank you, Commissioner. Is there any other Commissioner? Commissioner Jones? Never misses a chance.

MR. JONES: I can't pass up the opportunity. Well, first of all, I'd like to welcome our California commissioners. We have three eloquent commissioners up here, and it's a good thing to have Californians up here in the beautiful, rainy Pacific Northwest.

One thing I would like to hear more of in the afternoon panel is Wall Street analysis and how Wall Street looks at these new plans. Obviously, when you talk about cost recovery and directing

state PUCs to do certain things, we take our responsibilities very carefully and very seriously, and, obviously, whether it's a corporate credit rating or, you know, how a base load or a wind generating or a coal plant fits into the mix is

very important information to us, and I haven't heard any analysis of that yet.

The other point I would like to make is we have one utility in our state -- Puget Sound Energy, that is locating its load resource balance is looming. It's right ahead of us. We hear that they are looking -- as well as others -- at coal plants, and really the issue is how to model the uncertainty of federal legislation and political risk. How do you model that in an IRP? How do you develop scenarios in which -- whether it's $8, $10, $12, zero -- it could be higher. Mr. Gore, obviously, is out with his movie. It sounds like he's on the campaign trail again.

So there's a whole new area of political risk in what the PSE -- I don't know if Eric Markel or anybody from PSE is in the audience -- but what they tell us is we need certainty. We need certainty on how to model carbon risk and mitigation strategies.

So I'd like to hear a little bit from our panel this afternoon about, you know, looking back on the nuclear scenarios that went wrong in the 1970s where we did a poor job of predicting political risk and load forecast. You know, what have we

learned from that lesson and how could we do it better this time around.

MR. BEYER: Any other commissioners? Last chance. No -- there's never a last chance for commissioners. Last chance comes when the ink goes to the order, doesn't it?

Okay. We'll open it briefly to the floor -- is there anybody who has questions or comments that you'd like to pose to the policy panelists?

Could I get you to -- either shout real loud or use -- there's a microphone in the middle.

AUDIENCE MEMBER: My name is Dan (Inaudible) from Governor Richardson's office, and I wanted to thank you for doing this and say Governor Richardson believes very strongly that we need to connect the energy hinterland to your markets and to do it in a way that delivers good, clean, reliable energy, including carbon.

And I heard the comment earlier by Chairman Beyer that this is going to fall to the ratepayers. There are generating states out there that are saying we want to help develop these technologies and put them in the marketplace. Governor Richardson said let's explore the idea of coming to the table with forgiveness of severance tax on coal

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for a period of time while we test sequestration and figure out how to do it. Let's develop the liability laws in the generating states so that you can have sequestration, have it be reliable, and make sure that the ratepayers don't end up carrying the burden.

So there are things that generating states can do so that this doesn't -- this exploration of new carbon clean technology and energy options doesn't fall just in consumer states. Thank you.

MR. BEYER: Thank you very much. Thank you for coming.

I knew we'd hear from Wyoming.

MR. ELLENBECKER: Good morning, and I, too, thank you for putting this important dialogue together. I'm Steve Ellenbecker from Wyoming. Please work with us to develop the criteria that you set standards, which you have every right to set for the procurement of coal resources. Give us a chance to develop the resources that meet those criteria, as you see them, as good public policy, and work with us to enable those resources to be built that meet the public policy criteria and you're responsible and have every right to enforce.

I'm reaching out in a sense of partnership on

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behalf of Governor Freudenthal, asking you to consider these abundant low-cost resources and work with us to develop them in a way that meets your needs and your customers' needs and gives us a chance for abundant, reliable, low-cost resources in the West.

This meeting is critical. Please reach out and develop a partnership with us in those states that have the resources that can help you keep your lights on -- in addition to conservation, energy efficiency, and your strong renewable portfolio standards. There should be a viable place for all these resources together in the future, and, again, my compliments to you for holding this important conference.

MR. BEYER: Thank you, Steve. Thank you for being here.

Is there anyone else?

AUDIENCE MEMBER: Good morning, and thank you. My name is Morris (Inaudible). I'm from a consumer organization in San Francisco, California. I guess I'd just like to just follow up on the last comment and ask President Peevey or one of the California commissioners how they see the potential performance standard that California has adopted in

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theory for (Inaudible) base generation impacting potential development of either conventional or advanced coal plants throughout the West?

MR. PEEVEY: Well, I'll speak briefly. I

thought I mentioned that in the opening remarks. Obviously, if we put in a carbon (Inaudible) or perhaps higher -- which, Mr. Jones, I would suggest you might suggest for Puget -- don't feel reluctant to borrow a little bit from Southern California, facing you to the south -- and have them do their resource plan with that number in the mix and see what it comes out to. I mean, obviously --

MR. JONES: Yes, sir.

MR. SAVAGE: We can do it right and use Oregon's numbers.

MR. PEEVEY: It's kind of a rhetorical question. I mean, I want to -- you know, applaud what these folks -- Richardson and Wyoming and New Mexico have said. Our governors have indicated we need to work on these matters. California is the big thing, (Inaudible) and everybody wants to settle in California, and there's limits to what we can have in California, even if all the technological challenges are overcome. But we will -- because there's finite limits, and we've

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put everyone, as I said, into energy efficiency and renewables and so forth, and we're going to have more gas in California, too.

But we will shape this market working with you. We have an agreement to look at transmission lines in Wyoming, determine the cost, helping the utilities kick in on that effort. We have an interest with New Mexico. It's a similar kind of thing.

I just want to make sure that -- speaking very emphatically -- that what we do not set in motion some long-term detrimental consequences environmentally for -- not just for California, but for, indeed, the West and the U.S. and keep going. But, I mean, the point is that we could help shape these markets, and we intend to help shape these markets. It's an, I think, appropriate and responsible thing to do and totally consistent with what the governor has laid out -- Governor Schwarzenegger has laid out for California, and there's sympathetic response, I think, by the legislature in other states, and it's our challenge to bring this to some meaningful resolution over the next 12, 18, 24 months, and so I think we intend to do that. Dian, do you want to chime in

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on this?

MS. GRUENEICH: No. Actually, I think that you said it very, very well. But I did learn something important, hanging out down at this end of the table, which is that I guess that, Commissioner Savage, you have a proceeding in which you will be updating the carbon adder for your state and will be having a proposed decision or final decision out in --

MR. SAVAGE: About a month.
MS. GRUENEICH: This to me, alone, is worth being here, since we obviously have the carbon adder in California, and it will make a lot of sense to look at what they have. That was the only thing I would add. President Peevey?
MR. BEYER: Does anybody else want to comment? Anybody else have any comment? We knew you were there some place.
MS. GRUENEICH: Oh, Ralph.
MR. PEEVEY: You're supposed to wait until the end of the day.
MR. CAVANAGH: I plan to do that, President Peevey. Seeing all of you up there --
MR. BEYER: Ralph -- in case there's anybody who may not know who you are --

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MR. CAVANAGH: Ralph Cavanagh from NRD. I do not want to take this opportunity, Mr. Chairman, to discuss. I wanted to do something I always wanted to do, which is to wish you well and to express the hope that in the course of the day we can come to more of a common understanding about where climate risks ought to fit in the enormously important challenges of portfolio management and resources development that all of you face together, and I think all of us look forward to helping with that, and I will reserve my substantive comments for the end of the day, but I couldn't let the moment pass without an invocation on behalf of all of us.
MR. BEYER: Thank you, Ralph.
MR. JANI: Good morning, my name is Andy Jani, and I am from British Columbia in Canada, and I just wanted to share a few thoughts on this morning's issues. I'd like to congratulate you on establishing this event. I think it's a worthwhile cause. In British Columbia we have, of course, no coal plants, but we have significant resources in coal, and, of course, our neighboring state has (Inaudible) and around GHG and, of course, the neighboring state of Alberta (Inaudible) where they are doing some immense work in terms of (Inaudible)

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sequestration. So we look forward to working with all of the western states -- the standard western states -- and we wish you best wishes and participation in the future.
MR. BEYER: Thank you very much. Thanks for being here. Time for one more. Is there anybody else? There is not.
Well, I think this morning has been interesting from a policy perspective. What strikes me as very intriguing listening to Bill talk about where the Western Governors are. It's real clear that there's strong concensus to address these issues and address the environmental concerns as best as we can.

As I said, we're not in Kansas anymore, and times are different, and we're trying to do the right things.

Interestingly, the governors are showing strong leadership, and note that it's not a partisan issue. We're looking at bipartisan efforts looking at these. Steve Ellenbecker said it's not about not doing coal; it's about doing it right and merging it into the portfolio, and that's what we hope to learn today.

Clearly, the West is not willing to wait for a

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national policy. We're going to try to do it the right way. You're seeing pretty unanimity from the governors on down to the regulatory commissions, and I think -- as I hear it from people in the industry -- we're trying to strive to say how do we do it right? How do we do it the fair way so that ratepayers and industries are carrying the load together as we meet our need?

So it should be interesting. I'm looking forward to this afternoon as we look to move more from the policy and regulatory side to the technical side, which is, I think, why most of us are here, and it's kind of the question how do we do that? We've got a couple of good panels of industry experts that will help us with that.

We're going to break now for lunch, and what we'd like to do is get back right at 1:00 so that we get started on time and make sure that we have adequate time to take advantage of the technical experts.

As I said, lunch is sort of out the door and to the right. There's buffet style. There's an opportunity to pay at the front of the line. We'll see you back at 1:00. Thank you.

(Noon recess)

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MR. OSHIE: What we have in store for everyone this afternoon looks to be a very interesting program.

We're going to lead off with a group that's going to be speaking on the technology, IGCC technology, innovations that have taken place for the new trends within the science of the development of the projects. I think that's what a lot of people are here for.

We're also going to be addressing barriers or thresholds to investment, and that's going to be an approach both taken from the owner/operator/builder perspective, which is going to be Mr. Redman, and also from the investment community, which is Mr. Degernes.

And then following that discussion, we're going to have someone who's actually involved in building an IGCC plant. That's Mr. Krueger. He's going to be talking about where they're at in the

development process and the problems, if any, that they've had in the development, some issues and how to address them.

So the first speaker that I'd like to introduce for today's panel is Mr. Stu Dalton, and Stu is going to be addressing the technology piece.

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And Stu is -- I met him through my work with the Electric Power Research Institute. He's been with the Institute, EPRI, since 1976. He's done a lot of work in the areas of advance coal, fuel economies, and emissions control. He's currently the director for EPRI's generation sector, and before that time, Mr. Dalton -- before he joined EPRI, he evaluated generation options, including coal gasification and conventional coal at Pacific Gas & Electric and worked with Babcock & Wilcox as a coal boiler in the pulp and paper services as a technician.

I'd like to give a very warm welcome, have everyone give a very warm welcome to Mr. Dalton. This should be a very interesting presentation, as I think they all will be. Thank you.

(Applause)

MR. DALTON: Thank you, Pat, ladies and gentlemen. I appreciate the opportunity for several reasons: One is we had a great lead-in for this afternoon's panel from this morning's session; so we appreciate that.

You'll find out, if you've listened to me or if you've heard me before, I have some passion around this area. I spent a career working in

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environmental control, largely around coal plants, but not entirely, and I have heard a few things today that might be interesting: "If we build it, we'll pay for it," was one comment that I heard that I thought was very interesting, because there's some comments on what makes this go, and in one sense I'm going to talk about one leg of the three-legged stool -- that's the technology leg -- and a little bit about the second leg, which is economics, and the third leg is the regulatory or -- and in some cases the political leg, which I'm not going to talk about, and you can, but I really don't hit that part. We see that all three legs will be needed to hold up the technology change that's going on.

This morning when I turned on the television, I saw Al Gore in a Today Show interview on his new movie. So the climate -- if you'll pardon the expression -- is changing. The political climate, the economic climate, the kinds of considerations we heard about this morning are changing.

I'll make one point as I start, that I'm going to be primarily talking about gasification, because that's what I was asked to talk about. I can talk

about carbon capture and the economics of that, and

I will make a point about that right off the bat. There are two issues when you talk about CO2 capture and sequestration: Capture -- the cost of it -- and sequestration -- feasibility of it. So at the start -- and I'll be talking about the technology and the cost. The end panel, later today, they'll be talking about the long-term effectiveness and storage.

The four pictures you see on this slide are of four commercial gasification combined cycle plants, originally all of them designed to use coal. Some of them use other things now -- petroleum coke, poultry litter, biomass. A lot of different things have been put into some of these gasifier plants.

If you look at this, you may not recognize it as a conventional power plant. Some of them look a little more like a chemical plant. In fact, one example -- this happens to be the Wabash station, the ConocoPhillips, E-Gas ConocoPhillips station. The power generation is that little piece there. The rest is the front end -- the air separation, the gasification, and the acid gas cleaner. So, in effect, you're putting the emission control at the front end of the plant, so you have a visualization of these. I'll get back to these slides later to

talk a little more about these plants.

I'm going to talk about just briefly the status and the context of it, some of the competing IGCC technologies, and these are changing literally weekly. There's a new entrant as of last week. Recent technical advances and some of the things that are going on in the business and some of the industry R & D efforts -- that's what I was asked to talk about; so I'm going to get right to it.

Many people recognize we built a lot of natural gas in the last few years. This is a rather remarkable chart. The highest increase in generation, the biggest build-out in any year in any country ever occurred in the U.S. just a few years ago. Why? Natural gas is going to be $2 a million BTU forever. Well, that's a little overstatement, and it was not what happened. A number of these same folks that built out the megawatts of natural gas are in bankruptcy or have had financial issues.

What you see here are some of the ones we think are pretty well bedded on megawatts, and so you see the little wedge out there. After 2010, 2011 you can start building a plant or permitting a plant now and seeing some of the coal come in. So there

are some new plants being permitted, and we expect to be built out.

Now, there are a lot more that are projected.

How many of those will be built? That's a good question. I don't know the answer to that. Those will be largely dependent on the permitting process. But you can see the large combined cycle build-out and simple cycle gas turbine build-out and almost no coal built during roughly a 10-year period before that in the U.S.

This -- I've modified a chart that came out of one of our reports for the last year that had some of the well-bedded permits and plans for coal plants, some of which may not go forward. This is a snapshot of last year, and overlayed on that in big green triangles so they can see from the floor are five of the potential sites -- I'll talk a little bit more about them -- including the one here, which lands right on top of us, the way I drew it. Actually it would be a little further toward the mouth of the Columbia and a little further away, and there's a much better drawing later. Pardon the artwork. I'm an engineer.

The other in the west, of course, is the Carson refinery, BP and Edison Mission generation

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proposal, that is being proposed for Southern California, with CO2 capture built into that proposal. That is not coal, but it is petroleum coke, which happens to be produced, among other places, in California and in Washington, and so in one sense it's an indigenous fuel in California and Washington.

I'll make the point that there's a horse race going on, especially in the west, and the technology is in the horse race over what technologies might be best for different situations. We believe that is a horse race that's not been run, and it has not been won yet, but there are several technologies looking at CO2 capture, and IGCC is a leading contender.

The idea behind GE and ConocoPhillips slurry-fed gasifiers is that they work very well on bituminous coals. There's some questions on sub-bituminous, Powder River Basin coals, et cetera, as to the economics. There are other gasifiers being looked at for some of these.

Right now, the way we see the economics -- and there's a lot of controversy over this -- but without CO2 capture, IGCC is not favored. There's a differential. The differential goes up in the

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west. It's more expensive in the west than it is in the eastern bituminous regions in the country. Emissions are lower, surprisingly not as much lower as they used to be. There's a lot of controversy over just how low the emissions are from the newest of pulverized coal plants. I have some data on that that I'll show you in a minute.

New IGCC designs are being developed. It might

be better for western coals. One came into the running last week. Siemens bought an East German -- pardon me -- was East German firm, now they're German -- firm that developed a version of a water-cooled reactor with dry feed. It is a new technology. I'll mention that in a later slide.

Other things -- waste coals, biomass, tire drive fuels -- all sorts of things are burned with fluid beds. That's another technology that can be used for -- almost anything you can grind up to a quarter inch and feed in.

Most U.S. coal plants use what people would call normally conventional coal. The higher temperature, higher efficiency plants that have been used elsewhere in the world, haven't been used much in the U.S. We haven't built anything much for the last few years, and coal has been cheap.

Well, coal is not as cheap anymore, and now more and more U.S. units are looking at these more advanced designs. CO_2 can change this balance.

Simple versions of gasification -- and they are simple, as I mentioned. You've got a picture up in the corner to see the reality. But the simple block flows have a -- you take air and distill it into oxygen, nitrogen, and trace gases. In that distillation process, you use a lot of energy. So this air separation unit, ASU, separates O_2. Coal is mixed in a -- normally a powdered form or in slurried form, but not in the same -- not in space powder, but in small granules -- with oxygen, enough to create CO and hydrogen. That's what gasification is all about. And oxygen does a pretty good job of breaking down the molecule and causing a glassy or vitreous material to be formed, a slag. That can actually be sold and used for a number of purposes. It's nonleachable.

The gas is then cleaned up. So you have a clean-up, but instead of being a duct that might be from here to the other side of the room, in the back end of a power plant, a flue gas, you have a duct that might be my arm span, a very concentrated stream at high pressure; so it's a lot easier to

clean up, less energy, chemically easier, and then you burn it.

Now, what most people don't seem to -- many people don't realize is this idea is very clean of all the criteria pollutants. The question is does it have any lower CO_2 emissions? And the answer is no. This puts out the same amount of CO_2 as a conventional power plant, unless you do the item down at the bottom, which is capture.

Capture has one different thing in it -- shift. What this is is a very simple chemical reaction. You take the carbon dioxide, add water, high pressure, temperature, and you get hydrogen and CO_2.

So that's the alchemy, if you will, of converting carbon, coal, into hydrogen. That's the shift reaction, and that's the one difference. Then you can separate out sulfur and CO2, and this is what FutureGen or the BP/Carson flowsheet looks at its simplest.

There are these four existing units. None of those capture CO2. There are units out there that gasify coal and capture CO2. They aren't power production units. These four are for IGCC. You can see a little bit more in these -- it would help if I point at the right thing -- the gasification

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and acid gas removal is this large removal here. Air separation is this large area here. The combined cycle is this smaller area over here, and that's the Wabash station.

Puertollano in Spain was supported by the EU in the development, and so was Buggenum in the Netherlands. Those are both Shell gasifiers or variations on Shell gasifiers to be offered then with Siemens turbines on the back. The Wabash is a GE turbine, but it's what's now ConocoPhillips process on the front of the gasification. The Polk plant in Florida is a -- what's now GE's front end and GE's back end.

By the way, there's a lot of information in the background that includes the size of all the plants, the manufacturers, et cetera, that I just don't have time to present; so they're in the handout. Roughly 250 megawatts on all the plants. All of them were supported by public monies. Roughly half of each was supported by public monies, and as (inaudible) up they're more expensive plants.

This is the status, markets, and vendors all in one slide. Included at the very bottom -- and these are all in the handout -- at the very bottom

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is the recent acquisition by Siemens of the German Future Energy. This was just announced a little over a week ago and represents a move to acquire something that's somewhat similar to the Shell gasification in that it has water walls and has some similarities to others, in that it has a quench, which might make it very efficient and might make it suitable for CO2 production.

The point on this slide, though, is there are these four that are out there, 250 to 300 megawatts. The main needs are capital cost reduction right now, because it's more expensive, and availability improvement, and there's a slide in the very back attachment showing availability history for the world's gasification plants over their first half dozen years, and the first of the kind units weren't all that available the first half dozen years.

AEP and Duke, which was previously Cinergy, plan a 600-megawatt-coal-base plants. Several others are in development for liquids, Syngas, et cetera -- Pacific Natural Gas, rather. We believe the technology needs improvement for the economics, if it works, but the economics on lower end coal.

Petroleum Residuals -- there are a number of

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plants, and, of course, Energy Northwest and British Petroleum and Edison Mission Generation plan projects in that area, and the vendor teams really are for GE and Bechtel, ConocoPhillips, Fluor/Siemens, Shell/Uhde/Black & Veatch -- three teams that most people know about -- and the brand-new one with the Siemens acquisition. So there's interesting commonality of names in some of these.

The gasification idea is you -- and the red object here is a gasifier. You add oxygen and a coal/water slurry. The water is evaporated. The coal is gasified, and you make vitreous slag. That's really what happens in the gasification.

Then you have to recover the heat, and you get a cooling of the gas. That's the radiant gas cooler, and then the idea was even more cooling of the gas and clean-up, and that's a simple, very simple flow schematic of the Polk station. And that piece is not trivial.

This is a during-construction photograph of the gasifier itself at Polk, and you'll notice a couple of comments on here. For the western audience, I wanted to point out some of the issues on Powder River Basin coal. The efficiency -- because

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you're -- simple way to put it is boiling water with oxygen. You have to gasify coal to boil the water off. It's a slurry of water and coal. You're boiling it off with oxygen, and that's expensive, and that hurts the economics. Now, there are other reasons that aren't worth going into at this point. There are new -- and right now as of today, GE has not offered a PRB design. They expect to later this summer, is what they have told us. You can blend it or use it independently with petroleum coke. That will upgrade the quality of it.

Similarly, E-Gas ConocoPhillips -- technology now owned by ConocoPhillips -- has some water slurry feeds. It's an easy way to feed a solid into a pressurized vessel as a slurry. If you think about trying to pump rock or coal, it's not easy. Pumping a slurry is easier. So there's a poor efficiency, higher pressure design that offers some improvement. They can blend with petroleum coke. There is experience with both lignite and with Powder River Basin coal, but, again, it's the economics that is the question, and they're looking

at some new designs, multi-stage designs. This one is shown as a multi-stage design. It might have some significant advantages when you look at CO2 capture technology.

Shell has a difference. It's dry fed. They are pumping coal, in effect. They use a hopper arrangement -- two valves, shove in coal, pressurize it, feed it out. Putting solids through valves is also not easy, and as a technical issue, feeding it and getting the slag out are two of the technical questions. But this has water walls, and so it has some efficiency advantages. It has a dry feed, and so it has an efficiency advantage on western coal.

There are a number of other gasification related projects. Not all these are IGCC, meaning Integrated Gasification Combined Cycle. Some of them are making Syngas, as well as some power. Some of them are making Fischer-Tropes liquid or proposing to make Fischer-Tropes liquid, some making hydrogen. You can see the list of other products down there, and this varies. This list actually changes. It gets out of date very quickly, and so I probably have some information that might be easily out of date. When it comes to putting the permit in, they have to go for the final product's leg.

But there are projects all across the U.S., many of which are supported by state incentives or support, and a number of these are probably going to be supported by clean coal power initiative money at the federal level or by incentives.

You can see, though, there are a number, and some of them have a little Notes/Status. FEED is not what we just did at lunch. FEED is front-end engineering design, and it's a multi-million-dollar project that goes before you can ever get the final bid. Most people think, "Well, I go out and get a bid." It's not the way it works in gasification. There was a presentation last October where one of our AEP reps got up and said, "Well, first you spend several hundred thousand dollars for a feasibility study, and then you spend up to tens of millions of dollars to get a design study, and then you get your bids." It's a little different than, "I want a new power plant. I'll go out and get bids," because these are customized designs right now.

Emissions -- there's a lot of controversy on this. Last summer we had a seminar where one gasification company and one combustion or conventional power plant company were up right after each other on our podium, and one said, "Our emissions are lowest." The very next person said,

"No, ours are." It was a very interesting tableau, and I'll show you some of the numbers of both.

These are actual and permitted emissions from the four operating IGCCs worldwide put on a common basis that recognizes the efficiency of the generations -- pounds per megawatt hour, not pounds per heat input, pounds per megawatt hour. It's an output based number. It's all correlated, and the numbers for permit levels are in solid, and the numbers for actual are in dashed. Notice normally the actuals are lower. Well, they have to be. For you to meet your permit, you have to be able to operate below the -- well, it's the point of your permit. And, in fact, you have to get a guarantee from your manufacturer somewhere between so that you can be assured you can operate below.

But notice that the Spain, Netherlands and two U.S. are all below. Notice they're also below the proposed new source performance federal standards.

Notice, also, that there are two on here that are newly proposed and permitted. There are two gasification systems that are permitted now in the U.S., the Steelhead and Elm Road. Now, Elm Road

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doesn't look like it's going to get built, but it does have a permit. You can see the permit numbers on these.

And there is one other on here that's pretty interesting. This is one of the most stringent prefectures in Japan for emissions. It's an oil based -- it's not coal -- but it's a little easier to gasify oil than it is coal. But notice how low the emissions are, because it's a very stringent location. It is a -- again, we're just reporting the data here. We're not saying how low can you go. We're not saying what might be done. We're just saying, "Here are the permits. Here are the emissions that have been measured."

This is PC. Same scale. Now, normally you don't use these scales, and normally you wouldn't have things that are -- that look so high on there, but these are actually pretty well-controlled plants. They're just not 98, 99 percent emission control like some of the new units are being proposed for conventional coal with emission controls. Elm Road and Trimble County are both high-sulfur coal, and they're much lower than even some of these low-sulfur coal units with conventional control, and the new low-sulfur

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units -- as examples, these are permits again -- again, they believe they can come in at these lower sorts of levels, and, again, we have a Japanese set of data, including that same prefecture in Japan where a conventional coal plant is sited, very low emission.

So how low is low? What can be done? These

are the kinds of things that are very controversial, and it really depends on the guarantees.

What about the cost? What about the efficiency? That's changing, too. If you talk -- right now gasification is certainly more than conventional coal. How much? Well, give me the context -- what state? What construction costs? What coal? -- and we might be able to give you a rough idea. Costs have gone up something like 20 percent in the last year for all the technology in this area. These are a snapshot in 2004. We're updating some of these.

But this says some of the things you need to do short-term, medium-term, and long-term to bring down those costs, at the same time improving -- and this is with 90 percent CO2 capture, these projections, and these projections are trying to

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show what kinds of R & D is needed in the time frame to bring down the costs and improve the efficiency at the same time. There's a lot going on that is not just in the U.S., certainly not just with EPRI. The DOE has many more dollars than we do in this area, but it's a concerted program worldwide that's really aimed at reducing the costs, improving the efficiency.

What about CO2? Higher efficiency inherently reduces cost. I delivered a paper in Florida yesterday on that point, the fact that higher efficiency is sort of a no-lose proposition because you reduce the amount of CO2 formed, and if you have to capture it, reduces the amounts that's captured and stored. But neither IGCC nor conventional coal inherently captures it.

If it's a horse race, I contend it's a team of two horses on each team. On the gasification team, the horse that captures CO2 -- the technology to capture CO2 is fairly well proven at scale. The technology for scaling it up and reducing the cost of gasification is not as well proven.

On the combustion side, on the conventional plant, the horse that is very well proven is the conventional plant, not the CO2 capture, and that's

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the one that has a lot of development to be done. So you've got a team of two. To finish, both have to finish, and the costs are what's the levelizing value. I'll show you a couple of quick ones of those.

World efforts are aimed at that high efficiency generation and then understanding how to capture and safely store CO2, which we'll hear more about later.

This is a series of what some people call the kids game of pick-up sticks or pixie-sticks, where you throw them all down, and you lay them on top of

each other. These lay on top of each other. They relate to this morning's discussion, and if you want a more extensive version of this, you can go on something that's not EPRI's, but our CEO was taped and is available online at eand -- eande -- eandetv.org, and they have his slide presentation, his verbatim transcript and all of his slides, including biomass, wind, nuclear, gas and coal. This is just a subset of some of those, but that's available online. I've looked at it myself. It's a 41-minute presentation. He did that for resources for the future about a month ago.

Natural gas versus PC, costs -- these are a

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midwestern site. The costs change, obviously, and it is 2004. Again, the cost changed, but it's an interesting comparison because it shows you against the metrics. We heard an $8 and $40 metric, and that would give you a difference even on this slide.

The next slide shows where we think pulverized coal is going without any capture, and, again, you see that there's some advances in the technology that we're involved in, including technology for pulverized coal forward.

The next slide shows IGCC today, and you see a bigger advance as you go out to 2020 in the reduction of costs. Again, you saw some of the R & D that goes into that.

And then what about capture? Well, right now if we tried to capture from a pulverized coal plant or a fluidized bed plant, it would be very expensive. Soda pop is actually made from CO2 captured today from a fluidized bed cost plant in the U.S. Most people don't know that. There's a very small plant, roughly 10 megawatts, that's been built with CO2 capture off the back end. It's very expensive. There are a lot of advancements being made in this area, but that's one of the horses.

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The more important one for this discussion is here, and if you notice the crossover point is right smack dab in the middle between 8 and 40 or almost, and the IGCC with capture is more expensive, but then once you captured it, the cost doesn't go up as you have a cost of metric ton of CO2.

This shows the gap between the two technologies, and you see it's a horse race. We think that that gap will be reduced, and we're actually working on some title work to do exactly that.

Just to point out there's a lot of work going on -- our work on -- the DOE's work I mentioned; our CoalFleet for Tomorrow Program works in all the technologies; the FutureGen Alliance and work on capture from pulverized coal plants.

We do have a lot of this work covered in our CoalFleet for Tomorrow effort. This is a cover from our last summer's journal article, which is available online, if you're interested, looking at how reliable is it, and we're looking at -- you know, our CoalFleet -- what designs are best and how it can be configured, finaled.

And then just in conclusion, we see IGCC being

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very promising technology. We see the very low emissions, excellent promised efficiency, and IGCC has the potential for capturing CO2 more easily than off of a pulverized coal unit. Right now it's more expensive, and it's a horse race, in our opinion, as to how these will pan out in the future. It's got to be the team of horses on each side.

We've seen that other programs such as -- I'm sure Sally will talk about the regional partnerships with CO2 -- the FutureGen program and our CoalFleet for Tomorrow will all be providing some of the R & D for that work.

I don't know if the questions are after. I imagine they are. Thank you.

(Applause)

MR. OSHIE: Our next speaker on this panel is going to be Mr. Eric Redman.

As I explained earlier, he has been involved in the actual negotiations with owners or builders for this technology, and he promises to bring some of his experience to all of us this afternoon and to talk about what the threshold issues are -- what are the barriers? What are the -- you know, what are the concerns of those who would own or build? And this should prove to be very interesting.

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He's an attorney right now with Heller, Ehrman in Seattle, Washington. He founded the firm's energy practice group. He has worked -- and his work now centers on new energy projects and technologies. He's represented in his career the aluminum industry here in the Northwest. He's been very active in representing utilities. In his firm -- he leads the firm's group representing the Trans Alaska Pipeline System. So please welcome Mr. Eric Redman.

(Applause)

MR. REDMAN: When my old friend Marilyn Showalter was on the Washington Commission, she really hated Power Point presentations, which is fine, but she used to get up in public and say that I was the one that told her the reasons why they were bad, and this never went over very well with our client Microsoft. So I want to make sure that people understand that the only thing bad about them that I ever said to Marilyn was that NASA had found that the culture counter of Power Point had contributed to the Shuttle disaster, and

the reason was that when you do the Power Point, you're so constrained by the format, that you don't get in all the little qualifiers that you ought to

have on a slide. So I'm famous for getting them all in and my slides being impossible to read.

In this case I'm going to skip over some because Stu has covered some of what I would otherwise cover in this presentation, but the presentations are all printed. You all have copies of them, and so that should be useful.

Let me mention -- pull out of the first slide -- Stu mentioned that pulverized coal might work or might be made to work for the -- may be things that could improve it, and it's carbon capture and so forth, and all that's true, and it's worth talking about it. But I'm not religious on the subject, but I think that, for plenty of reasons, burning coal is inherently dirty, and we should be trying to stop it. I personally won't work on one of those plants, and I think that the effort to find substitutes is extremely important.

From a climate standpoint, just let me mention, that we also -- of course, I'm very avid on renewables. I think we all are and every other thing. I'm even very open-minded about nuclear. None of them -- if you've seen the charts, none of them -- we need to do all of them, but they're not sufficient to deal with the climate issues. In the

next century the climate problem is a coal problem. That will be what we have to deal with. And the advantage by IGCC -- the promise of it is it does allow the carbon to be captured. It can be done. It's feasible.

The first-generation method, that I call -- what I call -- they're all refinery based. Stu knows ten times more about them than I do. But let me mention that they're not anything inherently new and novel. Just as Stu mentioned, they've been running for a long time. 100 years ago our cities got pound gas by gasifying coal. It was Syngas that they got from the pound gas gasifiers. It's not new.

The trick in IGCC turns out to be the "I." That's how you integrate the electric power production, and some interesting things happen as you get into the design of actual plants for a customer. You find some interesting things about how that plant might optimally be configured. But they can -- the gasification can also be used to produce other things, and, in particular, that last item is important. It can create pipeline quality natural gas.

There's a chart. It's just a Siemens' generic

chart. I'll skip it.

The first generation, ones that they've talked about, I would say my view is a little bit different from Stu's. His is better informed; so mine is more free-formed. That is that I don't think that there are inherent reliability problems with these projects. There certainly are not inherent reliability problems with the gasifiers. The integration is the issue, as I mentioned.

And I think on cost -- we should probably spend some time on that. I hope there's time in questions, because I think there's a lot of mythology around the costs. Within the industry, if you were to -- many of the conferences, industry conferences -- if you looked at the cost curve for IGCC, it would look like a ski, with the tip of the ski over on the left-hand side of the chart. The first glance are expected to be more expensive than all the rest of the plants, and the end plant is where you start to get the levelized cost, and everybody debates about what is the end plant. As someone out in the front lines, I'm going to talk about that approach that we've been trying to take, persuade vendors to take, persuade others to take.

Coming from Seattle, I always mention Boeing.

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When Boeing builds a new aircraft, they do not take the entire cost of the factory and put it onto the first customer who buys the first plane.

This is a trillion-dollar world market, and these companies all need to get their reference plants built, and the cost of getting those built -- some of that cost is the cost of getting into this market. So this notion of the high cost of the first plants is in some respects an exaggerated one.

There are other gasification technologies. I think it's important to remember the so-called advanced technologies are not part of this big group. The Gas Technology Institute has a handle on a lot of them. You'll hear about a lot of them. We represent a bunch of them. We're trying to help them get commercialized. Some of them have an awful lot of promise compared to the first generation. They don't use refinery methods. Consequently some of them are more versatile; some of them are less expensive, but none of them is proven yet. So until they're proven, we don't know everything that could happen with them.

I want to mention underground coal gasification. It was tried in the United States.

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It was a disaster when it was first tried. The type of thing that tends to prejudice you against it was people get killed in accidents some years ago.

But there is a company -- you can look up on their website -- Ergo Exergy. They're not a

client. I sure hope they become one, though. They seem to have actually cracked this underground coal gasification in a remarkable way, and they have a commercial project and another one about to start. They're very, very low cost. I sat with them. I met with them in Montreal, and I couldn't believe the cost numbers on their existing project, and they said, "Of course it's cheaper. We don't have to mine the coal. We don't have to build a gasifier. That's why it's cheaper."

One of the ironies about gasification -- and it will come up again today -- is that the moment that the prices were -- this has a lot to do with the utilities and how utilities are regulated as opposed to gas markets -- but at the moment, the prices actually make it better to use gasification for methane or synthetic natural gas than they do to make electrical power, and that's a complexity to be dealt with in the commercial world.

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The report from the commercial front lines -- which is what I really was asked to talk about -- I've been working for Summit Power. Summit Power, as a lot of you know, is an Oregon station headed by Don Hodel, former energy secretary and former Bonneville Power administrator. Earl Gjelde, who was his No. 2 in both of those positions -- even headed Bonneville briefly -- they have been responsible for $5 billion worth of natural gas fired power plants that are now operating in the United States and have gotten into IGCC.

My wife, too -- many people have met Heather Redman -- she's the principal of Summit Power. I've been out on their behalf. I've served as the tip of their spear. They've been the tip of the Siemens spear primarily on IGCC for a couple of years, trying different approaches to see if we couldn't crack some of the commercial problems, and so here's my battle report: We've done seven projects that we've proposed in the last two years. Four of them were killed. Three of them are still alive, one in the Pacific Northwest. We're the low-profile IGCC plant in the Northwest, the Lower Columbia project across the river from Energy Northwest you're going to hear about later.

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So what killed the four? This is probably interesting. First was timing. Most of these were companies that were already too far down the road on a pulverized coal plant and decided to take their chances on sticking to the pulverized coal plant.

Cost -- there's this idea that it costs a lot more to build an IGCC plant. You need to remember that when you hear that 15 to 20 percent premium, first of all, think of the tip of that ski, and, secondly, remember to just reverse the capital

costs of plant. There are other costs than the capital.

Availability -- there's this idea that the availability of IGCC is poor. There's some reasons for that, but I think it's essentially a myth. A lot of these companies went out and pinged the market about 18 months ago, and they found there were no full-wrap warranties available from the vendors who were going to build the plant, which meant they weren't going to be able to finance them, and they still believe that, and they go home and tell their boards that today and their commissions that today, and but you'll hear from everybody here that that's no longer true.

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The inflexibility to fuel -- Energy Northwest has been creative about this. You're going to hear some more about that from Tom, I guess, if he speaks, but these first generation plants are pretty -- they're designed sort of the way you would design a refinery, the gasifiers, and they're pretty dependent on that fuel stream that you pick to begin with, and if you get too far off that stream, there are efficiency issues, and some companies look at that, and they think, "Boy, I don't want to be locked into the life of this plant for one particular coal supplier," or "I don't want to be dependent on a railroad," or whatever. So they have reasons that that troubles them.

There have been some surprise attacks -- this is all the battlefield analogies here -- surprise attacks by the pulverized coal bidders. The pulverized coal bids during the course of the last year have just been going up and up and up and up, and actually it goes up faster than it does for IGCC for specific reasons. Consequently, IGCC was starting to gain an advantage against pulverized coal in actual competitions of utilities opening bids, but there have been some bidders who have decided to come in on low cost on pulverized coal.

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Carbon risk, the fear of perverse effect for IGCC -- I'm going to talk about this in a bit. This is the thing that drives Ralph Cabana nuts. Ralph is in the audience here, and he's probably responsible for my being here today. I want the world to know if Ralph were in charge of all this, it would come out, and we wouldn't have to worry about this issue, because Ralph's views on it are absolutely correct, and there's also a concern among the utilities that has to do with the whole acquisition process and how they're regulated, how this will affect them.

The -- what accounts for the three that are still alive, as opposed to the four that died? I should mention one of those four also ran into the problem with a partially completed nuclear power

plant, which people think they can complete more cheaply than building this plant.

What accounts for survivors? Well, the first is that -- at least in the ones we've been working on -- our whole approach has been to not waste our time trying to tell somebody that they ought to buy something that's going to cost them 15 percent more than the alternative. I don't know why anyone would want to waste their time on that. Our whole

approach has been to avoid government funding, government spending, because it tends to slow you down, and the FEED study approach that Stu mentioned, my own view is that that is fatal to the sale of IGCC. For all the work we've all been doing, there's not a single one of these plants under construction today in the United States, and this FEED study approach where you say, "Let's go spend $15 million to design the plant, and then we'll tell the customer what price he's going to pay," this is deadly for selling plants. So we've tried to find ways to have commercial terms that take that pioneer's penalty off the utility or off the IPT at least in some significant extent.

We've also found in configuring them that if you add some methanations, some synthetic natural gas productions to the total mix, you're able to reduce the total cost, improve the total returns. We try to retain the flexibility to swap in these advance technologies or the one that Stu just mentioned, that Siemens just bought; so if you can improve the performance without any expense to the customer, as you go down the road, have that ability to do that, and then concentrate on who are the best candidate buyers.

So who are they? Who are the best people to buy these technologies? Well, first of all they ought to be entities that aren't too far down the road on a big plant. They should have some good prospect somewhere for carbon sequestration at some point, because they are all concerned about what will happen on the carbon risk.

They have to be in tune, I think, with the national environmental groups, who are the ones who really have figured out the importance of this IGCC technology, and they have to be companies or entities that for some reason are poised for a strategic business decision. We all know "strategic" means bad business deal, and those are the kind of people you want to deal with.

The calculus of risk on carbon capture -- from the plant owner's perspective, the standard argument, the one I agree with is if you make it, if you do this plant and it's carbon capture ready -- you retrofit it -- then you're in the best position you could be when the world of caps and

trades comes, and it's coming inevitably. I think Ralph believes it; I believe it, and I think it should be persuasive.

But there is a counter argument. I know it's

real because I've run into it, the utilities who say, "I think I'll stick with my plants through the pulverized coal plant," because they believe they're going to be able to get grandfathered out of any scheme like that when the time comes, and when you say, "That's ridiculous. No one has ever suggested that anybody is going to be grandfathered out of it," people say, "Look at the Energy Act. Tell me how you think that got written. If we have IGCC and we're able to capture the carbon, we're going to have to do it, but if we build the last pulverized coal plant, you know, we'll be able to plead with our congressional delegation to get us an exemption." I think it's ridiculous, but there are people who believe that.

There are solutions to this. We can talk about some of those, but we try to deal with that commercially in a variety of ways. I think from a public policy standpoint, what we need is an early adopter program. We need an incentive. We need sort of like a free pass for the first ten plants in some form or another. Say, "You build this plant. You be the one that's responsible for these reference plants getting built. You're contributing to the whole global" -- "solving a

global problem. We sure as hell are going to give you some sort of a pass, compared to your colleagues as opposed to creating -- having incentives be the other way around."

From a climate perspective -- this matters in the Northwest particularly, you know, the calculus of risk about these plants. The first question is should we support any of these plants without carbon capture and sequestration from day one? And so the standard argument, which I don't agree with is, no, we shouldn't do that, because even though they're better than gas plants, better than pulverized coal, they're not better than gasifier plants.

I think the counter argument is very basic, and I think it's true. The key is to get pulverized coal plants replaced as fast as possible with another technology. IGCC could do it, and when they're built, those reference plants are done, and I think you come back, and you deal with the issues of carbon capture with them. But to hold them up waiting for this is just to allow more pulverized coal plants to be built at an incredible rate.

And the second issue -- of course, the Northwest issue is should we support them here,

because people in the Northwest say, "Well, we don't need coal in the Northwest." So I think the same argument applies above, but, in addition, you know, we ought to think globally.

Again, the key for all of these consortiums is to get these reference plants designs built. You know, I've dealt with the Chinese. The Chinese say, "Why don't they come over here and build them in China?" I've dealt with the China embassy on this, and I said, "Well, they have three reasons: They think you're going to steal the technology," and the Chinese said, "Hitler had this technology. I mean, what is there to steal?"

"The second thing is they think they're not going to get paid," and the Chinese say, "We can arrange that through the Hong Kong banks," and I said, "Yep, we can do that."

And I said, "But the third thing is they don't have their reference plants built yet, and if you're going to build your reference plants, you probably want to build it down the street where you can run down to the hardware store if you need something, compared to building it on the other side of the world." This is what's holding it up, folks, is to get these reference plants built.

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The utilities' concerns of -- the regulatory concerns of the utilities, though, are real. The paradigm that we're all having to live with is AEP, General Electric and, in the Midwest, PUCs, where this notion of, "Give us preapproval for 10 or 15 or 20 percent more, a cost premium, and we'll get this IGCC built," and that's been the battleground for -- what? -- the last two or three years, and it looks like it's going to happen. I think it's really slowed down IGCC to do that. If I were a commissioner -- which I'm not -- but if I were czar of all the commissioners, the head of NERU, whatever, and I could adopt it as a policy, what I would suggest to you is to say to those utilities, "Do gasification." It's what they should be doing. Don't pay extra for it, and get the utilities to go deal with that, and get the vendors to deal with that. That's the way we're going to get this thing done.

There are several ways -- I've mentioned four here -- there are several ways to do it. Of course, if you can configure the plant to include the methanation, it makes the plant cheaper. It makes the real economics of the plant cheaper, because it's just inherently cheaper to build a

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methanator for half of the Syngas than to build electric power, which generates half. Plus most of these entities have gasifier power plants that are sitting idle for lack of methane; so it improves the economics greatly.

Make the comparison fair. Don't just look at the capital cost of the installed capacity for something that's more efficient, that doesn't put out sulfur, that doesn't put out mercury, that allows the carbon to be captured, that has the ability to be flexible to use these different fuels. You know, let's get the apples to oranges out of the comparison to pulverized coal.

Preserve the ability to -- to switch to advance gasifiers later, because they are definitely coming, and I think induce the project vendors to bite the bullet. You know, you need to say to them, "You're Boeing. You've got a trillion dollar market. It's worth getting this plant built. If you will build a plant at a price that works for our utility, there will be lots of understanding and a lot of cooperation in getting the plant built, and you'll have a reference plant you can go sell."

What about the process concerns? We've run

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into this big time with utilities as a potential buyer, which is why the first of these plants ironically might end up being owned by private equity and IPPs.

They weren't thinking -- the investors and the utilities initially weren't thinking about IGCC when they did their last integrated resource plans. So you can come in with them today -- and there are people in the room that can vouch for this, because I can see them -- where we've gone in and said, "We will make you this offer at this price for output of power and this price output for methane, both of which are below market, both of which are cheaper than you're going to get in any RFP process that you do," and they are as professionals, but with a problem as a deer in the headlights and say, "What do I do now? I go to my commission and say, 'Something turned up that was cheaper than what I knew about when I did my RFP plan.' Gee, you know, if you guys say jump, they say how high, but if you don't say jump, they're not going to jump on this and figure out how to solve this, and this is certainly true -- Stu mentioned it. It's critical. You cannot -- Tom may contradict me, and if he does, I'll be very interested to hear his report.

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But for the utilities, generally, investor utilities, you're not going to be able to buy these plants through an RFP process. This plant has to be designed specifically for the customer. There are 100 choices to make in what the customer wants in that plant, and until those choices have been made, you can't price it, you know, completely, definitively and so forth. They're not off-the-shelf items like the combined cycle plants. So it's not suitable for an RFP process; it's only

suitable to bilateral negotiation.

One of my partners, who appears in front of you all on behalf of Vestron Utilities, says, "Tell them they should make a special pre-approval process for this. I don't know if you should or not, but I do know that for the investor-owned utilities, at least" -- and they're so critical to the electric power side of IGCC" -- it's really in your hands."

This is my last slide. Some of you have seen this because you've heard me do presentations before, and I never leave it out. Last year I got to stand at Mauna Loa with Jim Hansen. Dr. Hansen was by my side and took this picture. We drove all the way up there to see this plaque. This is a

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spot where Charles Keeling decided to start measuring CO2, and look at that curve. That one only goes out to 1997. If you continued today in bronze, it would be intersecting with "1958" that you see on the right side there.

CO2 is increasing by two parts per million a year, and it was only 300 parts per million in the year 1900, and to me it's this curve that we're all about here.

Inside this building there's a different curve on the wall. It's the curve for CFCs. Do you remember CFCs? Fluoro-hydrocarbons, the carbons that were found to be creating an ozone in the universe in 1985 -- not in the universe-- in the polar atmosphere. By 1987 CFCs had peaked because we decided to get off that, and Hansen and I stood there and watched the curve at Mauna Loa -- the CFC curve has now turned down for the first time. CFC concentration in the atmosphere has turned down. It turned down because people decided to go do something to turn it down. This curve we really have to turn down. Thank you very much.

(Applause)

MR. OSHIE: Our next speaker -- and we're going to be running a little long on this panel. We

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started late, as well -- is Mike Degernes. Mike worked for the Washington Utilities Commission a long time ago as an economist, and he has since moved on, as they say. He worked for PacifiCorp, from there served as the assistant treasurer and vice president of finance. He then went to work for Bank of America. With Bank of America he was the managing director of their electric utilities independent power fixed income research. He also served as their senior VP of industry research of Bank of America covering electric, gas, and water utilities.

He's now the senior credit analyst for Aberdeen Asset Management, covering the electric, power, chemical and health care industries. So please a

warm welcome for Mike Degernes.

MR. DEGERNES: When Pat called me and asked me if I was interested in speaking, he asked me to really talk about what does it take to get one of these projects financed, and I guess the summary is properly designed, in terms of financing and the structure, these plants are easy to finance. The problem is getting everybody to agree on who takes what risks and how they're going to be divvied up and who gets paid for it.

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As a historical perspective, the last two construction building cycles for the utility industry didn't end very well for the industry. When I was up at the Washington Utility and Transportation Commission in the early '80s, we were there trying to deal with who was going to pay for nuclear power plants that either were going to be built and extremely expensive or weren't going to get built and who paid for the cost of that.

Then earlier this decade with the merger generators, they overbuilt, they misforecasted the cost of power, and you had a number of bankruptcies. Financial institutions ended up taking back power plants. They're selling at a fraction of their new construction costs.

The problem in the '80s led a number of utilities to say they weren't going to build anymore power plants, and they were happy to see the merchant companies come in and take over, and that was because they felt there was a misallocation of the risk.

The next point there, "Regulation is political as well as financial" -- it's easy to be a regulator when prices are stable. It's not so easy when prices are going up, and when you get into a

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new construction cycle or when there's a shift change in the price of energy, it gets very difficult to be a regulator, because the financial rules say you have to raise rates, but you've got politicians that are either elected commissioners or appointed by a politician, and the governor will get involved. We're seeing that now in different parts of the country where deregulation -- price freezes are coming to an end, and suddenly the governor -- it becomes an issue in a governor's election. So you have to keep in mind as an investor that it's not only the financial decision, but also the political decision on getting these things financed.

Regulation -- and I've always felt this -- tends to discourage risk-taking. The penalty for being wrong always exceeds the reward for being right, and it doesn't -- it just doesn't work well to be a risk-taker in the utility industry, and many of the managements haven't been brought up in

a culture to take big risks.

In terms of experimental projects, which in many investor's point of view IGCC is an experimental technology today, utilities and the regulatory framework really doesn't handle

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allocating those risks and dealing with experimental techniques. If it works, fine. If it doesn't, you know, regulators find it very difficult to pass those costs onto consumers and probably for good policy reasons. Consumers really aren't the appropriate party to take these risks, but, you know, neither are utility investors in many cases.

Whenever you get into a major construction program, the credit profile of the company deteriorates. Even when in states that are deemed to have strong regulatory climates and strong in the sense that investors look to those states and say, "Those are a pro-company type of regulators," the financial metrics of these companies still deteriorate, you know, whether they -- it's the additional issuance of equity, coming to market with more bonds and having that extra supply depress the price or increasing the interest rates. So investors know that, and when we see the next round of construction, we're going to look less favorably on the utility industry because of it, and that's just a fact of life.

These are -- when I talk to other investors about IGCC, these are some of the points that they

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talk about, and they may have merit; they may not. It's a new unproven technology with a limited track record. I mean, Stu maybe will tell you that, you know, there are solutions to the problems, but today we can't look to a number of operating plants and say, "Yeah, it works well." It's more capital intensive than either gas combined cycle or conventional coal plants, and, therefore, it's going to have higher capital costs, and it's going to take more of our money to get it financed.

It may have attractive environmental characteristics, may be easier to sequester the CO2, and that, in effect, becomes a hedge against, you know, additional costs later on. You spend it up front, and you'll have fewer costs later on if you have to start sequestering CO2, and it may be a hedge against the more restrictive regulations. So that plan may be able to continue operating with a smaller capital investment.

When I used to testify in rate cases, when you got to the issue of, "Well, investors are getting paid to take those risks," I think it's important to point out we don't get paid a lot to take these risks. If you're buying an investment grade utility bond today, 10-year bond, you're lucky to

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get 100 basis points over cost of Treasury. Another way to look at it, a basis point is 1/100 of a percentage point; so we have a 1 percentage point higher return expectation on our investments than we would if we were buying government Treasuries and not taking any risks.

Another way to look at that is if we faced more than a 1 percent risk of loss, we're better off just buying Treasuries and not investing in the utility industry. So we're taking, as a bondholder, a very, very small risk that we're not going to get paid back, and to date in every utility bankruptcy -- and there have been several in the last 20 years -- utility bondholders, particularly first mortgage bondholders, have all been made whole at the end. We suffered some delayed interest payments. We suffered a loss in market value of the bonds, but ultimately if you held those bonds through the bankruptcy, you were made whole. So we didn't take a loss of risk. We don't price a lot of risk into the investment.

On the less than investment grade, you know, the NRGs of the world, they're able to issue bonds today at 200 to 300 over Treasuries. Again, a slight premium to what investment rate bondholders,

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but still a very small premium for the risk that we aren't going to get our money back at the end of the project.

Equity investors in the utility business -- regulators are giving, you know, 10 percent to maybe 12 percent these days or anywhere in the 5 to 700 basis points or 5 percentage points to 7 percentage points more than Treasuries. Again, still a very small risk, and if you're asking a utility investor or an investor in a merchant power company today to take the experimental risk, I think it's very difficult, unless you define what conditions are going to be placed on it so -- you know, whether we shift costs to the constructor, whether we shift some of the cost to ratepayers, but you're going to have to define who's taking some of those risks, because we don't get paid enough today to step up to an experimental technology.

If I were looking at trying to get one financed, it would be easiest for me to go to my credit committee and say, "Hey, I think we ought to invest in this company who is building" -- "this regulated utility company who is building an IGCC." Assuming that regulators have signed off on the

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project, there's some decision on who's going to be taking the risks, whether those risks have been shifted to an engineering company or the company that's sponsoring the technology, but if we go into

the project and I go to the credit committee and say, "I think we ought to invest in these bonds," but if this plant that is going to cost a billion dollars doesn't work, it's going to come out of the investors' pockets, and we'll just pass and move on to another investment. There are plenty of other alternatives out there.

To properly -- if you want the utility to finance it and if the regulators want that as a part of the utility portfolio generation assets, regulators are going to have to address some of these risk issues and may well have to put them on the shoulders of the ratepayers or some portion on the shoulders of the ratepayers, recognizing that the technology may not work or events may make the plant less economic later on. You know, if natural gas prices were to go back to $3 -- you know, it's probably unlikely today -- but if natural gas prices go back down, the economics of these plants are much worse, you know, than they are today with the high price of natural gas. So you have to

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define who's going to take that risk if the alternative energy prices go against the project.

Regulators can do a number of things to encourage the construction. They can approve it prior -- you know, approve the budget, approve the project, and as long as it comes within that, there's no risk to the investors that it won't get added to rate base. They can provide construction work and progress in the rate bases, an anathema to some regulators, but it basically says that current customers are going to be paying for the cost of construction -- that the capital costs during construction, rather than deferring those and letting future ratepayers pay those costs.

If you want to discourage it, you wait until the end of the project, and then you second guess the company and say, "Okay. Well, now let's look at it. It takes three years to build. Let's look at it now in hindsight. Was it a good deal?" and don't look at it from the perspective of what -- what they went into it. They could capitalize HEDC, which basically says, "We're going to capitalize the interest and equity cost of the plant, add it to the cost of the plant, and future rate-payers will pay those, not current

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ratepayers." That makes the current company's credit metrics much weaker.

If you want to project-finance it, the No. 1 requirement for project finances -- somebody is going to have to pay the revenue that pays the operating cost of the plant, pays the interest on the bonds and basically returns the money to investors over the life of the project, and without a very strong contract with a strong creditworthy

party, you can't get project financing. All project financing does is shift the risk to somebody with deep pockets, and in many cases those deep pockets have been the rate-payers. A utility will sign a long-term contract with a non-investment grade generating company, who takes that contract to the bank, borrows money against that contract and gets the project financed, but the bank isn't looking at the Calpines of the world and say, "They're a great credit." They're looking at the California customers and saying, "Well, we know that those customers are going to be forced to continue to pay the power, and that money will flow through, and then we'll capture it in various revenue accounts before it actually can be used by Calpine for anything else," and so they structure

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the project basically to minimize Calpine -- I'm picking on Calpine -- but minimize the impact of that weaker company's credit and pass the cost onto -- or pass the risks onto the deeper pockets, the stronger companies.

You also need an established construction engineering firm. If they can get a wrap of some kind guaranteeing that the project works, you need an established operator, because most of the contracts don't pay if the plant doesn't run, and there's no revenue there, and you want to have technology that there's not a lot of risk there.

The final group -- and, really, it's a much smaller universe today than it was a few years ago -- are the merchant generators. I'll use NRG as an example. They're big enough, they've got enough track record, they could probably go out and build one of these plants and get it financed, albeit more expensive than their current financing, but they're unlikely to do it, especially if they don't have a contract, because the output is going to be more expensive, and they're subject to the whims of the market, and they can't sell their power for any more just because it comes from a more expensive generating source. So I don't think

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you're going to see many of the merchant generators actually stepping up and doing these types of projects.

My guess will be that the regulated utilities will be where the first several plants get built and only in areas where they have strong support from regulators. AEP is one of the ones that was talked about earlier today. The Ohio Commission has authorized them to recover the first-year engineering costs on an IGCC, and it's going to be, I think, in the neighborhood of $26 million for the first-year engineering costs, and those costs can be passed onto consumers even if the plant never gets built. So they've taken -- the regulatories

have decided as a policy matter that they want this type of plant built in their state, and they're willing to pass those costs onto consumers ahead of time, and AEP has said without that, they won't proceed. So it's a risk that even one of the largest utility companies in the country is unwilling to take without strong regulatory support.

Given that we're kind of running out of time a little bit, I will kind of pass over the rating agency, the risk -- the reaction of the financial

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market of the rating agencies and bondholders and equities.

But generally, to summarize it, they are going to be less -- less excited to see another round of construction, regardless of the type of construction because of credit metrics deteriorating, and if you're going with a new technology or an unproven technology, they're going to be much less willing to assign higher ratings or the same bond ratings to the market because of the additional risks, and regulators or somebody is going to have to make up the difference to persuade them that really it isn't as bad as it was the last two times around if you get the construction. So thank you.

(Applause)

MR. OSHIE: The last speaker of the afternoon is Tom Krueger, and Tom is the lead developer of the Pacific Mountain Energy Project, which is an IGCC plant that is being at least projected to be built in the state of Washington, and they're in the development process.

Tom has been around the industry for a number of years, somewhere around 25. He's developed several energy projects, both in, I'd say,

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conventional generation and biofuels, and he's going to close out this panel. He's going to, you know, talk generally about the issues that they are facing with Pacific Mountain.

Because this panel has run later than we expected, we're going to hold the questions until the end of the carbon sequestration panel, and we're going to shorten the break down, and it will be -- we'll take a 10-minute break after Mr. Krueger is finished. So thank you very much.

MR. KRUEGER: Gosh, you're getting a lot of information today. This actually reminds me of about a decade ago or so when we were talking about natural gas plants, and this is not an unusual circumstance when we're looking at new technologies. We were doing coal plants and nuclear plants before that. We were looking at deployment of natural gas plants, and we had these same kind of stories, and you're not going to see

everything in alignment. So at the end of the day, as a developer, what I have to do is I have to take the uncertainties -- I have to herd all these cats together and take the uncertainties out of the project, and it has to get financed. So at the end of the day, we have to take the risks out of it, or

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it won't get financed, and that's what we can assure the utility commissions, as well as the utilities, apart from paying for these projects.

Because we are running a little short of time, I'm going to move ahead and probably miss -- skip the -- how do we get this going? There we are -- I'm going to skip the introductory portions of this, but I think it's good that you have it for your personal context, and I'll just get right into the IGCC plant that we call Pacific Mountain Energy.

And I'll start out by just giving a little bit of context. Our job at Energy Northwest is to provide our members and regional utilities energy options. We're developing a lot of renewables -- wind, biomass. We have a solar project, and so I don't want to say that this project in anyway overshadows those projects. We're committed to renewables and moving forward in that area.

This is a base-load project. So we're looking at a need for a new base-load project in the Northwest, and we think IGCC makes sense because it fits some basic design and business principles that we have been kind of directed by our utilities to do.

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The first one of those is we need to be a low-cost, competitive resource in the region, and we need to find a way to overcome the transmission constraints that we have in this region, and it makes sense to put a project closer to the load centers, and so that's one of the other criteria we looked at.

It makes sense to look at a technology that can use diversity in fuels. We're not stuck to one fuel like we've been with natural gas. People like that kind of option, and maybe even the most important is it has to be environmental, and it has to -- when we talk about environmental, it's not just the regulated emissions; it's GHGs, as well. So we're looking at greenhouse gases, and we think IGCCs makes the most sense in the state of Washington and the Northwest.

We're looking at a 600-megawatt project not only because we get the economies of scale at that level, but this is the reference plant that all the technology providers are providing. So just like we were talking about with the natural gas plants years ago, they eventually became very unified and standardized, and that became financeable, and we

could move very quickly both permitting and on the financing side.

So IGCC -- and when you hear about commercialization, that's one of the big steps that IGCC is making today is the big vendors, and I'll talk more about them, and you've heard about some of their names. They're working hard on these front-end engineering packages, and they're going to continually try to make them a reference plant, and we're going to utilize that in our project. I'll tell you more about it.

Flexible fuel design -- we have -- and we looked at -- part of this, when you look at siting a project, is you have to look at where the site is, and so when we looked at a site, we looked at multiple coal sources, delivery options. We looked at the -- but more importantly in the West -- what we have going in the West is we have a growing supply of a waste product, and that's called petroleum coke, and the reason we have that is you've noticed your gasoline prices going up, and that's because we're kind of short of oil, and as the price of oil exceeded $35 a barrel, it then became cost effective to start to look at the heavy sour crudes that we have in Alberta, and we have those oil shales in Colorado, and those reserves are very significant. They're as big as the reserves in Saudi Arabia.

So right now you have major projects going on to capture this heavy crude, and so you're going to see the refineries in the West start to move from processing light sweet crudes to a heavy sour crude. "Sour" means it has a lot of sulfur in it. So you can't burn that in a conventional boiler or a coal plant. You can take that product, and you can transform it into a gas in a gasification plant and take the sulfur out.

So we have the flexibility -- and we talked a little bit about that before -- we have the flexibility of using not only coal; we can use petroleum coke, which is a higher BTU component to it, which makes it more efficient and also lowers the CO2. So the CO2 production is really going to be based on the heat rate or efficiency of your project, and so IGCC is a way to take solid feedstock and do that in a very efficient way.

Natural gas -- we are going to be using natural gas to actually start up a gasifier. We always have that available to run these gas turbines. The Syngas programs can run on natural gas, as well as Syngas, which is the hydrogen CO that you heard about earlier. So that gives you the ability to do fuel-switching, and you're not going to have to do it with oil as your alternative. You can start to

do it with clean alternatives and clean gases that you manage.

So what we end up with is a competitive cost of power, and the reason that we have that is we have these abundant feed stocks, but also with the petroleum coke, we're actually going to see a supply increase over the next five years that's tripling today's market, which is about 14 million tons a year, and so we're going to have this -- as a matter of fact, I was talking to a broker just the other day, and he said, "You're seeing the pet coke go from a commodity to actually becoming a disposal product," and so it's actually net zero at Long Beach right now, and they're taking that over to Japan, and they're getting the pet coke for just the cost of transportation. That can help a lot. So not only are we able to help our project economics with that, but we're actually helping get rid of a waste product.

Favorable emissions profile -- we'll talk more about that, and, gosh, I'll tell you working in Kalama and Longview where we're putting this

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project, they're pretty excited about it. It's new jobs, new capital investments, and the capital investment is significant. It's expensive. So we'll be bringing into it up to 500 to 1,000 construction jobs for a pretty extended period of time. It's not like a natural gas plant that you put up in a year and a half. You actually take three to four years to build one of these projects, and that's why it's important to work on it today.

And we're excited about being near the load centers, again, and hopefully that provides us some transmission grid stability and helps BPA.

So we've decided -- we've looked at, you know, a lot of different sites. We looked at all the sites in the region, and to meet the criteria I talked about, we chose the site at the Port of Kalama, and this is a very attractive site. It's about -- almost 40 miles north of here. It's right along I-5 and the Columbia River, and that gives us access to the good transportation systems that we need.

And it's in an industrial area, in an industrial court. So one of the things that we look at is having the least impact of all -- visual impact, infrastructure impact, having the workers

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kind of fit into the neighborhood; so this is a heavy industrial area up there. There's chemical plants. There's paper mills. There's a steel processing company right next to us, and so it has the infrastructure, and so we don't have to build that. We're not having an impact on that. We have the water available. We have the rail there. We have actually two rails -- UP and BN. We have dock

access, and we have a permitted dock expansion.

We have, like I mentioned, the two rails. We have truck. We have the Northwest pipeline just right at the Port of Kalama; so we can interconnect to that line. We're not going to have to build significant transmission either, but we can connect into the Longview sub where the electric plant used to be.

Here's an aerial site, picture of this site, and it's a little bit old. So the site actually has been expanded closer to the river, and here's the rail lines right here. This is a 600-foot dock. So these things are already in place. It's permitted right now to be expanded 1,000 feet. The water rights are there.

And the other thing that's really exciting about this that we don't always think about is what

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is the constructability of the project. So the contractors and the vendors are really excited about they can do module construction. They can go to big fab shops in different parts of the country, and they can bring in these pieces in one piece on a ship or a barge, and they don't have to worry about going through tunnels and trains and building so many pieces on site. The construction can be much more efficient, and it can reduce their cost.

Here's just a picture of transmissions. I know you're not all transmission experts, but this just gives you a sense of the transmission on the western side of the state, and that's what we're connecting. So there's still problems. There's some congestion going south, but the impacts are a lot smaller than in other locations.

Here's a -- just a preliminary graphic. We're actually working on an updated version. I'll just point out a couple things, though, that I think are very significant. We have this designed for a loop track, and so we can bring in 135-unit trains. That is the way that the industry works. They don't really like to have small trains. They like a unit train that they -- it's very efficient. It just comes in. It literally slows down, comes in

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here, slows down to about a mile and a half an hour, goes through an enclosed high-speed-unloading-bottom-dump system that's enclosed; so we're not having dust from that, and the feed stocks go into enclosed domes, and these domes are not -- you don't see them out here, but they're all over the place. You usually just don't see them because they're not economical, but these are easy to manage the product. You're not going to have dust; you're not going to have fire, and so we fit well into the neighborhood. So we're taking every step we can to be environmental, and to give you a sense of that, in the state of Washington the

permit for a coal pile is a wind fence, and so we're going the extra miles, not just with IGCC, but with the whole project.

Operation characteristics -- I'll go through that pretty quickly. Like I mentioned before, you have ability to use different feed stocks, and one of the potential future feed stocks for us -- but, again, because of financing, I've got to keep a certainty to this project -- but one of the future feed stocks would be paper sludge. There happens to be about 175 tons a day of paper sludge produced in this area, and so maybe we can help remove that.

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It's generally getting burnt in boilers, and it's getting landfilled. That's another economic and environmental opportunity of the future.

We have an attractive heat rate. So we're doing all this processing, but we're at a very competitive heat rate, and the availability that you'll hear talked about -- it actually -- it can be improved very easily by putting in a spare gasifier, and so that's where most of the maintenance are, and that's where you can manage your maintenance, and you can take the system out and put in another gasifier.

Fuel adaptability -- you can actually adjust the blends on the fly. You can ramp down to 50 percent without any significant deterioration. You can do that at about 10 percent a minute. It's a pretty fast ramp-down. The ramping up isn't too fast, but I guess the point is it's not big. You know, it's not days. It's hours, not days, and so you can actually have some flexibility on managing your loads.

But all this is good stuff, but just like you heard from the other speakers, unless we can finance this project, we wouldn't be promoting it. So we're talking hard and working with all the

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major alliances, and like you heard earlier, there now is a new one, and that's Siemens. That technology probably won't be ready for our project, but we are working with all three of these major alliances, and they are offering a fixed-price turnkey EPC -- "EPC" is engineering, procurement, construction. So they'll take the project, and they'll deliver an operating project with performance guarantees, with liquidated damages to protect that and equipment warranties, and I guess with that, that's the kind of stuff we had for natural gas plants, and that's how we could finance them.

We're doing a little bit of a unique process here at Energy Northwest in that we're not going to go out and spend 10 or $15 million on a front-end engineering package and be locked into a technology and then negotiate the cost of the project, and

just like Eric was saying, the whole industry -- that's a barrier to industries. So if GE and ConocoPhillips want to move this ahead, they understand that. They're hearing that from the entire industry, and they're moving really hard and fast to produce these reference plants.

And so we're working on a process where we're

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going to use the alternative public works process in the state of Washington, and it's a negotiated process, and we've already started that. Here's kind of a -- not a very good picture. We had about 35 to 40 people, contractors attend. All the large contractors are attending, and they're putting together proposals for us. Here they are at the site, and we had very good response, but they are going to put together a proposal. We're going to negotiate both the design and the -- and the technology for -- and construction for the -- for the project, and we're going to do that up front using a reference plant.

One of the things we have here in the West is we have -- what you almost call -- you call them ISO conditions. We have operating conditions -- the best temperature. We're at sea level; so we get better performance than other areas that have high altitudes, hot weather or cold weather. Our projects out here operate a little better, and so it's easier to apply a reference plant to our project site.

Here's just a graph. You're hearing a lot about the different aspects to the regulated emissions. I'll just highlight -- here's the

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Wabash project that you heard about before. Here is our project with what is called the Best Available Control Technology or BACT, and we're actually taking it one step further by using a Selexol system. So that system is set up to take out additional sulfur, and it's also used for bulk CO2 capture.

We -- also because we have less sulfur, we lower our SO2, and we eliminate a problem of fouling on an SCR. So we actually can add a selective catalytic reduction system that reduces NOx, and so we're not only setting ourselves up for CO2 capture, we're able to produce SO2 and NOx, which are regulated emissions.

Here's just a real quick table that compares a modern pulverized coal plant, IGCC BACT and then our project, PMEC, and then a natural gas project, and I guess the highlight on that is with the Selexol system and the SCR, we actually are lower than the natural gas plant on two of the major regulated emissions.

In addition to that, we have the CO2 capture capabilities, and we're working right now -- and

you're going to hear from Susan in a few minutes about some of the work with the Big Sky carbon sequestration partnership, and what we have in the Northwest -- we don't have oil wells to do enhanced oil recovery, but we do have basalt, and we do have saline aquifers. So we're identifying those; we're categorizing those, and we're going to be working together on identifying specific costs to sequester CO2. This will be part of our CO2 mitigation plan that's required in the state of Washington. So at the end of the day, we will be in compliance with the state of Washington law, and we will be moving forward to sequestration as that market picks up and helps us pay for some of that.

I may add to this, just on the basalt -- essentially how that process works is you inject CO2 -- and she'll talk more about that -- but the labs in the Northwest have done extensive work on this already in labs. When you inject it into the basalt, you end up with a mineralization process, and it transforms the CO2 into a calcium carbonator alliance in the ground. The aquifers -- they're fairly deep. They're about 1,000 to 2,000 feet deep. You inject the CO2 into them, and at that level, the pressure is heavy enough that it liquifies the gas, and it then turns into water and sinks, and so those are two very viable geological formations.

This is just a timeline, and it gives you a sense of how important it is for us all to be looking at this now because we are growing. We have utilities -- some utilities are growing 4 percent load, others -- but most of them are looking at 1, 1 and a half to 2 percent; so we have a growth going on, and it takes a long time to build these projects, and one of the hurdles that I'm finding is the agencies -- and even including BPA -- haven't been looking up any of these major projects like this. They're used to merchant natural gas plants that get put up in about a year, and so everybody has to learn how to work through a process like this, but we have a long time. So any delays will actually push us out even further. So we're looking at an early 2012 operation date, and that's because we're moving ahead today.

So that's the end of my discussion, and hopefully that helps, and if we have some time for questions.

(Applause)

MR. BEYER: We're a little bit behind time. We're a little bit behind. How about we take a quick five minute or so break, kind of quick. Try to get back here, starting again by 10 'til, and then we're going to move right into the next panel.

(Brief recess)

MR. BEYER: Our next panel member is Commissioner Dian Grueneich from California.

MS. GRUENEICH: Do we have everyone? Please, can somebody let folks out there know that we're starting up again.

And I was asked to make the brief public service announcement that all the Power Points will be posted on the Oregon Commission website by the end of this week, and there is a transcript being kept, and that will also be available next week, and I'm assuming that we will also have it on the California website, and I'm sure our good friends in Washington will figure out their website, as well, but basically the idea is that all the materials, as well as the transcript, will be available electronically.

Because we want to allow some time at the end for discussion among the commissioners, as well as to have a brief period of public comment, we are going to ask our next panelists to move forward their presentation in a little bit more abbreviated fashion than they had hoped, but, again, you'll be

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able to view all of their materials on the website, as well as I think you have a hard copy.

So let's start off with -- our first panelist is Dr. Sally Benson, and she's going to be talking on what is geological carbon sequestration; will it work, and how will we know, which is obviously a key part of thinking about carbon sequestration.

Dr. Benson is a staff scientist at the Lawrence Berkeley National Laboratory where she has spent the last seven years developing the scientific foundation towards storage of carbon dioxide in deep geologic formations.

She also serves as the project director for the GeoSec project, principal investigator for the Zero-Emissions Research Center at Lawrence Berkeley Lab and is a geological pilot test leader for the WESTCARB Regional Sequestration. She -- actually, given our time frame, I think I'm going to skip through the rest of it, but let's just say Dr. Benson is eminently qualified to talk to us today about carbon sequestration.

(Applause)

MS. BENSON: Okay. Thank you very much. If I can -- there we go. Okay.

So you know what I'm going to talk about, and I

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have about ten minutes. So we're going to move along, and I'll try to emphasize the things that I think are most important, but basically I'll try to answer the three questions that are shown up on the screen.

As a preface, though, I'd like to point your attention to a recently completed report, the IPCC,

that's the Intergovernmental Plan on Climate Change special report on carbon dioxide capture and storage. This took three years. There were more than 100 authors from around the world who worked on this. It went through numerous review cycles where thousands and thousands of comments were addressed. So it's a really tremendous resource. It's very current, and you can get it free on the web, or if you want the fancy version, you can order it. So many of the summary statements that I make in my remarks today are derived from this report, and the reasoning behind them will be described there in great detail.

Okay. All right. So CO2 capture and storage is a four-step process. First you need to capture it. The CO2 -- we heard more about that earlier today. It's then compressed basically to a liquid, put into a pipeline and transported to the site for

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deep underground injection. So when we talk about deep underground injection, how deep are we talking about? Basically we're talking about depths of greater than a kilometer, and the reason that we want to go to a kilometer or deeper is CO2 becomes very dense. It becomes a super critical fluid, which basically has almost liquid-like densities, and so we want to -- so when we talk about "deep," this isn't right under your feet. It's a kilometer or more down, sort of like a typical oil and gas reservoir depths.

So where can we put the CO2? We can put the CO2 in depleted oil and gas reservoirs. We can also put it into active oil reservoirs, in particular, and try to simultaneously store CO2 and enhance recovery of oil.

The third option is storage in deep saline formations. These are basically the same kind of rocks where oil and gas are found, but instead of being filled with oil and gas, they're filled with very salty water, so salty that we would never want to use it for any beneficial purpose.

The fourth option is to store carbon dioxide in coal, and that option is less well-developed than the first three that I talked about. So oil and

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gas and deep saline formations are really the principal targets that we're talking about today, and the rest of my remarks will focus on those.

So one of the big questions is, "Well, what does it look like deep underground? And when you put it underground, what's it like? Is it forming a big bubble? Is it forming a big plume?" Well, we wanted to be able to answer those questions, and what we can do is we can look at rocks. Like, you know, if you have a CT scan of your body, well we can do the same thing with rocks, and there's a very fancy machine shown here on the left that we

actually do these scans, and I just want to draw your attention to one image here, and that's this picture up here. This is 2.2 millimeters. This is tiny. This is smaller than your little baby fingernail, and the red are the rocks; the green is the water; and these black globs, this is where the CO2 is. So when we think about CO2 injection underground, where is it? It's in tiny little pore spaces; so it's not easy for it to move around. It's basically very tightly bound in these pore spaces. So when we think about injection and what it looks like under, think back to this picture, and think about the tiny, tiny scale of this.

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Okay. So if we put CO2 underground, what keeps it underground? Well, the most important thing is the presence of a seal or a cap rock, and the kinds of places that we imagine putting CO2 are in sedimentary basins, which typically have the sort of layer-cake geology. So there's sandstone, very permeable formations that are good for storage. There's -- they have shales, which -- or -- and hydrides that provide a seal, basically very, very tight rocks, very impermeable and porous, and so this seal is very, very important.

So, however, over the long run there are other mechanisms that contribute to long-term storage security. CO2 dissolves in the water. Once it dissolves in the water, basically it's not coming back up.

Second, when it's in the pore spaces, as water tries to fill those pore spaces where the CO2 is, it basically traps the CO2. A phenomena called snap-off occurs, and you get individual bubbles of CO2, and if these bubbles are not connected, they're not going anywhere.

And then finally carbon dioxide in a formation can be converted to solid mineral phases. That's basically calcite, siderite, things that -- again,

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they're not going anywhere.

So we have a combination of trapping mechanisms which over time lead to increases in the storage security. So it's not like we propose to put CO2 underground, and it gets less and less secure over time. In fact, it gets more secure over time, because these mechanisms continue to act on the carbon dioxide even after we stop injecting, and most of the simulations and experimental studies suggest that within 100 years, maybe 1,000 years, several thousand years, all of the carbon dioxide is basically permanently trapped, and it's not going anywhere, even if you no longer have that good cap-rock seal.

So I think I'm going to just skip through this. Basically, this is the proof that carbon dioxide would stay underground, and there's multiple lines

of evidence, but the bottom-line conclusion that the IPCC developed and documented is that retention rates are likely to exceed 99 percent over 1,000 years. So in 1,000 years of storage, maybe 1 percent or less is going to be released back into the atmosphere. So when we think about geologic storage, we're not talking about something short-term, something transient; we're talking

about, in essence, permanent storage of carbon dioxide.

So is this a big opportunity? Are there lots of storage sites, or is this sort of a niche opportunity? And this is a worldwide map showing the location of storage sites. The dark areas are areas where it's highly likely that if you went there, you could find something.

The gray areas are areas where it's likely, but we're really not sure because not that many studies have been, and the white areas are indicative of regions where there's not likely to be CO2 storage capacity. So when you look at the world, you see that there's fairly broadly distributed potential, and certainly in North America there's tremendous potential for finding the needed capacity.

So what's sort of the bottom line here? Well, there appears to be at least enough carbon dioxide sequestration capacity for 100 years. There's likely to be more, particularly in saline formations, but sort of looking out into sort of a century kind of time frame, capacity limitations are unlikely to limit the technology. Really, the bigger issue is is the capacity where you would need it.

Okay. What about the risks? We know a lot about injection. There's a tremendous amount of injection around this country, around the world, and as a result of that we've learned what the major risks are. The first of them is leakage up the injection well itself. We may improperly construct that well, or over time it may become degraded. So the remedy here is that you simply need to very carefully monitor the conditions of your well, and this is done regularly in most injection projects.

It's also possible that you'll have leakage up abandoned wells, and in the United States, Canada, in particular, a tremendous amount of wells have been drilled over time. It's going to be careful to go locate those wells, assess their condition, and if they're not in good condition, to basically go back and replug them.

Another possibility of risk is that the cap rock or the seal is not correctly characterized, and early on in some of these underground injection projects, this was somewhat of an issue; however,

with improved seismic imaging technology and characterization technology, this is less of a risk.

And then the final one is that those projects that don't have good monitoring, those are the ones that tended to have more problems.

So, again, a conclusion kind of a statement from the IPCC report that says, basically, "With appropriate site selection informed by available subservice information, a monitoring program to detect problems, a regulatory system, and the appropriate use of remediation methods to stop or control CO2 releases, should they occur" -- now -- so those are the caveats, and the conclusion is that, "The local health, safety, and environmental risks of geological storage would be comparable to the risks of current activities such as natural gas storage, enhanced ore recovery, and deep underground disposal of acid gas." So basically the bottom-line conclusion today is that these activities will pose the same level of risk of many activities that go on every day.

So monitoring is one of key things that you need to do to ensure that the projects are performing correctly. There are a number of different monitoring approaches. You can monitor right above the storage formation using seismic methods, formation pressure measurements or

directly sampling fluids. Moving up into the ground water, a similar suite of technologies could be deployed. In the vadose zone or soil, you can go and actually sample the soil gas or sample soil, and then in the atmosphere, there are also methods developed primarily from the ecosystem in carbon cycling studies that can also be deployed to measure any potential leakage. The important thing here is the suite of technologies appears to have sufficient resolution so as to be able to detect important amounts of leakage from these projects.

I'm just going to say one more thing about actual projects. There are three real projects in the world today. One of them is the Sleipner project. This began in 1996. A million tons a year are injected. So this is a decade-old project. 10 million tons have been injected, and they have extensively deployed seismic monitoring to basically demonstrate where the CO2 is going underground and demonstrate that it's not leaking, and this is a very, very famous data set that is sort of the proof that, in fact, Sleipner is a very successful project.

And I don't have time to go into this in great detail, but this is before any CO2 is injected.

This is the top of the formation and the bottom.

Here is after three years of injection. You can see a CO2 plume. Two years later it's growing and so forth. So that's one important thing. We can see CO2 underground with seismic methods very well. No. 2, it's very important -- if you look above the storage formation, no indication whatsoever of leakage from the site.

There are other projects, but I'm not going to go into those. There are more commercial projects in the pipeline, and I'd just like to wrap up with one thing. There's a program called WESTCARB. It's sponsored by the Department of Energy in partnership with all of our state governments here in the western United States, along with a number of industry partners. The focus is on geological and terrestrial sequestration in the West, and there's opportunities with regard to forestry, in particular, some rangeland opportunities, as well. The goals of this project are to characterize the capacity, to assess risks, to perform specific source sync matching between particular power plants and storage sites.

And most importantly over the next four years there are going to be three pilot tests of

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geological storage -- two of them in California and one of them in Arizona. There will also be a very, very detailed assessment that will take place in Washington at the Trans Alta facility in Centralia, Washington. Over $18 million is being invested in this over four years with about a 20 percent cost share from our state and industry partners. So if any of you would like more information about WESTCARB, it's got a very good website. Larry Meyer is the technical director of that, and please don't hesitate to call us. His phone number will be on the slides, and also you can reach me. So thank you very much.

(Applause)

MS. GRUENEICH: Thank you. Next we have Dr. Susan Capalbo. Hope that's --

MS. CAPALBO: That's close.

MS. GRUENEICH: Is that close? Great. And she's the director of the Big Sky Carbon Sequestration Partnership, and I just want to say I'm very excited because I've heard about this for some time, and so should I go through your background? Okay. Again, we're going to have skipping the background, but we're going to hear all about this.

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MS. CAPALBO: Thank you very much. I come from -- well, I live in Montana now. I'm originally not from Montana, as you can probably surmise.

Anyway, I'm very happy to be here and to talk about the Big Sky Partnership. The Big Sky

Partnership is one of the seven partnerships that Sally mentioned. WESTCARB is another one, and so there's a number of them, and the idea with the partnerships is actually to help close this loop on opportunities for capture and sequestration, to look at regional opportunities as they relate to the whole U.S. So the Big Sky Partnership covers Montana, Wyoming, Idaho and the eastern parts of Washington and Oregon. What I'm going to do is just talk very quickly about our efforts and then get into this assessment of sources and sinks. This parallels really well with some of the work that we heard from Tom a few minutes ago. Okay.

I'll just move through these. This is just the DOE carbon sequestration program structure. If you haven't seen that before, it's basically the infrastructure, which is seven regional partnerships up in the brown-colored button there.

The growing case for carbon sequestration --

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once again, I don't really think I need to go through this, as well. There has been lots of regulations at the state and regional levels, far less so at the national levels, and we'll talk about that in a few minutes. There is a renewed emphasis on U.S. coal both as for electric power generation, the FutureGen, for some of the feedstock for the hydrogen economy.

The last bullet there -- carbon sequestration, I think, really does provide a means to achieve economic growth using fossil fuels and as well as meeting the environmental goals of reducing greenhouse gas emissions.

To be successful -- the technology to sequester carbon do have to be effective and cost competitive. We've heard that today. It has to provide -- as Sally indicated -- some long-term stable storage, and perhaps most importantly, it's got to be acceptable to the public. So these are some of the criteria that we're looking at as we design these sequestration technologies.

And then I add here "the challenges of carbon sequestration." Once again, these are challenges. I'm an economist, and so I look at things a little bit differently than simply looking at, "Are we

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technically able to do it?" I'm looking at, "What is the cost of doing it, and what are some of these tradeoffs?"

So the challenges that we have with carbon sequestration, once again, is the cost of cutting these carbon emissions going to be felt immediately, but some of the benefits are deferred for much further in the future, and so some people have a hard time in terms of weighing those tradeoffs.

Greenhouse gas buildups are a global

externality, not a regional one. So unlike SO2 emissions where if you cut the emissions, you felt you were cleaning up the watershed of the air shed in your region, now with greenhouse gas emissions, it's global. What we do could be counteracted by somebody in another part of the world, and we're going to bear those benefits or those costs associated with that. So this is always a difficult problem. We don't have a policy at the federal level. This is a real challenge, and it's a real challenge to get industry to think about it in terms of, "I may need to do something in a few years."

And then, once again, we hear a lot -- and

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there's been a lot of publicity in some of the periodicals and stuff about global climate change, and we need to do something. Remember the cover on Time Magazine about a month ago? We need to be worried, very worried, but we need to connect this public anxiety about climate change with some willingness to pay, which is a difficult challenge there to do.

Okay. Our partnership -- in our region, we have a lot of energy resources. We have a lot of the coal resources. 40 percent of the total U.S. coal resources are basically in this Big Sky region. We have water resources. We have wind power, natural gas, et cetera. The bottom little quote there, I think, characterizes our region: "We are a wealth of sinks, and we have real opportunities to develop future energy supplies."

When I show you some of -- whoops. Let's me -- let me -- I just want to go a little bit quickly here -- to where we are with our emissions. In the Big Sky region, we are not a major emitter of CO2 relative to other parts of the United States. We do have -- our emission breakdown is such that we have a lot of CO2 emissions from point sources coming from natural gas and coal, but this slide is

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just a relative proportion.

If I go to the next slide, the total utility -- total emissions from utilities in our region, not including Washington and Oregon, is only about 65 million metric tons of CO2 equivalent a year from coal and natural gas. If you look at the Midwest, they all look in order of magnitude more. So we don't have a lot of emissions right now. What we do have is a lot of opportunities for developing the future energy supplies and to do that in a clean technology way.

This map -- what the partnership has been doing is matching up sources of CO2 emissions with potential sinks. This map just shows -- the big red and yellow dots are the major point sources of CO2 emissions, and we're matching these up with

different types of sinks in the region. This one happens to be the oil and gas petroleum reservoirs.

Let me move to some oil and gas fields. So we've been spending a lot of time in the partnership kind of a linking up where are the sequestration opportunities relative to existing point sources and relative to ones that may be coming online.

So maps then look at these sources of CO2 emissions, where is the sinks, and then where is some of the infrastructure both in terms of pipelines, as well as transmission lines in our regions. So we have a number of these, and I don't really have a lot of time to go through them.

I want to focus, though, back on the basalt, because this is what Tom had up there before. One of the areas that we're looking at in our partnership is to address the geological sequestration and the nature for aquifers of basalt, and, once again, this is unique to our partnership. Many of the other partnerships are looking at enhanced oil recovery, some of the saline aquifers and these kinds of things. We're focusing a lot of these efforts on the basalt for a number of reasons: One is because they are unique to our partnership, and, secondly, because we believe they do provide a vast amount of potential storage to regions where we might want to be developing IGCC and future energy power plants.

So this one -- this graph here just shows these major basalt formations, and I can overlay on that the different types of transmission and railroads that we have in the region to transport both the end product, as well as some of the coal, which may be used for these power plants in the future and also, then, some of the pipeline opportunities. So the partnership has spent a lot of time in Phase I looking at these different types of maps and overlays and where these potential sources and sinks match up.

We built what we call the geological carbon atlas. This carbon atlas takes very detailed information from -- in this case it's well data, and we've developed a GIS model to calculate the sequestration volumes of these geological sinks, and we've characterized these sequestration volumes for lots of formations in different parts of the Big Sky region. This is just a snapshot from the carbon atlas which is up on our website. Once again, another snapshot from there.

Let me just go to some of the promising -- what we're doing in Phase II with the geological sequestration efforts. We do have three demonstration pilots that we're doing. The first one is the basalt that I'll talk about, and then we

have an EOR, the carbonate aquifer assessment, and then finally just a little bit of work on deep coal bed exchange.

The geological sequestration approach --

basically to sort of reflect a little bit of what Sally said -- is taking advantage of the reactive properties of CO2 and identify the sequestration targets. We're emphasizing sort of the mineral and other chemical trapping properties, and we want to develop these sequestration options that will permanently store CO2, once again, not looking at it as a temporary holding, but a permanent storage.

The geological field activities that we have -- we have the blue star, which is the basalt one that's on the Hanford site, and then the green star is coal bed methane, and the red star there is our EOR formation.

I'll talk just a little bit about the basalt one, because I think that's of interest to this audience. We're planning on injecting about 3,000 metric tons of CO2 in this formation. Once again, in our region we don't have pipelines, and so we have to, at this point, transport it by rail; so it's not -- it's very expensive to do this. It's going to be injected into a deep well infrastructure that exists on the Hanford site to minimize the drilling costs, and we're going to be looking at post-injection core sampling to verify some of the mineralization reaction, which we hope

would occur, which would basically adhere that CO2 to the geological sink in the rock.

The rationale for the basalt -- once again, the Columbia River basalt group, which is in the -- along the Columbia River area -- has a huge capacity. It's been estimated that it could store up to 100 years of U.S. CO2 emissions. It's 3 percent of basalt is suitable for injection, and we could inject potentially 100 gigatons of CO2 storage; so it's a lot. This is a technical assessment. What is the economics? What is the cost of doing this, which I think is extremely important.

The other reason why we're looking at basalt and mafic rock is because they exist in our region, as you can see with the moth color up there, but they're also existing in other parts of the U.S., as well. So this map overlays the basalt formations where the dots are gas and electricity or power plants, and so you see that in other parts of the Eastern part of the U.S. there's also some potential for using these basalts, and so what we'd like to do is transfer results of this pilot to other parts of the U.S.

And then even more importantly as we look at --

remember I said this is a global problem, and so we want to look at what's happening in the rest of the world. There are substantial basalts that exist on developing countries, in particular China and in India, that could also be sequestering CO2 as those countries develop their fossil energy resources.

The conclusions, then, for the basalt is that we do have large basalt providence since they're globally distributed. There's an economic opportunity. Cost for using the basalt are minimal. What I mean here is that they're currently not providing oil and gas; so putting CO2 down them is not preventing future use of those resources.

It's got some geological properties that we like, and, once again, there's a lot of them that sequester, and they estimate worldwide up to 10,000 years of world CO2 emissions. I'm never quite sure how that number gets estimated, but, anyway, it's large.

The big question, though, I have at the bottom is how does this compare to other sequestration and mitigation options, and this is basically the flavor of the DOE partnership is to look at these different types of sequestration options, much like

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not just looking at pulverized coal plants, but investing in different types of technology, developing energy resources, we also want to be looking at different types of sinks for sequestering the CO2.

You know, I think I'm just going to -- there's some other stuff in here on what we're doing in the other parts of the partnership, but it doesn't really pertain to the West Coast, as much as the EOR opportunities that we're looking at. So, you know, why don't I just -- we do have some sequestration efforts, as well, but in the interest of time, I will just maybe end with one thing that we're also looking at, which is -- as an economist I'm extremely interested in not just the technical capabilities and the technical capacity, but what is the economic cost of these particular sinks.

So we've invested a lot of resources in terms of looking at what is the economic cost of sequestering CO2 and trying to use a common unit for comparison across these different types of sinks that we have, taking into account spacial and temporal metrics.

The end product of all of this -- and I think I have a slide in the handout -- is to come up with

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these regional supply curves for carbon. If we want to be sequestering so many tons of carbon in our Big Sky region, what would be some of the estimates of these regional supply curves, which would give us the cost of sequestering that much

carbon, which would be useful for industry.

The importance of this economic component I think was reflected in the earlier presentations that I heard. Once again, we need to have some idea of the economic cost. It's critical for assessing the feasibility as we scale up. It's also useful for addressing, I think, the long-term financial viability of power plants under these carbon constraint scenarios, and it's extremely useful to adjust tradeoffs among the alternative sequestration options.

I'll close with one last slide, and this slide relates to the last criteria that I had for sequestration technologies to be, quote, unquote, "successful as they have to be acceptable to the public," and so we have a major effort looking at education and outreach activities associated with the sequestration and working both with industry with state legislators and with stakeholders on this, and I'll stop there.

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Contact -- we have a website, as well. I'm the director of the web. My e-mail address is up there, and the website is just bigskyco2.org. Thanks.

(Applause)

MS. GRUENEICH: Our last speaker is Charles Christopher, who is BP's carbon program manager for the Americas, and he has over 30 years experience in all phases of improved oil recovery and has been involved for a number of years in the capture and sequestration of carbon dioxide.

He is responsible for identifying options for geologic storage for BP's largest U.S. carbon dioxide sources, and so with that, here is our last speaker for the day.

MR. CHRISTOPHER: Thank you.

I have a friend that's a professor at Stanford, and when he gets to this point on the agenda, he says, "This is the place where everything has been said, but not everyone has said it." I hope that won't be the case of my presentation.

BP is about to undergo a large new business which we call alternative energy. It's an umbrella that will take care of a number of new business types that we hope will provide a bridge from where

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we are now in the carbon era to the future that will be a renewable era. So what I want to talk to you about is some of the first efforts to get us going in that business.

Of course, it's all about emissions. The IEA says that the emissions currently are about 41 percent power, 38 percent heat from all sources, and 21 percent transportation, and in the future, say, in 2020, it will be about the same distribution. The nice thing about this is that

about 80 percent of the emissions come from stationary sources -- they're not running around on freeways -- and so they're much easier to deal with.

If you ask the public if they want clean electricity, they will tell you yes. If you ask them how much they want to pay extra for it, they will say nothing. So there are technologies available today that will take you to a clean energy future, but they are expensive, and, of course, technology will bring these costs down, and we will begin to edge out towards those in the future, but if you -- this is sort of the distribution now, going from coal to other types of things, but if you imply a carbon-constrained

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future, this distribution changes, and it can change rather dramatically.

Hydrogen is one route to the future. We're planning two of the world's first large-scale demonstration projects that will produce clean power from hydrogen and will store the CO2 in the subsurface. One of those -- the first one that we announced was in Scotland; the second one we announced was in Carson, California, just off of Long Beach. So we're in the middle of ramping up our alternative energy business rather dramatically.

This is what the project in California looks like or will look like at some stage. You take petroleum coke, and has been mentioned before, there are large quantities of that available. It's currently being exported to China where it's being converted into CO2 and vented into the atmosphere. There's going to be a lot more of it in the future as the crude supply gets heavier; so the U.S. is going to have a lot of -- and there are places where pet coke is now buried to get rid of it. It's hardly worth anything. It may or may not be zero, but it's not worth much.

So in our case the pet coke is going to go into

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a gasification unit. We're currently investigating the technologies to do that, and the technology has not yet been chosen, but you know who the players are.

Coming out of that, there's a carbon capture system that the heart is the sequestration part, and that goes into a hydrogen power plant. The electricity from the plant then goes into the grid. Part of it goes to our refinery, as well, and then there's hydrogen available for other uses, such as for transportation, if necessary, and all refineries use hydrogen, as well.

But the storage part of this is that the CO2 goes from here into oil feeds that may not be very far away from this particular location, and the oil

from it then goes to the refinery. So that's the basic components.

The ability to do something like this rests, then, on three principal components: The first one is the fuel. You want the fuel to be an advantage fuel of some sort, such as coal or petroleum coke; the second part is the products. You want it to be a product that is valuable, sells into a good market, perhaps even a market that would recognize the difference between clean energy and not clean

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energy; and an ability to do CO2 EOR.

If you look at where our refinery is off of Long Beach, you can send the CO2 basically in two directions: One is to the southwest, to the Wilmington field, which is essentially under the Queen Mary, and the other one is up to the San Joaquin Valley. There are a number of oil fields up there. If you draw a straight line between the refinery and those oil fields, it goes through Beverly Hills. Obviously this thing won't be a straight line.

There is a lot of room to put CO2 in the ground around Los Angeles. There are issues about earthquakes and other things, but the oil fields have been there for a very long time. They've contained oil and gas, and they've not -- they have not reached the surface in any appreciable way. So we think that storing the CO2 in the ground is something that is very viable. We think, though, that our objective -- our big objective is to show the rest of the world that it's safe.

CO2 enhanced recovery is a very mature technology. Back in the early 1980s, CO2 was found in reservoirs in Colorado and New Mexico and was piped down to West Texas where they did EOR. They

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injected it, and it becomes a very good solvent, and it pushes the oil out. A number of projects were built in the early '80s, and then the oil price fell, and they stopped building new ones, but they had commitments to keep going, and now the number is going up. The number is limited now by the supply of CO2. There's not enough CO2 in West Texas to supply all the fields that want to do CO2 EOR.

If you take a tube like this one and fill it full of sand and then saturate it with oil and inject CO2 at a low pressure, you'll recover some of the oil. If you then raise the pressure and do it again, you'll recover more oil, and if you continue to do that, you can go right up this curve until the point where you get about 95 percent of the oil out, and that's the point that we define as minimum miscibility pressure. It's good to do projects like this at the point where it is miscible, because all of the reservoir that's contacted by

the CO2 will swept clean of the oil, but it's not absolutely necessary to do that. You can get good recovery at lower pressures. So it depends on what your reservoir pressure is or the pressure at which you can bring your reservoir as to how much

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recovery you can get from CO2 injection.

CO2 capture and storage has been investigated quite a lot. The regional partnerships -- we've been involved in organizing and participating with a number of the regional partnerships. The CO2 capture project was organized by BP, and it is studying capture and storage in order to address the two key issues, which are the cost of capture and the safety of storage.

There are a number of projects that are underway now that are actually doing this. The Weyburn project in Canada, taking CO2 from North Dakota, is injecting about a million tons a year, and this has been going on for several years.

The project that Sally mentioned in Algeria, called In Salah Gas, is taking CO2 from the gas stream. It has to be removed from the gas stream before the gas can be sold, and that would normally be vented, but we're not doing that. We're taking the CO2 and injecting it down the leg into the water part of the reservoir and storing about a million tons a year of CO2 there.

The Sleipner project in the North Sea is doing the same thing. It's taking CO2 from a gas stream that's being taken from another reservoir and

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putting it into a water leg, and that's also doing about a million tons a year. So these projects are going full stream.

These are the reservoirs in West Texas and Colorado and New Mexico that are supplying CO2 to a huge infrastructure in West Texas. If you go out there and see this, the compressors, the pipelines, the equipment going around is enormous. But as big as it is -- it's currently handling about 30 million tons a year of CO2, which is about equivalent to three or four large power plants. So the scale of the operation is enormous. There are other -- this is sort of the fertile crescent for CO2 at this time, going from the North Dakota project down to a project in Louisiana and Mississippi.

But the industry has been doing this for some 30 years. We understand how the process works. It's been done safely and effectively. We understand the corrosion issues and the well issues; so this is not a new technology. It's something we've been doing for quite sometime.

The benefits of the project we're doing in California are numerous, and I'll enumerate a few of them. This is going to produce about 500

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megawatts of clean electricity going into the grids in Southern California, a place where electricity is in shortage. It will eliminate some four million tons a year of CO2 that would be vented if the petroleum coke was sent to China and burned. This is bigger than all those demonstration projects combined that you saw earlier. It will produce additional energy from existing California oil fields, which will increase the prosperity of California and will provide jobs in California, as well.

It will boost the California economy. There will be about 1,000 jobs associated with the construction and about 150 long-term to operate the plant. It will reduce the stress on U.S. gas supplies. The energy that's currently being used to produce for our refinery and others in the area comes from natural gas. This will eliminate that all together.

It will preserve limited fresh water sources. It will use recycled water from that area; so it will not use any new water supplies. It will build a hydrogen source for this and for other future sources. It will begin to develop an infrastructure for hydrogen and for CO2. One of the

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things that is true about the CO2 EOR business is that you have to create an infrastructure. The sources have to be available, and they have to be reliable, and the sinks have to be available, and they have to be reliable. Once you established a business to do this, then those things can take off on their own economics.

It will also significantly reduce emissions from pet coke transportation. There are about 3,000 truck miles a day that are used to carry the pet coke to the port. Those will be eliminated all together and the marine transportation emissions that carry the pet coke to China, as well.

So the way forward -- we've announced this Carson Hydrogen Power Plant, CHPP. It's responsive to state and federal governments' intent to reduce greenhouse gases. This is a commercial project. This is not a pie-in-the-sky project. It's one that has -- looks like it has really good economics, and we see no reason at all why it wouldn't go ahead.

It will have significant challenges through the design, engineering, and procurement stage. What we're doing is putting together a number of processes that are fairly well known. The

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gasification process is a challenge, and the separation process will be a challenge, but we're intent on showing that these can be put together in a commercial-scale project.

It needs the support of a regulatory framework that encourages this type of a project and removes some of the roadblocks to getting it done. We'll work very closely with all of the stakeholders involved to make this thing a reality, and we're growing our low-carbon business. This is just one part of it, but it's part of a very big business that BP intends to see go forward in the future. Thank you.

(Applause)

MR. BEYER: Okay. We're almost back on schedule. I'd just note that, Commissioner Oshie, do you see what can happen when you get that California focus going?

MS. GRUENEICH: Yeah, I was saying with the women.

MR. BEYER: The women? Oh, okay.

All right. Now, we're back, and questions of either of the two panels? If we'd use the mic in front of you, it would be really helpful so everybody can hear the questions.

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MR. SAVAGE: Can we ask a question?

MR. BEYER: Yeah.

MR. PEEVEY: Well, why don't we start over here.

MR. BEYER: Well, let me strike it because I've already got a mic over here. I'm sorry.

MR. WOOLEY: David Wooley with the Energy Foundation.

I wonder if the speakers could go a little bit deeper on what they estimate the cost of sequestration would be. I imagine there must be a range at this stage. I didn't see any material on that. I looked through it. I wonder if you could summarize what you currently know about the costs.

MR. DALTON: Sally and I are looking at each other.

There have been a number of studies looking at the cost of sequestration from the point of the plant boundary, if you will, where it's a high-pressure, super-critical clean sorts of CO2, and most of those tend to range in about the $10 a ton. That doesn't say it's near a sink where you could use it for CO2. In that case, it might actually be positive. You might be be able to be paid for that or that you have a long pipeline and

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unusual reservoir conditions. The trouble with averages is, of course -- $10 a ton is not a bad working number. There have been estimates that are lower than that for the cost to pipeline it, get it -- any additional pressurization and put it in the reservoir, with the cost of the reservoir.

Sally, would you like to say anything else?

MS. BENSON: Yeah. Certainly the costs vary, you know, depending on a lot of the specifics. The

IPCC numbers for the storage part alone were in the range of $2 to $8 per ton. I think, though, that one needs to look at the overall costs, including the costs of capture. So if we're doing it (inaudible) so the IPCC numbers were in the range of $30 to $70 per ton for everything, so capture and storage, but Stu has probably more up-to-date numbers on the captured costs that you might want to talk about.

MR. DALTON: The captured costs, per se, we had the -- it was built into those cost to power charts, but they weren't in dollars per ton of CO2.

Sally's numbers actually are (inaudible) wide range, depending on which (inaudible) for the cost to capture technology.

MR. WOOLEY: Is there a way to convert that

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into dollars per megawatt hour or just (inaudible).

MR. DALTON: The costs after the bid put on those charts are -- were in dollars per megawatt hour. If you look at how this was done, the difference between capture and no capture were in dollars per megawatt hour. It doesn't add that much to the cost of -- to the cost for the storage. I think everybody agrees it's the lesser part of the equation. The two issues -- the cost of capture -- cost is not the issue of storage; it's safety and effectiveness.

MS. BENSON: I think the sort of numbers that I use as a rule of thumb are one to two cents of kilowatt hour for that.

MR. BEYER: Dian?

MS. GRUENEICH: I think I have two questions: One is melding together what we heard today on the advance coal with the carbon sequestration, does it make much difference when you're building an advance coal project to be thinking about having it be able to do carbon sequestration? Because that's certainly -- a lot of the discussion we've had is that to the extent that we don't have -- there may be a difference in timing where we may have IGCC or other advance coal technologies available before

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we've solved everything on the carbon sequestration, and so that a logical approach would be to ensure that the advance coal plants are able to do carbon sequestration. So my question is is that a big thing technically cost-wise if one were to require that aspect?

And then I guess the second thing is -- the second question is I ended up -- and this is my first briefing on carbon sequestration -- with, frankly, the feeling, "Gosh, there's an awful lot of work going on on carbon sequestration," and is there -- are there any big gaps with regard to how overall we're approaching carbon sequestration, or is it -- because this is the takeaway I took --

which is we have a lot of money that's going on. We've got a lot of studies going on. We've got a lot of capable people that are involved in it, and we really just have to have that work proceed, and part of it is a timing issue that we may not have many answers for five or even longer years.

So my second question is is there any big gaps out there in terms of cracking this nut on carbon sequestration?

MR BEYER: Stu?

MR. DALTON: I'll at least take a shot at both,

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and other people may want to add.

Yes, there is quite a bit you can do on pre-engineering, and there are differences in design in both things, like the way you would size the amount of air that's separated, the way that you would size and design the gasifier, and it's more than just leaving the back 40 vacant, which a lot of people -- they get that impression, but there are pre-engineering.

We have literally published some of the ideas of phased gasification with -- we've done this literally for about 15 years, looking at the idea of, first, natural gas, then gasification, and the more recent studies have looked at then what do you do to add CO2 capture. How do the systems match up, and what are these things you can do to pre-engineer, and I made a presentation about two years ago to the national commission on energy policy on some of the results of those studies. So some of those are available in public presentations.

You can argue about how you would go about doing those, and there are many ways you can go about pre-engineering for gasification, and there are differences, and, if you will, pre-investment

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options would allow you to reduce the cost later on (inaudible) and reduce significant penalty with integration problems. So there are some things that can be done.

On the second one -- one big gap that's been identified by a number of organizations, not just EPRI, is you have to prove the safety long-term at large scale. Now, there are some projects going on, ones that we heard about, the three that are going on. There's things being proposed, like the FutureGen project. Many people say you have to have multiple regional, large scale so people can feel confident in the different geologies, and you will have assurance that you can store safely. The thing is there are a lot of analogies, like Sally and other folks stated. That's one example of something that's fairly large, and many people say is needed in the long-term, but that could go along with early deployment, if you will, of plants if

there's the right financial structure.
MR. CHRISTOPHER: Can I address that, as well?
For the storage part, people, I think, are approaching this as though there would be a large quantity of CO2 injected in the ground, and that would be the end of it, and people would walk away,

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and some day it could explode or whatever. That's what might happen. That's not the way things will be approached.
The way they will be approached is that there will be a site selection and risk assessment done of the site that will be really easy to do for oil fields where there's a lot of information already available. It would be much more difficult to do on -- in aquifers where very limited information is currently known. Oil fields have already proven their capacity to hold oil and gas, and it will also hold CO2, but aquifers have not been proven that way. So it will take more up-front information to do that, and there's a question about where the money will come from to do all that site assessment.
Once the site assessment is done, there will be a monitoring program put in place to detect in the case there is a problem. There are methods to do that that are currently well known. All of the sites that have been instituted so far have used every technology known to man just to understand how those technologies work, but a limited fit-for-purpose monitoring program will be in place for all the projects that be will be done, and then

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there will be a remediation technology that will be done in case there is a leak in order to fix it. So this is not something that will just happen, and then there will be a large risk associated with it. It will be a carefully measured procedure that will reduce the risk.
MR. BEYER: Others?
MR. KRUEGER: The only thing I would add from a developer's perspective is that I think you're right. I think it does makes sense to look at designing that capability for a project in advance, and we certainly are doing that.
In the case -- in our case the initial cost estimates are in the range of $35 million to do some of these bigger piping sizing and putting in a Selexol system and getting set up for that. That doesn't include real estate, as Stu said, but, yeah, it's a big cost, but at the same time it makes good business sense, I think.
MS. CAPALBO: I think we also really need to push really hard on the federal policy, because once, you know -- if we don't -- if we have a federal policy that we know is going to be probably constrained in five or six years, these plants will

be automatically factoring that in. In the absence of that, in the absence of any kind of a guideline on what that policy is going to be, we're in a nebulous situation where we don't really truly value the investments that people are making in IGCC.

I was at a conference, and Sally was there last week, as well, and I think even DOE admitted that they're probably going to be some serious movement on a policy for CO2 emissions in the future.

MS. BENSON: I want to go back to your gaps question. I agree with what we've heard so far. I think the single most helpful thing to be done is to encourage the number of mid-scale projects, sort of early opportunities to further probe the geological storage of CO2, to gain experience, to have the regulatory agencies to gain experience to where (inaudible) fit for purpose-monitoring so as to transition them to the routine repeatable practices.

There are other gaps that, I think, are being addressed, things like race for mineralization, as an example. How do you optimize (inaudible) volume. So there are research questions that certainly, you know, need to be addressed, but they're not the kind of things we need to wait in order to begin more of these pilot projects that would be so helpful.

MR. KEESE: And, Dian, you're coming back to what the recommendations are going to be from the CDEAC, which is that the -- if the states of the West are going to incent these projects, they should incent the first tier, which will be with sequestration, and if they do anything else, they should incent to Tier 2, which is capable of sequestration. So the capable is a very important ingredient of the recommendations that's coming forward.

MR. BEYER: Mr. Savage.

MR. SAVAGE: Yeah. That segues to my question. This was -- Eric Redman had proposed an early adopter program. Other than not using RFPs, what's kind of the commission's role, if that's kind of our strategy for advancing this technology?

MR. BEYER: Commission, the question is what should the commission's role be? Bill is biting at the bit here.

MR. KEESE: If the parties who are going to get involved -- and that generally will be the regulated utilities -- are going to get -- they need some assurance that their involvement is going to be fiscally rewarding, safe, is not going -- we -- different presenters present different -- are not going to jeopardize their bottom line, their

credit rating. There's just -- there will be many things I think we can look at that the commissions would have to do to entice utilities to participate in the exact things.

Deep pockets like BP and Shell can do this with a resource, petroleum coke, which is free, with a chance to benefit from enhanced oil recovery or other -- they will probably be the ones, in my mind, who test the utility scale of these activities, but if we're going to talk about the West generating electricity, we're talking about western coal, at altitude, without petroleum coke as the feedstock, with sequestration that's going to cost. I think you've got to figure out what you're going to do to enhance -- entice them to participate.

MR. DEGERNES: There's a number of examples of regulatory incentives in other types of generation. Wind is an example where states mandate a certain percentage of the utilities' generation mix come from energy renewables. You've got federal tax subsidies in the form of production tax credits.

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So there are a number of examples in other types of generation where you can encourage it, and those could be applicable to IGCC or any other technology that regulators and policymakers want to encourage.

MR. DALTON: One more point along that line.

Last April we testified in the senate. I testified in the senate to the -- on those exact points, but there are different impacts, of course, on different sorts of entities. Now, the PUCs aren't the only regulatory entities involved with tax policies, et cetera, but certainly if you're a tax-exempt sort of organization, some of the public power entities, it's a big difference between that and some of the other incentive mechanisms, and we analyze the merchants, public and co-op and IOU and looked at the differences in the balance sheet for encouraging sort of the second tier of incentives for early gasification. Anybody else?

MR. CHRISTOPHER: One thing -- one place where you could make a huge contribution is to define what "sequestration ready" means.

MR. BEYER: Do you have some advice?

MR. CHRISTOPHER: It should mean more than a vacant lot.

MR. BEYER: Commissioner Oshie.

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MR. OSHIE: Thank you. My question is for the panel. Let's assume that -- kind of put it into context -- that a number of utilities in the -- just say in the Northwest decide that they want to move to a IGCC plant, and they do -- they make that decision next year, and so we're looking five to six years out. Let's use that as an example. Well -- and so will the industry be ready? Utility

engineers are fully capable of running combined cycle plants. They've been doing that for a long time, running power plants, but they haven't had any experience, to my knowledge, in running synthetic gas plants. And so will there be the skill sets within the industry so that if there's a need, that there will be -- that the skill sets will be made available to those utilities should they move to this technology?

MR. KRUEGER: We talked a lot about financing and taking the risk out of projects, and one of the things that would be required -- and I think Mike talked a little bit about this -- is that there are -- there's over 600 gasification projects -- not IGCC -- but there's a lot of gasification in the world, and so there's a lot of skilled gasification employees. There's a lot of skilled

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combined cycle plant operators, and so the combination of this -- there are people out there, and there are -- the industry is also responding and offering -- they're going to offer guarantees. They're going to actually operate the plant for a while. So in our situation, we have over three years of that kind of scenario.

MS. CAPALBO: I would like to add that from the academic world, from where my position is, I think we do have, you know, a serious concern with engaging and educating capacity building at the university level for science and engineering expertise.

As we look around this room, myself included, there's a lot of, you know, gray hairs and stuff, and I don't see a lot of younger people coming in to run these, and I think what we really need to do is step up to the plate in terms of a science and engineering education. Right now we have a number of cases where we're having to get visas to import science and engineering expertise from China and India. So I think we really need to -- if we're going to couple this and have it be clean coal and clean energy, we need to step up to the plate with those types of investments.

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MR. DALTON: Just to add -- one of the reasons we put together 50 companies and change, including a lot of manufacturers and engineering firms and put together some guidelines on IGCC in the past year -- I think we ended up doing it as a primer, as well, because people were saying, "I don't essentially design the machine. I need to know how to operate them. I need to cull the lessons learned from the last 30 years around the world and into a consolidated (inaudible)" So I think training is an issue.

We see -- hey, I'm a chemical engineer. There aren't that many of them in the power industry, and

many of them work on water treatment and things. So you do need to know how to operate, but there are things that can be developed from web seminars, from training kind of -- we're developing other kinds of standard design and training packages and simulators that are out there. There are things that can be developed, and I think there's a gap in the human capital.

And I would add that if you go to China -- and I've been there a few times in the last couple of years and talked to them about the cull programs -- they're cranking out a lot of engineers these days

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specializing in that, and we aren't doing as many specializing in those areas.

MS. BENSON: I'd like to comment with regard to the geological storage site. There has been a dearth of students moving through the pipeline in the geological sciences for quite a while, first because of the downturn of the petroleum industry that happened in the '90s and, also, the downturn in the environmental remediation industry that happened over the past decade or so. So there really is a need to have people see an opportunity for a career here and get students working on these projects, get them out there working on the pilot programs so that when the regulatory agencies need to gear up to permit these projects, that they've got people who do have a background. So I think that capacity building is very, very important on the geologic storage site.

MR. BEYER: Commissioner Savage.

MR. SAVAGE: Yeah. I just want to -- what was the opportunity and value of coke products within the IGCC technology? And the other one was what is the value of flexible fueling, or is that unique to the Kalama plant?

MR. BEYER: Did you hear those?

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MR. KRUEGER: Yeah. All of the IGCC has the ability to mix different feedstocks. As a matter of fact, Stu can talk more about the projects in Spain and others. They're mixing biomass in there and everything else. There is some flexibility depending on how you design the IGCC.

As far as -- you know, what -- you know, putting together your project, you have to get contracts, and so those types of opportunities on the byproducts and on the supply side, your project gets too complex up front, but power is the lowest margin product you can produce with gasification. We will continue to get approached by higher margin products and doing biodiesels and substituting natural gas and hydrogen. Those are higher margin products that are attractive as supplemental modules.

MR. DALTON: On both points -- flexible

fueling -- we agree. Frankly, if you can get any type of hydrocarbon into a gasifier, put oxygen in there, it will gasify. The problems, in a nutshell, are getting it in and getting it out, because feeding it into a pressurized system with, as an example, turkey feathers -- I'll be polite -- but think about a feather and feeding it through a

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valve. You can almost visualize it yourself. It's not easy to do.

There are many biofuels. They vary. Simple example is agricultural waste. It varies by season. It varies by water content, and you can't have them rot in the field and do a septic line. So you have to worry about how you get it there, how you transport it, how you consolidate it, how you process it, and what it does to the system. You're right, you want to design for a uniform fuel, but this is going to be much more variable.

On the value of coke products -- we think there are valuable coke products. We're doing things right now (inaudible) with the DOE looking at the option value of co-production of (inaudible). We looked at hydrogen. A fact today for the audience is 1 percent of a 500-megawatt gasification plant is enough for 10,000 hydrogen-fuel vehicles. That's a lot.

So there are values in these coke products, but you have to find the right slave to manage the slave, and a BP that's looking at 100 units or so refinery of CO2 coke product and power in the overall project (inaudible) look at a lot of different co-products, and usually it doesn't fit

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with the utility economics very well, but that's been the -- we're looking more at those options.

MR. BEYER: Other questions?

MS. GRUENEICH: In California we've -- in the last couple of years -- adopted policies and taken actions that I'm encouraged are trying to look at the longer term and little bit different from what may be the traditional utility rate-making approach, and as examples of energy efficiency, we've set 10-year energy efficiency goals that we refresh every three years, extending them out, and that's provided a real good basis for our utilities to then be able to really take those goals and use them as their basis for their procurement planning.

On our recently adopted solar initiative, we basically have set up, again, another 10-year program with the idea of really moving the solar industry, because we are providing some real basis for helping industry to make the investment in solar.

And I'm interested in your folks' reaction as if we took the concept that we are moving at a state level quite quickly on policies of clean

energy and addressing climate change and we said, "What can we do at the state level?" and if, as

regulators, we set up essentially the same sort of 10-year horizon and maybe through procurement charges through the utilities we had some increment of the charge that would go into a fund solely addressing carbon sequestration and/or advance coal projects where it would basically be money available, that if one of our utilities then proposed to come in and participate in one of the advanced coal carbon sequestration demonstration or actual, you know, projects, we could look at it, and determine that that money might -- would be available to be used, then, because we'd be looking at on a 10-year horizon, it would be more than just an individual project, where a utility comes in and says, "Here's what we're thinking of." What would be your reaction? Would that be something meaningful to do, or would that be more just sort of talking amongst ourselves and in the real life of what you're all trying to do, it wouldn't make much difference?

MR. BEYER: Who wants to take a shot at that?

MR. DALTON: No.

MR. BEYER: No.

MS. GRUENEICH: Okay.

MR. DALTON: I'll just point out the obvious.

Anything that makes the economics look better long-term with carbon capture reduces the risk, financial risk, is going to be beneficial as we go through the planning process, and there are a lot of different ways that different states are incenting technology, and what you're suggesting is a method of technologies. It's just stating the obvious.

It depends how it's structured, I'm sure. Financial people probably are better able to answer that. We are looking at the option evaluation of CO2 capture features right now as a financial analysis tool, trying to understand where the levers are on that, how much is it worth to me to have that option, and so we're doing some analysis of that.

MR. DEGERNES: I think having money available to subsidize a new technology is helpful in speeding up the implementation of it. I think in a state like California, you end up with a potential battle between the regulated companies and a merchant company who might want to avail themselves of that money. You know, it's -- are you going to give the money only to the utility and then let them be more competitive vis-a-vis a merchant

company, who might want to try that technology within a few years, as well; whereas, in a state

where it's entirely regulated, you don't get into that same kind of a subsidy and who collects the money and who gets to spend the money. That's just an observation that there's a potential conflict out there that happens regularly.

MR. KEESE: The Energy Policy Act went a long way towards funding one pilot project. It's written in, I believe, to be located in Wyoming. Whether the money was ever appropriated for that purpose is a question, but as far as the Energy Policy Act was concerned, it specifically funded two projects in the country of IGCC, one at elevation in the West.

If they're not going to fund it, it's -- I think the governors feel -- it's critical that we have one, and it doesn't really matter whether you get a benefit from it; everyone is going to benefit if we get one that proves the concept. So how you figure this in a curved regulatory scheme, I don't know, but it is going to be important in some way or another that somebody fund an IGCC project at elevation with western coal and sequestration.

MR. CHRISTOPHER: There's another issue that

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hasn't been discussed, and that is the liability -- the long-term liability for a sequestration site.

We believe that these projects can be sited successfully and safely and so on, but there is no commercial enterprise that can take on an infinite link in liability; so there has to be someplace where with proper and judicious monitoring and site selection that's been done that that liability is then turned over to the public domain, and there will have to be some money set aside to deal with issues in the long-term in case they arise and even monitoring for the long-term. So there are organizations that can embark on this now with the idea that the long-term liability situation hasn't been resolved, but before it becomes a widespread activity, some decisions are going to have to be made about how that liability is handled.

MR. BEYER: Any other questions?

MR. SAVAGE: One more, and I'll just quit.

This has to do with the availability factor that was raised -- I saw a very distinct curve for the four operating plants. They are extremely lousy availability about the first four or five years and then started picking up year after year. Is that -- what caused that shape?

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MR. DALTON: I can answer that since that's my curve. It wasn't presented today; it was in the backup --

MR. SAVAGE: Oh --

MR. DALTON: -- slides.

MR. SAVAGE: -- somewhere.

MR. DALTON: Those are graphed from first year

of operation, and there were a number of factors. Each one of those has been analyzed. We've been through that analysis with each. There were (inaudible) such as faring that will help. Some of those early plants were -- had a single gasification train. Some of them were also on what's called early combustion turbine family problems. In other words, this is where the first of the kind FA turbines were rolled out, and many of them had FLEET problems that were not related to the gasification, but they were related to their -- the FLEET of gas turbines. One was ran on natural gas and had some of the same problems. Combinations have often been not just the gasification pieces, but the other pieces, as well.

Now, when you run a chemical plant, Eastman has superb availability of record, but they run it flat out. They have spares. They have a schedule, but

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they don't run it to produce power. When you produce power, there are issues on (inaudible). There are additional stresses when you turn it off, and there are issues when you try and ramp up and down and integration issues, as well. Those are some of the things that we believe have caused some of the issues. Our -- the number maximum for any of those, you'll notice, of the coal variety was one year at 82 percent. That's not a commercial availability that anyone would want to run on, but there are things you can do, and we believe the designs we're developing and the designs that the manufacturing is developing, that will help in that regard.

MR. KRUEGER: Yeah, I think having the spare equipment and having the experienced operators, like Eastman, working on the projects early on and overseeing the operations are what's going to make it a successful project.

MR. BEYER: I think I want to turn to the audience now and give you a chance to ask questions.

MR. CAVANAGH: Would the chairman entertain a comment?

MR. BEYER: Could I not, Ralph?

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MR. CAVANAGH: I'm Ralph Cavanagh from NRCE.

Now, Commissioners, this was the day when what you had to say to us was more important, I think, than what we have to say to you, but I am emboldened to make one suggestion: As we walk -- you have brought us to the verge of a really exciting technology, revolution in coal, and I want to tell you I'm rooting for that revolution not just for the United States, but for what it would mean worldwide, for all the places that rely even more heavily than we do on coal.

But there seems to me a crucial contribution

that you can make that we haven't said enough about, going right to the core of your basic jurisdiction, the super protection, development of utility inventories and resources going forward.

We've heard a lot said today about what to say yes to, and you're probably not quite ready to pick your favorite form of sequestration, your favorite IGCC plant. You may, however, be ready to see something to say no to. John Wellinghoff, who will be our next western FIR commissioner, is here in this room, and he led the successful fight against a 1500-megawatt coal plant, conventional coal-burning power plant, which is less than 5

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percent of the plants seeking authorization from commissioners like you for long-term financial investments. That one plant, less than 5 percent of the pending proposals in the West, would have emitted 12 million tons of carbon dioxide per year. The entire state of Oregon emits about 70 million tons.

Commissioners, you now know enough about the exciting alternatives not just on the coal side, but renewables, energy efficiency, high-efficiency gas. You know enough about the alternatives to be able to send a firm and clear signal to the marketplace that you are not interested in any more long-term bets on irresponsible uses of coal, and I think many in this room hope that that message is one of the things that will come clearly from the commissions as you go out of this meeting and decide what next to do with these extraordinarily important issues you bring for us today. Thank you.

(Applause)

MS. WEINZIMER: Thank you for delivery of this.

This is Lisa Weinzimer with Platts, and, Bill Keese, I'm returning to questions I've asked you. But the recommendation sent to the governors,

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do they provide any -- any details on incentives that states should develop for these projects, for these advance coal projects?

MR. KEESE: Yes, but I'll answer it more generically. Across the board we have broad recommendations in energy efficiency, in solar, in geothermal, and clearly in coal. The coal ones are focused on Tier 1 and Tier 2 I spoke about.

MS. WEINZIMER: Right.

MR. KEESE: What we -- we don't say, "Do this, do this, and do this." We say, "Here are the 20 things you could do towards this goal that we have, and you pick," and we would think that some of them will be done statewide, and some of them clearly will be done regionally, and if you're talking about my plant that I love, the one at altitude, the IGCC sequestration, it almost certainly will be

done somewhat regionally by some grouping of states.

MS. WEINZIMER: Thank you.

MR. BEYER: Anybody else, question or comment?

MS. PETRILL: I'm Ellen Petrill from the Electric Power Research Institute.

Unfortunately Eric Redman is not here, but I wanted to see what the other panelists thought

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about some of his -- well, his four ways to -- he said, "Do gasification. Don't pay extra," and I want to know what you guys think about this. He said, "Include methanation" -- so it's really other products -- "make the apples to oranges comparison fair; preserve the advance gasification technology option" -- so he meant switch technologies in or out, I guess -- "and then induce the project vendors to bite the bullet."

Do you think those ways could make IGCC not more expensive?

MR. KRUEGER: Well, yeah. I guess with co-products, you're selling high-margin products like substitute natural gas or methanol or other products. It does bring down the cost of the entire IGCC where you have a separate module that you're getting a reference from.

MS. CAPALBO: Yeah, I mean, I interpret some of his stuff as, you know (inaudible) the internal idea (inaudible) associated with producing energy, and if you did that and you properly valued the air as grounds for dumping CO2 and you put, you know, a cost on that, then I think IGCC potentially would -- would -- the cost -- developer's cost, the shadow cost would come down.

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MR. DEGERNES: Eric was right in the sense that he was talking about the developer being -- who was planning to internalize those costs and spread them over a broad base, and then AEP goes into Ohio and says to Ohio, "You're going to need to spend $26 million this year on a new plant." Well, the commission there went the other way. "Okay. We want the plant. We want it in Ohio, and the utility is telling us the only way that's going to happen in Ohio is we pay up front." It makes it harder for everybody else to justify spreading the cost when one state steps up and says, "We'll spend the money to do it."

MR. GALLOWAY: Thank you. I'm John Galloway from the Union of Concerned Scientists.

And I'm really interested in the point that Commissioner Grueneich brought up around bridging the gap between plants that are sequestration ready, meaning that they separate out the CO2 and actually getting to a stage where we actually sequester the carbon, and I think that may be an area that we touched on a bit, but it's one I think

we really should explore a lot further as we move forward in establishing policies at the state level and potentially even at the federal level, as we discussed earlier.

And so maybe the answer to my question was somewhat addressed by Sally in saying that working with mid-range projects to gain some experience with the technologies is really the way to go, but I guess maybe my question would more be for the commissioners on the regulatory side. What we do in terms of bridging that gap over what time frame, it seems to me that if we established policy of IGCC that separates the carbon stream, and we're not sequestering it because we're developing that technology is like close, but no cigar, and as we all know, cigars burn in oxygen, not in carbon dioxide, and so I'm particularly interested in the perspectives of Oregon and Washington. You know, I think the California Commission has made clear that the utilities they regulate must address carbon dioxide emissions and other greenhouse gas emissions, but, really, I would open that question to any of you.

MR. BEYER: Commissioner Savage, do you have any thoughts?

MR. SAVAGE: You know, going back to the -- I guess what we were saying is that the -- any new plant should have the ability to capture carbon and sequester it eventually. Does that answer your question?

MS. GRUENEICH: But did you take Ralph's pledge?

MR. SAVAGE: De facto we've taken Ralph's pledge.

MR. OSHIE: I would agree that if you're going to invest in the technology, then you have to -- you know, you have to be prepared for the future. If we're going to be involved -- if there's going to be carbon constraints -- I mean, you can buy your way out through mitigation, but I think it's a lot cheaper in the long run, and I know some of the studies that EPRI has done, when you look at sequestration over time, it is the lease cost option.

MR. BEYER: Commissioner?

MR. PEEVEY: Yeah, let me just say one thing, and several of us have to get out of here.

Two or three points: I came here today with the attitude no coal under any circumstances anytime, anyplace, anywhere. I'm leaving here with maybe. As long as I know it's deep underground and all those beautiful spots that were laid out there, (inaudible) going to come back, but I say that a little facetiously.

To take up with something that Ralph Cabana said and all -- and I hope a couple of things come out of this meeting. I hope one of things that comes out of this meeting is that a stronger ongoing working relationship of these three commissions on the West Coast and that we formalize -- like we've done in California -- is formalize some agreed-on actions and policies that the three states at least can look to, and I would love to have Wyoming be part of it; I'd love to have New Mexico be part of it; you know, some of the other states that aren't here. I shudder when I read about a publicly owned entity like Salt River Project and Tucson planning to build coal plants, Springerville, units 4 and 5 and all this kind of stuff -- I don't think that we have the luxury of waiting, and as a regulator, I will say this: We will find the mechanisms to incentivize the right kind of development to the best we can. There's a lot of ways, but I don't want to have a fiddling while Rome burns kind of attitude that, you know, you get into here, with you put up a little bit of money up front, and should you not and so on and so forth.

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I think that we have to move, and we have to move with a certainty and vigor to really make some fairly radical early steps here. I think we started on that course, but we have a long ways to go.

MR. BEYER: Well said.

Anybody else with a question? Yes.

MR. EMMERT: Stephen Emmert with Puget Sound Energy.

I had a question for the panel. I'm a little unclear as to what the consensus is on the state of the technology of CO2 sequestration. I hear that the oil and gas industry has been doing it for 30 years, three to four power plants equivalent to CO2 going underground. (Inaudible) demonstration projects going on. What is the status of the CO2 sequestration?

MR. CHRISTOPHER: Well, we think -- we came into this business years ago thinking that this is a safe and effective way to deal with CO2. If you look at large-scale ways to get CO2 out of the atmosphere, this far and away wins the game.

If you -- if you do it as I described by doing a careful selection of the site, followed by a good monitoring program and/or remediation program to go

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with it, we think it's very safe.

MS. BENSON: I'd just like to add a little bit to that. The oil industry isn't CO2 EOR. Those are not projects where people have looked for leakage, and obviously there hasn't been enough leakage to make it so -- you know, so it is an environmental

problem, but, you know, I think there's due diligence added to, "Well, you know, we should go look," rather than (inaudible) why demonstration (inaudible) valuable and why projects like Weyburn, which is an EOR (inaudible) has very extensive monitoring to look whether there was any, and there wasn't, but that, I think, is helpful in giving confidence.

The second thing is, as Charles mentioned earlier, we do know somewhat less about the (inaudible) and on the other end, the principle of how they should perform, but the seals that would be present haven't stood the test of time like oil and gas reservoirs have. So we believe they should be very effective. (Inaudible) appears to be effective, but it would be helpful to just gain more experience because geology is, by nature, very heterogenous, and each location is unique. So that's why the goal is for developing more

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demonstration projects.

MS. CAPALBO: And the other point I would add, you know, the question is how much leakage can we live with. You know, the cost of monitoring and measuring and these type of things is nonlinear with respect to how much leakage you're willing to live with. So, I mean, if we're saying we can inject these into these underground aquifers, so maybe 5 percent leaks back out. So how -- you know, what is the tradeoff between the cost to ensure that -- you know, that we're down to 99.5 percent versus 95 percent? So I think those issues are extremely important, some of those need to be done.

The MMV and those monitoring costs could overwhelm you if you to have to go to such a high level of nonleakage. So there's a lot of issues that need to be addressed here, but I think the bottom line is that looking at the EOR is useful, but I think the really long-term storage of the other opportunities that we have -- and we've got to be willing to incur those costs now.

It's a hard thing in an economic study, like, you know, do a typical cost benefit analysis and discount, because when you start discounting beyond

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20 years, of course, these things -- the benefits go to zero clear off into the future. So we need to take that into account and look at other means of valuing these costs that we're going to incur now and weigh them against the benefits.

MR. KEESE: Speaking as a layman, I think the point is we're just putting it in the air right now. We're just sending it up. We're talking about making it better by putting it down. Yes, if we have some leakage -- once you start working in an oil field, if you pump natural gas down to push

the oil, you get more natural gas, but then you take it out and put it down, and it's the same with CO2, and it's the same with water.

If we adopt a goal of putting 60 percent in the ground and we've put 65 percent and we've got 5 percent leakage, we've still got our 60 percent.

There is an economic basis that's going to come here. We're talking about massive scale sequestration versus anything that's been done in the past. So the studying of it, the monitoring of it seems to me to be critical, but we are talking about CO2, which is all around us, and we're talking about making our CO2 environment much better than if we don't do something.

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MR. BEYER: Okay. We're kind of hitting the end here. I'm going to give the commissioners a chance for parting comments.

Commissioner Oshie?

MR. OSHIE: Just to add a brief -- briefly to what President Peevey said. You know, this is an opportunity I think that we had taken. As I mentioned earlier, the energy foundation was really central to the three commissions getting together, and this has really grown to a much larger gathering, a much broader covering of the subject matters than we eventually envisioned.

But we'll look, I think, to the future to having the three commissions continue to work together, and whether we get to some kind of a uniform policy with regard to greenhouse gases, I don't know, because in the large respect, it doesn't really reside within the commission so much as it resides with the governors' offices, but we'll see where we go, but I look forward to the opportunity to continue to work with California and with Oregon, and we hopefully will be back here again before too long either addressing other subject matters of equal importance. So thank you very much.

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MR. BEYER: Ms. Grueneich?

MS. GRUENEICH: Thank you. I want to say that for me this has been a very useful day in learning a great deal about this area and also just getting to know my fellow commissioners better. That alone has been extremely worthwhile. So I, too, want to join in that. My hope is that at least annually we can have this type of three-commission meeting on whatever topics in the world of energy are of importance to us, and I am interested in seeing if there are ways that we can put together a common document that at least talks about areas where we have common policies among the three states and the three-state commissions. Our ways of implementing them may be different, but I think that it will be useful for the public to understand where we do

have common areas, because as we all know, in the West energy, electricity -- our grids are interconnected, and it seems to me that this is a great service that we could provide.

The last thing that I'll end with -- and some of you have heard me say this before -- that I'm a mom. I have two 12-year-olds, and I am not interested in leaving them a world in which they are going to have to make very, very significant

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sacrifices because I personally wasn't willing to step up to the plate.

And I was appointed by Governor Schwartzenegger last year. I was given what I consider a tremendous opportunity in the area of energy policy and in this critical area of climate change to make decisions, and I want to be able to look my children in the eye and say, "I made the right decisions for them and for their peers," and so I join with President Peevey in stating we are very serious about taking whatever steps we can to address climate change. It's an area we have to deal with now. That's what our governor has said, and we will deal with it vigorously. So we look forward to everybody helping us understand how we do that, but we have a very, very strong commitment to move forward in this area.

MR. BEYER: Commissioner Baum?

MR. BAUM: (Commissioner shakes head.)

MR. BEYER: Commissioner Byrne.

MS. BYRNES: I don't know. I want to thank you all for inviting me to this dais today, and speaking from Wyoming, I know that we look for collaboration and partnerships with filling the needs of energy responsibly, and I know

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Governor Freudenthal has said that along the way in some agreements, and I suppose we'll see something come out of the Western Governors Association.

And I share also with Dian my personal beliefs is that I have two young children, and I feel the very same way. We are very responsible for what goes on in this world, and thank you all very much.

MR. BEYER: Commissioner Savage?

MR. SAVAGE: Yeah, I have three things to say: One, I hope you got something out of this today. You know, when we first envisioned this, I had -- you know, how you envision this coming up -- when we first came up with this idea and how it actually comes off, it's completely different. So I hope that you got something out of this. I want to thank our panelists. I thought we had an excellent group of panelists.

(Applause)

MR. SAVAGE: Second, I have an old child, much older than Dian, and we must act on climate change. There's just no ifs, ands or buts about that.

Third, I commit -- and I can't say -- I will commit that we will generate a shared action plan for the three West Coast commissions to address climate change.

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And, second, I hope this is -- I really want to set up another one of these three-commission or multi-commission issue meetings very quickly. I got so much out of this. So thank you all.

MR. BEYER: Well, that brings us to the close. I hope that this was worthwhile for all of you, and thank you all for coming. It was a little bit, this afternoon particularly, like drinking out of the proverbial fire hose. It was a lot to digest.

Again, I would like to thank all the panelists for coming out and helping us understand this. It was very informative. We'll try to do the best we can with all the information provided.

So thank you all, and have a good return trip home, wherever that is.

(Concluded at 4:38 p.m.)