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RENEWABLE ENERGY OPPORTUNITIES AND ISSUES ON FEDERAL LANDS: REVIEW OF TITLE II, SUBTITLE B, GEOTHERMAL ENERGY OF EPACT; AND OTHER RENEWABLE PROGRAMS AND PROPOSALS FOR PUBLIC RESOURCES

OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

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OVERSIGHT HEARING ON RENEWABLE ENERGY OPPORTUNITIES AND ISSUES ON FEDERAL LANDS: REVIEW OF TITLE II, SUBTITLE B, GEOTHERMAL ENERGY OF EPACT; AND OTHER RENEWABLE PROGRAMS AND PROPOSALS FOR PUBLIC RESOURCES.

Thursday, April 19, 2007
U.S. House of Representatives
Subcommittee on Energy and Mineral Resources
Committee on Natural Resources
Washington, D.C.

The Subcommittee met, pursuant to call, at 2:05 p.m. in Room 1324, Longworth House Office Building, Hon. Jim Costa [Chairman of the Subcommittee] presiding.

Present: Representatives Costa, Sali, Pearce, Kennedy, Solis, and McMorris Rodgers.

STATEMENT OF HON. JIM COSTA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. COSTA. The Energy and Mineral Resources Subcommittee of the Natural Resources Committee will now come to order. This is an oversight hearing dealing with renewable energy opportunities and issues as it relates to our committee's jurisdiction on Federal lands. Obviously there are a number of areas where we have jurisdiction dealing with Title II and Subtitle B as it relates to the Geothermal Energy Act and other renewable programs and proposals for public resources.

We have here this afternoon two panels before us of witnesses who are highly reputable and have experience and expertise in their respective fields, and we look forward to hearing that testimony. Let me indicate that we are challenged with a roll call that will be coming up here shortly, and so in conversation with the Ranking Member we have decided we would give our opening statements if that is fine with you folks, although we are not really putting it up for a vote, and then we suspect we will be called to go over to the Floor and cast our votes, and so that will be as of a form of a little break for those of you who would like to have a little break and go get some coffee or whatever.

Hopefully we will be back within 25 minutes but let us try to get as far as we can here. We have a lot of other committees that are

currently holding hearings, and it is that time of year, and I am mindful of my colleagues' time, and we want to try to expedite it in a way that makes sense. So having said all that, let me go through some formalities that I am supposed to do as the Chairperson of this Subcommittee.

As was indicated, under Rule 4[g], the Chairman and the Ranking Member may make an opening statement. If any Members have other statements, we will include them in the record under unanimous consent. Additionally, under Committee Rule 4[h], additional material for the record should be submitted by the Members or witnesses within 10 days of this hearing. I always ask those who are testifying that when we submit questions from our colleagues who could not be here because they had another commitment or hearing, that you try to get your responses to the questions to us sooner rather than later. That would certainly be appreciated. So your cooperation is certainly important.

Let me briefly open up in suggesting that this is part of a larger effort to look at how we can complement previous efforts that have taken place by those Congresses before us to enhance our efforts to produce additional energy alternatives and enhance other existing energy uses that we and our country benefit from both economically as well as socially.

The testimony that we will receive this afternoon is from nine individuals who have various experiences and expertise on renewable energy technologies and policies. Those include but are not limited to geothermal, solar, wind and biomass, four technologies that have I believe significant potential to produce additional energy for citizens of this country as it relates to public resources on public lands.

Today we will look at the EPAct Section 211 that urges the Secretary of Interior to seek in the next 10 years to have approved additional energy from renewable sources on public lands within a generation capacity of at least 10,000 megawatts. Frankly, I would like us to see us do better, and I think we can.

There are a number of focuses as it relates to our current energy uses and to all the management tools that currently are available to us, and that in the future will be available to us as we see new technology breakthroughs occurring. Certainly we know that for any scenario that we envision that our current sustainable energy uses of coal, oil and gas resources will continue to provide a significant, significant amount of our energy source as it does today.

But trying to use new technologies and use additional energy sources I think is common sense. This opportunity to look ahead then must look at the longer term not just the short term, but the longer term to address prospects that include but are not limited to climate change and change in terms of economies on the world global market. Let me be clear in terms of my own opinion of renewable energy. Renewable energy is an important opportunity but I do not believe that it is a silver bullet.

I do not think there is a silver bullet but I think that continuing efforts, not just in these that we are testifying about today, but I also serve on the Ag Committee and we are looking at real opportunities that U.S. agriculture can play in terms of providing additional energy sources to America, and if we are successful here,

obviously it will benefit other parts of the world. We already see in Brazil where they have done that very successfully.

So that is kind of what I am looking for today in terms of the testimony. We have had a number of groups that have weighed in. The Western Governors' Association has adopted a resolution to develop an additional 30,000 megawatts of energy by the year 2015, and I think those are good goals. Increasing energy efficiency by 20 percent in 2020. I know in California and other western states there is an aggressive effort to do just that.

Obviously we are going to have to also look at reliable transmission, and I will be interested in hearing these witnesses today talk about the challenges of transmission of this energy from the source as it becomes a reality. So those are among the many questions and concerns I have, and I am anxiously looking forward to the testimony. I will now defer to my colleague, the gentleman from New Mexico, for an opening statement.

STATEMENT OF HON. STEVAN PEARCE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW MEXICO

Mr. PEARCE. Thank you, Mr. Chairman. I want to thank you for having this hearing on geothermal energy. We have lots of hot water in New Mexico, and I find myself in it more than I should. You and I both voted for the Energy Policy Act. I felt like it was a positive landmark step in the effort to lower energy prices for our constituents and reduce our dependence on foreign sources of energy.

The Energy Policy Act sought to find a balance between the use of conventional fossil fuels, the expansion of renewable and alternative energy sources, and conservation to meet the energy needs of our nation. We need to diversify our energy resources as we go forward in time. For my part, last August we convened a seminar in New Mexico declaring that we as research scientists, we as the university people, businesspeople, and consumer advocates felt like New Mexico could and should be the leader in renewable, the alternative sources of energy. We are well positioned with respect to wind, solar, geothermal, biomass, hydrogen and nuclear, and so New Mexico can and should be a leader in converting to those sources of energy.

However, there are problems in the transition, and that is what I think the purposes of this committee are. This hearing is going to focus on geothermal energy, the provisions in the Act, and the opportunities for development of other renewable energy sources on Federal lands. Among other policies, the geothermal provisions allow us to lease geothermal resources just like the oil and gas leasing program. It allows us to revise and simplify the royalty assessments. It provides incentives to companies to expedite construction, and also allows us to regrow the BLM geothermal program staff with money generated by geothermal leasing by the geothermal leasing program itself.

We will hear from the witnesses on our first panel about the opportunities for expanded use of geothermal resources that are beyond our imagination when we crafted the geothermal provisions of the Energy Policy Act in 2005. These witnesses will illustrate once again that the geothermal technology continues to evolve, and

that Federal research dollars for geothermal engineering and science research are a prudent investment for our future.

We hope that in future budgets set by the Administration that Department of Energy funding for geothermal research is restored. Geothermal energy is an important energy resource to my home state of New Mexico and to Chairman Costa's home state of California.

We also included in the Energy Policy Act a sense of Congress that the Secretary of the Interior should be generating at least 10,000 megawatts from use of renewable energy projects including hydroelectric within 10 years. To that end, we will hear from Mr. Hughes the progress that BLM has made in processing leases for wind energy, biomass, geothermal and solar projects on Federal land.

The Federal lands will play a significant role for the western public land states that have established renewable portfolio standards. Both California and Nevada have renewable portfolio standard requiring that 20 percent of the electricity used in that state must come from renewable energy resources within 10 years. I would like to remind people that while wind and solar can augment our electrical energy generation, they cannot provide base load power.

Fortunately geothermal and hydropower can provide that base load power. In fact, today's hydropower provides the largest percent of the renewable energy produced in the U.S. and also some of the lowest cost energy available, as Mr. Lutgen can testify to. Again, I thank all of the witnesses for their time, and I look forward to the discussion on implementation of the Energy Policy Act 2005 geothermal energy provisions. Thank you, Mr. Chairman. I yield back.

Mr. COSTA. Thank you very much, Congressman Pearce, for that good statement. And what we will again try to do, asking staff now to give us a hand on how far we are from our votes, but again to try to expedite the time we are going to see since it is five minutes each, 10 minutes now, let us try to see if we can get through at least the first statement of our first witness who is Mr. Hughes.

She is trying to confuse me. Mr. Hughes is no stranger to this committee. He is the acting Director of the Bureau of Land Management, U.S. Department of Labor. U.S. Department of Interior. Excuse me. I put you in a different department. Before us in the past and here again today, and we are glad to have you. Please, we will have your statement and then we will break for us to go cast our votes.

STATEMENT OF JIM HUGHES, DIRECTOR, BUREAU OF LAND MANAGEMENT

Mr. HUGHES. Thank you, Mr. Chairman, and members of the Subcommittee.

Mr. COSTA. Bring that mic a little closer to you, please.

Mr. HUGHES. I appreciate this opportunity to appear before you today to discuss renewable energy opportunities and issues on Federal lands. With the 37th anniversary of earth day approaching this Sunday, it is fitting that I am here today to update you on the BLM's ongoing efforts to facilitate renewable energy development

on public lands and the progress the BLM has made implementing the requirements of the Energy Policy Act of 2005.

The Energy Policy Act directs the Department of Interior to take actions to promote the development of domestic renewable energy supplies. The BLM has a clear mandate to provide access to energy development on public lands in balance with other multiple use purposes. Strict mitigation measures are employed to minimize environmental impacts on public lands.

Through our land use planning process, the BLM works with local communities and other interested stakeholders to consider a range of concerns and opinions and provide for environmentally sound management of the resources. The BLM has supported the development of renewable energy projects on public lands for decades but recent guidance from the Energy Policy Act and increased interest in project development has provided the impetus to improve our processes and focus increased efforts in the area of renewable energy development.

Improved technology, higher fossil fuel prices, state requirements to produce renewable energy, and extended tax credits in the Energy Policy Act have all contributed to increased interest in the applications for renewable energy projects. Twenty-one states and the District of Columbia have already instituted renewable portfolio standards. The BLM continues to do its part to contribute to domestic energy production through the implementation of the Energy Policy Act.

Through the Act, Congress affirmed the critical role of the public lands in creating a balanced energy portfolio for the Nation by direction the Bureau of Land Management to approve enough projects on the public lands to generate at least 10,000 megawatts of electricity from nonhydropower renewable resources by the year 2015.

The BLM is advancing the development of geothermal, wind, solar and biomass energy from the public lands. The annual electrical needs of 1.2 million homes are currently generated by 55 geothermal leases on BLM managed lands. Another one million homes could be powered in coming years by wind energy produced on public lands. The BLM has approved nearly 300 geothermal lease applications since 2001, and more than 100 wind energy right-of-ways during that same period of time. Interest in solar energy development is beginning to increase on public lands with 43 applications currently pending.

Significant accomplishments in the geothermal, wind and solar programs include the soon to be published geothermal regulations. Also the release of the final programmatic wind energy development environmental impact statement in 2005 has also assisted our efforts, and just this month we released updated policy guidance for processing applications for solar energy projects on public lands.

Each of these milestones furthers the BLM's ability to respond in a timely, efficient manner to applications for renewable energy development on public lands. We have also been working with state, tribal and local government partners as well as private interests to develop strategies to increase the commercial utilization of

woody biomass and expand economic opportunities for local communities to develop energy generation industries.

Since implementation of its biomass strategy in 2004, the BLM has increased its biomass offerings from 30,000 tons to 122,000 tons in the year 2006. When it comes to our own energy consumption, the Secretary of the Interior has made it clear that he welcomes the President's call for increased energy efficiency in the Federal government, and that DOI will continue to be a leader in energy efficiency.

The BLM has installed over 600 photovoltaic solar equipment systems in our facilities to self-generate electricity, and we expect to generate more. Energy efficiency as well as the installation of renewable energy generation will be a focus in future BLM facility improvements and construction projects, and we have several current initiatives well underway.

I have just touched on a few of the highlights in each of these areas of renewable energy development and BLM's own use of these technologies. Each of these is explained in more detail in my full testimony which the committee has. Mr. Chairman, this concludes my opening remarks. I will be happy to answer any questions when you return.

[The prepared statement of Mr. Hughes follows:]

Statement of Jim Hughes, Acting Director,
Bureau of Land Management, U.S. Department of the Interior

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear here today to discuss renewable energy development on public lands.

Background

As steward of 258 million acres of this nation's lands, the Bureau of Land Management (BLM) has tremendous responsibility to ensure multiple-use management of these resources for all Americans. Today's testimony will focus on one aspect of that multiple-use mandate: renewable energy development.

In providing an appropriate mix of both renewable and conventional energy supplies from the public lands, the BLM contributes to a more secure and reliable energy future for our country. The BLM has supported the development of renewable energy projects on public lands for decades, but recent guidance through the Energy Policy Act of 2005 (EPAct) and increased interest in project development has provided impetus to improve our processes and increase our efforts in the area of renewable energy development.

While the quantity of domestic energy produced from renewable resources is relatively small in comparison to conventional resources, the Energy Information Administration projects that the use of renewable technologies for electricity generation will grow steadily through 2030, stimulated by improved technology, higher fossil fuel prices, State requirements to produce renewable energy, and extended tax credits in the EPAct.

Through the EPAct, Congress affirmed the critical role of the public lands in creating a balanced energy portfolio for the nation by providing a sense of the Congress that BLM should approve enough projects on public lands to generate at least 10,000 megawatts (MW) of electricity from non-hydropower renewable resources by 2015. The BLM continues to implement the EPAct, which requires the development of renewable energy resources as part of an overall strategy to develop a diverse portfolio of domestic energy supplies for our future.

Protecting the Environment

The BLM's land use planning process seeks to ensure that energy development on public lands is done in a way that protects the environment. Strict mitigation measures are employed to minimize impacts on wildlife from habitat fragmentation, ground disturbances, or noise resulting from renewable energy development. Increasingly, BLM is mitigating effects of energy production and other activities through available land use planning tools.

In August 2006, an environmental review was completed for the largest wind energy project on Federal land in the last 25 years. Approval of the Record of Decision and right-of-way grant for the Cotterel Wind Power Project on 4,500 acres of BLM-managed public land cleared the way for the installation of up to 98 turbines on a ridge in south-central Idaho. The right-of-way grant includes important measures for mitigating the effects of wind generation on wildlife resources. Best Management Practices, offsite mitigation, and adaptive management strategies were incorporated into the project to address impacts to sage-grouse, raptors, bats, and migratory birds. An interagency team of Federal and state biologists developed the mitigation plan and will continue to monitor wildlife impacts. In this case, the applicant has executed a letter of commitment for annual contributions to be in an amount equal to approximately one-half of one percent of the gross revenues received from the project's electricity sales. The 200 MW project will generate enough electricity to supply approximately 50,000 homes.

The Healthy Lands Initiative proposed in the FY 2008 budget is another example of taking aggressive steps now to help avoid the need for future restrictions on uses of public land that would directly affect the Nation's economy and quality of life. Land health is being affected by pressures such as community expansion, wildfires, unprecedented demands for energy resources, ever-expanding recreation uses, and weed invasion. These pressures often interact to affect large landscapes and ecosystems, particularly those in the growing wildlife-energy interface. The Healthy Lands Initiative represents a new concept for meeting emerging challenges in managing natural resources with flexible, landscape-level approaches for maintaining or improving land health where lands continue to be available for multiple uses.

Renewable Energy Development on Public Lands

The BLM is advancing the development of geothermal, wind, solar, and biomass energy from public lands. Recently, BLM began a collaborative effort with the Department of Energy's National Renewable Energy Laboratory (NREL) to focus on expediting the processing of renewable energy projects on public lands. NREL will be providing additional technical resources to assist BLM in the review of wind and solar projects. In addition, NREL will provide additional assessments to identify areas for possible future leasing.

Geothermal: Fully 90 percent of the existing and future geothermal resources in the United States are on Federal lands. The BLM currently manages 354 geothermal leases, 55 of which are producing and generate over 1,250 MW of electrical power (enough to power 1.2 million homes). In addition, the BLM manages a small number of direct-use leases, which provide an alternative source of energy for greenhouses, fish farms, and other commercial facilities. Demand for both electrical power and direct-use from Federal geothermal resources is increasing. Since 2001, the BLM has processed more than 200 geothermal lease applications, compared to 20 lease applications received from 1997-2001. Geothermal energy generates over $12 million in Federal revenues each year.

Title II of the EPAct made comprehensive changes to the Geothermal Steam Act—the authorizing statute for geothermal development on public lands—by requiring land nominated and made available for leasing to be leased on a competitive basis; restructuring royalties; and revising lease terms, conditions and rentals. As a result, the BLM and the Minerals Management Service have rewritten their geothermal rules to conform to the statutory changes. The Final Rule will be published in the Federal Register in the near future, and is scheduled to take effect 30 days after publication.

The BLM and Forest Service signed an Interagency Memorandum of Understanding (MOU) in April 2006 in accordance with section 225 of the EPAct. The MOU sets the foundation for increasing the collaborative approach between the agencies. The BLM and Forest Service have decided to prepare a Programmatic Environmental Impact Statement for Geothermal Development to assist in geothermal leasing and permitting on BLM public lands and National Forest lands. A draft of the Programmatic EIS is tentatively scheduled for release in December 2007.

Wind Energy: Section 211 of the Energy Policy Act provides a sense of the Congress that the Secretary of the Interior should seek to approve at least 10,000 MW of non-hydropower renewable energy projects on BLM-managed public lands by the year 2015. There are 330 MW of installed wind energy projects on public lands, and another 599 MW proposed or recently approved, creating the potential to power nearly 300,000 homes. Responding to increasing demand for wind power, the BLM has granted over 100 authorizations associated with wind energy in the last five years, compared with fewer than five issued between 1997 and 2001.

A programmatic Environmental Impact Statement (EIS) relating to the authorization of wind energy projects was completed in 2005. This EIS amended 52 BLM land

use plans and provides the foundation for environmental analysis of future wind proposals on BLM lands. The BLM has identified 20.6 million acres of public land in the West with wind energy potential. Because wind energy facilities require only small amounts of land, actual development will involve just a fraction of that acreage.

In 2006, the BLM updated internal policy that implemented Best Management Practices and other mitigation measures for wind energy projects to avoid impacts to sage-grouse, raptors, bats and migratory birds, and to minimize habitat fragmentation, ground disturbance, and noise. These measures, combined with advances in technology, are allowing increased capacity to generate wind energy on public lands while conserving other important resource values.

Solar: Recognizing the recent technological advancements in the production of solar energy, this month the BLM updated policy guidance for processing applications for solar energy projects on public lands. The latest policy guidance directs BLM field offices to provide adequate resources to review and process applications for solar energy projects in a timely manner. The guidance also requires the BLM to address solar development when revising or updating land use plans for areas shown to have potential for commercial solar energy development.

The policy requires appropriate stipulations in authorizations to mitigate environmental impacts of projects, as well as bonding to ensure compliance and site reclamation. The guidance also describes the level of environmental review required before an authorization can be issued.

The development and use of solar energy has significant potential in the Western states. The BLM is prepared to respond to industry interest in this renewable energy resource.

Biomass: Biomass from the public lands managed by the BLM is predominantly woody debris, the by-product of hazardous fuels removal projects undertaken to reduce the risk of wildland fire and projects to improve forest and rangeland health. Using stewardship contracting and other tools provided in the Healthy Forests Initiative, the Healthy Forest Restoration Act, and the Tribal Forest Protection Act, the BLM has been working with state, Tribal, and local government partners, as well as private interests, to develop strategies to increase the commercial utilization of woody biomass and expand economic opportunities for local communities to develop energy generation industries. Woody debris that used to go up in smoke may instead be converted to heat, light, and economic development. Since implementation of its biomass strategy, the BLM increased its biomass offering from 30,000 tons in FY 04 to 122,000 tons in FY 06.

BLM has undertaken biomass demonstration projects across the West, including Alaska, California, Colorado, Idaho, and Oregon, in which local field offices are working with nearby communities and entrepreneurs to develop strategies for using biomass to generate energy.

In 2006 in Lakeview, Oregon, the BLM, the Forest Service, and 20 others representing local government, business, and non-profit organizations signed a Declaration of Cooperation in support of a 10-15 MW Biomass Energy Facility with the potential to supply electricity to more than 14,000 homes. The proposed Biomass Energy Facility is expected to be operational in 2008.

In Central Oregon, the BLM and Forest Service have committed to offering 80,000 tons of woody biomass material annually to the Confederated Tribes of Warm Springs. In addition, the proposal will treat 10,000 acres per year of forest and grasslands hazardous fuels for the next ten years. The Tribe will use the agencies' long-term commitment to provide biomass material to expand its existing energy facility near Warm Springs, Oregon.

Section 210 of the Energy Policy Act authorizes Federal grants for biomass use. BLM assisted the Forest Service with reviews and selections of Forest Service Biomass Grants in FY 2006 and 2007. Eighteen small enterprises received $4.2 million in grants to develop innovative uses for wood biomass as sources of renewable energy and new products in 2006, and 26 small businesses and community groups received grants totaling $6.2 million in 2007. The grant recipients were selected based on their capacity to increase biomass use on Forest Service land; however, 14 of them have the potential to also increase biomass use on BLM lands. Together with the non-federal matches required by the grant program, a total of approximately $12 million will be spent on these biomass projects in FY 2007.

Walking the talk—use of renewable energy by BLM

In addition to its significant role in domestic energy production, BLM is taking a leadership role by working to advance the use of renewable energy resources at numerous facilities in the field. There is significant potential for the installation and

use of renewable energy resources, such as solar, geothermal, and wind power at existing and new BLM facilities.

The BLM generates a total of 185 megawatt-hours of electricity from photovoltaic systems each year from over 600 installations. Varied uses of photovoltaic energy include water pumping, outdoor lighting, communication sites, weather and water monitoring, remote field station, and visitor centers. Since 1995, the BLM has installed over 130 photovoltaic systems to replace fossil fuel powered generators. The seasonal nature of the remote facilities and long summer sun hours have made solar energy a cost effective approach to supplying power to these facilities.

The BLM's Campbell Creek Science Center in Anchorage, Alaska, recently completed a biomass demonstration project that provided environmental education opportunities to demonstrate an alternative to diesel fuel to many local villages. A newly installed biomass furnace, fired by beetle-killed spruce, was added to the existing natural gas system to provide dual-fuel capabilities to reduce heating costs at the facility.

The BLM is expanding on the success of these efforts by incorporating energy efficiency technologies and renewable energy into more of its installations and facilities. A Greening Workshop was held in March for BLM engineers, property and facility specialists, and environmental specialists. The purpose of the workshop was to refine the BLM Strategic Greening Plan and develop specific action plans for the integration of "greening" activities in BLM, consistent with Executive Order 13423 (Strengthening Federal Environmental, Energy and Transportation Management, January 24, 2007). Energy efficiency as well as installation of renewable energy generation (solar, wind and geothermal) will be a focus in future BLM facility improvement and construction projects.

BLM issued a Fleet Management Plan in 2005, establishing goals for general purpose fleet size, reduction in fuel consumption, and the acquisition of alternative fueled and more energy efficient vehicles. As a result of this process, the BLM fleet size has been reduced by 5 percent since 2005 and fuel consumption has also been reduced.

Conclusion

In conclusion, Mr. Chairman, thank you for the opportunity to highlight a few of the steps BLM has taken to encourage the development of renewable energy resources on public lands and its own efforts to employ renewable energy at its facilities. This concludes my testimony. I would be happy to answer any questions you may have.

Response to questions submitted for the record by Jim Hughes, Director, Bureau of Land Management

Please describe how your agency is taking an integrated approach to renewable energy generation on BLM lands, to ensure that Congress, States, and the public will understand the total footprint of renewables production in a given area, and cumulative or total impacts on habitat or other natural resources. Please provide an example of ways in which your land use planning programs and your renewables staff have collaborated recently.

The BLM requested that the National Renewable Energy Laboratory (NREL) identify areas on the public lands with renewable resources that showed potential for energy development. The NREL reported its findings to the BLM in a February 2003 report, entitled "Assessing the Potential for Renewable Energy on Public Lands." This information was prepared to assist in the incorporation of renewable energy resources into future BLM land use planning efforts. It is through our land use planning process that we integrate consideration of renewable energy resources with other natural resources on the public lands and also provide opportunities for State and public input.

For example, the BLM completed a Programmatic Wind Energy EIS in June 2005, to specifically address wind energy development on the public lands. This EIS amended 52 BLM land use plans and established a set of best management practices to mitigate potential impacts on other resource values from wind energy development on the public lands. The BLM will be initiating shortly a similar effort for geothermal energy development on the public lands. This effort will also amend applicable BLM land use plans and the development of mitigation measures for protecting other resource values.

Please detail how and where the Department of the Interior is identifying renewable energy resources zones that have the most energy potential and connecting that information to the long-distance transmission planning effort under Section 368 of the Energy Policy Act. The National Renewable Energy Laboratory (NREL) has mapped prime areas for various renewable power generation; are you, for example, integrating the solar power analysis in NREL's report "Assessing the Potential for Renewable Energy on Public Lands" (or similar data) with data on transmission constraints or congestion in the process of identifying transmission corridors pursuant to Sections 368 and 1221 on the Energy Policy Act? If not, why not?

In preparing the Programmatic Environmental Impact Statement (PEIS) for the West-wide energy corridors study pursuant to Section 368 of the Energy Policy Act of 2005 (EPAct), the BLM and the Department of Energy (DOE) incorporated the NREL maps showing the distribution of renewable energy resources. These maps were used to identify areas in the West where renewable energy production exists or may be developed in the future. The informationwas then used during development of the unrestricted conceptual West-wide energy distribution network. The network that was developed and subsequently refined into the proposed Section 368 corridors that will be included in the draft PEIS for the implementation of Section 368 includes segments that directly intersect with, or are within a relatively short distance of, known and potential renewable energy sources. The proposed corridors are intended to provide access to long-distance transmission paths for energy produced from these renewable sources.

The NREL maps can be accessed at the following website: http://www.nrel.gov/renewable__resources/

Describe your current timeline and intended public review process for the programmatic EIS for energy transmission corridors.

The BLM and the Department of Energy (DOE) are co-lead agencies for preparing the Programmatic Environmental Impact Statement (PEIS), pursuant to the National Environmental Policy Act (NEPA), for implementing Section 368 of the EPAct. The United States Forest Service, the Department of Defense and the Fish and Wildlife Service are cooperating agencies in the effort. The Department of Commerce is a consulting agency. The current schedule anticipates releasing the draft PEIS for public review and comment at the end of July 2007. There will be a 90-day public comment period, and we plan to have public meetings beginning in September 2007 to give the public the opportunity to offer their comments in an open forum. After the closure of the comment period, the BLM, the DOE, and the cooperating agencies will carefully review all comments received and prepare the final EIS.Questions

Under the new Geothermal Rule, published in the Federal Register on 05/01/2007, is there a provision outside of the normal competitive lease sale process for geothermal energy development on public lands adjacent to geothermal energy development projects on private lands?

The new Geothermal Rule provides for noncompetitive leasing under four conditions:

1. Subpart 3204 provides that lands offered at a competitive lease sale that receive no bids will be available for noncompetitive leasing for a 2-year period beginning the first business day following the sale.
2. Lands available exclusively for direct use of geothermal resources may be noncompetitively leased under Subpart 3205.
3. The holder of a mining claim for which a current plan of operations has been approved may obtain a noncompetitive lease for lands subject to the mining claim.
4. If a lease application was pending on August 8, 2005, the holder may obtain a noncompetitive lease under the leasing process in effect on that date.

When will the Programmatic EIS on Energy Corridors on Federal lands be published?

The BLM and the Department of Energy (DOE) are co-lead agencies for preparing the programmatic Environmental Impact Statement (PEIS), pursuant to the National Environmental Policy Act (NEPA), for implementing Section 368 of the EPAct. The United States Forest Service, the Department of Defense and the Fish and Wildlife Service are cooperating agencies in the effort. . The Department of Commerce is a consulting agency. The current schedule anticipates releasing the draft PEIS for public review and comment at the end of July 2007. There will be

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Mr. COSTA. And we appreciate that, Mr. Hughes, and we will look forward to asking you those questions. However, I am informed that we have about five minutes to vote at this time. So I am going to take the prerogative of the Chair and ask that we recess for the interim. I suspect that will last approximately 15, 20 minutes.

We have a vote now, and then one following this, and so we would hope to see all of you back, and we will proceed with the other three witnesses on this panel, if I am counting correctly, and then we will go through our first round of questioning. So we hope to be back here within 15, 20 minutes. So we will afford all of you a little opportunity to have a break yourselves, and we will see you shortly. Thank you. The committee is now in interim recess.

[Recess.]

Mr. COSTA. All right. We hope you had a sufficient break, and we will continue on with our first panel. Our next witness I believe is Mr. Tester, and you are a Professor of Chemical Engineering at MIT. Obviously a very distinguished university. We look forward to your testimony on the future of geothermal. Please begin.

STATEMENT OF JEFF TESTER, CHAIR, MIT CLIMATE CHANGE PANEL

Mr. TESTER. Thank you, Mr. Chairman. America's strength as a nation can be connected to the diversity of our ideas and our people. The time has come now to diversify our energy supply to provide a more secure and sustainable future for our children and their children. One such option that is too often ignored is geothermal, produced both from conventional hydrothermal systems as well as enhanced or engineered geothermal systems, EGS.

For 15 months, starting in September of 2005, a comprehensive independent assessment was conducted by an 18-member international panel assembled to evaluate the feasibility of EGS for becoming a major supplier of primary energy, particular base load generation capacity by the year 2050. I had the privilege of chairing that panel, and this afternoon I would like to share with you some of our findings and recommendations.

In simple terms, the major question that we tried to answer was whether there was a feasible path from today's hydrothermal system——

Mr. COSTA. Pardon me, Professor, on my time. Since my eyes are not as good as I would like them to be, is this included in the book that you distributed for us?

Mr. TESTER. Yes. Absolutely.

Mr. COSTA. Would you refer which page it is?

Mr. TESTER. It is also in my testimony, the written testimony as a part of the record. This particular slide is not but the question is in both that document as well as in the report itself.

Mr. COSTA. OK. Very good. On your time.

Mr. TESTER. Is there a feasible path from today's hydrothermal systems in the United States with about 3,000 megawatts of capacity to tomorrow's EGS with 100,000 or more capacity by 2050? The reason we picked 100,000 megawatts was to put it on the same level as our current combined pumped hydro and conventional hydro as well as our nuclear capacity that we have right now in the country. We have about a terawatt of total generating capacity. So this would place geothermal at 10 percent or more.

The study itself had four major components. The first dealt with the resource itself, the second with the technology, the third with the environmental attributes and constraints associated with geothermal, and the fourth with economic projections. If we look at the resource—these maps are also in the record in the report and in my written testimony—geothermal in simple terms can be characterized in terms of three dimensions. The first has to do with the gradient itself, the second with the permeability or connectivity of rock within that reservoir, and the third is the amount of fluid that is present in the form of liquid, water or steam.

High grade hydrothermal resources have high average gradients, high rock permeability and connectivity, sufficient natural fluids in place. All other geothermal resources lack at least one of these, and the goal of enhanced geothermal systems is to provide a pathway to achieve a means of emulating the characteristics of natural commercial geothermal systems.

EGS will be the enabler that carries us across this geothermal continuum from today's hydrothermal sites that are given to us by nature to tomorrow's universal heat mining plants that will be deployed where we need them. So I would like to quickly move to the other three graphs that we have in here. This illustrates again what happens as you go deeper into the surface beneath our feet from three kilometers, three and a half kilometers down to 10 kilometers, and that is how we defined our overall resource base for EGS.

You can see that most of the country when we get to 10 kilometers begins to look like what we might envision would exist in Yellowstone in terms of the stored thermal energy. When we add all this up, we come up with a rather extraordinarily large figure of 14 million exajoules. That amount of energy is obviously many times the amount that we are consuming annually, and from our perspective the fraction that could be captured and ultimately recovered shown with the blue bars in the graph will not be limited by the resource itself. It will depend only on extending existing extractive technologies for conventional hydrothermal systems and for oil and gas recovery.

Much has been learned, many lessons and much progress in the field programs that have occurred around the world. Starting in the site in the 1970's at the Fenton Hill, New Mexico site in northern New Mexico to where we are now operating around the world in such places as Cooper Base in Australia and the Soultz site in Europe, a lot has been learned.

Let me just summarize a few of the issues that relate to why we should be reinvesting now in enhanced geothermal systems as part of the geothermal continuum. This is a large and indigenous resource, and it is accessible to us. Again, the extractive amount of

energy will not be limited by resource size. It fits into the portfolio of sustainable renewable energy options. EGS and geothermal complement the DOE's renewable portfolio. It does not hamper the growth of the others.

It is scalable and environmentally friendly, carbon free. We have a graph in our testimony that illustrates that at different levels. Many of the elements on feasibility are in place right now, and the economic projections are favorable for high grade areas, so-called early targets of opportunity as we refer to them in our report, and the longer term looks quite attainable. In fact, the recommendations that we made in this panel in terms of deployment costs and supporting research seem very reasonable, averaging about $55 million per year for about a 10 to 15-year commitment would demonstrate this technology at a commercial scale to achieve these kind of levels of diffusion. All of this amounts to something less than the price of one clean coal plant. Thank you very much.

[The prepared statement of Mr. Tester follows:]

Statement of Jefferson Tester, Meissner Professor of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts

Overview: Recent national focus on the value of increasing our supply of indigenous, renewable energy underscores the need for reevaluating all alternatives, particularly those that are large and well-distributed nationally. One such option that is often ignored is geothermal energy, produced from both conventional hydrothermal and Enhanced (or engineered) Geothermal Systems (EGS). For 15 months starting in September of 2005, a comprehensive, independent assessment was conducted to evaluate the technical and economic feasibility of EGS becoming a major supplier of primary energy for U.S. base-load generation capacity by 2050. The assessment was commissioned by the U.S. Department of Energy and carried out by an 18-member, international panel assembled by the Massachusetts Institute of Technology (MIT). This testimony provides a summary of that assessment including the scope and motivation behind the study, as well as its major findings and recommendations. Supporting documentation is provided in the full report (Tester et al., 2006).

In simple terms, any geothermal resource can be viewed as a continuum in several dimensions. The grade of a specific geothermal resource depends on its temperature-depth relationship (i.e., geothermal gradient), the reservoir rock's permeability and porosity, and the amount of fluid saturation (in the form of liquid water and/or steam). High-grade hydrothermal resources have high average thermal gradients, high rock permeability and porosity, sufficient fluids in place, and an adequate reservoir recharge of fluids; all EGS resources lack at least one of these. For example, reservoir rock may be hot enough but not produce sufficient fluid for viable heat extraction, either because of low formation permeability/connectivity and insufficient reservoir volume, or the absence of naturally contained fluids.

A geothermal resource is usually described in terms of stored thermal energy content of the rock and contained fluids underlying land masses that that are accessible by drilling. The United States Geological Survey and other groups have used a maximum accessible depth of 10 km (approx. 30,000 ft) to define the resource. Although conventional hydrothermal resources are already being used effectively for both electric and non-electric applications in the United States, and will continue to be developed, they are somewhat limited by their locations and ultimate potential. Beyond these conventional resources are EGS resources with enormous potential for primary energy recovery using heat-mining technology, which is designed to extract and utilize the earth's stored thermal energy. In addition to hydrothermal and EGS, other geothermal resources include coproduced hot water associated with oil and gas production, and geopressured resources that contain hot fluids with dissolved methane. Because EGS resources have such a large potential for the long term, the panel focused its efforts on evaluating what it would take for EGS and other unconventional geothermal resources to provide 100,000 MWe of base-load electric-generating capacity by 2050.

Three main components were considered in the analysis:

1. Resource—mapping the magnitude and distribution of the U.S. EGS resource.

2. Technology—establishing requirements for extracting and utilizing energy from EGS reservoirs, including drilling, reservoir design and stimulation, and thermal energy conversion to electricity. Because EGS stimulation methods have been tested at a number of sites around the world, technology advances, lessons learned and remaining needs were considered.
3. Economics—estimating costs for EGS-supplied electricity on a national scale using newly developed methods for mining heat from the earth, as well as developing levelized energy costs and supply curves as a function of invested R&D and deployment levels in evolving U.S. energy markets.

Motivation: There are compelling reasons why the United States should be concerned about the security of our energy supply for the long term. Key reasons include growth in demand as a result of an increasing U.S. population, the increased electrification of our society, and concerns about the environment. According to the Energy Information Administration (EIA, 2006), U.S. nameplate generating capacity has increased more than 40% in the past 10 years and is now more than 1 TWe. For the past 2 decades, most of the increase resulted from adding gas-fired, combined-cycle generation plants. In the next 15 to 25 years, the electricity supply system is threatened with losing capacity as a result of retirement of existing nuclear and coal-fired generating plants (EIA, 2006). It is likely that 50 GWe or more of coal-fired capacity will need to be retired in the next 15 to 25 years because of environmental concerns. In addition, during that period, 40 GWe or more of nuclear capacity will be beyond even the most generous relicensing accommodations and will have to be decommissioned.

The current nonrenewable options for replacing this anticipated loss of U.S. base-load generating capacity are coal-fired thermal, nuclear, and combined-cycle gas-combustion turbines. While these are clearly practical options, there are some concerns. First, while electricity generated using natural gas is cleaner in terms of emissions, demand and prices for natural gas will escalate substantially during the next 25 years. As a result, large increases in imported gas will be needed to meet growing demand—further compromising U.S. energy security beyond just importing the majority of our oil for meeting transportation needs. Second, local, regional, and global environmental impacts associated with increased coal use will most likely require a transition to clean-coal power generation, possibly with sequestration of carbon dioxide. The costs and uncertainties associated with such a transition are daunting. Also, adopting this approach would accelerate our consumption of coal significantly, compromising its use as a source of liquid transportation fuel for the long term. It is also uncertain whether the American public is ready to embrace increasing nuclear power capacity, which would require siting and constructing many new reactor systems.

On the renewable side, there is considerable opportunity for capacity expansion of U.S. hydropower potential using existing dams and impoundments. But outside of a few pumped storage projects, hydropower growth has been hampered by reductions in capacity imposed by the Federal Energy Regulatory Commission (FERC) as a result of environmental concerns. Concentrating Solar Power (CSP) provides an option for increased base-load capacity in the Southwest where demand is growing. Although renewable solar and wind energy also have significant potential for the United States and are likely to be deployed in increasing amounts, it is unlikely that they alone can meet the entire demand. Furthermore, solar and wind energy are inherently intermittent and cannot provide 24-hour-a-day base load without mega-sized energy storage systems, which traditionally have not been easy to site and are costly to deploy. Biomass also can be used as a renewable fuel to provide electricity using existing heat-to-power technology, but its value to the United States as a feedstock for biofuels for transportation is much higher, given the current goals of reducing U.S. demand for imported oil.

Clearly, we need to increase energy efficiency in all end-use sectors; but even aggressive efforts cannot eliminate the substantial replacement and new capacity additions that will be needed to avoid severe reductions in the services that energy provides to all Americans.

Pursuing the geothermal option: The main question we address in our assessment of EGS is whether U.S.-based geothermal energy can provide a viable option for providing large amounts of generating capacity when and where it is needed.

Although geothermal energy has provided commercial base-load electricity around the world for more than a century, it is often ignored in national projections of evolving U.S. energy supply. Perhaps geothermal has been ignored as a result of the widespread perception that the total geothermal resource is only associated with identified high-grade, hydrothermal systems that are too few and too limited in their distribution in the United States to make a long term, major impact at a national level. This perception has led to undervaluing the long-term potential of geo-

thermal energy by missing a major opportunity to develop technologies for sustainable heat mining from large volumes of accessible hot rock anywhere in the United States. In fact, many attributes of geothermal energy, namely its widespread distribution, base-load dispatchability without storage, small footprint, and low emissions, are very desirable for reaching a sustainable energy future for the United States.

Expanding our energy supply portfolio to include more indigenous and renewable resources is a sound approach that will increase energy security in a manner that parallels the diversification ideals that have made America strong. Geothermal energy provides a robust, long-lasting option with attributes that would complement other important contributions from clean coal, nuclear, solar, wind, hydropower, and biomass.

Approach: The composition of the panel was designed to provide in-depth expertise in specific technology areas relevant to EGS development, such as resource characterization and assessment, drilling, reservoir stimulation, and economic analysis. Recognizing the possibility that some bias might emerge from a panel of knowledgeable experts who, to varying degrees, are advocates for geothermal energy, panel membership was expanded to include other experts on non-geothermal energy technologies and economics, and environmental systems. Overall, the panel took a completely new look at the geothermal potential of the United States. This study was partly in response to short- and long-term needs for a reliable low-cost electric power and heat supply for the nation. Equally important was a need to review and evaluate international progress in the development of EGS and related extractive technologies that followed the very active period of U.S. fieldwork conducted by Los Alamos National Laboratory during the 1970s and 1980s at the Fenton Hill site in New Mexico.

The assessment team was assembled in August 2005 and began work in September, following a series of discussions and workshops sponsored by the Department of Energy (DOE) to map out future pathways for developing EGS technology. The final report was released in January of 2007.

The first phase of the assessment considered our geothermal resource in detail. Earlier projections from studies in 1975 and 1978 by the U.S. Geological Survey (USGS Circulars 726 and 790) were amplified by ongoing research and analysis being conducted by U.S. heat-flow researchers and were analyzed by David Blackwell's group at Southern Methodist University (SMU) and other researchers. In the second phase, EGS technology was evaluated in three distinct parts: drilling to gain access to the system, reservoir design and stimulation, and energy conversion and utilization. Previous and current field experiences in the United States, Europe, Japan, and Australia were thoroughly reviewed. Finally, the general economic picture and anticipated costs for EGS were analyzed in the context of projected demand for base-load electric power in the United States.

Findings: Geothermal energy from EGS represents a large, indigenous resource that can provide base-load electric power and heat at a level that can have a major impact in the United States, while incurring minimal environmental impacts. With a reasonable investment in R&D, EGS could provide 100 GWe or more of cost-competitive generating capacity in the next 50 years. Further, EGS provides a secure source of power for the long term that would help protect America against economic instabilities resulting from fuel price fluctuations or supply disruptions. Most of the key technical requirements to make EGS economically viable over a wide area of the country are in effect. Remaining goals are easily within reach to provide performance verification and demonstrate the repeatability of EGS technology at a commercial scale within a 10- to 15-year period nationwide.

In spite of its enormous potential, the geothermal option for the United States has been largely ignored. In the short term, R&D funding levels and government policies and incentives have not favored growth of U.S. geothermal capacity from conventional, high-grade hydrothermal resources. Because of limited R&D support of EGS in the United States, field testing and support for applied geoscience and engineering research have been lacking for more than a decade. Because of this lack of support, EGS technology development and demonstration recently has advanced only outside the United States, with limited technology transfer, leading to the perception that insurmountable technical problems or limitations exist for EGS. However, in our detailed review of international field-testing data so far, the panel did not uncover any major barriers or limitations to the technology. In fact, we found that significant progress has been achieved in recent tests carried out at Soultz, France, under European Union (EU) sponsorship; and in Australia, under largely private sponsorship. For example, at Soultz, a connected reservoir-well system with an active volume of more than 2 km3 at depths from 4 to 5 km has been created and tested at fluid production rates within a factor of 2 to 3 of initial commercial goals.

Such progress leads us to be optimistic about achieving commercial viability in the United States in the next phase of testing, if a national-scale program is supported properly. Specific findings include:

1. The amount of accessible geothermal energy that is stored in rock is immense and well distributed across the U.S. The fraction that can be captured and ultimately recovered will not be resource-limited; it will depend only on extending existing extractive technologies for conventional hydrothermal systems and for oil and gas recovery. The U.S. geothermal resource is contained in a continuum of grades ranging from today's hydrothermal, convective systems through high- and mid-grade EGS resources (located primarily in the western United States) to the very large, conduction-dominated contributions in the deep basement and sedimentary rock formations throughout the country. By evaluating an extensive database of bottom-hole temperature and regional geologic data (rock types, stress levels, surface temperatures, etc.), we have estimated the total U.S. EGS resource base to be about 14 million exajoules (EJ). Figure 1 and Table 1 highlight the results of the resource assessment portion of the study. Figure 1 shows an average geothermal gradient map and temperature distributions at specific depths for the contiguous U.S. while Table 1 lists the resource bases for different categories of geothermal. Figure 2 compares the total resource to what we estimate might be technically recoverable. Using conservative assumptions regarding how heat would be mined from stimulated EGS reservoirs, we estimate the extractable portion to exceed 200,000 EJ or about 2,000 times the annual consumption of primary energy in the United States in 2005. With technology improvements, the economically extractable amount of useful energy could increase by a factor of 10 or more, thus making EGS sustainable for centuries.

2. Ongoing work on both hydrothermal and EGS resource development complement each other. Improvements to drilling and power conversion technologies, as well as better understanding of fractured rock structure and flow properties, benefit all geothermal energy development scenarios. Geothermal operators now routinely view their projects as heat mining and plan for managed injection to ensure long reservoir life. While stimulating geothermal wells in hydrothermal developments is now routine, understanding why some techniques work on some wells and not on others can come only from careful research.

3. EGS technology advances. EGS technology has advanced since its infancy in the 1970s at Fenton Hill. Field studies conducted worldwide for more than 30 years have shown that EGS is technically feasible in terms of producing net thermal energy by circulating water through stimulated regions of rock at depths ranging from 3 to 5 km. We can now stimulate large rock volumes (more than 2 km3), drill into these stimulated regions to establish connected reservoirs, generate connectivity in a controlled way if needed, circulate fluid without large pressure losses at near commercial rates, and generate power using the thermal energy produced at the surface from the created EGS system. Initial concerns regarding five key issues—flow short circuiting, a need for high injection pressures, water losses, geochemical impacts, and induced seismicity—appear to be either fully resolved or manageable with proper monitoring and operational changes.

4. Remaining EGS technology needs. At this point, the main constraint is creating sufficient connectivity within the injection and production well system in the stimulated region of the EGS reservoir to allow for high per-well production rates without reducing reservoir life by rapid cooling (see Figure 3). U.S. field demonstrations have been constrained by many external issues, which have limited further stimulation and development efforts and circulation testing times—and, as a result, risks and uncertainties have not been reduced to a point where private investments would completely support the commercial deployment of EGS in the United States. In Europe and Australia, where government policy creates a more favorable climate, the situation is different for EGS. There are now seven companies in Australia actively pursuing EGS projects, and two commercial projects in Europe.

5. Impact of Research, Development, and Demonstration (RD&D). Focus on critical research needs could greatly enhance the overall competitiveness of geothermal in two ways. First, such research would lead to generally lower development costs for all grade systems, which would increase the attractiveness of EGS projects for private investment. Second, research could substantially lower power plant, drilling, and stimulation costs, thereby increasing accessibility to lower-grade EGS areas at depths of 6 km or more. In a manner similar to the technologies developed for oil and gas and mineral extraction, the investments made in research to develop extractive technology for EGS would follow a natural learning curve that lowers development costs and increases reserves along a continuum of geothermal resource grades.

Examples of benefits that would result from research-driven improvements are presented in three areas:

- Drilling technology—Evolutionary improvements building on conventional approaches to drilling such as more robust drill bits, innovative casing methods, better cementing techniques for high temperatures, improved sensors, and electronics capable of operating at higher temperature in downhole tools will lower production costs. In addition, revolutionary improvements utilizing new methods of rock penetration will also lower costs. These improvements will enable access to deeper, hotter regions in high-grade formations or to economically acceptable temperatures in lower-grade formations.
- Power conversion technology—Although commercial technologies are in place for utilizing geothermal energy in 70 countries, further improvements to heat-transfer performance for lower- temperature fluids, and to developing plant designs for higher resource temperatures in the supercritical water region will lead to measurable gains. For example, at supercritical temperatures about an order of magnitude (or more) increase in both reservoir performance and heat-to-power conversion efficiency would be possible over today's liquid-dominated hydrothermal systems.
- Reservoir technology—Increasing production flow rates by targeting specific zones for stimulation and improving downhole lift systems for higher temperatures, and increasing swept areas and volumes to improve heat-removal efficiencies in fractured rock systems, will lead to immediate cost reductions by increasing output per well and extending reservoir lifetimes. For the longer term, using CO2 as a reservoir heat-transfer fluid for EGS could lead to improved reservoir performance as a result of its low viscosity and high density at supercritical conditions. In addition, using CO2 in EGS may provide an alternative means to sequester large amounts of carbon in stable formations.

6. EGS systems are versatile, inherently modular, and scalable. Individual power plants ranging from 1 to 50 MWe in capacity are possible for distributed applications and can be combined—leading to large "power parks," capable of providing thousands of MWe of continuous, base-load capacity. Of course, for most direct-heating and heat pump applications, effective use of shallow geothermal energy has been demonstrated at a scale of a few kilowatts-thermal (kWt) for individual buildings or homes and should be continued to be deployed aggressively when possible. For these particular applications, stimulating deeper reservoirs using EGS technology is not necessary. Nonetheless, EGS also can be easily deployed in larger-scale district heating and combined heat and power (cogeneration) applications to service both electric power and heating and cooling for buildings without a need for storage on-site. For other renewable options such as wind, hydropower, and solar PV, such co-gen applications are not possible.

7. A short term "win-win" opportunity. Using coproduced hot water, available in large quantities at temperatures up to 100oC or more from existing oil and gas operations, makes it possible to generate up to 11,000 MWe of new generating capacity with standard binary-cycle technology, and to increase hydrocarbon production by partially offsetting parasitic losses consumed during production.

8. The long term goal for EGS is tractable and affordable. Estimated supply curves for EGS shown in Figure 4 indicate that a large increase in geothermal generating capacity is possible by 2050 if investments are made now. A cumulative capacity of more than 100,000 MWe from EGS can be achieved in the United States within 50 years with a modest, multiyear federal investment for RD&D in several field projects in the United States. Because the field-demonstration program involves staged developments at different sites, committed support for an extended period is needed to demonstrate the viability, robustness, and reproducibility of methods for stimulating viable, commercial-sized EGS reservoirs at several locations. Based on the economic analysis we conducted as part of our study, a $300 million to $400 million investment over 15 years will be needed to make early-generation EGS power plant installations competitive in evolving U.S. electricity supply markets.

These funds compensate for the higher capital and financing costs expected for early-generation EGS plants, which would be expected as a result of somewhat higher field development (drilling and stimulation) costs per unit of power initially produced. Higher generating costs, in turn, lead to higher perceived financial risk for investors with corresponding higher-debt interest rates and equity rates of return. In effect, the federal investment can be viewed as equivalent to an "absorbed cost" of deployment. In addition, comparable investments in R&D will also be needed to develop technology improvements to lower costs for future deployment of EGS plants.

To a great extent, energy markets and government policies will influence the private sector's interest in developing EGS technology. In today's economic climate, there is reluctance for private industry to invest funds without strong guarantees. Thus, initially, it is likely that government will have to fully support EGS fieldwork and supporting R&D. Later, as field sites are established and proven, the private sector will assume a greater role in cofunding projects—especially with government incentives accelerating the transition to independently financed EGS projects in the private sector. Our analysis indicates that, after a few EGS plants at several sites are built and operating, the technology will improve to a point where development costs and risks would diminish significantly, allowing the levelized cost of producing EGS electricity in the United States to be at or below market prices.

Given these issues and growing concerns over long-term energy security, the federal government will need to provide funds directly or introduce other incentives in support of EGS as a long-term "public good," similar to early federal investments in large hydropower dam projects and nuclear power reactors.

9. Geothermal energy complements other renewables such as wind, solar and biomass operating in their appropriate domains. Geothermal energy provides continuous base-load power with minimal visual and other environmental impacts. Geothermal systems have a small footprint and virtually no emissions, including no carbon dioxide. Geothermal energy has significant base-load potential, requires no storage, and, thus, it complements other renewables—solar (CSP and PV), wind, hydropower—in a lower-carbon energy future. In the shorter term, having a significant portion of our base load supplied by geothermal sources would provide a buffer against the instabilities of gas price fluctuations and supply disruptions, as well as nuclear plant retirements. Estimates of the carbon emission reductions possible for different levels of EGS capacity are shown in Figure 5.

Recommendations for re-energizing the U.S. geothermal program: Based on growing markets in the United States for clean, base-load capacity, the panel believes that with a combined public/private investment of about $800 million to $1 billion over a 15-year period, EGS technology could be deployed commercially on a timescale that would produce more than 100,000 MWe or 100 GWe of new capacity by 2050. This amount is approximately equivalent to the total R&D investment made in the past 30 years to EGS internationally, which is still less than the cost of a single, new-generation, clean-coal power plant. Making such an investment now is appropriate and prudent, given the enormous potential of EGS and the technical progress that has been achieved so far in the field. Having EGS as an option will strengthen America's energy security for the long term in a manner that complements other renewables, clean fossil, and next-generation nuclear.

Because prototype commercial-scale EGS will take a few years to develop and field-test, the time for action is now. Supporting the EGS program now will move us along the learning curve to a point where the design and engineering of well-connected EGS reservoir systems is technically reliable and reproducible.

We believe that the benefit-to-cost ratio is more than sufficient to warrant such a modest investment in EGS technology. By enabling 100,000 MWe of new base-load capacity, the payoff for EGS is large, especially in light of how much would have to be spent for deployment of conventional gas, nuclear, or coal-fired systems to meet replacement of retiring plants and capacity increases, as there are no other options with sufficient scale on the horizon.

Specific recommendations include:

1. There should be a federal commitment to supporting EGS resource characterization and assessment. An aggressive, sufficiently supported, multiyear national program with USGS and DOE is needed along with other agency participation to further quantify and refine the EGS resource as extraction and conversion technologies improve.

2. High-grade EGS resources should be developed first as targets of opportunity on the margins of existing hydrothermal systems and in areas with sufficient natural recharge, or in oil fields with high-temperature water and abundant data, followed by field efforts at sites with above-average temperature gradients. Representative sites in high-grade areas, where field development and demonstration costs would be lower, should be selected initially to prove that EGS technology will work at a commercial scale. These near-term targets of opportunity include EGS sites that are currently under consideration at Desert Peak (Nevada), and Coso and Clear Lake (both in California), as well as others that would demonstrate that reservoir-stimulation methods can work in other geologic settings, such as the deep, high-temperature sedimentary basins in Louisiana, Texas, and Oklahoma. Such efforts would provide essential reservoir stimulation and operational information and would provide working "field laboratories" to train the next generation of scientists and engineers who will be needed to develop and deploy EGS on a national scale.

3. In the first 15 years of the program, a number of sites in different regions of the country should be under development. Demonstration of the repeatability and universality of EGS technologies in different geologic environments is needed to reduce risk and uncertainties, resulting in lower development costs.

4. Like all new energy-supply technologies, for EGS to enter and compete in evolving U.S. electricity markets, positive policies at the state and federal levels will be required. These policies must be similar to those that oil and gas and other mineral-extraction operations have received in the past—including provisions for accelerated permitting and licensing, loan guarantees, depletion allowances, intangible drilling write-offs, and accelerated depreciations, as well as those policies associated with cleaner and renewable energies such as production tax credits, renewable credits and portfolio standards, etc. The success of this approach would parallel the development of the U.S. coal-bed methane industry.

5. Given the significant leveraging of supporting research that will occur, we recommend that the United States actively participate in ongoing international field projects such as the EU project at Soultz, France, and the Cooper Basin project in Australia.

6. A commitment should be made to continue to update economic analyses as EGS technology improves with field testing, and EGS should be included in the National Energy Modeling System (NEMS) portfolio of evolving energy options.

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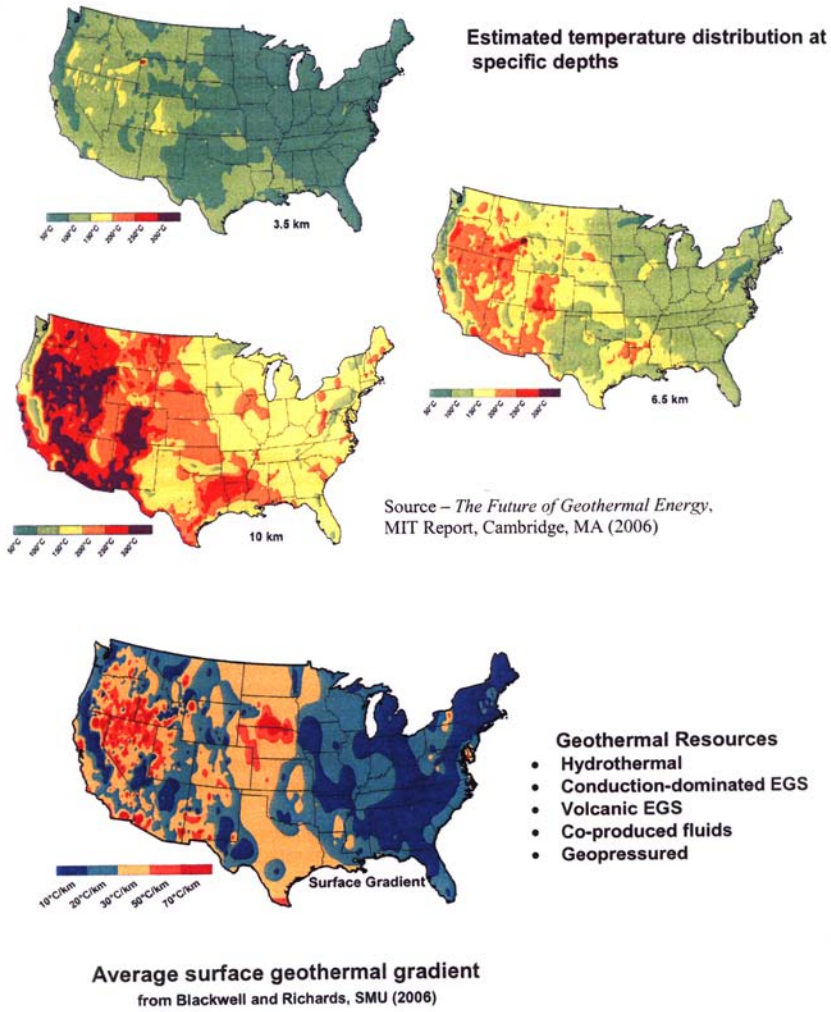

Figure 1. Estimated temperature distribution at specific depths and the average geothermal gradient distribution at the surface in the contiguous United States.

Table 1 Estimated U.S. geothermal resource base to 10 km depth by category (from *The Future of Geothermal Energy*, MIT Report, Cambridge, MA (2006)

Category of Resource	Thermal Energy, in Exajoules (1EJ = 10^{18} J)	Reference
Conduction-dominated EGS		
Sedimentary rock formations	>100,000	This study
Crystalline basement rock formations	13,900,000	This study
Supercritical Volcanic EGS*	74,100	USGS Circular 790
Hydrothermal	2,400 – 9,600	USGS Circulars 726 and 790
Coproduced fluids	0.0944 – 0.4510	McKenna, et al. (2005)
Geopressured systems	71,000 – 170,000**	USGS Circulars 726 and 790

* **Excludes Yellowstone National Park and Hawaii**
** **Includes methane content**

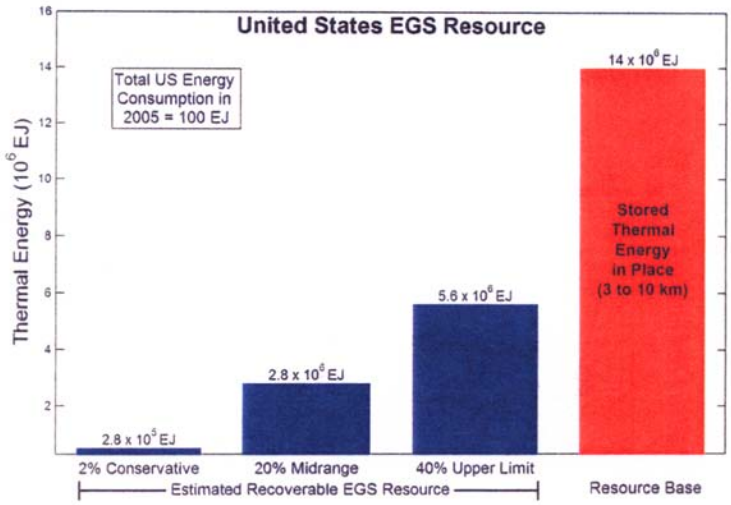

Figure 2. Estimated total U.S. geothermal resource base and recoverable resource the 40% upper limit is based on the analysis of Sanyal and Butler (2005) while lower recoverable amounts are estimates from *The Future of Geothermal Energy*, MIT report, 2006.

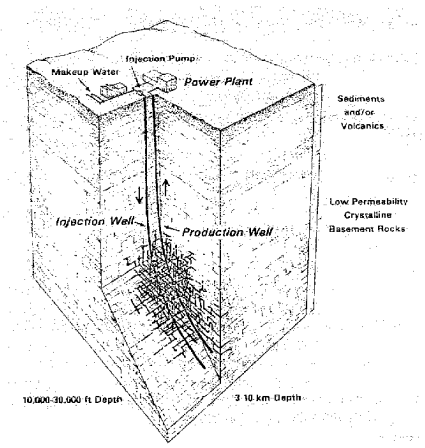

Figure 3. Schematic of a conceptual two-well enhanced geothermal system (EGS) in hot rock, in a low-permeability crystalline basement formation. Connectivity has been established by hydraulically stimulating the rock contained between the injection and production wells.

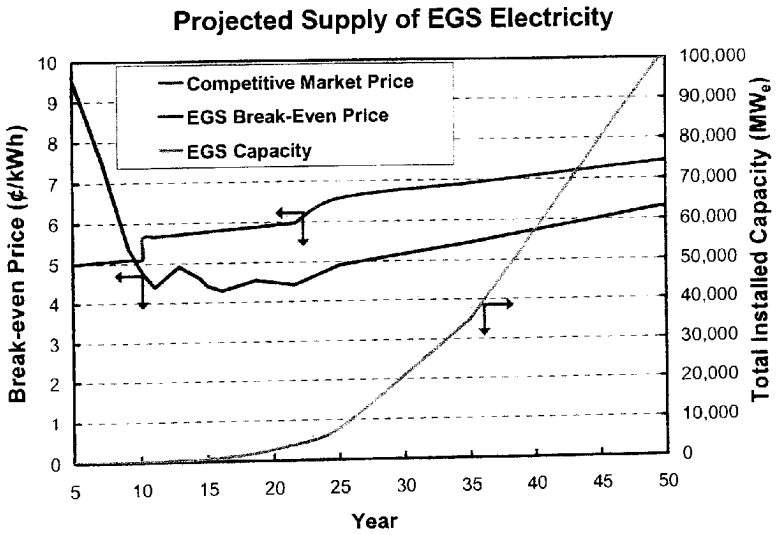

Figure 4. Estimated supply curve for EGS based on the MITEGS economic model. (from *The Future of Geothermal Energy*, MIT Report, Cambridge, MA (2006)

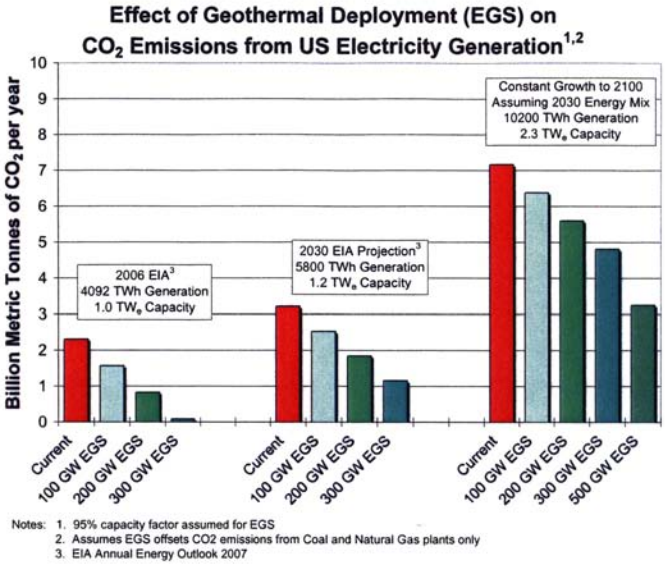

Figure 5. Estimated U.S. carbon emission reductions resulting from geothermal deployment

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Mr. COSTA. Less than one what?

Mr. TESTER. Less than one clean coal plant which would be roughly of the order of a billion dollars. So if we summed up the average commitment over that 15-year period, it would be of that order.

Mr. COSTA. Very good.

Mr. TESTER. Thank you, Mr. Chairman.

Mr. COSTA. Thank you, and we will look forward to getting back to you with some questions. Our next witness I believe is Mr. Daniel Kunz, President and Chief Executive Officer of U.S. Geothermal Inc. Mr. Kunz.

STATEMENT OF DANIEL KUNZ, PRESIDENT, US GEOTHERMAL, INC.

Mr. KUNZ. Thank you, Mr. Chairman and members of the Subcommittee. I appreciate this opportunity to discuss your oversight of renewable energy opportunities and issues on Federal lands. Geothermal has a unique and growing importance in the supply of green energy because it can supply clean, reliable, low-emission power 24 hours a day, 365 days a year. Geothermal energy currently provides nearly 3,000 megawatts of reliable electric power in the U.S. This represents only a small fraction of the U.S. resource potential.

There is a study out right now that identifies geothermal resource potential of about 22,000 megawatts and in areas of undiscovered or unidentified resource, the potential could be as high as 127,000 additional megawatts. Currently there is the possibility of

adding 5,000 megawatts of generation capacity in the U.S. within the next 5 to 10 years.

The MIT study just presented by Professor Tester talks about the future of geothermal, and that future needs to be addressed today in order for us to get there. I believe that the potential for geothermal development can be substantial if we can move the EGS concept forward and bring it to a point where we can demonstrate that this technology can work.

I believe also that if you ask the question what is needed to significantly move geothermal energy forward today, the answer I believe is to have more current and future expenditures on exploration, and this means in geological investigations on private and public lands. Thermal gradient and geofluid exploration well drilling is desperately needed in order to advance the understanding of where the resources are and what kind of capacities they have for generating power.

This is a high-risk application generally speaking in the renewable sector. Other energy sources, such as solar and wind, do not have this particular aspect. Robust investment incentives, grants, cost sharing and other methods that will reward risk takers for geothermal drilling for both conventional and the EGS development on Federal and other lands are needed to stimulate this area.

I believe that the Federal government should extend its support to geothermal energy through programs such as an enhanced investment tax credit for all geothermal drilling that would not be offset against any current credits available, such as the production tax credit. The investment tax credit I am proposing would be intended to address the crucial and very different set of risks and attract the capital necessary early on in geothermal development that is involved in this drilling that I have been talking about.

Also enhanced funding for Department of Interior's work to allow these agencies to accelerate land and resource management plans identify the highest priorities for geothermal exploration and conduct the new lease options I think is needed to move this work forward. Committed research funding is also required I think to move focus forward on EGS and conventional geothermal resource discovery and evaluation, drilling technology and low to medium temperature energy conversion.

With regard to the production tax credit, my company, US Geothermal, Inc., is developing Raff River, the site in Idaho. It will be one of the first new plants to benefit from the production tax credit. This tax credit was previously only available to the wind sector, and has now been made available to all of the renewable energy sectors. This is an important credit, and I think it should be extended in a much more significant way for geothermal projects. Other renewable energy technologies have had this PTC for about a decade, and geothermal needs this similar period of time to benefit from a shift in capital investment toward geothermal sectors. I urge Congress to extend the production tax credit 5 to 10 years.

I want to thank the Subcommittee for scheduling this hearing and inviting me to present testimony on public lands, and I will be happy to answer any questions. I have an additional testimony already provided in writing. Thank you, Mr. Chairman.

[The prepared statement of Mr. Kunz follows:]

Statement of Daniel Kunz, President and Chief Executive Officer, US Geothermal Inc.

Mr. Chairman and Members of the Subcommittee, I appreciate the Committee's interest in geothermal energy, its oversight on renewable energy opportunities and issues on Federal lands and its review of Title II, Subtitle B—Geothermal Energy of the EPAct.

I have knowledge that the Geothermal Energy Association ("GEA") submitted a Statement for the Record of this hearing. As a member of the board of directors of the GEA, I endorse that Statement of Record. To avoid duplication with GEA's statement, my testimony that follows comes from the viewpoint of a small but experienced geothermal developer who already has a new geothermal power plant under construction in Idaho and has the skill and ambition to construct and operate more geothermal power plants in the future. My testimony covers the issues that impact development of geothermal resources on public lands, some of which may be beyond the Bureau of Land Management's area of responsibility.

Geothermal has a unique and growing importance in the supply of green energy because it can supply clean, reliable, low emission power 24 hours a day, 365 days a year. Geothermal energy could also support our national hydrogen initiative and national biofuels goals, both of which will require significant amounts of energy to produce alternative domestic transportation fuels. Geothermal energy currently provides nearly 3,000 MW of reliable electric power in the US. But, according to the U.S. Geological Survey (USGS), this represents only a small fraction of U.S. resource potential. Representatives from the USGS testified before the Subcommittee on Energy and Mineral Resources of the House Resources Committee, U.S. House of Representatives, on May 3, 2001 that their 1978 report still represents the best available resource estimate. According to that report, there is an identified geothermal resource potential of 22,000 MW, and an undiscovered, unidentified geothermal resource potential of an additional 72,000 to 127,000 MW. This estimate totals some 150,000 MW of geothermal potential.

Recent reports issued by the GEA, National Renewable Energy Laboratory and Massachusetts Institute of Technology ("MIT") have identified the substantial potential for geothermal energy production from a range of technology applications. Each of these studies supports the potential to achieve 100,000 MW or more from the geothermal resource base.

A recent report published by MIT on Enhanced Geothermal Systems ("EGS"), called the "future of geothermal energy", highlights the fact that there is an enormous energy potential right beneath our feet within the rock of our earth. The technology needed to convert this heat to electricity is tried and true as it relates to the above-ground aspects of project development: the power plant, turbines, generators, control systems and the electrical distribution equipment.

The technology risks related to the development of EGS power sources are limited to deep drilling and fracturing of rock. Deep drilling technology has already been advanced a long way by the oil and gas industry. That know-how can be transferred to the geothermal industry and, with some additional work on better drill bits and faster drilling technology, we can assume that deep drilling will become a low risk aspect of EGS development. That leaves rock fracturing for reservoir development as the main risk area that requires advancement. The only way to reduce the development risk of rock fracturing is to create sites where the technologies can be advanced. It would be most desirable to provide proper investment incentives to private enterprise with funding support from the U.S. government.

I mention the future of geothermal energy first because the United States will not get to the future of geothermal power production—a future that holds the promise of delivering clean, renewable energy to drive economic development and quality of life—without initially fully understanding the present geothermal condition.

Geothermal energy is currently available with low technology risk. What is needed is a full appreciation of and recognizable way to finance the significant exploration and geologic risks related to this type of energy. Conventional and binary cycle geothermal energy under development and production today is based on geologic investigations that took place decades ago. What is needed to significantly move geothermal energy forward? Much more current and future expenditures on exploration and geologic investigations in the U.S. on public and private lands. Thermal gradient and geofluid exploration well drilling is desperately so that our nation can have harder information about the extent of geothermal resources suitable for power production.

Geothermal projects are unique because of the early capital costs involved prior to project confirmation. The exploration technologies available require confirmation of the resource by drilling, and drilling geothermal wells is expensive, with costs

ranging from a few million to over ten million dollars for a single well. Exploration is usually financed with high cost equity that takes a long time to be paid back. Exploration can take place up to a decade before any power is produced. The cost and risk of exploration for new geothermal resources is as high as or higher than those in the oil and gas industry, and the ability to attract capital to finance geothermal exploration is far more difficult.

Once an oil or gas discovery well is drilled, it can immediately be turned into a profitable cash flow generator. Geothermal wells are just the beginning of significant capital investment. A geothermal well cannot become profitable without an additional well drilled for injection of the fluids back into the reservoir. Then there is a requirement to drill more well pairs, build a plant, construct fluid pipelines, make transmission connections and deploy system controls. After that, the project can begin to generate income. So the geothermal drilling risks need to be recognized in a much different way than oil and gas drilling.

Robust investment incentives, grants, cost sharing and other methods that will reward risk takers for geothermal drilling for conventional and EGS geothermal development on Federal and other lands are needed to stimulate this area. I ask that Congress consider these:

1. Geothermal receives little support from the federal government relative to other forms of renewable energy and its untapped potential is vast. It is an indigenous and baseload energy supply with the highest availability of any renewable power source.
   a. Nevertheless, the pace of growth of geothermal energy can benefit greatly from federal government improvements and deployment of human and other resources in federal land leasing programs, specific technology commercialization support, and the extension of critical high voltage transmission infrastructure in the West.
2. The federal government should extend its support to geothermal energy with a multi billion dollar program over five years that provides:
   a. An enhanced Investment Tax Credit ("ITC") for all geothermal drilling that is not offset against any other federal credits. The ITC is intended to address a crucial and very different set of risks and attract capital to the early and highest risk stages of geothermal development involving drilling and proving the productive capacity of the geothermal resource.
   b. Enhanced funding of $25 million to $50 million per year to the Department of the Interior (BLM, U.S. Geological Survey and Forest Service) to allow these agencies to accelerate land and resource management plans, identify highest priority areas for geothermal exploration and new lease auctions and clear existing 10+ year backlog and institutional roadblocks to the growth of geothermal exploration and project development.
   c. Committed research funding of $75 million to $100 million per year administered by the Department of Energy with research focused on EGS, conventional geothermal resource discovery and evaluation, drilling technology, and low to medium temperature energy conversion (which will lead to additional applications in waste heat to energy conversion at industrial sites)
3. A $1 billion to $2 billion dollar program in support of geothermal power over five years could generate:
   a. Tens of thousands of megawatts of new geothermal power generation over the next 10 years;
   b. Tens of billions of dollars of capital investment in renewable infrastructure;
   c. Multibillion dollars in tax receipts associated with profits on capital spent;
   d. Important rural development and thousands of good permanent jobs; and
   e. Multibillion dollars per year of tax receipts associated with operating profits.

Public Land Leasing System

US Geothermal Inc. was not entirely in favor of the rule changes for federal geothermal land leasing resulting in a competitive auction environment. There are significant risks already embedded in the geothermal exploration and development effort and the new rules will add more risk for a developer. A leasing system similar to gold mineral exploration would have been more appropriate because of the intellectual and monetary capital required to advance geothermal lands to a stage where leasing or claim staking is merited. People will develop geologic ideas and theories about the possibility of the existence of a geothermal resource using their own cap-

ital and know-how. When the new BLM leasing rules are completed, they will be required to offer those ideas to a system that will create a public auction of their ideas.

I am not advocating changing the auction/leasing system now under way because it will mean that the entire process will again grind to a halt while rules are changed. BLM must keep pushing the current rule change process forward as efficiently as possible and make the new rules available so that people can plan accordingly. BLM should move ahead and set up the auction processes and get them going. It has been two years since any activity has resulted in new leases. We need to have access to the public lands so that risk expenditures can begin.

The only prescription for this particular discussion I would offer is this: when changes are being made to a leasing system like this, it would be more productive to avoid creating a logjam by stopping the requests already in the system. In the case of geothermal development the protracted lead-time for permitting, discovery, development and production of power is already much longer than desired. With the BLM rules, we have added another two years or more to the already long timeline. Given that new rules will now exist, I think more human resources need to be committed to the BLM and Dept of Interior specifically for the geothermal energy lease situation to implement the changes and accelerate the process.

Production Tax Credit

The Energy Policy Act of 2005 (EPAct) has already provided a significant and positive impact on the geothermal energy industry. To be specific, my company, US Geothermal Inc.'s Raft River geothermal project currently under construction in southeast Idaho is the first new installation that will qualify for the all-important Section 45 Production Tax Credit (PTC). This PTC, previously available only to wind and closed-loop biomass projects, was finally made available to the geothermal energy sector as part of the 2005 EPAct. To qualify, US Geothermal Inc. scrambled to fast track the development of the Raft River project to be constructed and online before the end of 2007. This is because the 2005 EPAct initially set that 2007 limit on the projects that could qualify. The deadline was subsequently extended one year so that any project coming online before the end of 2008 now can qualify.

This is good but geothermal projects require many more years to develop than most other renewable energy projects and I believe that the Production Tax Credit should be extended in a much more significant way for geothermal projects. Other renewable energy technologies have had the PTC for about a decade. Geothermal needs a similar period to benefit from a shift of capital investment into the geothermal sector. The PTC should be preserved for geothermal for a period of time at least equal to the time the tax credit has been available to the wind industry before any changes or reductions are made to it. This preservation of the existing PTC will allow capital planners to time needed to shift investment to the sector and gain the longer-term returns on investment needed to make the shift.

I urge Congress to extend the credit five to ten years. We also urge Congress to allow geothermal and other baseload projects to qualify once they have binding contracts and are under construction.

Build and sustain the momentum that EPAct has given geothermal energy and it will become a major U.S. energy source with an environmental profile we can be proud to promote.

Conclusion

I thank the Subcommittee for scheduling this important hearing and inviting me to present testimony on our public lands' potentially vast stores of geothermal energy that can help our nation address is energy and environmental needs.

The production tax credit is helping to spur renewed geothermal energy development. I urge Congress to support the BLM in its efforts to complete the new rules for public land leasing and provide the human resources needed to focus much more effort on geothermal energy. I also urge Congress to boldly support this domestic energy source by enacting a long-term extension of the production tax credit, modifying placed in service treatment for baseload power plants, and providing specific incentives for new geothermal exploration.

Mr. COSTA. Thank you, Mr. Kunz, for not only your testimony but your suggestions on how we might further increase opportunities for geothermal and for staying within the five-minute rule. Our next witness on this panel—actually the last witness on this panel

I believe—is Mr. Paul A. Thomas, who is a Public Policy Administrator with ORMAT out of Nevada I do believe.

STATEMENT OF PAUL THOMSEN, PUBLIC POLICY ADMINISTRATOR, ORMAT NEVADA

Mr. THOMSEN. Thank you, Mr. Chairman, members of the Subcommittee. Just for clarification, it is Thomsen. But it is my honor to testify today on——

Mr. COSTA. Thomsen. I stand corrected for the record.

Mr. THOMSEN. That is all right.

Mr. COSTA. I do apologize.

Mr. THOMSEN. It is a unique spelling. I am here today on behalf of ORMAT Technologies, and by way of introduction, ORMAT Technologies is a New York Stock Exchange registered company. You can find us under the ticker ORA, and ORMAT is a unique geothermal company in the fact that we manufacture, design, own and operate geothermal power plants around the world. ORMAT is responsible for over 900 megawatts of generation throughout the world and 300 megawatts right here in the United States in the State of Nevada, California and Hawaii, in no particular order. To date ORMAT has arranged for over one billion dollars in geothermal projects and corporate financing.

Now I want to talk about the impact of the EPAct. I had the pleasure of testifying to the Senate approximately a year ago on this issue, and at that time ORMAT agreed with GAO's report findings that it was simply too early to accurately assess the impact of the EPAct on the geothermal industry, and that was simply because at that time we only had one geothermal power plant that qualified for the production tax credit.

The new regulations for BLM and MMS were still being drafted, and the DOE geothermal research program had just been zeroed out. Today, unfortunately, little has changed. Since that time we have only had one geothermal power plant—which happens to be ORMAT's—qualify for the production tax credit. As you heard from Mr. Hughes, BLM and MMS regulations are still being drafted and have yet to be released. And finally, the DOE geothermal research budget again has been zeroed out, and I believe reestablished at a mere $5 million.

I agree with the Chairman that we can do better. That being said, ORMAT truly believes that the geothermal power can provide a significant domestic base load energy supply to this country, especially the PTC, the production tax credit, will enhance the ability of geothermal projects to compete with fossil fuel technology. The PTC, as I am sure you are all aware, can effectively lower the price of geothermal energy by approximately 1.97 cents a kilowatt hour, making more resources of geothermal energy cost competitive, enabling the full development of the 5,600 megawatts of near term economically viable geothermal resources in the western United States.

The John Rishel amendment to the Geothermal Steam Act will simplify processes allowing the BLM and other Federal and state agencies to work in the spirit of that legislation, encouraging expanded geothermal production. And finally, the significant increase in funding authorized by the EPAct for DOE's renewable research

programs including geothermal will facilitate collaboration between researchers and industry.

For an example of what can be done, I turn to the fact that ORMAT has signed a cooperative research and development agreement with the Department of Energy to validate the feasibility of our proven technology in coshared production with oil production in the U.S. The project will be conducted at the Department of Energy's Rocky Mountain oil test center, known as RMOTC, near Casper, Wyoming, and it will use the ORMAT Organic Rankine Cycle power generation system to produce commercial electricity.

ORMAT is willing to supply the ORC power unit as its own expense while DOE will install and operate the facility for a 12-month period. ORMAT and DOE are sharing the total cost of the test and the study with ORMAT bearing approximately two-thirds of the less than one million dollar investment.

The information gathered from this project will have implications to some 8,000 similar type wells that have been identified in Texas by Professor Richard Erdlac at the University of Texas at Permian Basin and the U.S. Department of Energy geothermal research project office. And Lyle Johnson, the senior engineer at the Rocky Mountain oil test center stated that the introduction of geothermal energy production in the oil field will increase the life and productivity of those fields.

While ORMAT recognizes that DOE research programs are outside the primary jurisdiction of this committee, last year the House passed the GEO Fund section of the DOER Act which looked at creating a funding mechanism for these types of cost shared pilot projects for coshared oil resources, and we hope this committee does the same.

This is one small example of the substantial needs for improvements in geothermal technology, information and efficiencies for which Federal research is vital. Instead of seeking to terminate the geothermal research program, ORMAT agrees with the comments of Congressman Pearce that we should be working with industry, universities and a laboratory research community to develop the tools necessary to access this massive domestic base load resource base. Thank you very much.

[The prepared statement of Mr. Thomsen follows:]

Statement of Paul A. Thomsen, Public Policy Administrator, ORMAT Technologies

Mr. Chairman, members of the committee, it is my honor to testify today on behalf of ORMAT Technologies.

By way of introduction ORMAT Technologies, is a New York Stock Exchange registered company (symbol "ORA"). ORMAT technologies develops, owns, and operates geothermal and recovered energy facilities throughout the world. ORMAT has supplied 800 MWs of geothermal power plants in 21 countries. Here in the United States ORMAT owns and operates 250 MWs of geothermal power plants in the states of California, Hawaii, Nevada, and we are pleased to be providing US Geothermal Company with the technology needed to bring Idaho's first geothermal power plant online. To date ORMAT has arranged over $1 billion dollars in geothermal projects and corporate financing which is particularly significant since geothermal projects require the upfront financing of a continuous lifetime supply of fuel.

Now..on to the Impact of EPAct:

I had the pleasure of testifying in the Senate approximately a year ago and at that time we agreed with the GAO report's findings that it was too early to accurately assess the impact of EPAct on the geothermal Industry at that time

WHY? BECAUSE (i) only one operating 20 MW project, which happens to be ORMAT's, has qualified to date for the PTC; (ii) the new regulations to implement the Rishell Amendment to the steam act are still currently being drafted, and (iii) the DOE Geothermal Research Program funding for Fiscal Year 2007 was zeroed out by the administration, causing uncertainty and delay.

Today, unfortunately, little has changed: (i) only one operating 20 MW project, which happens to be ORMAT's, has qualified to date for the PTC; (ii) the new regulations to implement the Rishell Amendment to the steam act are still currently being drafted, and (iii) the DOE Geothermal Research Program funding for Fiscal Year 2007 was zeroed out by the administration causing uncertainty and delay.

The Potential Impact of EPAct:

That being said, the Ormat truly believes that despite the fact that geothermal power currently provides approximately a significant portion of renewable energy produced in the United States, the geothermal provisions in EPAct, specifically the PTC will enhance the ability of geothermal projects to compete with fossil fuel technologies. The PTC can effectively lower the price of geothermal energy by 1.9c/KWh making more resources of geothermal energy cost competitive, enabling the full development of the 5,600 MW of near-term, economically viable capacity that's considered available in the Western United States over the next decade. I would note that Ormat is in advanced construction of four plants which will qualify for PTC, two plants will be operated by third parties and two by Ormat.

The John Rishel Amendment to the Geothermal Steam Act will simplify processes allowing the BLM and other federal and state agencies to work in the spirit of the legislation, encouraging expanded geothermal production.

The significant increase in the funding authorized by EPAct for DOE's renewable research programs, including geothermal energy will facilitate collaboration between researchers and industry to harness the underutilized geothermal resources through out this country.

For example ORMAT has signed a cost-shared Cooperative Research and Development Agreement (CRADA) with DOE to validate the feasibility of proven technology already used in geothermal and Recovered Energy Generation (REG).

The project will be conducted at the DOE Rocky Mountain Oil Test Center (RMOTC), near Casper Wyoming, and will use an Ormat Organic Rankine Cycle (ORC) power generation system to produce commercial electricity. The test will use a commercial air-cooled, skid mounted standard design Ormat Organic Rankine Cycle system. Ormat will supply the ORC power unit at its own expense while the DOE will install and operate the facility for a 12- month period. Ormat and the DOE will share the total cost of the test and the study, with Ormat bearing approximately two thirds of the less than $1M total investment.

Presently there are two large unutilized sources of hot water at the RMOTC Naval Petroleum Reserve No. 3, which produces water in excess of 190 degrees Fahrenheit and at flow rates sufficient for generation of approximately 200 kW. The project will consist of the installation, testing and evaluation of a binary geothermal power unit in the field near these hot water sources. The ORC power unit will be interconnected into the field electrical system and the energy produced will be used by RMOTC and monitored for reliability quality.

Some 8,000 similar type wells have been identified in Texas, by Prof. Richard Erdlac of the University of Texas of the Permian Basin, and the U.S. DOE Geothermal Research Project Office. Ormat is now assessing the feasibility of utilizing some of these wells to support on site power generation by employing Ormat's factory integrated sub megawatt geothermal power units, based on the Company's proprietary ORC technology, which has been field proven in installations totaling 900 MW world wide.

While Ormat recognizes that DOE research programs are outside of the primary jurisdiction of this Subcommittee, last year the house passed a GEO Fund section in the DOER Act which looked at creating a funding mechanism for cost shared pilot projects looking at these types of projects. We believe it is important to recognize that EPAct included a significant increase in the funding authorized for DOE's renewable research programs, including geothermal energy.

There are substantial needs for improvements in geothermal technology, information, and efficiencies for which federal research is vital.

Instead of seeking to terminate the geothermal research program, the Department of Energy should be working with industry, the university, and the laboratory research community to develop the tools needed to access this massive resource base.

So how do we make this committee's will a reality?

ORMAT believes that the Production Tax Credit should be extended five to ten years for geothermal facilities. This may be accomplished by qualifying geothermal facilities for the PTC before the operational placed in service date if: (i) the facility has a power purchase contract in place and (ii) has begun construction. This is not without precedent. For some other tax provisions with similar time-certain requirements, the law allows investments to qualify based upon having binding contracts in place that meet specified requirements.

ORMAT believes that the BLM and other state agencies need to move quickly on the pending lease applications and complete regulations that will implement the new law. BLM needs to hold new lease sales in every western state. Let's implement the new law and urge Congress to actively oversee the process to ensure that all agencies keep the spirit of the legislation—to boost production of geothermal energy. Then and only after a thorough review of the results, should industry ask Congress to take action on any changes that may be needed.

ORMAT believes that the full geothermal potential of the western United States can be brought online in the near term with the assistance of DOE. In the next decade ORMAT feels that the DOE research program can benefit by focusing its funding in the following areas: (i) improve accuracy of exploration technology to reduce risk; (ii) improve drilling technology to reduce risk and cost; (iii) improve identification, and characterizations of geothermal resource areas; (iv) share in the cost of exploration and drilling in these new areas; and (v) continue investigations into future technologies such as Enhanced Geothermal Systems (EGS), Oil and Gas applications, and Geo-pressured systems.

On behalf of ORMAT, I want to applaud this committee for its interest in the secure domestic baseload energy supply that is geothermal energy. We humbly realize that the decisions made by this committee impact our nations energy security. This concludes my prepared comments I am happy to respond to any questions the committee might have.

Mr. COSTA. Thank you very much. The testimony I think is very important, and we will reflect on that in terms of our questioning which we are coming up to at this point in time. Normally and for all who come and attend the various committee hearings and subcommittee hearings there is a process under which staff is notified for the purpose of photographing or for family purposes, and that did not occur in this particular instance but I am willing to ask unanimous consent to those who have identified themselves for that purpose and put you on notice at the same time, and if there is no objection we will allow you to continue to witness. Is there any objection?

Mr. PEARCE. No, I do not have an objection, Mr. Chairman, but I should get unanimous consent to be forgiven because I am the one that directed him from the elevator to here.

Mr. COSTA. Well thank you, I think.

Mr. SALI. Mr. Chairman, I object. How about that? The forgiveness.

Mr. COSTA. OK. All right. We try to be accommodating here but please there are rules that we follow, and so for those who are interested in filming I mean there is a requirement and Members do have an opportunity to object if they want to. So anyway that is said. Let us get back to the questions.

Mr. Hughes, you heard your fellow panel members testify, and it seems to me that notwithstanding your efforts that it seems to be that the ability to try to process these permits in light of the recent Act has not been as effective as one might hope, given the nature of the potential of this resource. Do you think that your

systems, your database, your technologies, your staff that you envision to provide additional support we need to be looking at this in the Congress so that you can handle your renewable energy portfolio in an efficient and effective way?

Mr. HUGHES. Mr. Chairman, obviously we want to work with the Congress to monitor our resources to advance the cause of renewable energy. In the case of geothermal, I think a lot of frustration has occurred because we had to shut down our leasing program basically while we rewrote a new leasing program based on the Energy Policy Act of 2005.

Mr. COSTA. That was referenced in the testimony, and they say they are still looking for the rules. Where are we?

Mr. HUGHES. We should have the final rule out on the street within the next 30 days. It will be effective 30 days after that, and that should lead us to a lease sale this summer.

Mr. COSTA. For certain?

Mr. HUGHES. I am as certain as a bureaucrat could be, sir.

Mr. COSTA. Oh my gosh. Well we are going to want to try to keep you to that timeline.

Mr. HUGHES. But having said that, I think in the case of wind energy, for instance, in 2005 we completed a programmatic EIS which has helped us greatly. That EIS amended 58 land use plans across the country. It makes our ability to process wind energy projects much easier. We are looking to do that with geothermal. We should have a draft programmatic EIS on the street in December. We are also considering I guess looking at ways to improve our processing of solar applications at the same time, sir.

Mr. COSTA. So what you are saying is you are going to try to have an even-handed commonality of process for the various renewables?

Mr. HUGHES. Yes, sir.

Mr. COSTA. The issue was raised on the hearing Tuesday—you may have not been aware of it—but the impact on a footprint on various renewable production, and the cumulative or total impacts on habitat and other natural resources. Your approach is integrated and complementary in working together with states when you process these permits for renewable sources of energy?

Mr. HUGHES. Yes, sir. Part of the environmental analysis that we go through we work with state game and fish agencies, also the Fish and Wildlife Service, and also obviously with the companies to try and come up with ways to look at site issues, to address environmental issues that will impact wildlife or the land there. That is part of the process we go through. In many cases there are conflicting uses out there.

Mr. COSTA. We understand that, but you are committed to the process and making it seamless as possible?

Mr. HUGHES. Yes, sir.

Mr. COSTA. Let me move on. The area of transmission, of course, with geothermal as well as with wind, the transmission corridors are an issue. Finding the source of energy is one thing but getting that energy to where it is needed is another. You know that there is an effort with energy corridor designation process under Sections 368 as well as 1221 under the Energy Policy Act. I am interested, therefore, in what efforts you are pursuing with the Department to

identify energy renewable resource zones so that we can maximize our opportunities for transmission to take place.

Mr. HUGHES. Yes, sir. We are part of an effort that is being led by Department of Energy, as you know, which had the lead on those energy corridors. We have been working closely with them. Initially there were concerns by a great number of people regarding where some of these corridors may go, existing designated areas that Congress had designated for special uses like parks, wildlife refuges, wilderness areas. We think we have worked out the vast majority of those issues. I think we are down to discussing maybe just about three wildlife refuges now where there may be issues involved that we try and mitigate.

But you are correct, and I think the other witnesses will tell you the issue of building lines or infrastructure to get that energy out of these locations—because in many cases they are not near existing transmission lines. So that is a major challenge we have, and we look forward to working with the companies and then all interested groups to route those properly.

Mr. COSTA. My time has expired, but do you have a timeline on when you and the Department of Energy will be able to publish this effort as it relates to corridors for transmission purposes?

Mr. HUGHES. I would have to provide that for the record. I am sorry.

Mr. COSTA. Please do.

Mr. HUGHES. Yes.

Mr. COSTA. The gentleman from New Mexico.

Mr. PEARCE. Thank you. I thank the Chairman. Mr. Hughes, I would echo the Chairman's concern that we expedite access. If you were to give me an understanding of all say the wind, the geothermal projects to date that have been requested, how many of those are without some environmental objection? In other words, I think that is going to be the largest hindrance. So give me a feel if you would.

Mr. HUGHES. Mr. Pearce, through our NEPA requirements when we go project-by-project, obviously people come forward with issues. My guess is probably 95 percent of the projects have some issue, and that is the purpose of a NEPA evaluation is to identify the extent of that problem, and then define ways to mitigate it. Most of the time we are able to find ways to mitigate those impacts but whether it is in the case of wind power, it can be obviously the bat issue, birds, site issues.

Mr. PEARCE. Yes. But you have objections almost all the time, 95 percent of the time, and then we have to work through some process. OK.

Mr. HUGHES. That is correct.

Mr. PEARCE. Mr. Tester, when you say that we need to get to 100,000 megawatts of power, I am trying to get that in my mind a fixed compared to the total power of the United States. I am not a college professor so you will have to help me here. I am trying to compare 100,000 megawatts to 3,660 billion kilowatts, and when I do the math—and you are going to have to verify it—I start crossing out zeros and I get a relationship of about 1 to 36,660. Is that correct?

Mr. TESTER. Mr. Pearce, I do not think that we are talking about the same exact thing. When I quoted a terawatt of capacity, a terawatt is a million megawatts.

Mr. COSTA. Bring the mic a little closer please.

Mr. TESTER. A terawatt is one million megawatts, and that is the capacity that the EIA reports right now for the United States. Of that capacity, we were viewing roughly 10 percent of it would have the kind of impact that would be comparable to what we have for all of our nuclear generating capacity today, slightly over 100 plants at about 1,000 megawatts a plant, and all of the hydro. If we consider our conventional hydro and pumped hydro, I believe the number comes slightly over 100,000 megawatts. So that is where we came up with the 100,000.

Mr. PEARCE. OK. But the 100,000 megawatts is still a very small percent of the overall base load for the U.S.

Mr. TESTER. It seems fairly large if we compare it with where we are now which is 3,000.

Mr. PEARCE. But when you consider coal and natural gas and all the other sources of energy. Yes, it is a tremendous increase in what we are doing now, and I support that 100 percent. I am just trying to get in mind——

Mr. TESTER. Mr. Pearce, it would be comparable to what all of the hydro capacity we have now in the United States. I think that is a fairly large component of our generating capacity. The nuclear capacity, it is also exactly the same as that.

Mr. PEARCE. OK. Thank you. Mr. Hughes, if we are to take that consideration, you have heard the discussion, how possible is it to get all those projects permitted? In other words, we have already talked about the fact that 95 percent are going to meet some resistance. How feasible is it to get that many projects permitted and get them online within the technology even that exists?

Mr. HUGHES. It will present a tremendous challenge to us.

Mr. PEARCE. OK. That is enough. In other words, we are talking about tremendous challenge. We are not talking just trying to get through it. Mr. Kunz, what is the cost of renewable per KW more or less? Just range.

Mr. KUNZ. It is a function of largely an exercise in amortizing the capital——

Mr. PEARCE. Approximately.

Mr. KUNZ. Roughly $60 a megawatt, $65.

Mr. PEARCE. So six?

Mr. KUNZ. Six cents.

Mr. PEARCE. Six cents per KW?

Mr. KUNZ. Yes.

Mr. PEARCE. Three cents more or less for hydroelectric. Six cents. What is nuclear? What does nuclear cost? About 7 to 10 cents on coal fired.

Mr. KUNZ. So it is comparable.

Mr. PEARCE. OK. Comparable. What kind of temperature do we have to get to? What kind of temperatures work for geothermal?

Mr. KUNZ. Right now we are exploiting a 280 degree Fahrenheit resource in Idaho, and it is a mile below the surface of the earth. So that is——

Mr. PEARCE. Now sometimes when we drill oil wells, we get very hot oil, very hot water. Is there ever a chance of colocating? In other words, using that water that is coming up to generate?

Mr. KUNZ. Absolutely. They are called geopressured systems in Texas and other areas like that. It happens to be quite a briny, nasty solution that has lots of dissolved solids. So you have an issue to deal with there.

Mr. PEARCE. Yes, it is. Cleanliness. OK, Mr. Chairman. I see my time is out. It looked like maybe Mr. Thomsen or Mr. Tester wanted to say something.

Mr. COSTA. Sure. Quickly.

Mr. THOMSEN. Well that is exactly the type of project that ORMAT is doing at the Rocky Mountain oil test center, taking that hot water and running it through our Organic Rankine Cycle system to draw out that extra heat from that process. So we can send you more details on that if you would like more information.

Mr. COSTA. Thank you. The gentleman from Rhode Island, Mr. Kennedy.

Mr. KENNEDY. Thank you, Mr. Chairman. Welcome. I am interested in hearing about this notion of how you guarantee the long-term sustainability of geothermal when so much of the science is predicated on such a mix of factors, stimulating large rock volumes, the connectivity of reservoirs, the fluidity, the permeability, the flow. I mean it seems as though you have got to have not only the right heat but it has to be the right flow of fluids, and it has to be the right chemical mix, but it cannot be too hot. But it has got to have the right pressure, and it cannot be too cold, and if you draw too much out it might reduce the pressure.

I mean it just seems to me you are working with a bag of tricks here, if any one of which comes undone, you are jeopardizing the whole mix. So how do you guarantee when you drill this thing and you have it online that you are going to be able to sustain a nameplate capacity?

Mr. THOMSEN. If I can, Mr. Chairman, through you to Mr. Kennedy, you have brought up some very crucial points, and first I would like to separate the idea of the resource definition and maintenance and the equipment needed to produce the electricity. ORMAT has designed and manufactured the equipment for over 40 years. We are very confident with the technology there.

Maintaining the reservoirs is a key component to adding reliability to the geothermal process. Our technology is what we call a closed loop system. The water we pump up to draw the heat from we reinject to the same reservoir. We let it reheat and then pump it back up again, and we have been doing this in the city of Reno, Nevada for over 20 years. We have been able to maintain the reservoir through heavy duty geology, monitoring those temperatures, making sure we do not draw up too much water, making sure we do not reinject too close to the hottest parts of those reservoirs so that we can maintain that heat and produce the same amount of power.

So with the closed loop system, we are getting much, much better at doing exactly that, monitoring the amount of heat we are using, the amount of flow that is going through our system, and that we are reinjecting back into the earth. The technology is pretty mature

in that area. In our technology we heat a working fluid that then vaporizes and turns the turbine. That working fluid that we use has very specific characteristics that we can then monitor and maintain.

So we are taking out a lot of those aspects of risk, and those are the key components to a successful geothermal project. Finding those resources, maintaining those resources is the key component, and that is why we are here today saying we need a robust subsurface DOE budget to help us find additional resources like that that we can maintain and utilize.

Mr. KENNEDY. Explain the talk about similarities in hydrothermal. What are those in terms of technology and capturing this power base?

Mr. THOMSEN. I can, Mr. Chairman through you and to Mr. Kennedy. The two types of technology in California for example you have the geysers which were an incredibly hot resource that we were able to drill to.

Mr. KENNEDY. Right.

Mr. THOMSEN. When the water comes up, it reacts with the atmosphere and the change in pressure, and it starts to boil, and then we simply put a steam turbine on that and are able to produce power. Incredible amounts of power using an incredibly hot resource that as it comes up reaches the boiling point of 212 and beyond.

The resources that ORMAT tends to utilize are temperatures much lower than that at the surface. We like to pump up water that is about at depth 300 degrees Fahrenheit. We keep it in a closed system. Let me go back to the first system. The flash system then turns to steam, turns the turbine, and then goes into the atmosphere, to then come down as rain, recharge and to be used again.

The closed loop system that we have we pump up the water, we keep it under pressure. There is no boiling. There is no sediment that comes out of it. It heats an intermediary working fluid that does the vaporization and turns the turbine. We take that water and reinject it back into the earth to preserve that reservoir. We do not have any evaporation. We do not have some of the environmental concerns of what happens when hot brine comes up and mixes with oxygen and things like that. Those are the two basic designs there.

Mr. KENNEDY. Very good. Well thank you very much for those explanations.

Mr. COSTA. The gentleman's time has expired but we will allow an opportunity to come back if you choose. Mr. Sali, the gentleman from Idaho.

Mr. SALI. Thank you, Mr. Chairman. Mr. Kunz, I was reading your material, and you are talking about the leasing system and while you are not advocating that we change anything right now because it will only slow things down, if I understand the system that exists today the BLM has gone out and put together their idea of what resources are out there, and they are offering those up for bid. But you are asking for a system that is similar to gold mining where people would go out and stake a claim, a certain area and whatnot. Do I understand that correctly?

Mr. KUNZ. Well almost, Congressman. Today if you know of some lands that you want to lease from the BLM, you file applications for that land. So you have some intellectual capital knowledge about why you would want to have that land. You submit it to the BLM, and then they conduct an auction process so that you can acquire those leases by bidding.

Mr. SALI. And your idea would be just if you have the information about what might be there, similar to a gold mine?

Mr. KUNZ. Exactly.

Mr. SALI. If you believe there is something there——

Mr. KUNZ. You go stake it.

Mr. SALI. You go stake it.

Mr. KUNZ. There is enough risk in this whole equation as it is but as I said in my testimony, I am not advocating any changes. I just wanted to make our personal views known on that particular topic.

Mr. SALI. You are not advocating a change now.

Mr. KUNZ. No.

Mr. SALI. But you would encourage Congress to move that direction or the agency to move in that direction. Is that a fair statement?

Mr. KUNZ. Well only if it meant that it did not create any delays in the current procedures.

Mr. SALI. Right. Mr. Hughes, why did we not do that?

Mr. HUGHES. We think the system we are setting up through our regulations is what the Energy Policy Act directed us to. We also have an obligation under the Federal Land Policy Management Act for a fair market return for resources that are out there. That is why I think this year we are going to start a programmatic EIS which will include an assessment of areas, reassessment of areas that I think was done in 1979, and then updated with some maps in 2004 but working with USGS, Forest Service and ourselves to go out there and so we will know where those areas are. But we think there is a public interest in the way we have set it up. That we satisfy the public interest in doing that.

Mr. SALI. Well Mr. Kunz and Mr. Thomsen have described an industry that requires a really significant amount of risk getting in on the front end, and if I understand Mr. Kunz' complaint, basically he is saying he can go find a place where he believes there is a resource, and when that is put out for bid, he could essentially lose that part of his investment if he does not get the lease. How is that fair to the people who are involved?

Mr. HUGHES. Our position is it is not fair to the American public. That we have a public interest to protect.

Mr. SALI. But can you not protect that through the lease though and the amount that they pay for the lease?

Mr. HUGHES. Again, we have people competing in the marketplace to bid on those leases, and that is what we are required to do to protect the public interest.

Mr. SALI. So you could not end up with a protection of the public interest through the leasing terms and basically these people if they go out and believe there is an area that could be exploited for geothermal energy, if they do not get the lease then they are just out of luck?

Mr. HUGHES. That is the way we run our oil and gas program where companies nominate those parcels for lease, and then they have to go and compete with other companies.

Mr. SALI. And you do not believe that there is a difference in that risk, Mr. Hughes?

Mr. HUGHES. There may be a difference there, but again we have a public interest standard that we have to protect the public's interest to get the proper revenue for the people, and we would do that through a bidding system where there is a competitive bid in the marketplace.

Mr. SALI. Thank you, Mr. Chairman.

Mr. COSTA. Thank you. Mr. Hughes, I am told—and I do not know if it is applicable or not—that the example that Mr. Kunz used with regards to adjacent property in which they have already fulfilled the process that there is no provisions to allow without going back through the competitive bid. Under the process where you have coal use in that area, if it is adjacent under that current process as I again have been told—and I do not pretend to understand it completely—that is not required. Would you think that such a change should be considered applicable for geothermal?

Mr. HUGHES. Perhaps I misunderstood the discussion we just had. I was under the assumption that we were talking about an area where there is no geothermal, and somebody wants to stake it. I am not sure. I would have to discuss this with our folks how we have handled that in the regulations.

Mr. COSTA. You are not sure. But I think that is something that we should look at. The Subcommittee should look at.

Mr. HUGHES. Right. I think we would be willing to look at that.

Mr. COSTA. OK. All right. We will take Mr. Kunz admonition that he does not want us to have you rewrite the rules. We are not suggesting that.

Mr. HUGHES. Right.

Mr. COSTA. OK. Mr. Tester, you I think with your technological background indicated what I believe are under the category of good news potential that is available with regards to geothermal but first of all you picked the year 2050, if I understand you correctly.

Mr. TESTER. Correct.

Mr. COSTA. Which is 40 years away or a little more, and I know it is important we think long-term for the purposes of our discussion but in terms of today's geothermal generation what might be possible with the current technology and the technologies that you see that are currently evolving in a shorter timeframe, like 2015. I think I cited in my opening statement the Western Governors' Association targeted goals on 2015 and 2020.

Mr. TESTER. The near term hydrothermal certainly is a large element of the potential that we would have in this 15-year period for sure. If you look at the curve that we provided in our written testimony that I would be happy to show you, Mr. Chairman, if you like at this moment, we were not really talking about EGS coming online in terms of any impact until out about 15 years or so.

Mr. COSTA. Why is that?

Mr. TESTER. Well because there has to be a period of time where you would demonstrate this technology. Going back to Mr. Kennedy's points earlier, the verification of connectivity in the

subsurface is an important development issue that needs to be worked out. The 30 years or so of testing that has occurred already around the world has established major elements of that but there still are additional thresholds that have to be achieved, a factor of two or three let us say in well productivity but in order to bring down risk you are going to have to operate those field sites for a period of time.

So what we were trying to do was to superimpose what would be a realistic research and development and deployment scenario on where we are now with the zero budget to where we might be 15 years from now, and if you also continue on that curve you will see that after about a 15-year period the costs associated with EGS would be in line with the current energy prices that we have for all electricity.

Mr. COSTA. For all electricity what date did you say because I was——

Mr. TESTER. Well 15 years from the starting point of the program. So if we started it today, it would——

Mr. COSTA. Geothermal would be cost effective?

Mr. TESTER. No. This is not geothermal. This is the more advanced, enhanced geothermal.

Mr. COSTA. Enhanced geothermal?

Mr. TESTER. Right. Now to come back to your earlier point though about hydrothermal, one of the issues that we raised in this analysis was the need for reenergizing the resource assessment elements carried out by the USGS and others. That would have to be done as well starting now, not waiting 15 years.

Mr. COSTA. So you think that needs to be expedited?

Mr. TESTER. Absolutely. Right. I think there——

Mr. COSTA. And listening to what Mr. Hughes said, promulgation of rules to be published in 30 days, and then 30 days for a comment period, and then the following lease, based on that timeline different regions of the country, how much different sites do you think need to be developed in the next 10 to 15 years to prove the reduced risk and then therefore lower the development costs?

Mr. TESTER. Our recommendation was to first go to high grade EGS sites which we refer to in our report as targets of opportunity. They would be on the margins of today's most characterized systems that we have in place, the hydrothermal systems that we have discussed this afternoon. Much of the infrastructure would be in place. A lot of information about the geology is known. Water issues and other issues are well manageable at those sites, and we recommended five or six of those in our assessment over this period of time.

Mr. COSTA. And those five or six sites would be all located. I mean each site would be within a precise area. How much megawatts of power would you anticipate coming from a site?

Mr. TESTER. OK. During that early period, we would be talking about a typical sized plant in the range of maybe 20 to 50 megawatts per plant. So you can take that factor and multiply it by five or so. So these would be small plants. This is not to compete necessarily with where we might want to be at the end of 2050 but it is to establish the base of technology for going forward.

Mr. COSTA. OK. My time has expired. The gentleman from New Mexico.

Mr. PEARCE. Thank you, Chairman. Mr. Tester, now this USGS requirement under the 2005 Energy Policy Act to assess the geothermal, do you think that is going to be adequate to tell us what we need to know about geothermal systems resource assessment?

Mr. TESTER. I am not familiar with the details of it but our feeling was that a serious geothermal assessment of the United States has not been carried out for roughly 30 years. The last major study published by the USGS was in 1979. We feel that a lot of technology has been developed certainly during that period of time that would alter the amount of near term geothermal that could be obtained and deployed. I think the Western Governors' Conference recently looked at this and would agree with that. The people within the USGS certainly feel that it needs to be done, and I think we have to get started soon on it.

Mr. PEARCE. Does EPAct require a new assessment, Energy Policy Act?

Mr. TESTER. Yes.

Mr. PEARCE. Yes. I think the Energy Policy Act.

Mr. HUGHES. Yes, I think that correct.

Mr. PEARCE. Yes. So it is required already. Mr. Hughes, if I were going to look at the footprint of a well drilled for geothermal purposes, what size casing do they generally run in a geothermal well? Do they actually drill a well down to 3 to 8, 10,000 feet? Do you know what size casing? Mr. Kunz, you may be a little bit better or Mr. Thomsen.

Mr. KUNZ. We are just completing drilling some wells in Idaho that are about a mile deep, and the casing starts at about 28 inches in diameter at the surface. That is the collar, and then by the time we get to that bottom depth we are still at about 13 and seven-eighths inches.

Mr. PEARCE. That is a big bit. Mr. Hughes, then so the footprint on public lands is going to be very similar or maybe even a little larger than for an oil well for each geothermal well?

Mr. HUGHES. Yes.

Mr. PEARCE. Very similar.

Mr. HUGHES. For a thousand megawatt power generation, our figures show we think a geothermal footprint would be about 7,000 acres. That would compare to oil about 1,700 and natural gas about 3,700 acres.

Mr. PEARCE. And if we——

Mr. HUGHES. The original footprint.

Mr. PEARCE. Sure. I do not know exactly which one of you might be best qualified to answer this but if we are going to extract tremendous amounts of geothermal, what kind of spacing are we going to have to have between wells? Professor Tester, that might be you. In other words, what is it going to look like? What is the land going to look like when we get a serious field that is extracting geothermal?

Mr. TESTER. Absolutely. Let me try to answer this in several levels of detail. The first is——

Mr. PEARCE. Not too many levels. I have only about two minutes.

Mr. TESTER. No. I will be short here. The first is we looked at the footprint of geothermal over the full fuel cycle or lifecycle of this and compared it with other electrical generating systems that we have in the U.S., and if you look at coal or others, I think you will see that the footprint is quite favorable.

Another feature that is important here I think in the overall impact is the capacity factor geothermal plants are very high. Over 90 percent or so is sort of the experience worldwide with this. That is an important issue with respect to the impact it might have in terms of net generation of not just kilowatts or megawatts but megawatt hours or kilowatt hours. But each site is going to be slightly different in terms of the spacing of wells both injectors and production wells.

We have a lot of experience with that in the hydrothermal development in this country and in other countries, and our feeling is that that is of the order of—I can give you the exact figures for the record, and I would be happy to provide that. It is in the report, and it maps out over a range that I think is quite reasonable compared to what we have for alternatives.

Mr. PEARCE. OK.

Mr. KUNZ. Mr. Pearce, I might add just one thing. I had a letter drawn up to me from the Geothermal Energy Association on this very topic, and I would like to submit it for the record.

Mr. PEARCE. With unanimous consent.

Mr. COSTA. Without objection.

Mr. PEARCE. To put that in.

Mr. COSTA. Yes, thank you.

Mr. PEARCE. Mr. Thomsen, these are pretty high risk ventures though. Am I correct that if you drill a geothermal well you can fail just as easily as you can fail at an oil well?

Mr. THOMSEN. Well no. I think you have a different type of risk in the fact that if you have an oil well that you have had a water break and it is already producing water, you can evaluate that resource because it is there at the surface and so forth. The Rocky Mountain oil test center project for example they kind of knew the temperature, gradient and the flow rate that they had. We could evaluate that and base our decisions on that.

When we look at a green field for a new geothermal project, it takes approximately two to five years for development to have our geologists evaluate the resource, do the drilling that is required, and then you are absolutely correct. There is a high capital cost to do that initial drilling and large amounts of risk. The EGS that you have heard about today as well hopes to limit some of that risk. If you find a hot resource that maybe does not have the medium, the water or brine, you can maybe then add that to the system. All of these technologies are tempting and doing it effectively reducing the blind risk of just drilling for the very first time somewhere.

Mr. PEARCE. You bet. Thanks. I appreciate it, Mr. Chairman.

Mr. COSTA. Just one quick question, Mr. Kunz, and we will go to the next panel. Mr. Tester has described a vision of 2050 and then in a more reduced time period of potential megawatt production and he used another term-of-art. Do you agree with those potential as hydrothermal in terms of the totality of its source of energy for the U.S. over the long term?

Mr. KUNZ. I do. I think that the shorter term hydrothermal possibilities say over the next 5 or 10 years is on the order of about 5,000 to 10,000 megawatts, and then from there it depends on what we do today to grow beyond that in terms of pursuing EGS and so on.

Mr. COSTA. Well thank you and your comments, suggestions about credits we will take into account, and we will move on to the next panel. Thank all of you for your good testimony and for your patience, and the next panel is going to have to bear with us I think in a similar fashion, although we want to get started because again time is valuable for all of us. But we have been notified that we will have to go for a vote here some time in the next 10, 15-minute period but during that time let us begin on the second panel.

We have Mr. Swisher, Executive Director of American Wind Association. Mr. Robert Gough, Secretary for the Intertribal Council on Utility Policy. Ms. Lynn Jungwirth, Executive Director, Watershed Research and Training Center. Mr. Joshua Bar-Lev, Vice President Regulatory Affairs, Bright Source Energy. And Mr. Will Lutgen, Executive Director for the Northwest Public Power Association.

I will do as we did with the other panel, and you will have to go with the flow here my friends, and that is we will open up with the first witness, and when they tell us we have about five minutes left to go and vote, we will recess temporarily and then come back. So with that said, let us begin with our first witness, Mr. Randall Swisher, the Executive Director of American Wind Energy Association. Bring that mic a little closer please so that we can all hear you.

STATEMENT OF RANDALL SWISHER, EXECUTIVE DIRECTOR, AMERICAN WIND ENERGY ASSOCIATION

Mr. SWISHER. Thank you for the opportunity to address you today. My name is Randall Swisher, and I serve as Executive Director for the American Wind Energy Association, the national trade association for the U.S. wind energy industry, based here in Washington, D.C. I am here to discuss the topic of wind energy and Federal lands.

In terms of the current status of the wind industry, the wind industry is one of the fastest growing sources of electricity generation in the world with a worldwide average annual growth rate of 36 percent since 1994 which shows no sign of diminishing in the foreseeable future. U.S. wind electric generation has more than quadrupled in the last six years.

The potential for U.S. jobs is enormous. In fact, before the Senate Finance Committee last week the President of GE Energy stated we believe wind and solar energy are likely to be among the largest sources of new manufacturing jobs worldwide during the 21st century.

In terms of the potential for wind power in the U.S., the wind resource in the U.S. is almost unlimited. In fact, U.S. winds could generate more electricity in 15 years than all of Saudi Arabia's oil without being depleted. For a number of years the wind industry has had a goal of 100,000 megawatts of wind developed in the U.S.

by 2020. That would represent about 6 percent of the nation's electricity. That target is achievable.

In fact, at this point it is clear that there are no technical barriers to wind energy providing as much as 20 percent of the nation's electric power which is how much wind is currently providing to meet Danish electricity needs. The environmental payoff would be huge. According to our preliminary analysis, if wind were to provide 20 percent of U.S. power generation by 2030, it would avoid over 15 percent of expected power generation CO2 emissions.

In terms of major challenges facing the wind industry to achieve that kind of potential, the wind industry's future in this country is bright but one barrier—and I appreciated the Chairman's reference to transmission. That is the single largest constraint facing this industry in the future. But one barrier the U.S. will have to address to achieve its wind potential is the lack of a predictable permitting regime.

In terms of wind development on public lands, the U.S. is blessed with a huge expanse of public lands. Many of those lands, especially in the western U.S., are appropriate for wind development and have a significant wind resource as do the offshore areas, particularly the northeast coast. The wind energy industry has a long relationship with the Bureau of Land Management going back to the 1980s when some of the nation's first wind projects were developed in the southern California area near Palm Springs and Tehachapi.

BLM managers in that region took the time to understand the industry and how best to oversee the development process on BLM land, and in the last five years as wind development began to spread across the country, it became clear that the effort was needed to share lessons learned with public land managers that had little or no experience with wind development.

BLM initiated—as was mentioned earlier—a programmatic environmental impact statement in 2004 that was intended to address many of the issues that were generic to wind development. The objective was to analyze many of wind energy's impacts broadly so that site specific environmental assessments could deal with the particular issues at a site. The wind industry was consulted through the public process, and the end result was positive. Best management practices were established as part of the process. Approximately 5,000 people participated in the scoping process which addressed BLM lands in 11 states.

As of June 2005, approximately 500 megawatts of wind capacity has been installed under right-of-way authorizations administered by the BLM with about the same amount of capacity approved for construction but not yet built. We are conservatively expecting around 2,000 megawatts of additional wind development on BLM lands over the next decade, and the potential is considerably larger. We applaud BLM for their consultative approach. It clearly provides the best outcome for all parties involved, and an agency cannot effectively regulate without understanding the business practices involved, and BLM took the time to achieve that.

How is the wind industry applying some of the lessons learned in the development process? Collaboration is the answer with public agencies and nonprofits. Two examples are the bats and wind

energy cooperative and the grassland species collaborative. There are a number of specific recommendations in my testimony, written statement, related to BLM, and I will ask that that be entered in the record. Thanks for this opportunity to be with you.

[The prepared statement of Mr. Swisher follows:]

Statement of Randall Swisher, Executive Director, American Wind Energy Association

Chairman Costa and members of the subcommittee, thank you for the opportunity to address you today. My name is Randall Swisher and I serve as Executive Director for the American Wind Energy Association (AWEA), the national trade association for the U.S. wind energy industry, based here in Washington, D.C.

My testimony will cover four major topics:

1. The current status of the wind industry in the U.S.;
2. The potential contribution of the wind industry to U.S. electricity needs over the next few decades;
3. The major barriers to achieving that potential, and
4. The role of federal lands in achieving that potential, as well as the experience of the wind industry in working with agencies under this Committee's jurisdiction.

Current Status of the Wind Industry

The wind industry is one of the fastest growing sources of electricity generation in the world, with global manufacturing capacity for wind turbines having expanded from annual production of 368 megawatts (MW) in 1994 to 11,200 MW in 2005. This worldwide average annual growth rate of 36 percent shows no sign of diminishing in the foreseeable future, and has been driven by a number of factors, especially competitive economics, the environmental benefits of wind, and utility interest in being able to rely upon a diverse mix of electric generating options.

After many years of limited growth through the 1990s, the wind industry has begun to come of age in this country, and U.S. wind electric generation has more than quadrupled in the last six years. In fact, in the last two years, more new wind generating capacity (4,885 MW) was installed than in the industry's first 20 years (1981-2000).

The U.S. wind energy industry enjoyed a record year in 2006, installing 2,454 megawatts (MW) of new generating capacity, making wind one of the largest sources of new power generation in the country and a mainstream option with which to meet growing electricity demand. Last year the industry grew 27 percent in the U.S., bringing the industry to a total installed capacity of 11,603 MW at the end of 2006, with commercial-scale projects spread over two dozen states. Energy production will vary from site to site based upon the strength of the wind resource, but on average, one megawatt of wind power produces enough electricity to serve 250 to 300 homes each day.

This year will be another record, with approximately 3,500 MW of new wind capacity going on line. In fact, since 2005, the U.S. has held the status of being the largest single annual market in the world for new wind generating capacity.

Despite the rapid growth in the market for wind, we have not taken full advantage of the economic development potential of this technology. A lack of consistent policy support in the U.S. has been a much greater deterrent to investment in manufacturing than in project development. Because of the policy uncertainty, manufacturers have been slow to invest in U.S.-based turbine manufacturing capacity, and only one of the top ten wind turbine manufacturers in the world is based in this country. Although the U.S. was a pioneer in wind technology, establishing the world's first wind farms in California in 1981, tax incentives for wind power were suddenly dropped in 1986, and most of our nascent manufacturing capability disappeared at that time. We largely ceded policy leadership and market dominance to European countries. Today, about 70 percent of the world's installed wind capacity is to be found in Europe, and seven of the ten leading global turbine manufacturers are based in the three countries of Denmark, Germany and Spain.

But last year's extension of the wind production tax credit through the end of 2008 provided an important signal to the market, and because of a strong interest among U.S. electric utilities in wind, and this country's almost unlimited wind potential, there is movement to establish manufacturing facilities in the U.S. The potential for U.S. jobs is enormous. In fact, last week, before the Senate Finance Committee, Jon Krenicki, President of GE Energy stated: "We believe wind and solar

energy are likely to be among the largest sources of new manufacturing jobs worldwide during the 21st Century."

New jobs can be expected from other sources besides major turbine manufacturers such as GE. Manufacturers of components such as wind turbine towers, blades and generators, for example, will also provide an enormous number of jobs. In addition, rural America will be rewarded with a steady number of stable, well-paid jobs in operations and maintenance from the wind power plants popping up throughout the Great Plains and other rural areas.

As the U.S. market for wind has expanded, it has attracted well-capitalized global energy and financial companies with the capability to continue driving the industry's growth—manufacturing companies such as General Electric, Siemens and Mitsubishi; project developers or owners such as FPL Energy, Shell, BP, American Electric Power and AES; and international companies such as Babcock & Brown, Iberdrola and Electricite de France.

The surging interest in wind power among electric utilities has been sparked in part by increasingly strong technical performance by modern wind turbines. Technology has been steadily improving, including rotor blade airfoils specially designed for wind turbines, variable-speed generators, power electronics and sophisticated computer modeling of design changes. The scale and efficiency of wind turbines has progressed markedly, and new, larger turbines (1 MW to 3 MW each) generate 120 times as much electricity as 1980s models at one-fifth the cost per unit of output. Performance data from almost 5,000 MW of operating wind turbines in the Midwest shows energy production per turbine almost 50 percent higher in 2005 than from turbines deployed in the years prior to 1999.

Owing to land constraints, Europe has been the leader in regard to offshore wind development. We expect offshore wind development to play a role in the U.S., but because it is more expensive compared to land-based development, offshore wind, outside of a few pioneering projects, won't see significant development here until after 2010. Nonetheless, the Department of Energy estimates 900,000 MW of wind energy potential is located off the east coast of the U.S., strategically located near many population centers.

Potential for the Wind Industry in the U.S.

The growth in the wind industry in the last few years has lead to a more robust vision of the potential role wind could play in the U.S. electric industry.

The wind resource in the U.S. is almost unlimited, with endless expanses of plains and agricultural land well suited for wind development. In fact, U.S. winds could generate more electricity in 15 years than all of Saudi Arabia's oil, without being depleted.

For a number of years, AWEA has had an established goal of 100,000 MW of wind developed in the U.S. by 2020. That would represent about 6 percent of the nation's electricity. We believe that with proper policy support that this is a realistic and achievable goal, building upon the current installed capacity in this country of about 12,000 MW.

Over the last six months, the American Wind Energy Association has been working in cooperation with a number of other entities—the U.S. Department of Energy, the National Renewable Energy Laboratory, Black & Veatch, and other organizations—to develop a more thorough understanding of how much of America's electricity could be generated from the wind within the next few decades.

Specifically, the organizations are evaluating the costs and benefits of wind providing 20 percent of America's electricity by 2030, as well as the major barriers that would need to be overcome. The analysis is yet to be completed, but it is clear at this point that there are no technical barriers to wind energy providing as much as 20 percent of the nation's electric power, which is how much wind is currently providing to meet Danish electricity needs.

The environmental payoff would be huge. The existing U.S. wind turbine fleet (11,603 MW) displaces more than 19 million tons of carbon dioxide each year, based on the current average U.S. utility fuel mix. Robert Socolow and his colleagues at Princeton have already identified wind as one of the invaluable "wedges" that will together be required to achieve climate stabilization. According to our preliminary analysis, if wind were to provide 20 percent of U.S. power generation in 2030, it would avoid over 15 percent of expected power generation CO2 emissions.

Major Challenges Facing the Wind Industry

The wind industry's future in this country is bright, but the U.S. will have to address the following major barriers to achieve its wind energy potential:

1. Lack of consistent policy support—The wind industry, and especially the manufacturing sector, has been constrained by the lack of consistent federal policy

support. The on-again, off-again nature of the federal production tax credit, which has been allowed to expire three times, has been a significant disincentive to investment. Long-term, stable policy, such as a ten year extension of the wind production tax credit and a federal renewable portfolio standard, will be essential to establish the U.S. as a manufacturing center for the rapidly growing global wind energy industry.

2. Worldwide turbine shortage—Record growth in the wind industry has lead to turbine shortages on a worldwide basis. More stable federal policies will help assure the creation of a robust global supply chain to meet the growing demand.
3. Transmission constraints—The need for transmission infrastructure serving major wind resource areas on the Great Plains is the most significant long-term constraint on the growth of the wind industry. The electric industry as a whole has substantially underinvested in transmission relative to the needs of our wholesale electric markets, so lack of transmission is not an issue that the wind industry faces alone. But transmission constraints are particularly critical to a resource such as wind that is distant from major cities. Despite the level of transmission investment required, the cost is modest relative to the value of cost-competitive, clean and renewable electricity that would be made available.
4. Balkanized electric markets—Electric utilities have grown up relatively isolated and their operations have been designed to reflect the characteristics of conventional generating technologies such as coal or gas-fired generation. For wind to achieve its potential, it is important that the Federal Energy Regulatory Commission (FERC), regional transmission organizations, and individual electric utilities begin to operate more as regional pools, in which variable resources such as wind can flourish. Strong progress has been made in this area in recent years, such as the introduction of the Midwest ISO covering 15 states, but other regions have a much longer way to go.
5. Environmental costs of fossil fuels not recognized in market cost—Wind power produces no air emissions and makes no contribution to problems associated with air pollution or global warming. For wind to receive a level playing field in the market, the environmental costs of conventional electricity must be fully internalized.
6. Need to continue reducing the cost of wind power—In the end, wind energy's market share will be determined to a significant extent by economics. The cost of wind has declined by about 90 percent since the mid-80s, but in the last few years, wind turbine prices have increased due to turbine shortages and increases in the costs of materials such as steel and fiberglass (as they have with conventional resources). The industry must focus on continuing to reduce the cost of wind-generated electricity, and there are opportunities to do that as the industry scales up.
7. Lack of a predictable permitting regime—Siting, regulatory and permitting agencies at the state and federal level are still learning how to deal with wind development, and some permitting processes take considerably more time than is in the public interest. Without a more predictable and comprehensive permitting or regulatory regime, it will be difficult to move from the current pace of about 3,500 MW annually and achieve installation rates of 10,000 MW or more per year, which is the level required for wind to fully contribute to our national effort to reduce the impacts of global warming.

Wind Energy Development on Public Lands

The U.S. is blessed with a huge expanse of public lands in many parts of this country. Many of those lands, especially in the western U.S., are appropriate for wind development and have a significant wind resource, as do the offshore areas of the northeast coast.

The wind energy industry has a long relationship with the Bureau of Land Management, going back to the 1980s when some of the nation's first wind projects were developed in the Palm Springs and Tehachapi areas of southern California. BLM managers in that region generally took the time to understand the industry and how best to oversee the development process on BLM land, but wind development presents some unique issues to land managers, and in the last five years, as development began to spread around the country, it quickly became clear that an effort was needed to systematically share lessons learned in California, Wyoming and a few other pioneering areas with public lands managers that had little or no experience with wind development.

As a tool to ensure each office didn't have to "reinvent the wheel," BLM initiated a Programmatic Environmental Impact Statement (PEIS) in 2004 that was intended

to address many of the issues that were generic to wind development but not always familiar to agency personnel. The objective was to analyze many of wind energy's impacts broadly so that site-specific Environmental Assessments could deal with the particular issues at a site. The wind industry was consulted through the public process and the end result was a document that many in the industry and elsewhere support. Best Management Practices (BMPs) were established as part of the process, and involved extensive consultation with a wide range of interests. Approximately 5,000 people participated in the scoping process, which addressed BLM lands in eleven states: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming.

As a brief overview, the conclusion of the PEIS reads as follows: "it appears that the proposed action would present the best approach for managing wind energy development on BLM-administered lands. The proposed Wind Energy Development Program is likely to result in the greatest amount of wind energy development over the next 20 years, at the lowest potential cost to industry. Simultaneously, the proposed action would provide the most comprehensive approach for ensuring that potential adverse impacts are minimized to the greatest extent possible. And, finally, the proposed action is likely to provide the greatest economic benefits to local communities and the region as a whole. As a result, the proposed action appears to best meet the objectives of the National Energy Policy recommendations to increase renewable energy production on federal lands."

At the conclusion of the process, in January 2006, the Department of Interior issued its decision, and AWEA stated the following:

> "The U.S. wind energy industry welcomes the Department of Interior's record of decision on the final wind energy Programmatic Environmental Impact Statement, both for the inclusive manner in which it was developed, and for the end result: a process that encourages the responsible development on BLM land of a clean, domestic, and strategic energy source."

As of June 2005, approximately 500 MW of wind capacity was installed under Right Of Way authorizations administered by the BLM. We are conservatively expecting around 2,000 MW of additional wind development on BLM lands over the next decade. The potential is considerably larger, as the projected economically developable wind resources on BLM-administered lands in these eleven states is 160,100 acres.

We applaud BLM for their consultative approach, and wish other agencies were as open to public input. It clearly provides for the best outcome for all parties involved, and most certainly the interests of the public at large.

The wind industry likewise has a long history with the U.S. Fish & Wildlife Service, although the Service has not always been as effective at achieving the agency's objectives. Nonetheless, the wind energy industry is pleased that the Department of the Interior has finally announced the Wind Turbine Guidelines Federal Advisory Committee. This effort has real potential to revise the ineffective 2003 Interim Guidelines on wind and wildlife that were developed essentially without wind industry or other stakeholder input, and to move the issue forward in a collaborative fashion. We applaud the Department and look forward to the Secretary naming a constructive group to this important committee.

The wind industry's relationship with the Minerals Management Service (MMS) is relatively new. MMS was given oversight for offshore wind development as part of the Energy Policy Act of 2005, assuming responsibilities for which the U.S. Army Corps of Engineers had previously been the lead. Although there are no major offshore wind development projects that have been built in U.S. waters (in contrast to Europe, where offshore is a major focus for the industry), two significant projects off the coasts of Massachusetts and Long Island had spent months in the permitting process, only to have jurisdiction transferred to MMS midway through the process. One of those projects, Cape Wind, proposed off the Massachusetts coast, had filed its original permits in 2001, and a 4,000 page draft Environmental Impact Statement had been completed by the Corps with 16 federal and state agencies involved. Although AWEA supported the transfer of jurisdiction to MMS, we were lead to believe that already proposed projects would be treated with more fairness, in part because the legislation included a 270 day timeline for implementation of the offshore provisions of EPAct (which would have resulted in action by May, 2006). Therefore we were disheartened to learn that MMS recently announced that the release of their final rule would once again be delayed, this time until the fall of 2008.

How is the wind industry applying some of the lessons learned in the development process? What are some of the most effective means of identifying and institutionalizing wind development best practices?

- AWEA Siting Committee's Wind/Wildlife Initiative—The wind industry has worked collaboratively with government agencies and non-governmental

organizations on a number of levels—locally, state-wide, regionally or nationally—to develop ways to minimize wind energy's biological impacts. AWEA's Siting Committee is looking to replicate this model on a bigger scale by proactively meeting with NGOs and government agencies to determine how to work together most effectively as the industry continues to scale up. Many of the questions surrounding wind energy's impacts are evolving, and more research is often needed. The best model we have identified is collaboration which provides the credible scientific work that all parties require, and we are part of some effective public/private partnerships today:

- Bats & Wind Energy Cooperative—This collaborative was set up immediately after the industry discovered higher-than-expected bat mortality at a wind project in West Virginia. AWEA, Bat Conservation International, the U.S. Fish & Wildlife Service, and the National Renewable Energy Laboratory partnered to determine what research is needed to address this issue, and then raised the funds necessary to get it done. Collaboration among diverse parties is challenging, but we are seeing tremendous progress on an important issue.
- The Grassland/Shrub-Steppe Species Collaborative is set up in a similar way, with industry, conservation organizations and government agencies. In this instance, the collaborative is attempting to find out if prairie chickens, an important grassland species in the Plains, are adversely affected by the presence of wind turbines. Again, it is only through the partnership of wind companies, The Nature Conservancy, NREL, and a state wildlife agency that we are able to fund the necessary research to answer this question.

Based upon years of work with BLM, and the more recent experience of developing the PEIS, what are some of the wind industry's potential concerns moving forward?

- The wind industry would like to ensure that as BLM's policy is carried out in the field, the important analytic work underlying the PEIS is systematically relied upon and used as means of speeding project approvals to the extent feasible and in the public interest.
- The wind industry is a dynamic industry. It is important to establish best management practices (BMPs) but there must be recognition that this is still a relatively young industry, and as it grows, management practices and scientific research are still evolving, and there should be a way of ensuring that agency BMPs can keep pace.
- Agency personnel can be competent and collaborative, but overwhelming workloads on limited budgets can be detrimental to timely decision-making. As the wind industry strives to maximize its contribution to our nation's energy and environmental needs, a more predictable and comprehensive permitting or regulatory regime is needed at the state and federal levels, cutting across multiple agencies. Without such a consistent framework, it will be difficult to move from the current pace of about 3,500 MW annually and achieve the desired installation of 10,000 MW or more per year.

I appreciate the opportunity to be with you today, and welcome any questions you might have.

Response to questions submitted for the record by Randall Swisher, Executive Director, American Wind Energy Association

Have technologies for wind generation changed in terms of their impacts on bird mortality?

Yes, wind turbine technology has changed tremendously since the first commercial wind energy projects were installed in the early 1980s. Turbines are much larger in energy capacity and physical size. Turbines also are sleeker, with tubular towers and internal ladders and access points. And years of study has documented that bird mortality at wind energy projects is low. In fact, a recent study released by the National Research Council of the National Academies concludes: "Compared to relatively high raptor fatalities at some older facilities in California [the Altamont Pass, described in more detail below], direct impacts of wind energy development on passerines at the current level of development appear to be minimal." In addition, when compared to all of the other human-related causes of bird collisions: "Clearly, bird deaths caused by wind turbines are a minute fraction of the total anthropogenic bird deaths—less than 0.003% in 2003 based on the estimates of Erickson et. al. (2005)."

Wind technology has evolved dramatically over the last fifteen years. Most turbines deployed in the Altamont Pass in California, where the only instance of

relatively high bird mortality, specifically raptors, has occurred in the U.S., were built in the 1980s. The first generation technology deployed in the Altamont, along with some of the attributes of the site, makes it the avian impact anomaly that it remains today. First, the turbines are small and sited relatively closely together, so there is not that much space between the swept area of one rotor and the swept area of the next. Second, smaller and older turbine rotors have a high RPM, a factor which some experts believe may contribute to problems; and third, these turbines have lattice towers with horizontal reinforcement bars that provide convenient perching locations for birds. Modern machines are designed to provide few or no perching locations.

Beyond the technology, the Altamont Pass site also has a number of attributes that may make it more harmful to birds: it houses one of nation's largest concentrations of federally-protected raptors, there is an abundant prey base, and there is also heavy year-round raptor use. Thankfully, the experience in the Altamont has not been repeated elsewhere, and the industry is now taking steps in partnership with groups like the Golden Gate Audubon Society to make changes there to reduce the raptor mortality, including even shutting down the turbines for a couple of months out of the year and eventually replacing all of the older machines with newer machines (at a ratio of about 10 or 15 to 1), which is expected to reduce mortality there.

Can you tell us about other technological changes or best management practices which are in the works to address wildlife issues which wind development will encounter on public lands?

The BLM, working in cooperation with the industry, developed Best Management Practices (BMPs) as part of the Programmatic Environmental Impact Statement completed in 2005. These BMPs lay out some of the requirements of how to deal with wildlife issues on BLM-managed lands, and they provide clear guidance to developers and BLM field offices of how to handle wind energy projects. Examples of BMPs include:

- "Operators shall evaluate avian and bat use of the project area and design the project to minimize or mitigate the potential for bird and bat strikes (e.g., development shall not occur in riparian habitats and wetlands). Scientifically rigorous avian and bat use surveys shall be conducted; the amount and extent of ecological baseline data required shall be determined on a project basis."
- "Facilities shall be designed to discourage their use as perching or nesting substrates by birds. For example, power lines and poles shall be configured to minimize raptor electrocutions and discourage raptor and raven nesting and perching."

As far as technological changes, the wind energy industry is active in a number of wildlife research collaboratives and there has been technology tested in the past.

- Bats & Wind Energy Cooperative (BWEC)—A relatively new wildlife concern is turbine impacts on bats. While bats were found at projects during post-construction monitoring in the past, they were not discovered in large numbers until 2003 at a project in West Virginia. The wind industry immediately moved to partner with Bat Conservation International, the U.S. Fish & Wildlife Service, and the Department of Energy's National Renewable Energy Laboratory to create the BWEC. BWEC's purpose is to identify and fund research needed to understand why and how bats are being impacted and to explore ways to minimize impacts through deterrent methods. BWEC's current 2-pronged research plan is looking at how to determine if a site is risky for bats, because mortality is not widespread at projects across the country, and testing of a device that would emit an ultrasonic frequency to warn bats away from turbines. This type of collaborative effort is producing great results and something the wind industry hopes serves as a model for other wildlife issues and maybe for other industries.
- Grassland/Shrub-Steppe Species Collaborative (GS3C)—Another collaborative industry participates in is the GS3C. The GS3C is identifying and conducting research on the potential avoidance of certain keystone avian species from areas with wind turbines. Species such as prairie chickens and sage grouse have demonstrated avoidance from structures such as power lines and roads, so the GS3C is attempting to discover if the same is true for wind turbines and how such impact may be avoided or mitigated.

Testing has also taken place in the past with regard to raptor impacts at the Altamont Pass (described above), the only site in the U.S. with demonstrated high avian mortality due to turbine collisions. The industry has tested technologies such as painting blades or nacelles in specific patterns to increase their visibility to raptors. Additionally, advances such as tubular towers to discourage perching on

new machines and deploying perch guards on older machines have been methods to attempt to reduce mortality.

In your oral and written testimony, you state that American Wind Energy Association has an established goal of generating 100,000 MW of wind in the U.S. by 2020—or 6 percent of the nation's electricity. Your testimony says you "conservatively expect that 2,000 MW will be developed on BLM lands over the next decade." Could you comment on why you project that a relatively small proportion of AWEA's goal will be reached on public lands, given the vast developable wind resources in the west?

Some of this conservative estimate is just that, conservative. With more access to transmission lines and new lines installed, the figure could be higher. BLM itself through the development of the PEIS projected the megawatt (MW) capacity installed in 2015—2630 MW—and 2025—3260 MW. These projections are derived from information on the available wind resource, access to transmission, exclusion areas and physical limitations such as slope, etc.

Policies such as the PEIS should further standardize the permitting process on BLM-managed lands. One concern of the wind industry is whether the BLM offices have the resources necessary to review the multiple applications required for wind projects and that these applications are given the high priority they deserve to move ahead. If not, developers will move on to other project sites in the development pipeline.

Do you think the current Energy Policy Act provisions will enable you to meet your goals on public lands and nationally? If not, why not?

Section 211 of the Energy Policy Act (EPAct) stated "It is the Sense of Congress that the Secretary of the Interior should, before the end of the 10-year period beginning on the date of enactment of this Act, seek to have approved non-hydropower renewable energy projects located on the public lands with a generation capacity of at least 10,000 megawatts of electricity." As the previous discussion makes clear, this will be a stretch goal to achieve.

The extension of the renewable energy Production Tax Credit (PTC) in the Energy Policy Act (EPAct) was a critical component of the wind energy industry's continued success. The PTC in 2005 was extended for the first time before it expired, allowing for longer planning horizons and it avoided the boom-and-bust cycle the industry has experienced due to three expirations since it went into effect in 1994. While the two year extension in EPAct was enough to keep the market moving forward briskly, it has not been a long enough timeframe to facilitate strong investment in manufacturing and the supply chain. Those investments require a five to ten year extension of the PTC, and it is our hope Congress will recognize and respond to that need and the enormous economic development opportunity. As Jon Krenicki, President of GE Energy, testified before Senate Finance Committee earlier this year, "We believe wind and solar energy are likely to be among the largest sources of new manufacturing jobs worldwide during the 21st Century," but they require stable, long-term policy if those jobs are to be captured in the U.S. A long-term extension of the PTC and a Renewable Portfolio Standard are vital to maximizing these economic development benefits for the U.S.

Another aspect of EPAct was the transference of authority for offshore renewable energy resources to the Minerals Management Service (MMS). Although offshore wind is well-established in Europe, no offshore wind projects are currently installed in American waters. In some parts of the country, such as the Northeast, the load (demand for electricity) is near the coast and the wind resource over the ocean is excellent in some of those same areas. Offshore wind technology is limited in where it can currently be installed, so AWEA does not predict significant numbers of projects in the near future, but offshore wind energy definitely has a role in achieving the wind industry's vision in the future. MMS is now developing the regulations to govern offshore renewable energy projects, including wind energy. AWEA is concerned that MMS has delayed the release of final regulations a number of times. While developing new regulations is a difficult task, no offshore wind developments can move forward, including the Cape Wind and Long Island Power Authority projects that are moving separately from this environmental review process, until the regulations are final. AWEA will request clarification from MMS on when the regulations will be released.

The Energy Policy Act also included provisions in Section 368 and 1221 for electric transmission development which are helpful to wind energy because transmission is needed to deliver the power from remote areas to load centers.

What is the position of the American Wind Energy Association of Section 368 of the Energy Policy Act of 2005? What recommendations do you have regarding transmission of wind power?

AWEA supports the energy corridors provisions in Section 368 of the Energy Policy Act ("energy right-of-way corridors on federal land"). Section 368 provides an opportunity for the nation to meet growing energy demands with resources that are abundant in the West, including wind energy. Accessing these resources will require electric transmission facilities crossing many federally owned lands, and thus many different siting procedures and decision makers. The coordinated process under section 368 provides much greater likelihood of successfully developing corridors for needed energy delivery infrastructure including electric transmission.

AWEA supports transmission infrastructure development as a critical piece of a national strategy to address energy security and global warming. The existing transmission grid is congested and has suffered from under-investment in recent decades. There are some opportunities to increase the efficiency and usage of the existing transmission grid. But importantly for this committee, new infrastructure will be required to tap the hundreds of Gigawatts of low cost wind resources across much of the interior West. The two primary barriers are cost allocation and siting. Federal leadership in the West on siting is critical given the amount of federal land that would need to be crossed by new transmission lines. We encourage federal land managers to work with regional transmission planners at the Western Electric Coordinating Committee and other forums in the West to ensure properly sited, well coordinated infrastructure development.

Mr. COSTA. Thank you very much, Mr. Swisher, and we will get back to you on that and your good testimony. Your radio-like voice obviously makes you even more effective. We have a vote that is being cast as we speak. So in speaking with the Ranking Member, if you do not mind we are going to recess briefly. The two of us will go and vote, and we will be back I would hope in about 10 minutes or so. As long as it takes us to walk over and walk back. So anyway you have a little break, and we will see you in a little bit. The committee is now recessed.

[Recess.]

Mr. COSTA. If we have all of our witnesses here, I would like to reconvene the Subcommittee and move on to our next witness. As I look at the second panel, that on my list happens to be Mr. Robert Gough, is that correct?

Mr. GOUGH. That is correct, sir.

Mr. COSTA. Who is the Secretary of the Intertribal Council Utility Policy.

Mr. GOUGH. Yes, sir.

Mr. COSTA. And so that is obviously a lot of public lands and sovereign nations that are on those lands. Is this your camera?

Mr. GOUGH. It is, sir, yes.

Mr. COSTA. Good. Fine. I would like to have a camera follow me some day. Anyway. Well maybe not. Please begin with your testimony.

STATEMENT OF ROBERT GOUGH, SECRETARY, INTERTRIBAL COUNCIL ON UTILITY POLICY

Mr. GOUGH. I appreciate that. Good afternoon. My name is Bob Gough, and I am the Secretary of the Intertribal Counsel on Utility Policy, Intertribal COUP. It is composed of tribes in the northern plains. Primarily North and South Dakota, Nebraska and Wyoming. There are 12 tribes membered there now, and the background is spelled out in our testimony, and it is an honor to speak to this Subcommittee and in this room.

About 15 years ago we were here on behalf of the tribes to actually secure hydropower allocations. The tribes live along the dams on the northern greater plains on the Missouri and basically had been flooded. Many of the tribes had been flooded with the building of the dams, and it was only this year 2000 tribes were able to secure hydropower allocations. So it has been a long time, and we are glad to be back here on the next round of energy development.

I appreciate what you had to say with regard for the nation. There is no silver bullets but I would like to posit that there are a lot of silver buckshot. There is a lot of opportunities for lots of energy efficiency and the rest to make it, and for tribes who are Federal——

Mr. COSTA. I would concur.

Mr. GOUGH. And for tribes with Federal lands, that land is held in trust, and it is a very special kind of land. It is not public land in the same sense that parks are in that it is there for the benefit just for the tribes. The tribes hold that beneficial title but there is still Federal responsibility to help assume economic development on the reservations.

I have had the honor of serving on the Western Governors' Energy Advisory Committee for the last two years, three years now—I guess it is into the third year—putting together the recommendations and looking at the opportunities. Intertribal COUP has posited a plan for 3,000 megawatts of tribally owned wind in the great plains. That is only 150 megawatts on 20 reservations, and that was an audaciously large amount of development, and a year later the Western Governors posited 30,000 megawatts of clean energy for the west. So all of a sudden we were like 10 percent of what the Western Governors were looking at by 2015.

I have a number of slides here that I will go through very briefly just to put into context of why wind development for the reservations makes a whole lot of sense, and a couple of changes in policy that need to be considered that could really help development happen. If we look at the drought that has gripped the west, particularly in the northern plains, we see that we are facing almost the same scenario climate change is predicting for the west. We are running out of hydropower water. Water for hydropower, and we are running into situations where more and more even conventional power plants are having to curtail because of water constraints, either thermal constraints or just lack of water present, and that is what the first slide is all about.

We are looking at new normals and new ways of working with the resources. In the west, Western Area Power Administration runs from Minnesota to California, and it has got 9 of the 10 windiest states in the country. The great wind resource and they are running out of hydropower. If they just use Class 4 wind resources and above, we would have 2,000 gigawatts of wind power potential. The whole country operates on an installed capacity of about 800 gigawatts. So there is a tremendous resource out there throughout the west.

On the reservations, NREL has mapped with the blue dots here the wind potential on each of the reservations, and you can see clustered in the northern plains the greatest wind resource we have in the country. Many of those reservations have that. So

while it may not be a silver bullet, it could be a golden opportunity for reservations to be able to utilize that resource.

The red lines on this map are the WAPA grid. We need to be able to find ways for the tribes to have access to that grid. Rethinking how we operate the grid. Right now it is operated by hydro, and then when there is not enough hydro they go to the market for dispatchable coal power. What was once 100 percent hydropower is now 15 percent hydro, 85 percent coal on those wires, and there is no place for wind on those wires as it currently stands.

The opportunities for treating tribes as governments in a government-to-government relationship with the Federal government, recognizing tribal projects as governmental instrumentalities, and giving them a preference on the grid the same way that the dams have a preference on the grid.

The production tax credit is one of the three major incentives of revenue streams for wind power, and that is one that the tribes currently do not have access to since they are governments. They do not pay Federal income tax. Therefore there is no place for that tax credit to hold. We would like to tribes in joint ventures to be able to shift their credits that they would get as an equity partner over to their private capital partners in those tribal joint ventures.

Great benefits could come to the whole country. The wind resource throughout the northeast, you get our air two days after we are finished with it, and if we can build more clean energy, you have cleaner air coming your way, and it brings revenue and new economic and educational opportunities for the reservations through the tribal colleges and the like. I appreciate the time is up, and I appreciate the committee's patience.

[The prepared statement of Mr. Gough follows:]

Statement of Robert Gough, Secretary,
Intertribal Council On Utility Policy, Rosebud, South Dakota

Good afternoon distinguished and honorable representatives. My name is Robert Gough and I am the secretary of the Intertribal Council On Utility Policy, and I am honored to be able to appear before this committee to speak on behalf of the American Indian tribal opportunities and desires to develop some of the tremendous wind, solar and other renewable energy potentials found on Indian reservations across the West. A letter attached below outlines the specific message sent to this committee from the President of the Intertribal Council On Utility Policy, Mr. Patrick Spears, who could not be here today.

Background: The Intertribal Council On Utility Policy (COUP) is composed of twelve federally recognized Indian tribes in North and South Dakota, Nebraska and Wyoming, with affiliates throughout the northern Great Plains. Organized in 1994, it is chartered and headquartered on the Rosebud Sioux Reservation to provide a tribal forum for policy issues dealing with telecommunications and energy utility operations and services. Low-cost federal hydroelectric power has been generated from tribal lands and waters along the Missouri River for decades without proper allocations provided to the tribes in the region. Intertribal COUP grew out of the unified efforts of the Missouri River Tribes seeking a fair share of the federal power distributed by the Western Area Power Administration.

Mission: Intertribal COUP strongly adheres to the principles of tribal self-determination and ecological sustainability, supporting the development of sustainable homeland economies built upon renewable energy resources. Intertribal COUP is a vehicle for educating Tribal governments about economic development opportunities available through public and private partnerships to provide reservation utility services. Intertribal COUP seeks to assure that the benefits of tribal partnerships with the federal government, as envisioned in our treaties, are promoted in federal legislation and policy.

This country could harvest the vast renewable energy from renewable such as wind power from the Great Plains and solar from the Southwest through changes

in federal priorities for renewable energy carried on the federal grids throughout the west. American Indian tribes in the west have tremendous wind and solar resources and are arrayed along the federal grid system built out from the dams on the Missouri and the Colorado river systems, for example.

American Indian tribes have a special "government to government" relationship with the United States, and their renewable energy projects should be considered as "government instrumentalities" much like the federal dams, often built on and flooding their homelands. It would be a tremendous opportunity to meet this country's demand for clean energy while honoring our trust relationship and treaty obligations with the Tribes in their pursuit for economic development though wind and solar energy development. Such a relationship would allow tribal projects to stand next to federal energy projects as governmental instrumentalities, in terms of access and priority to the federal grids which cross and connect almost all of the Indian reservations in the heartland of this country.

To tap this vast resource of clean power and build sustainable tribal economies in some of the poorest communities in America, large scale tribal renewable energy projects have requirements:

1. Assessment of the resources for feasibility and development;
2. Access to the federal grid;
3. Integration with the federal hydropower resources, and
4. Adjustment of federal renewable energy incentives, namely the PTC, which as currently written penalize the attraction of outside capital to help build tribal projects in which Tribes have an ongoing equity interest.

I have included six slides which I will make reference to during this testimony.

SLIDE 1. The current state of the Missouri River where the dams are operated and managed by the Corps of Engineers and the Bureau of Reclamation for navigation, flood control, endangered species, and irrigation among other purposes. The hydrological system is under no one's management and the system is facing dramatic reductions in water flow, and thus diminished hydropower resources due to the extended drought throughout the West and particularly in the Northern Great Plains and headwaters of the Missouri River.

Western Area Power Administration, with its 20 year hydropower allocation contacts, cannot fulfill its allocation contracts with reduced hydropower resource currently available, and must purchase increasingly more expensive and greater quantities of non-hydropower electricity, most often lignite coal power, which is the most carbon dioxide intensive power per megawatt hour in the country.

Coal power is the least expensive source of electric power, only because most of its true life-cycle and environmental costs have been externalized. Current federal policy utilizing such conventional fossil fuel power creates a positive feed back loop, further reducing snow pack and precipitation and thus requiring increasing amounts of supplement power annually. Western's supplemental power budget has increased from $25 million dollars to over $240 million dollars in just this decade to date.

Investment of a portion of such staggering sums, through long-term power purchase agreements, into Tribal wind projects could produce clean electricity at a relatively fixed cost for over the next three decades, without the extraordinary consumption of water currently associated with conventional power production.

SLIDE 2. The Western Area Power Administration sits in the windiest region of the country, with 9 of the 10 windiest states within its service territory. Just utilizing the potential from the class 4 wind sites and above, the WAPA service territory has a total wind power potential over 2,000 gigawatts. The entire United States currently has an installed electricity generation capacity of about 800 gigawatts, or less than half the wind potential of the superior class wind sites in the WAPA footprint. Western requires any taker of federal hydropower to conduct IRPs or Integrated Resource Plans to optimize the use of a variety of its conventional and renewable energy resources. As WAPA hydropower is diminished, ways should be sought to optimize the region's renewable sources into the federal grid administered by WAPA. In line with the federal government's trust responsibilities, treaty relationships and statutory requirements to assist Tribes in building their reservation economies, Tribal wind coupled with federal hydropower could enhance both Western's power supplies while building sustainable tribal economies based upon renewable energy.

SLIDE 3. The blue dots on the U.S. map show the wind potential on the Indian reservations across America, which totals to some 535 Billion kilowatt hours/year. The entire country used about 3,853 Billion kilowatt hours in 2004. The northern Plains reservations have the greatest wind generation potential clustered along the red lines representing the federal transmission grid administered by WAPA. In seeking to integrate tribal projects onto the existing grid, Tribes find themselves in

the position as the "new kid on the block" entering into a long established set of relationships between the federal power marketers and the existing utilities with dispatchable resources. Western cannot control when or if the Corps of Engineers may or can supply federal hydropower from a diminishing resource to meet contractual obligations and expected demands. Therefore, it seeks dispatchable supplemental generation at the times when it needs the power, and thus dismisses the value of wind energy, which is only available where the wind blows. The rules of the grid have been formed about the formerly reliable hydropower resource and the dispatchable conventional sources such as coal or natural gas. Under the current practices, there is "no place on the grid" for wind if it isn't there when the PMA needs it.

Congress should help the PMA's consider how to integrate wind, the cleanest, most abundant but least dispatchable resource, by arrangements which provide for the minimal flow of hydropower as the river system may require, while making the most advantage of the wind when it does blow (about 40% of the time), and then supplementing the wind with what ever additional hydropower may be available, and only then going to outside non-governmental markets for additional, more dispatchable generation. Such a re-thinking of how the grid could operate would optimize the two governmental resources of non-polluting generation sources, tribal wind and federal hydropower, creating a renewable energy dynamo along the Missouri River system, which could then be augmented by more conventional, non-governmental sources of power. Congress should direct the PMA's to integrate wind and other renewable energy sources into their systems, and to give particular preference to Tribal projects as part of their unique government to government relationship.

SLIDE 4. This slide shows the approximate revenue streams one might expect from a wind project. The price that a wind project might get from the sale of the energy generated depends in part, upon the nature of the resource, and in part upon the current market price for power in the region. In the Northern Great Plains, new wind projects compete against heavily subsidized federal hydropower and the low priced lignite coal being burned in grandfathered coal plants. Wind, however, is very competitive against NEW COAL plants, particularly if the project can utilize the federal production tax credit (PTC).

Reservation projects, under current law, are penalized to the extent of tribal ownership because the PTC is apportioned according the ownership interest. To the extent private capital flows into a reservation project where Tribes hold an equity position, the project is penalized to the extent of that ownership because:

A) Tribes, as governments, have no federal income tax liability, and
B) Purchasing utilities ASSUME that the project gets the full tax credit when they set their tariffs.

So far, the federal renewable energy incentives such as the PTC, the Renewable Energy Production Incentive (REPI), and most recently the Clean Renewable Energy Bonds (CREBs) have been designed with other entities in mind, such as municipal utility authorities and rural electric cooperatives,—entities which have an obligation to serve their rate payers, and not truly tailored to large utility scale tribal projects, whose tribal members are often members of rural cooperatives or area IOUs. Tribes have historically had little, if any, representation on the elected rural cooperative boards. Thus, Tribes cannot use their membership to rate-base project development in the ways that munies and coops can and do.

Greater detail on the "sharable PTC" is attached to this testimony.

SLIDE 5. The northern tier of the United States sits in a windshed, with the richest wind regime sitting upwind from the largest energy consuming region in the country. Fossil fuel power generation has brought both economic boon and environmental degradation to this region in the form of acid rain, NO_x, So_x, particulate and mercury pollution to the northeastern part of the country. And now we realize that our energy system is also a major emitter of carbon dioxide as a green house gas associated with global warming.

As a region, the upwind generation of clean energy could deliver cleaner air today, and cleaner power tomorrow, once a smarter and more capable transmission system, tying the Great Plains to the Northeast, is provided. Tribal wind power on the Great Plains can bring tremendous benefit to the nation and regions downwind, while building sustainable economic development in the "New American Ghetto" as the Dec. 8, 2005 issue of "The Economist" called the states of Montana, Nebraska, and North and South Dakota.

SLIDE 6. There is potential benefit to Indian reservation in terms of the training opportunities through the network of tribal colleges that can be achieved for the ever growing Indian populations which are the fastest growing segment of the U.S. population, the least electrified, in terms of rural America, and the most unemployed in the country. The same strategic locations of the reservations, in terms of

large scale distribute wind energy generation, brings value to weather forecasting for agriculture in general, and more importantly, wind forecasting, in particular, which can be utilized as a new source of employment and value-added economics to wind generation.

CONCLUSION: Wind power and solar, unlike conventional generation from the burning of fossil fuels, provides clean electricity but do not consume water or generate GHG emissions. Facilitating tribal renewable energy could help meet this nation's and build sustainable tribal economies based on renewable energy. Tribal lands on the northern plains have some 200,000 megawatts of wind resources and could meet a significant portion of America's rural and urban electric energy needs.

Intertribal wind energy from the reservations arrayed along the Missouri River and the Western Area Power Administration transmission grid could be merged with hydropower delivered by WAPA on the federal grid system that connects us all. Native Wind energy can have a major impact on the reduction of global warming gases and other pollutants, and enhancing the clean energy security of the United States, and the building of sustainable economies on America's Indian reservations. I would be happy to answer any questions the committee may have either now or in writing, and would request the opportunity to expand these remarks, should that be necessary.

Thank you on behalf of the federally recognized Tribes who are members of the Intertribal Council On Utility Policy.

[NOTE: Slides have been retained in the Committee's official files.]

INTERTRIBAL COUNCIL ON UTILITY POLICY

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Tribal Joint Venture Production Tax Credit

An Intertribal COUP Background Policy Paper for a Comparable and Appropriate Tribal Energy Production Incentive

Western Governors, 25 x25 Campaign, Intertribal COUP and NCAI Support Needed Tribal Renewable Energy Incentive:

In the context of reaching the Western Governors' goal of 30,000 MWs of clean and diversified energy throughout the West by 2015, it is recognized that Indian Tribes control a vast renewable power potential, including the wind resource found across the western reservations, but that a comparative and appropriately tailored incentive is needed to encourage tribal development compatible with tribal aspirations, federal responsibilities and the financial realities of the existing energy system.

A **Tribal Joint Venture Production Tax Credit** incentive for "partnership sharing" of the PTC is needed to spur Tribally owned renewable energy development, attract needed capital investment to reservations in an equitable and respectful manner, reduce the cost of clean power, and keep more of the benefits in the local community.

This tribal **"partnership sharing"** concept was proposed by the Wind Task Force and recommended by the Clean and Diversified Energy Advisory Committee of the Western Governors' Association after 18 months of study. This recommendation was adopted unanimously by the Western Governors on June 11th in Sedona, AZ, (WGA Policy Resolution 06-10) and endorsed as a key recommendation by the 25 x 25 Campaign. The Intertribal Council On Utility Policy (COUP) and the National Congress of American Indians (Resolution SAC-06-030) have proposed the language below.

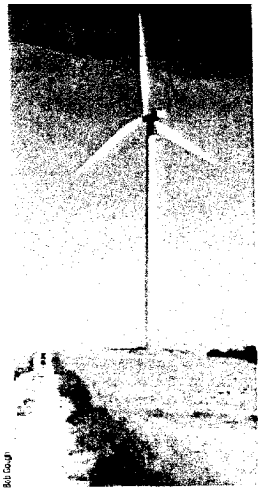
> A tribal energy production incentive is recommended, whereby Tribes may assign their share of any production tax credit (PTC) within a tribal joint venture, such as a tribal energy resource development organization (EPAct 2005, Section 2602), so that Tribes can retain significant project ownership while allocating their share of the PTC to their taxable TJV partners:
>
> Section 45(d)(3) of 26 USC 45 (relating to additional definitions and special rules) should be amended by adding at the end the following new paragraph:
>
> ***PTC Sharing Allowed within a Tribal Joint Venture:***
>
> ***In the case of a qualified facility as defined in 26 USC 45 (c)(3) in which one or more of the persons with an ownership interest is an Indian tribe or tribes, the tribal owner or owners may allocate their share of the renewable electricity production credit among the other, non-tribal, taxpaying owner or owners of the production in the gross sales from such facility.***

For more info: http://www.intertribalcoup.org/policy/index.html

Falling Water, Rising Wind

Seeking answers to problems of drought and economic stagnation, Indian tribes in the American West are listening to the wind.

by Bob Gough



Bob Gough

This 750kW wind turbine on the Rosebud Sioux Reservation, completed in April 2003, is the first phase of a planned 10MW wind farm.

Water has always been the lifeblood of the arid American West, and electricity—the primary byproduct of U.S. federal government water management in the area—is the current that powers urban and rural life after a century of settlement. But the West is now suffering its sixth year of drought, the longest and harshest in recorded history. Electricity trickles from the six big hydropower dams on the Missouri River at a rate less than two-thirds of the 10 billion kilowatthours produced in a "normal" year. The Western Area Power Administration (WAPA) supplements its hydro shortfalls with coal-fired power using lignite, which is not only the dirtiest form of coal but has increased fivefold in cost since the drought began.

There is, however, a domestically secure, carbon-free resource that will conserve water, enhance regional air quality, and broaden reservation economies beyond the opportunities offered by casinos and smokeshops.

For the past decade, several Missouri-basin tribes—the Lakota, Nakota, and Dakota, the Mandan, Hidatsa, and Arikara, and the Omaha—have gathered as the Intertribal Council On Utility Policy (Intertribal COUP) to formulate energy and utility policy recommendations, beginning with how best to utilize the hard-won 20-year contract for a WAPA allocation of about 4 percent (65 megawatts) of the river's hydropower capacity. (WAPA manages over 17,000 miles of the high-voltage transmission system stretched across 15 western states. If you live on an Indian reservation, you are 10 times less likely to have electricity than anywhere else in the country, but are far more likely to have a federal transmission line towering overhead.) Federal power began flowing directly to reservation customers in 2001, after 15 years of unprecedented tribal cooperation to secure this modest benefit from the dams that flooded tribal lands 50 years ago.

One condition of the allocation, however, was for tribes to develop integrated resource plans for reservation energy resources. The resulting assessments showed that, along with remarkable solar, geo-thermal, and biomass resources, the COUP tribes have thousands of megawatts of power potential in the wind that blows across their reservations every day—one of the richest wind regimes in the world. Moreover, the transmission grid, designed to distribute hydropower from the dams, can just as easily collect and transmit native wind power beyond the region. The Intertribal COUP tribes are collaborating in a plan providing for tribal control and ownership of reservation NativeWind™ projects that could install up to 3,000 megawatts of capacity on two dozen reservations within a decade, to meet tribal needs and produce power for sale into the regional grid. That grid once carried 100-percent renewable hydropower, but as demand growth has outpaced hydroelectric capacity and drought has reduced water levels, hydropower is now less than 20 percent of the mix. The balance comes from coal-fired plants, but the COUP plan could recharge the system with clean, renewable, and water-saving power.

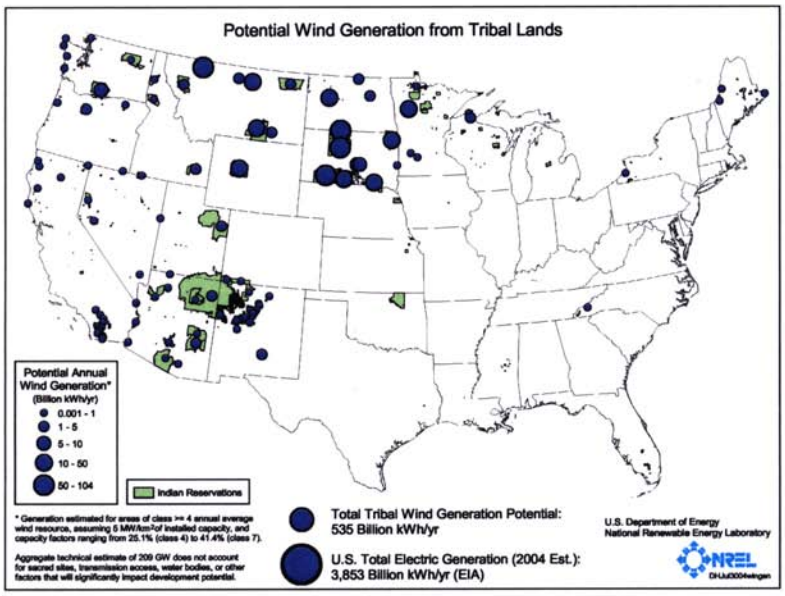
The current drought may be a result of climate change, or part of a natural transition from the historical long-term wet cycle to a dry phase. In either case, the West's electrical system relies heavily on water that is in short supply and may remain so. Wind needs no water to generate electricity, and unlike coal produces no CO_2 emissions. Rural tribal economies building upon our domestic wind resources offer both Indian Country and our nation a no-regrets option for energy security and a step toward national energy independence.

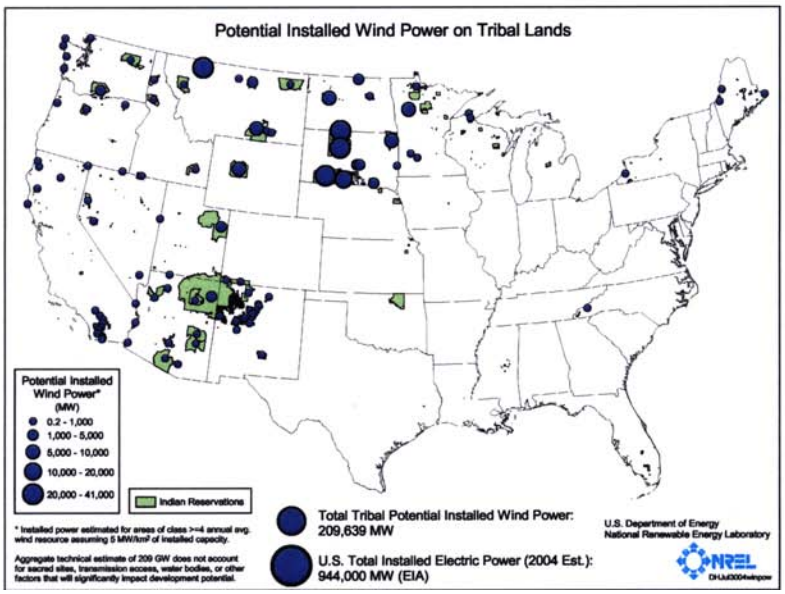
Bob Gough *is Secretary of the Intertribal Council On Utility Policy. For more information on the work of Intertribal COUP and its partner organizations, go to www.energyindependenceday.org.*

Response to questions submitted for the record by Robert Gough, Secretary, Intertribal Council On Utility Policy

Thank you for the opportunity to address your questions with regard to my testimony of April 19th before the Energy and Minerals Subcommittee of the House Resources Committee.

Can you quantify some of the environmental or social benefits you foresee specifically for tribes from the wind energy development areas you envision?





Wind energy development on tribal lands can have significant social and environmental benefits in the Northern Great Plains and throughout the West.

The social benefits would include the ability of well over 150 reservations to be able to generate most of the energy consumed on their reservation from clean re-

newable energy, with over half of those able to provide off reservation sales of surplus energy, providing millions of dollars of income over the life of the projects. One important aspect of wind power as a renewable resource, tribes could generate 35% to 40% of their electricity from a one-time, single capital investment, to realize both power and additional revenues from the sale of "green tags" (the environmental benefits associated with non-polluting generation) also called "renewable energy credits" or "carbon offsets" for the 25 to 30 year life of the project, and after that time period, have no open pit holes in the ground, have unpolluted waters and still have 100% of the resource they started with.

Further, it has been estimated by the Union of Concerned Scientists that over the life of the project there is one new job for every 10 megawatts of installed generation. With an estimate 209,639 total tribal potential installed megawatts from wind, there could be at least 20,000 new, direct, longterm, well paying jobs created in Indian Country to service the tribal wind energy potential. Construction could add some 7,000 to 10,000 or so well paying, short-term reservation jobs that would have applicability in the off reservation wind industry as well. Additional jobs could also be assumed if manufacturing and assembly plants for wind power technologies were located in Indian Country. It is unlikely that the full potential wind power on tribal lands would actually be realized, so job estimates would necessarily be revised downwards in proportion to the actual build out, both on tribal lands and on other federal lands where Tribes may exercise their government to government partnerships for tribal projects may be built on federal public lands. A further benefit would be for employment in more energy dependent industries and activities that could use wind energy as electricity or in other forms (such as mechanical) or stored as ice or heat, for later use in heating or cooling (displacing need for carbon based electricity). Such energy intensive activities might be agriculture based, such as for water pumping, green house heating, lighting and cooling, food processing, and in service activities such as community or industrial laundries for hospitals and care homes.

The environmental benefits would include a major reduction in air pollution and green house gas generation. Given that well over half of America's electrical power comes from the burning of fossil fuels, if tribes installed up to their potential, then nearly 25% of that fossil generation could be displaced by tribal wind power, leaving almost 32,000 tons of coal in the ground and carbon out of the atmosphere for each megawatt of wind generation over the life of the project.

Beyond air quality benefits, wind power does not consume any water when compared to conventional generation, such as coal, oil, nuclear or gas power plants, most of which boil water to spin turbines and require make up water even for closed loop systems and require the evaporation of thousands of gallons of water per minute to cool their steam plants down. In the drought stricken West, the water savings alone could be extremely significant.

Your testimony focused on wind power, but please share any thoughts you have on solar power generation on tribal lands as relevant to the jurisdiction of the Subcommittee on Energy and Minerals and the Energy Policy Act of 2005.

Tribes have already utilized both photovoltaic and active and passive thermal technologies capturing solar power in a variety of ways for electricity and hot water, particularly to meet residential housing and remote, off-grid electrical needs.

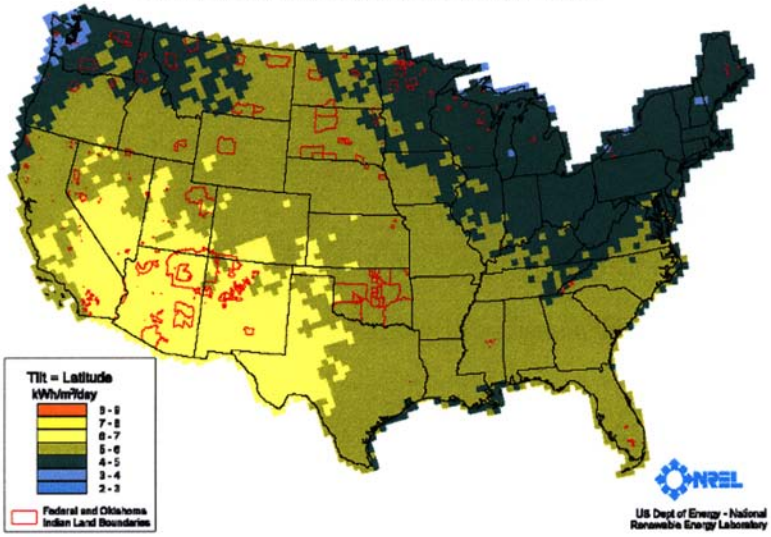
A detailed report on the vast array of tribal renewable energy opportunities has been produced by the Energy Information Administration and is found at: http://www.eia.doe.gov/cneaf/solar.renewables/ilands

And, specifically, at:

http://www.eia.doe.gov/cneaf/solar.renewables/ilands/chapter3.html

The following slides from that EIA report show the country's solar photovoltaic and large scale solar power potentials.

Figure 11. Solar Photovoltaic (PV) Resource Potential



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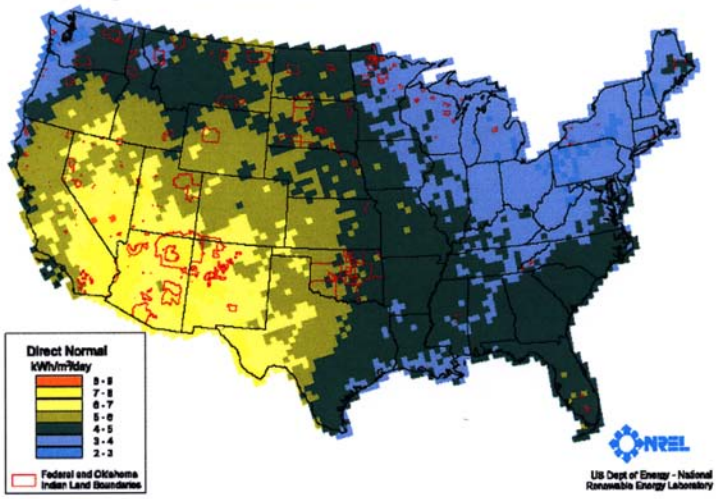
Page last modified on Tue Apr 29 04:16:18 MDT 2003.
URL: http://www.eia.doe.gov/cneaf/solar.renewables/ilands/fig11.html

Figure 12. Concentrated Solar Power (CSP) Resource Potential



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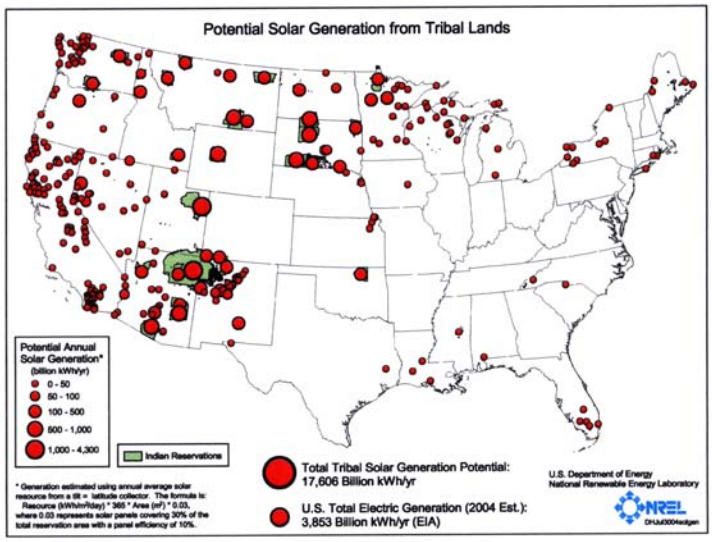
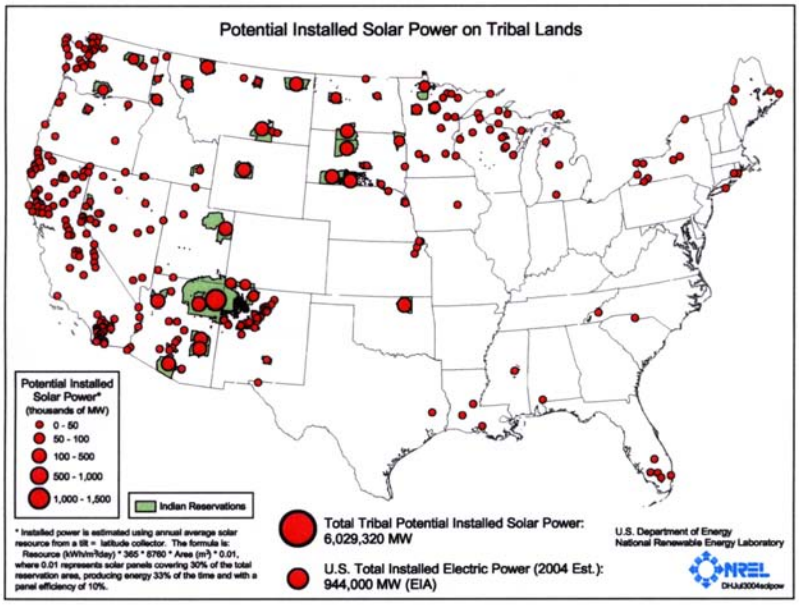
Page last modified on Tue Apr 29 04:16:18 MDT 2003.
URL: http://www.eia.doe.gov/cneaf/solar.renewables/ilands/fig12.html





As can been seen by the slides above, Tribes have an extremely significant solar potential on their federal Indian reservations, with over 17,606 billion kilowatt hours available annually. While solar power is often more expensive on smaller scales technologies, Tribes could, in partnership with federal projects and agencies,

produce solar power to meet local and regional needs. With regard to tribal renewable energy development on lands subject to this subcommittee's jurisdiction, several of the southwestern Tribes are exploring some large, utility scale projects that would warrant significant investment to jump start solar technology manufacturing that could be of a scale to bring down solar costs. Again, utility scale projects installed on tribal or federal lands can produce a significant contribution to the country's energy mix.

Again, I thank the subcommittee for their consideration of the renewable energy potential on tribal lands and the opportunities for Tribes to consider projects on a variety of other federal, non-tribal lands throughout the West. Tribal participation in industrial scale projects will also require appropriately crafted incentives that do not penalize tribal participation in renewable energy projects. Congressional support and passage of such legislation as H.R. 1954, which will allow tribal to transfer renewable energy production tax credits in the context of tribal joint ventures with private capital and expertise.

Mr. COSTA. Thank you very much, Mr. Gough. I thought all the wind that occurred here originated here but that must be a different kind of wind I am talking about. Our next witness—and we will come back to you with questions—is Ms. Lynn Jungwirth, is that correct, the Executive Director for the Watershed Research and Training Center.

STATEMENT OF LYNN JUNGWIRTH, EXECUTIVE DIRECTOR, THE WATERSHED RESEARCH AND TRAINING CENTER

Ms. JUNGWIRTH. Thank you.

Mr. COSTA. Thank you.

Ms. JUNGWIRTH. I am happy to be here.

Mr. COSTA. We are happy to have you here.

Ms. JUNGWIRTH. And to talk about the potential for biomass from public lands. I understand the testimony about the permitting processes and the difficulty with the technologies. Biomass and public lands has other problems, as you might imagine. Getting social agreement to do that has been a challenge as well as making the economics work.

I work with public land communities all over the west, and my job was to bring to you some examples of how we are approaching that and how that seems to be working out. The biomass issue on public lands for us is a natural resource management issue. It is not a renewable energy issue. We have lots of public lands that need to be restored, and the fire suppression budget, as you probably know, is really inhibiting the ability of the land management agency to manage their lands and to restore them so that the fire that costs all that money does not have to happen. Biomass we see as part of that solution.

But there are several issues. The only place that this works is where people work collaboratively to set a restoration framework and to agree that they will allow the NEPA process to move forward to make that supply available. We have seen that happen. It works where local businesses have ownership and try to figure out the highest and best use. Wood biomass to electricity is only one energy use of wood. Liquid fuels is going to happen, and then you have thermal energy from wood pellets.

We think that this is really important. A stand alone biomass plant that just makes electricity is 20 percent efficient, 20 percent efficient. Wood ethanol is 50 percent efficient. A wood pellet is 80 percent efficient. We do not believe that subsidizing a low efficiency

use of wood is in our interest and will help us get the restoration work done. So we would like you to consider encouraging the use of high efficiency energy from wood.

We also would like you to consider encouraging integrated use facilities, and let me tell you why that is important. Right now hog fuel for a biomass plant to make electricity is worth about $20 a ton. That is it, and if you put all of that into that biomass market for electricity at 20 percent efficiency on a long-term contract that will be the price you are going to have for 10 years.

In the Apache-Sitgreaves on the White Mountain, they sold that material to a pellet plant who then pulled out higher and better use for post and pole and saw timber, and now they have 13 businesses instead of one business supported by that material, and they have increased the value of that material so the cost of doing that treatment dropped from $600 an acre to $400 an acre, and saved the Federal government $20 million. We have to let this integrated use happen, differentiating the markets, letting people get access to material to create value for that material because the Federal government cannot pay for the restoration of Federal lands anymore.

Biomass is a good way to help us do that but only if it is appropriately scaled, only it have the social agreement through a restoration collaborative framework so people let the NEPA happen, and only if we encourage integrated use. There you go. You have time back.

[The prepared statement of Ms. Jungwirth follows:]

Statement of Lynn Jungwirth, Executive Director, Watershed Research and Training Center, Hayfork, California

Thank you for the opportunity to address these important subjects today. I work in a small, public land community in the middle of the Shasta-Trinity National Forest. In 1994 our forest changed from timber management to management for biodiversity, clean water, clean air, and other ecosystem services. The icon of that change was the Northern Spotted Owl. We have worked diligently since the early 1990s to find pathways to restoring the forest, protecting the owls and the coho, and restoring our local economic vitality. During that period I have worked with others on the National Fire Plan, (I currently serve on the Western Governors' Forest Health Advisory Group), stewardship contracting, collaborative stewardship, Community Wildfire Planning, and the nexus of forest management and community health. Through the Rural Voices for Conservation Coalition, a group of over 60 western community groups working with public land issues, I have developed a unique perspective on biomass and renewable energy, which I hope to share with you today.

My comments will deal with the role of public lands and the role of federal investments in developing biomass energy facilities with supply from public lands. The Community Forestry groups believe biomass utilization is a land management issue, not a renewable energy issue. We see renewable energy as part of an integrated strategy to

1. Improve the resilience and health of the forest.
2. Reduce the cost of fire suppression
3. Improve the social and economic condition of public land communities

I believe our collective jobs are to use the federal investment and federal lands to maximum advantage in terms of forest health, energy efficiency, and local economic returns. Luckily, we have some examples of how that can work and what it takes to make it work. My comments are based upon actual experiences on the ground and in your public land communities.

Renewable Energy production is possible in an integrated-use program. It cannot stand alone.

Rural businesses and communities are working with Forest Service and BLM partners to develop "integrated-use biomass facilities". These facilities usually

include a clean chip product (for sale to a regional paper plant), a dirty chip product (for use in a co-located pellet plant or wood-fired boiler for steam/electricity), a post and pole processor, and a small log processor. The key is the ability to sort and merchandize for highest and best use, therefore creating maximum value for the raw materials and maximum market flexibility.

These integrated-use program oftentimes include a composter, dry-kiln, animal bedding, or landscape bark plant, moulding plants, and wood-plastic facilities. The key is that they are developed at the local level as appropriate. Instructive examples come from the Collaborative Forestry Restoration Program in New Mexico, the White Mountain Stewardship Contract on the Apache-Sitgraves National Forest, and the Boardman Chip Plant. Other communities around the west are in some phase of similar development.

The White Mountain Stewardship Contract on the Apache-Sitgraves National Forest is the most mature example. It included: 1) A collaborative process which included a very powerful environmental activist community. 2.) Federal Investment of $1.5million in four businesses through the Economic Action program of the Forest Service, Forest Products Lab woody-biomass grants, and the Four Corners/Sustainable Forests Partnership. 3.)A ten-year stewardship contract on 150,000 acres which brought a consortium of local businesses to the table. 4.) An integrated use approach including clean chips/dirty chips/roundwood/and sawlogs.

So far, the results have been: per acre costs of treatments fell from over $600/acre to under $400 (that alone is a $20 million savings to the federal treasury); 9,000 acres treated; 24,000 acres under contract; 70,000 acres NEPA ready; businesses involved grew from five to thirteen with expansion into molding/flooring/ and oriented strand board in the planning stages; job count, 449 f.t.e.; and, $12 million per year in local purchasing of goods and services. The payroll and business taxes alone have proven this to have been a smart investment for the federal government.

If that supply had been dedicated to a single-use stand alone biomass to electricity plant, the employment would have been 15-24 jobs at the plant, and the supply would have been monopolized by that plant for 10 years. Single use is an inefficient model for public land supply and limits innovation and adaptability.

Lessons from the field:

A. A Collaborative forest restoration program appears to be a pre-requisite for public land supply: It provides a politically durable agreement to maximize forest health and provide raw material for utilization through stewardship contracts and appropriated dollars.

Collaborative forest restoration projects require an up-front federal investment in the collaborative process. Where restoration frameworks have been worked out through a multi-stakeholder process projects have social support and appeals are reduced. Examples abound throughout the west and appear to be essential in making biomass available from public lands. Collaboration is not in current agency performance measures or targets and therefore, often does not get dedicated resources.

B. Using woody bio-mass for solid pelletized fuel which maximizes the energy efficiency in wood.

A standard wood-fired electrical generation plant recovers about 20% of the energy in the wood it burns. Converting wood to ethanol gives you about a 50% net efficiency. Converting wood residues into solid pelletized fuel gives you about a net 80% efficiency.

The cost of a standard wood-fired bio-mass to energy electrical plant is about $2.5 million per megawatt. That would be about $25 million for a 10 megawatt plant. A ten megawatt plant requires 167,500 green tons of wood residue per year. A ten megawatt plant requires a 7.5cents/kilowatt hour in order to work economically and today the biomass to electricity industry needs a subsidy to reach that 7.5cents. If you assume thinning 25 tons/acre you would have to thin 6,700 acres per year to feed the plant. That's roughly the equivalent of 33.5 million board feet.

A wood pellet facility for 60,000 green tons (about 35% of what a 10 megawatt plant would require) can be built for $2.5 million (about 10% of what a 10 megawatt plant would require.) That 60,000 green tons is roughly equivalent to 12 million board feet but delivers roughly 1.5 times the renewable energy of the 10 megawatt biomass to electricity plant.

If the federal policy is to subsidize the market for bio-mass generated electricity, then perhaps it needs to incentivise markets for solid pelletized fuel as well—which can directly heat schools, hospitals, public buildings and homes, as well as co-fire coal plants and help them burn more cleanly.

C. Build Integrated "Use facilities: to maximize local economic returns.

Integrated-use facilities simply mean a single campus making more than one product out of forest biomass. Currently the historic example is a sawmill or veneer plant with a wood-fired boiler for both steam and electricity. These are the plants you see being proposed and built in Oregon, where they still have private land forestry and the public land supply is becoming more predictable because it comes from thinnings. These plants work economically because the wood products plant uses the heat and some of the electricity for its own processing. That is the traditional "sawlog" version.

The woody bio-mass version is a small scale facility that can produce a clean chip for the paper industry, hogged-fuel for a biomass plant or pellet plant, a small pole, and a small log processing facility. Oftentimes a composter is added, or a dry kiln, or a landscape bark facility. The concept is, you go for the highest and best use. That allows you to be flexible over time as markets change. It also allows you to have multiple locally owned businesses participating. These integrated use facilities work for local economies because of appropriate scale, and appropriate ownership structure. They also add the greatest value, eventually making the raw material more valuable, thus reducing treatment costs on public land.

1. Ownership structure: While many reports have noted the potential for rural development around biomass utilization, most fail to address how a community might participate in the benefits. The examples of bio-energy that has been most studied recently are ethanol plants owned by farmers or co-ops of farmers. Ownership of ethanol refineries by local farmers and community members is seen as the key aspect to sustainable rural development. Local ownership, as opposed to absentee-ownership, assures that the facility is based to some extent on local resources and needs, and that much of the money generated remains in the local economy. While "economies of scale" traditionally pointed to larger plants, today "economies of scale" point to the added benefits of smaller, locally owned plants, where typically the spending of dividends by community investors has been found to contribute significantly more to the local economy. An initial plant corn-ethanol would create about 40 full-time jobs and an increase in annual direct spending in the community of around $56 million. When community investors re-invest dividends in their community we see an additional 821 jobs, an increase in $37 million in household income, and over $60 million more in Gross State Product—than what a community gains through local siting of an absentee-owned plant. (studies by John Urbanchuk, "Economic Impacts on the Farm Community of Cooperative Ownership" (2002-2006) www.ncga.com)
2. Federal Role: If the Federal Government wants to invest in biomass utilization through transportation subsidies, technical assistance, and grants, it would do well to incentivise these integrated-use facilities now emerging. For example: SBS Wood Shavings in New Mexico is now SBS Wood Shavings and Sawmill and Dry Kiln; Dodge Logging in Oregon is now the Boardman Chip Plant and Pellet Mill and small log mill, Fremont Lumber is working with DG Energy on a mixed-use facility in Lakeview, Oregon as is the Warm Springs Tribe in Central Oregon.

D. Scale is an issue. It's a supply issue:

In the earlier discussion of a 10 megawatt power plant (considered small scale by many in the biomass industry) the supply required is equivalent to 33.5 million board feet. Consider, if you will, the drastically reduced allowable sales quantities on most of your National Forests. For instance, the entire ASQ for the Trinity Forest, where I live is 28 million, and they rarely put out more than 8 million (the ASQ in 1989 was around 200 million board feet). On the neighboring Klamath Forest (which produced 440 million board feet in 1989)the ASQ is 44 million board feet and they average about 15 million board feet per year.

Large scale facilities can no longer be supported on the public land supply alone. Even where there is an inadequate mix of public/private land, they are struggling to survive.

Small scale isn't just the best alternative for public lands. It is often the only alternative in areas where public ownership is over 50% of the land and volumes of material are so small compared to an industrial scale.

Its an environmental issue: Restoration forestry is a fairly new science. Our monitoring for learning (as opposed to compliance or accountability) is likewise fairly new and while most of the conservation community supports landscape level treatments there are those who don't and who will surely oppose large scale approaches. Collaboration helps. There are several strategies for "scaling up". We believe you are seeing "small scale on a large scale" emerging throughout the west and should

support it. The industry that builds renewable energy opportunities from public land supply has to remain responsive to maintaining forest health in a dynamic system. Diversity in the industry maintains adaptability and stops boom/bust cycles.

It's a sustainability issue: Clean chips, dirty chips, roundwood, and sawtimber allow the businesses to change as the needs of the forest change overtime. At biomass conferences I'm often challenged by activists to defend the "sustainability" of biomass energy plants. My response is simple: "I hope this isn't sustainable. I hope, that in 20 years we are no longer facing 130 million acres of overstocked stands, catastrophic wildfire, and forest conversion to brushfield. I hope we will move on to a more resilient forest, a larger diameter size class and a new global standard for sustaining our public lands for ecosystem services, including biodiversity, clean water, clean air, carbon, and forest products." I do not expect the public lands to be managed for quick rotation fuel for renewable energy plants.

It's a community development issue. The west is replete with infrastructure in the form of abandoned mill sites, commonly referred to as "brownfields". They usually are 50 or so miles apart. They are located on major transportation routes, close to transmission lines (because most used 3 megawatts of power for their processing) and close to water sources. These old mill sites are perfect for small scale, integrated-use facilities are fairly low capital, reduce the energy loss and the high costs of transportation, and are appropriate to the landscape and the community.

Recommendations:

The Federal Investments should be in priority areas where fire suppression costs are escalating, over 50% of the forest is in Fire Risk Condition Class 3, and the likelihood of a catastrophic fire is over 10 on the current assessment scale. The Forest Service has this data available by Region. Investments should go to areas within the highest risk quartile in each region.

The Federal Investments should be in creating the supply: stewardship contracts, increased planning resources, and increased resources for collaborative processes. Focused up-front investment in collaboration paid off for the Apache-Sitgraves, the Lakeview Stewardship Unit, the Colorado Front Range, and many other areas.

The Federal Investments should be in developing the harvesting and processing capacity: Continue to fund The Forest Products Lab Woody-biomass Grants and Technical Assistance; fund Section 210 of the Energy Bill and perhaps add some pilots for these integrated-use facilities; fund the Forest Service Economic Action Program, this program has the flexibility to provide grants to communities for collaborative planning, technical and market assistance, and demonstration projects. The Farm Bill's Rural Development Title could provide substantial funding to assist rural business start-ups and provide public land communities and businesses with access to capital. Most Rural Development programs are aimed at private landowners. Public land communities do not own the land and will probably need a specific program. The Farm Bill's energy title and the Energy Policy Act could put greater emphasis on appropriate, community-scale development. It may be appropriate to authorize and fund some pilot/demonstration integrated-use facilities.

The Federal Investments should be in incentivising markets: subsidize the burners and boilers needed to use pellets for heat, equalize the renewable energy tax credit to the same standards as wind and solar for wood-fired electrical generation when it is part of a combined heat and power, integrated-use facility.

Do not subsidize transportation. That seems counter-intuitive if we are trying to save energy. Instead, fund forest health treatments and require the utilization of the material when appropriate. (This is an aside: Agency targets often inadvertently double count acres when one line item is used to pay a crew to cut and pile biomass (say at $600/acre) and a force account crew is paid to burn the piles (say at $400/acre). By reporting twice and counting twice, the average per acre treatment is $500. If a biomass facility wants to cut and extract the same material at a cost of $700, it cannot compete merely because of the accounting system, not the outcomes. To incentivize utilization, perhaps acres treated through extraction and therefore not requiring pile burning should also be double counted. Considering the return to the federal coffers through payroll and business taxes, perhaps they should be triple counted.)

Take a business plan approach. Award these incentives to projects where the business plan shows the reduction in cost of acres treated over time and the reduction in the likelihood of a Type 3 fire incident overtime as a result of these investments. Award these incentives to integrated-use facilities in public land communities with low income and expressed need for economic development (hub-zone designation comes to mind). Award these incentives to communities in counties where the federal government owns over 50% of the land (for example) and where the fire risk

condition class is very high and the risk of catastrophic wildfire is ranked above 10 on the current scale.

The public lands are in need of restoration. Your public land communities and businesses are taking the lead in finding solutions to these complex challenges of developing social agreement, learning appropriate land treatments, finding economic uses for by-products of forest restoration/ fuels reduction and creating a fire-adapted society. Renewable energy is an important piece of this system, but forest health and community vitality must remain the drivers.

Mr. COSTA. Wow. You have given us an extra minute. Well we will reward you in some way.

Ms. JUNGWIRTH. Thank you.

Mr. COSTA. The Chair is pleased to welcome a new addition to our Subcommittee this afternoon, Congresswoman McMorris from eastern Washington state, and she has a constituent I believe who will be testifying here shortly, and it is good to have you here. Our next witness is another Californian. I understand you are from Hayfork, California?

Ms. JUNGWIRTH. Hayfork, California, yes.

Mr. COSTA. Wally Herger country, right?

Ms. JUNGWIRTH. Absolutely, Wally Herger country.

Mr. COSTA. Another Californian, Mr. Joshua Bar-Lev who is Vice President of Regulatory Affairs with Bright Source Energy and a gentleman who I think I ran across in Sacramento in a previous life. Mr. Bar-Lev.

STATEMENT OF JOSHUA BAR-LEV, VICE PRESIDENT OF REGULATORY AFFAIRS, BRIGHTSOURCE ENERGY

Mr. BAR-LEV. Is that right?

Mr. COSTA. Yes.

Mr. BAR-LEV. I would like to remember that.

Mr. COSTA. You were with PG&E?

Mr. BAR-LEV. Yes, I was for almost 30 years.

Mr. COSTA. Yes.

Mr. BAR-LEV. Thank you very much for having me.

Mr. COSTA. We will not go all over those people that we know together but go ahead. Please testify.

Mr. BAR-LEV. OK. I would like to talk about technology, land and policy. You have my testimony, and I have provided a lot of information, and I think I have also provided some maps up there that I think are great maps that show the potential for this technology. Let me talk a little bit about the technology. In a former incarnation, which is when I may have known you, I was vice president of a company called Luz International Limited that built solar projects in the Mojave Desert, and between 1984 and 1991, we were able to build nine of these projects, and they are still there today operating beautifully and reliably, and in a total of 350 megawatts, which is enough for roughly 400,000 people.

That photograph is a picture of one of our projects. I believe that was probably number six, probably only about 30 megawatts. Each of our projects and most of these concentrated solar power type solar projects need about a square mile for every 100 megawatts. The reason that this picture is so instructive is that I was with that company 16 years ago, and there are lessons to be learned because that company ultimately went bankrupt.

Mr. COSTA. Are those people down in between those solar panels? It looks like four people from here.

Mr. BAR-LEV. Those are three I think human beings.

Mr. COSTA. Well that give size and perspective. I was trying to figure out if those were ants or if those——

Mr. BAR-LEV. No. And by the way what is sort of interesting about that photograph is it was the cover photo for Audubon magazine in 1991, and on the bottom right on the caption would say on the magazine cover, it said, "Renewable energy-answer to global warming?" And that was 1991.

So what we were able to do in the seven years of our existence at that time, just through very simple tinkering, economies of scale, learning, was to reduce our costs by almost 50 percent, and we were actually we felt we were within earshot of being competitive with fossil fuel, but that was during a period when the Federal and state governments were very supportive of solar energy, and because of long-term policies in place at that time we were able to actually reduce our costs by almost 50 percent.

And that makes me confidently able to tell you that if we had that kind of dedication from this Congress and from the states we would be competitive with fossil fuel in the very near term, and I am confident of that based on the experience I had with Luz at that time and having been at PG&E for 30 years.

The second thing I want to talk about is land, and that is our most treasured resource. If you look at the map over there of the western United States that we got from NREL, what NREL did that is just wonderful actually is that they eliminated all the sloping, all the environmentally fragile high radiation land and basically filtered it out so that what you have there in different colors is optimal solar areas, and all these sort of orange to gold——

Mr. COSTA. You are describing the lower left-hand corner?

Mr. BAR-LEV. That is right. Well, they are spread in Nevada, New Mexico.

Mr. COSTA. No. I understand that but I mean where the inset is where it seems to be magnified.

Mr. BAR-LEV. Yes. But what NREL also did then was that they filtered out. What they wanted to do was show how many of those high radiation areas were near transmission lines, gas lines, highways and load centers, and so what you have and I think you have the maps there, are a tremendous filtering that shows you how valuable this land can be.

The United States has some of the best solar energy in the entire world. Just what NREL has done there is capable of generating 200 gigawatts, which is about three and a half times what California's peak is, and if you wanted to put that in square miles, 200 gigawatts would be roughly 40 miles by 50 miles. So you could put that kind of technology on 40 miles by 50 miles. That is 2,000 square miles of high desert land, probably trying to seek the dark red areas over there, but any of the gold, orange and red areas would be suitable, and you could take care of the entire west's needs.

The problem that we have is we need consistent and stable policy, and that is we need a long-term investment tax credit which has already been submitted to this Congress. I think that is

H.R. 550, and we need the BLM to move forward, to be funded, to identify the optimal solar areas in the west and to provide us with programmatic environmental clearance for those areas, and to work with the DOE to bring transmission to those areas. I am beyond my time, and I very much appreciate the opportunity to speak to you.

[The prepared statement of Mr. Bar-Lev follows:]

Statement of Joshua Bar-Lev, Vice President of Regulatory Affairs, BrightSource Energy

Mr. Chairman and members of the Subcommittee, I am Joshua Bar-Lev, Vice President for Regulatory Affairs, BrightSource Energy, a company located in California that seeks to develop utility scale solar energy projects. I am here to speak on behalf of the utility scale solar member companies of Solar Energy Industries Association (SEIA). SEIA is the national trade association of companies which supports the development of clean renewable solar energy. Neither BrightSource nor I are new to this subject.

BrightSource has the same management team as did a solar company that ceased operations in 1991, Luz International Ltd. Over 16 years ago, Luz built nine (9) utility scale solar energy plants in the California Mohave Desert that still are operating today and together produce 350 MW of electricity. That history informs my remarks and recommendations to this Subcommittee on what actions Congress might take to encourage utility scale solar energy.

First, some background. In order to use solar energy to produce commercial levels of power, a technology called Concentrated Solar Power (CSP) is used to reflect and focus solar energy onto an absorbing material. This absorbing material becomes quite hot and in the case of the use of a heat engine causes a gas to expand and drive a piston, or in the case of a steam turbine heats water to create steam to power a conventional steam turbine. Either CSP method creates electricity which is then transmitted to the customer over transmission lines. See U.S. Department of the Interior, Bureau of Land Management, Solar Energy Development Policy (IM 2007-097), and attachment defining solar energy systems. Ex. 1. (www.blm.gov/wo/st/en/info/newsroom/2007/april/NR0704__1.print.html)

There are a number of CSP companies in the market—each with a different technology. These technologies include: the use of parabolic mirrors to focus the sunlight against tubes that run up and down the field of mirrors; others use flat mirrors to reflect against a tower containing heat absorbing pipes; and others may use photovoltaics to concentrate the sun. Unlike direct use solar, each of the CSP technologies is built to generate large amounts of electricity that can be integrated into the utility system.

Typically, utility scale CSP systems need roughly a square mile (800 acres) of reflective mirrors and turbines to generate about 100MW of electricity. A 100MW facility serves a city of roughly 100,000 people. CSP plants are particularly well-suited to meet peak demand load in the West beginning in the late morning and then throughout the daylight hours. CSP plants typically use natural gas as back-up power for those times when the cloud cover prevents the solar powered start-up and shut-down of the CSP plant. CSP plants are built to last 30 years and typically use very little water.

I invite the Committee to take a field trip to see these impressive, essentially carbon-free systems in operation. A CSP system is being completed near Boulder City, NV, another is underway in Arizona and a number are in operation in Spain. As I mentioned, I was personally involved in the construction of several CSP systems between 1984 and 1991 in California's Mohave Desert that continue in operation today—generating enough energy for 400,000 people. See http://www.blm.gov/wo/st/en/prog/energy/solar__energy.html for links to Mohave Desert projects.

These California projects, besides having personal meaning to me, are an instructive example to this Subcommittee about the consequences of failing to maintain consistent, supportive policies to encourage the development of alternative energy sources. The momentum that was encouraging the development, testing and increased economies of CSP technologies in the 1980's and 1990's was lost when the government reversed policy course for solar energy. It is my opinion that our nation squandered an opportunity to sustain the development of a clean, secure, and infinite source of energy.

The lessons from these early California CSP plants are several. First, during the years we built these projects, the federal and state governments had in place long-term tax policies that encouraged the development of utility scale solar projects.

Second, these long-term tax policies gave the industry stability and predictability. This allowed Luz to learn as we operated these solar plants, to find economies of scale, and to build, finance and sell projects at a progressively lower cost of production. By 1991, we were able to build our projects at almost 50% of the cost per kWh compared to our early projects in 1984. Luz believed that within a few years we would become competitive with the cost of fossil fuel power plants.

Third, once those supportive government policies ended, our capital intensive projects could not be financed and we had to cease operations. Since 1991, no utility scale solar power plant has been built in the United States until very recently. Favorable tax and government policies for alternative energy are once again encouraging development of CSP.

After being in the solar business and also working as a chief counsel at a utility, Pacific Gas and Electric Company, for many years, I can tell you confidently that with supportive near-term federal and state policies in place, large scale, and cost effective, competitive solar energy is within reach. That is the conclusion of many experts, including the Department of Energy (DOE), and is also the conclusion of the Western Governors' Association (WGA) in their 2006 resolution supporting the Clean and Diversified Energy Committee (CDEAC) report. To assist the Subcommittee, I have attached the WGA recommendations of their Policy Resolution, 06-10, "Clean and Diversified Energy for the West", detailing near term renewable energy policy initiatives as well as the executive summary of the CDEAC solar committee report. Ex. 2 See also www.westgov.org/wga/initiatives/cdeac/index.htm for links to full reports.

I will come back to SEIA's policy recommendations to the Subcommittee in a moment, but let me start with an important basic foundation for the U.S. CSP industry—our unique national resource—plentiful, flat, non-environmentally sensitive desert land in the West that has high solar insolation, low cloud cover and is in proximity to gas and electric transmission lines, highways and urban load centers.

This CSP quality land is largely public land managed for multiple uses including energy production by the Department of the Interior, Bureau of Land Management (BLM). BLM reported that as of April 1, 2007 there are 43 solar applications pending in California, Arizona and Nevada with 34 in California alone. As recently as the end of 2004, there was no expressed interest in CSP development on BLM public lands. Enactment of California's renewable portfolio standard and favorable tax policies led to the filing of these BLM applications—most over the last eight months.

In 2003, BLM and the Department of Energy (DOE), National Renewable Energy Lab (NREL) issued a GIS-based report, "Assessing the Potential for Renewable Energy on Public Lands." See http://www.nrel.gov/docs/fy03osti/33530.pdf. More recently, in support of the WGA CDEAC initiative, NREL has mapped the best locations for solar energy on public lands in Arizona, California, Nevada, and New Mexico. The NREL report and GIS maps identify areas with 1 percent or less of slope with high levels of solar insolation for utility-grade CSP plants. I have attached the multi-state and California CSP maps prepared by NREL. Ex. 3 (http://www.nrel.gov/csp/maps.html).

The NREL study "filtered out" unsuitable land that had too much slope (mountains), was too cloudy, too environmentally sensitive, in or near Wilderness, Parks or other unsuitable areas. The result will not surprise any of you from the West. The western United States has some of the best solar radiation areas in the entire world. Conservatively, there is enough land using today's utility scale technology to generate at least 7000GW of solar energy. This 7000GW of potential solar energy is about seven times the total United States demand capacity. To give you a sense of scale, California's peak demand capacity is 60GW.

California alone has at least 6000 square miles of ideal desert terrain for CSP. However, if we limit the development of CSP to high-potential solar areas that also have proximity to gas and electric transmission lines, we can conservatively estimate that we have ideal desert land for at least 200GW.

How do we bridge the cost gap to get utility scale solar energy to be competitive with conventional and other renewable fuels? Energy experts believe that a concerted effort to develop somewhere around 4GW (which represents about 10% of the expected growth in peak load for the western states) of CSP in the next decade will bring the cost down to competitive levels, through R&D, economies of scale and learning curve benefits. The WGA study found that development of as little as 4GW will bring the cost of solar down to fewer than 10 cents a kWh, which is equivalent to $7 per MMBTU gas.

Production of 4GW of CSP energy will have major economic benefits—one study by Black and Veatch estimates that 4GW will produce a $22 billion increase in gross state product, including 13,000 construction jobs, 1,100 permanent jobs and $2 billion in state tax revenues. And this 4GW will conservatively displace almost 8 million tons of CO2, which is 7% of California's electric utility output of carbon.

What governmental policies will result in deployment of sufficient utility scale solar energy in the western United States in the next decade? I believe it's a combination of federal and state actions. I will focus first on federal actions and conclude with a brief mention of state initiatives.

RECOMMENDATIONS

Federal actions:

- Facilitate the use of federal public lands for CSP. Public lands are uniquely important for the development of CSP. Much of the best CSP solar is on public lands and these lands also provide the land area necessary for CSP facilities. First, the Secretaries of Interior and Energy should carry out the directive of EPACT 2005, § 201 to assess and update available assessments of solar resources. See also EPACT § 1833 (directing the preparation of a National Academy of Science (NAS) study of the renewable potential of public resources.) The agencies should be provided the budgetary resources to identify, in no more than six months, optimal sites for utility scale (CSP) solar energy. By optimal, I mean sites that are in proximity to electric and gas transmission lines, are sufficiently flat, not environmentally sensitive, and have a radiation level of at least 7 kWh per square meter. Although the NREL GIS report and maps mentioned above are a good start, more assessment work can and should be done to accelerate the development of CSP. For example, the NREL GIS maps must be integrated with the BLM land use planning GIS, which is not now the case.
- These identified optimal sites should be set aside as potential "CSP solar parks" of at least 10 square miles (enough for at least 1GW in each solar park). This designation would allow common infrastructure—roads and transmission lines—to be effectively consolidated and timely and cost-efficient planning and environmental permitting completed.
- BLM must be directed to expeditiously update their land use plans in these optimal areas to provide for the use of public lands for CSP projects and the development of CSP solar parks. BLM has recently identified the need to complete new or updated land use plans to include consideration of the NREL solar assessments of CSP potential areas. BLM has suggested that land use plan amendments can be concurrently completed during the application process for a particular CSP project. Ex. 1, BLM IM 2007-097 at 2.
- We are concerned about BLM's suggested approach for land use plan amendments to allow for CSP development. First, conducting plan amendments as CSP projects are proposed would create significant delay for the development of solar power on public lands. These BLM plan amendments take at least 18 months and, in California, some planning processes have stretched as long as 10 years. This should be an unacceptable delay to those in Congress interested in accelerating the development of CSP. Second, this proposal places the considerable costs of preparing a plan amendment and the required National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) on the first CSP project proponent in the area. We do not believe this is the most efficient way to analyze the use of public lands for CSP nor is it appropriate to have the first applicant in line bear the cost for all other applicants to follow. We believe the development of public land solar is a larger public good that should be borne by the public as a whole. Accordingly, we request that Congress consider the use of a Programmatic Environmental Impact Study (PEIS) for CSP that would, in one action, amend all BLM land use plans in these optimal areas to provide for the development of CSP. We request that Congress fund the preparation of this PEIS. A PEIS was utilized by the BLM in amending land use plans to permit the development of wind energy on public lands in 2005. See http://windeis.anl.gov. A PEIS is being used by BLM and DOE to carry out the West-wide Transmission study in EPACT 2005 § 368. See http://corridreis.anl.gov. A CSP PEIS would be timelier, more cost-effective and would demonstrate the nation's support for alternative energy sources. Preparation of such a CSP PEIS should be given a time certain deadline of 18 months for completion.
- Congress should examine what other federal procedures could be made more efficient: including project-specific NEPA documents; Endangered Species Act consultations; National Historic Preservation Act cultural resource consultations;

and related federal permitting procedures including BLM's processing of right of way permits for CSP projects. Today solar projects must go through a second round of project specific NEPA and environmental compliance after the NEPA conducted at the BLM plan level. This takes considerable time and we suggest that Congress consider how to expedite the permitting process so that CSP developers may take advantage of the tax incentives and the current window of opportunity. One process improvement we would suggest is that the proposed CSP PEIS for solar parks act as the environmental clearance process for such solar parks so that projects within the solar parks are deemed in compliance with all federal and state environmental laws and process. Alternatively, Congress could consider the use of a NEPA categorical exclusion for CSP projects within identified solar parks analyzed in the suggested CSP PEIS. Or, Congress could consider if project specific NEPA can be tiered to plan amendment NEPA documents. State and federal agencies must be encouraged to work together more efficiently to permit CSP projects.

- Right of way fees charged by BLM for the rental of public lands for CSP projects or for the proposed CSP solar parks should be at the lowest cost for the use of public lands as an incentive to develop solar energy, rather than the highest rental cost. Today, Title V of the Federal Land Policy Management Act (43 U.S.C. § 1761) and BLM right of way regulations (43 C.F.R. § 2804) require "fair market value" for the rental of public land. See also Ex. 1, BLM IM 2007-096 at 2, 4-5. BLM solar policy currently directs that annual rent for CSP be established by BLM using appraised values for "commercial land or industrial land, as of the date of the appraisal." Id. at 4. Thus the rental for CSP is at the highest rental rate for the use of public land—a rate charged for coal-fired power plants or other industrial facilities. For example, in an existing Boulder City, NV example, the fair market value for a CSP facility amounts to $25,000 per acre and several millions of dollars per year in rent. We would ask Congress to direct a specific per acre rental fee for CSP that would be at a dollar amount to create an incentive for solar energy production from public lands. We would suggest that the CSP rental for public lands be closer to the assessed value of the land for livestock grazing rather than the value of the land for industrial facilities.
- The Departments of Energy and Interior should complete within 6 months the directive in EPACT 2005 § 368 to identify transmission corridors in the West with particular attention to transmission to the optimal solar areas identified by the BLM. In addition, the EPACT 2005 § 1221 study should expeditiously identify optimal solar areas where transmission constraints or congestion exist. The Departments of Energy and Interior should work together with state authorities and transmission operators to develop transmission facilities to access such solar areas. Using the authority in EPACT 2005 § 1221 the Federal Energy Regulatory Commission (FERC) should issue transmission construction permits to such areas. In the absence of expeditious transmission permitting and construction by local transmission authorities, the Secretary of Energy, acting through the geographically appropriate power marketing agency, should use its authority under EPACT § 1222 to "design, develop, construct, operate, maintain or own" transmission lines to such optimal solar zones.
- FERC should facilitate interconnections to utility scale solar projects. Right now the FERC and state processes of queuing up and getting interconnections to the transmission grid is time-consuming and beset with bureaucratic delays. It now takes a solar project longer to connect to the transmission grid than it does to permit and construct the solar project. FERC should encourage transmission operators to determine if there is a batch of renewable projects in a given area and then support efforts to permit utilities to add the cost of such interconnection to rates.
- The federal Investment Tax Credit (ITC) for solar currently expires at the end of 2008. Congressmen Michael McNulty (D-NY) and David Camp (R-MI) have introduced the Securing America's Energy Independence Act (HR 550) an eight year extension of the ITC and, currently, the bill has over 50 cosponsors. It is imperative that, despite the challenge of the federal budget process, the ITC for CSP receives a long-term extension. This is the strong recommendation of WGA and recognizes the importance of the ITC to the development of a CSP industry. I have already provided an example of what can happen when the tax policies of the federal government change—the CSP industry stalled. CSP projects are capital intensive projects and take 4-6 years to negotiate, permit, finance and construct. If CSP developers and their suppliers are to have a predictable, stable climate for planning and financing, for building manufacturing plants for mirrors and other parts, and for negotiating multi-year development contracts

to bring down the cost of CSP energy, the industry must have a ten year tax credit.

State actions:

- States must also do their part to facilitate the development of a utility scale solar energy industry in their economies. States should work together with federal agencies to expedite transmission planning and permitting to solar zones. States should make their property and sales tax policies fairer to capital intensive solar equipment. States should encourage longer power purchase agreements with solar developers, reflecting the length of time these projects normally last, and states should enact legislation or promote policies that encourage the construction of transmission to identified solar areas, including the ability to recover the cost of such transmission in rates. Finally, State and Federal agencies must be encouraged to work together more efficiently to permit CSP projects.

Conclusion: On behalf of the CSP member companies of SEIA and BrightSource, I want to thank the Subcommittee for the opportunity to testify about recommendations for change in federal policies to support the development of utility scale solar energy. We have a window of opportunity now, when this Congress and the nation are focused on diversifying our energy supply with clean, low-carbon domestic sources of energy. We urge the Committee to act expeditiously.

Thank you, Mr. Chairman and members of the Subcommittee. I will be happy to answer any questions you may have.

NOTE: Exhibits have been retained in the Committee's official files.

Mr. COSTA. Well thank you very much, Mr. Bar-Lev. We appreciate your testimony, and we will have some questions when we come to that point of the hearing. Our last witness, but certainly not least, and I stand corrected, it is Congresswoman McMorris-Rodgers, and I am pleased to have you here. I answer to a lot of things but that is not here nor there. But a person I believe who is from your part of the country, Mr. Will Lutgen, Executive Director of Northwest Public Power Association and how hydropower has an important part in this effort, and I think you have some suggestions you want to leave with us. Mr. Lutgen.

STATEMENT OF WILL LUTGEN, JR., EXECUTIVE DIRECTOR, NORTHWESTERN PUBLIC POWER ASSOCIATION

Mr. LUTGEN. Thank you, Mr. Chairman, Ranking Member Pearce and certainly to Representative McMorris-Rodgers. Thank you for being here today. I am with the Northwest Public Power Association. We are a nonprofit organization serving 148 electric municipal utilities, cooperatives and public utility districts throughout the western United States.

Our members serve approximately 15 million customers. To give you an idea of our footprint, our most northerly member is the city of Barrow, Alaska, our most southerly member is the Imperial Irrigation District on the Mexican border, and our most easterly member is Tongue River Electric in Ashland, Montana. So we have quite a footprint of utilities that know about public lands.

I am pleased to be here today to share my thoughts about actions that Congress might take to pursue renewable opportunities on public lands. My written testimony covers four things: One, a request that Congress reconsider hydro as a renewable resource; two, NWPPA's support for fully funding renewable energy production incentives or REPI; clean renewable energy bonds so that public power utilities have comparable incentives to investor owned utilities in building renewable energy projects.

My written testimony also covers a request to consider renewable portfolio standards that do not conflict with state standards and recognize that a one-size-fits-all will not work. Finally, my written testimony requests that Congress be very deliberate in how it approaches regulating greenhouse gas emissions and allocation of emission allowances.

Since five minutes does not permit covering everything in my written comments, I would like to spend my time discussing why I think hydro should be a renewable resource. Webster's dictionary defines a renewable resource as, "Capable of being replaced by natural ecological cycles." Under this definition, hydropower is a renewable resource. However, for a variety of reasons over the last number of years hydropower has fallen out of favor, and in many instances is not treated as renewable.

I think it is time for Congress to reconsider this policy because hydro has several very important attributes that make it a valuable addition to the U.S. energy portfolio. First, hydropower is a flexible resource that can be used to produce both base load and peaking energy. Second, hydropower serves a very valuable function in assuring electric reliability. The committee might be aware that during the 1996 west coast blackout that Hoover Dam was used and was resynchronized and brought the west back online. Similarly, Glenn Canyon Dam on the Colorado River is designated as the primary black start unit in the event of a shortage in the southwest.

Third, hydropower works extremely well to integrate wind resources into the existing power system because it can be brought online when the wind is not blowing to backup wind projects. For this reason, the Bonneville Power Administration and the Northwest Power and Conservation Council recently announced a plan to integrate nearly 6,000 megawatts of proposed wind generation into the northwest power system, again using hydropower as the critical backup resource.

Fourth, hydropower is a clean resource that is relatively emissions free and can play a positive role in controlling greenhouse gases. The National Hydropower Association estimates that more than 160 million tons of CO2 emissions were avoided in the U.S. in 2004 when 268 million megawatt hours of hydropower were generated.

Finally, hydropower, unlike other renewable resources such as solar and geothermal, is located in most regions of the country, and therefore would be a benefit to consumers throughout the United States. During the rest of the 21st century, we will face increasingly difficult challenges in order to meet anticipated increases and demand for electricity, reduce emissions of greenhouse gases, and reduce dependence on foreign sources of fuel.

It is my understanding that no single generation resource can meet those challenges alone and that each resource has both positive and negative aspects. I believe we must use all arrows in our energy resource quiver in a balanced way.

In conclusion, I would like to thank the committee for this opportunity to provide some input on why hydropower should be considered as the quintessential renewable resource. I hope you will take the time to read my written testimony regarding the need to fully

fund incentives to develop renewables, the need to carefully consider a national renewable portfolio standard, and the need to treat all forms of generation and regions of the country equally when it comes to policies on emissions of greenhouses gases. Thank you.

[The prepared statement of Mr. Lutgen follows:]

Statement of Will Lutgen, Northwest Public Power Association

Thank you, Chairman Costa, Ranking Member Pearce and other members of the Subcommittee for inviting me to be here today. My name is Will Lutgen, Jr. I'm the Executive Director of the Northwest Public Power Association, an organization of 148 not-for-profit public or people's utility districts, electric cooperatives and municipalities providing cost-based electric services to approximately 15 million customers in the Western U.S. NWPPA also serves over 230 Associate Members and is a member of the National Rural Electric Cooperative Association and the American Public Power Association.

I am pleased to be here today to speak about renewable resource opportunities on public lands. Throughout the West and Northwest, NWPPA members and the consumers they serve have benefited for decades from hydropower generated at federal dams and marketed by the Bonneville Power Administration and the Western Area Power Administration. They have also benefited from hydropower generated at numerous FERC-licensed projects on navigable rivers and streams throughout those regions.

I am here today to share my thoughts about actions Congress can take to:

(1) Recognize that hydropower is a renewable resource;
(2) Fully fund incentives to encourage all sectors of the utility industry to develop renewable resources;
(3) Consider carefully a national renewable portfolio standard; and
(4) Not disadvantage certain regions of the country and certain forms of electric generation as it works to develop policies to address limiting emissions of greenhouse gases.

Hydropower is a Renewable Resource

Merriam Webster's dictionary defines a "renewable" resource as "capable of being replaced by natural ecological cycles..." Under this definition, hydropower is a renewable resource. However, for various reasons, over the last several years hydropower has fallen into disfavor and, in many instances, is not treated as a renewable resource. I think it is time for Congress to re-consider that policy, because hydro has several significant attributes that make it a valuable addition to the U.S. energy portfolio.

First, hydropower is a flexible resource that can be used as a baseload or peaking resource. The Federal Columbia River Power System uses its dams as both a baseload and a peaking resource. Hydropower is relatively affordable and, when used as a "peaking" resource during the hours when electric demand is highest, it avoids the use of much higher cost alternatives.

Second, hydropower serves a very valuable function in assuring electric reliability and restoring power after an outage, because it can be brought on line almost instantaneously. This "cold start" capability can be used to re-start fossil generators, which need a much longer time to come on line.

Third, hydropower works extremely well to integrate wind resources into a power system because it can be brought on line when the wind is not blowing, to backup the wind projects. For this reason, the Bonneville Power Administration and the NW Power and Conservation Council recently announced a plan to integrate nearly 6000 MW of proposed wind generation into the Northwest Power System, using hydropower as the critical backup resource.

Fourth, hydropower is a clean resource that is relatively emissions-free and, thus, can play a positive role in controlling emissions of greenhouse gases. The National Hydropower Association estimates that more than 160 million tons of CO2 emissions were avoided in the U.S. in 2004, when 268 million megawatt hours of hydropower were generated.

Finally, hydropower, unlike some other renewable resources, such as solar or geothermal, is located in most regions of the country and, therefore, would benefit consumers throughout the United States.

In the rest of the 21st century, we will face increasingly difficult challenges in order to meet anticipated increases in demand for electricity, reduce emissions of greenhouse gases and reduce dependence on foreign sources of fuel. No single generation resource can meet those challenges alone and each available resource has

positive and negative aspects. I believe that we must use all available domestic resources to meet these goals in a balanced way.

Need to Fully Fund Renewable Incentives

NWPPA fully supports the tax incentives for renewable resources that Congress authorized (or extended) in the Energy Policy Act of 2005. The two federal incentives that are of particular benefit to NWPPA members, as not-for-profit utilities, are the Renewable Energy Production Incentive (REPI) and the Clean Renewable Energy Bond (CREB) program.

REPI is funded through appropriations and, because it must compete for dollars against a large number of worthy water and power programs, it has been funded, historically, at only about $5 million per year. The Department of Energy estimates it would take more than $50 million per year to pay the full incentive to projects that have already met the criteria to receive funds. In Fiscal Year 2008 and beyond, we hope Congress will remedy this situation and provide adequate funding for REPI.

The CREB program, essentially, provided interest free bonding authority to consumer-owned utilities and other public entities to develop renewable projects. NWPPA supports H.R. 1821, introduced by Rep. Jim McDermott and Jim Ramstad, to extend and expand the CREB program. We urge your support for that bill.

Renewable Portfolio Standard

We understand that Congress will soon debate whether to enact a federal renewable portfolio standard (RPS). To date, 23 states and the District of Columbia have enacted an RPS. When the debate begins, we urge you to consider these factors:

- If there is a "one-size-fits-all" RPS, states that are not lucky enough to have native wind, solar, geothermal or other renewable resources may find themselves at a competitive disadvantage, compared to those states that have plentiful renewable resources. As a partial remedy for this problem, and for the reasons stated above, NWPPA believes that hydropower must be considered a renewable resource;
- A single federal RPS will likely increase the cost of renewable resources by creating a surge of demand for those resources. In addition, in the so-called "organized markets", operated by Regional Transmission Organizations or Independent System Operators, renewable resources sold on the spot market will be priced at the highest bid, which would also likely increase the cost to consumers.
- The debate on a federal RPS should recognize that numerous jurisdictions have already adopted policies on renewables. Care must be taken to "grandfather" those prior state laws or to ensure that a federal RPS does not require utilities to comply with two sets of mandates or impose inconsistent or conflicting requirements on utilities; and
- If Congress enacts a federal RPS, it must ensure that the level of incentives available to not-for-profit, consumer-owned utilities matches the level of incentives provided to investor-owned utilities under the Production Tax Credit and the Investment Tax Credit.

Climate Change Legislation

We know some in Congress want to move quickly on climate change legislation, but it is a very complex task and the devil is always in the details. We ask that Congress be very deliberate in how it approaches regulating greenhouse gas emissions and the allocation of emissions allowances. For example, we hope that the Northwest, which is heavily hydropower dependent, will not be penalized for having an abundance of this clean, renewable resource. In the future, utilities in the Northwest will have to develop new generation to meet electric demand, and if our utilities are not given a fair share of allowances, they may be competitively disadvantaged.

In conclusion, I would like to thank the committee for this opportunity to provide some input on why hydropower should be considered the quintessential renewable resource; the need to fully fund incentives to develop renewables; the need to carefully consider a national renewable portfolio standard; and the need to treat all forms of generation and regions of the country equally when it come to policies on emissions of greenhouse gases.

Thank you.

Mr. COSTA. Thank you very much, Mr. Lutgen, for your focused testimony. I concur with you. I do believe that hydroelectric power

should be treated as a renewable source, and trying to provide equitable treatment with all the renewable sources of energy is a goal certainly I think we should aspire for. I know some of the challenges that we faced. Having said that, we are now at the question stage. So let us begin.

Mr. Swisher, I am interested in a couple of areas that you addressed in your testimony. One, you talked about the transmission challenges that affect when we look at the maps and we see where our wind power generation that you and Mr. Gough both indicated, and unfortunately where a lot of that resource is although there are some transmission access. I want to get a sense from you whether or not BLM and the efforts on those public lands are doing all that they possibly could to provide the access for the transmission of that power that is generated.

Mr. SWISHER. I am sure they could always do more. In general though, our experience with BLM is that they have been paying attention and responsive on these issues.

Mr. COSTA. You indicated that the goal is to establish I believe 100,000 megawatts in the U.S. by the year 2020 or 6 percent of the nation's electricity, is that correct?

Mr. SWISHER. That is correct.

Mr. COSTA. But your testimony says that you conservatively expect 10,000 megawatts to be developed on BLM lands over the next decade. Did I get that number right, 2000 megawatts?

Mr. SWISHER. Two thousand, correct.

Mr. COSTA. Yes. On BLM land?

Mr. SWISHER. Correct.

Mr. COSTA. That is a big gap between 2,000 on public lands and the 100,000 megawatts. So you believe then most of the wind generation is going to be developed on private lands?

Mr. SWISHER. That is correct.

Mr. COSTA. OK. This is the last question and when I was touring Minnesota and some of the other areas where there is active generation and, of course, in California there is as well down in as was indicated the Palm Desert area and as well as up near the east bay of San Francisco. The technology as I understand was initially developed by General Electric and by others, but now most of the technology that we are purchasing to establish wind power is now from Europe. We have sold it. We have exported it.

Mr. SWISHER. Actually most. Only one of the top 10 manufacturers in the world is a U.S. based company, GE, and I think that that is attributable to the on again, off again nature of Federal policy support. It has had a very detrimental impact on manufacturing. You know the market is growing very strongly for wind in the U.S. but manufacturers require more than just a year or two extension of the production tax credit to feel secure about making multi billion dollar investments in the U.S.

Mr. COSTA. Mr. Gough, quickly before my time expires, having some experience with tribal sovereignty issues in California, you are required under the testimony that you gave to fulfill the requirements of the New Energy Act. You do not have to deal with the Bureau of Indian Affairs on these lands, do you?

Mr. GOUGH. Absolutely.

Mr. COSTA. For these energy projects?

Mr. GOUGH. Yes. You have to deal currently with many of the Federal regulations. NEPA is still required. There is an option for tribes to bring in their own permitting system and work with the Secretary to do that. No tribe to my knowledge has yet done that in the energy scope. Tribes could do it just for renewables if they liked but currently we are on Federal trust lands, have to abide by NEPA, Fish and Wildlife. We go through all of the Federal permitting process as well on tribal lands plus whatever tribal permitting may be required.

Mr. COSTA. OK. Mr. Bar-Lev, you spoke of the challenges when this project or the consortium with these projects went bankrupt, was that correct?

Mr. BAR-LEV. Yes.

Mr. COSTA. And you attributed that to inconsistent policies?

Mr. BAR-LEV. Well the cessation of policies. There was a property tax exemption at the state level that Governor Deukmejian at that time vetoed. These projects were all operating on the basis of being permitted by March by the California Energy Commission and having to be built in nine months, and we did it every time but all we needed to have was one sort of thing go wrong and that would sort of be the end of it. So when state and Federal policy sort of changed direction, we became much less credible in the market and it was difficult to hang on.

Mr. COSTA. My time has expired but I want to come back to that. Are these facilities currently operating now?

Mr. BAR-LEV. Absolutely and very well, and it has been over 20 years.

Mr. COSTA. They have been bought by another company?

Mr. BAR-LEV. Yes, they did. Yes, they were.

Mr. COSTA. OK. The gentleman from New Mexico.

Mr. PEARCE. Ms. Jungwirth, with respect to biomass what is happening in the area around the biomass plant needs to be dedicated to the harvesting for it to be economic. Do you have that number?

Ms. JUNGWIRTH. Well it really depends on the size of the biomass plant of course, and that is one of the issues is scale.

Mr. PEARCE. What about 30 KW say?

Ms. JUNGWIRTH. Thirty KW will take the equivalent of 100 million board feet, which is the size that we used to have to run our sawmills. So depending, of course, upon the forest type and trying to manage it sustainably, you are going to have to have a pretty big land base of probably——

Mr. PEARCE. Any estimate of how big?

Ms. JUNGWIRTH. Half a million acres.

Mr. PEARCE. So how many square miles would that be?

Ms. JUNGWIRTH. It is about 800 square miles.

Mr. PEARCE. Eight hundred square miles. So about 40 miles square?

Ms. JUNGWIRTH. Yes.

Mr. PEARCE. OK. And the reason I ask that is because we had a couple of biomass plants that wanted to come into southern New Mexico. Typically our arid climate would only support about 50 trees per acre, and we are up to about 2,500 trees per acre is one reason that our forests are burning.

Ms. JUNGWIRTH. Correct.

Mr. PEARCE. So there is the environmental need to go in and thin the trees back down to where nature would have normally put them but the Forest Service is just resistant to give that protection, that access to the timber, and so we cannot get these biomass plants because they do not have any certainty of supply, and it is a $20 million project to build a 30 KW plant. So do you find that to be a problem elsewhere? Is that just probably in our district or do you think——

Ms. JUNGWIRTH. No. That is the problem elsewhere but there are places where they have solved that, and when they do a collaborative process like they did with the White Mountain stewardship project that you are probably aware of, 150,000 acres, they built a restoration framework that everyone agreed upon including the environmental community. The Forest Service then tiered their NEPA to that, and they scaled their project to that.

This will happen if this material is made available as a byproduct of forest restoration. It will not happen if we want to lease public land to grow fuel for a renewable energy plant. That is not going to happen. We are not going to move the short rotation forestry for energy on public lands. So yes, there are ways to make that happen.

Mr. PEARCE. It is not like we are going to lease it to grow it. It is like we need to get rid of the junk anyway, and we literally are burning the forests down in New Mexico.

Ms. JUNGWIRTH. Absolutely, and the environmental community understands that, and has helped through these collaborative processes create the agreements to move forward.

Mr. PEARCE. Actually they are the ones that are blocking the process in New Mexico, and so it is very difficult.

Ms. JUNGWIRTH. It depends on if they get to come into the process up front and early they work it out. If you wait until the end, they stop them, and I am not part of the environmental community just let me tell you. I am a local person but we have found ways to broker the politics to make a durable, political solution to restore the land, reduce the cost of the wildfire suppression and help these local communities build jobs.

Mr. COSTA. Will the gentleman yield, please?

Mr. PEARCE. Sure.

Mr. COSTA. We have stopped the clock so no one's time is being taken. I have to step out for a brief moment but we are going to continue the hearing, and as his time expires he will then take my time and continue the questioning, and then when I come back we will follow up on a couple of the questions that I did not get to ask. So the gentleman from New Mexico.

Mr. PEARCE. Thank you, Mr. Chairman. Mr. Bar-Lev, I was interested, you said that back in some period of time—I would guess it to be the late 1980s, maybe in the 1990s—that you felt like you were just almost within the grasp of competitiveness with the oil and gas, with the fossil fuel generation. Can you give me an idea how close you were?

Mr. BAR-LEV. It has been 15 years, but we were around 15 cents a kilowatt hour at that point, and we had come down from about 28 cents a kilowatt hour.

Mr. PEARCE. See the thing that I find curious is I know the economics of the oil and gas is that back at that period oil and gas was selling for somewhere between $10 to $20 per barrel, and natural gas was about a dollar a quarter per MCF, and now then the price of oil is about $70, and the price of natural gas is about $7. So maybe a five-fold increase in natural gas and at least a three, maybe three and a half time increase in the price of oil, and with those dramatic increases I would believe that you would be at this point competitive, and that would be my hope because the economics of one industry then begin to affect the economics of another industry. So can you comment on that?

Mr. BAR-LEV. I did not hear the last part. Did you think that we would be competitive at this point?

Mr. PEARCE. Yes. It seems like if you take a resource that you just were within a hair of competing with and you drive it up by a factor of three to five times which is happening, I mean the oil is three and a half times, gas is five to maybe 10 times higher.

Mr. BAR-LEV. Yes.

Mr. PEARCE. It seems like at this point you all would be competitive.

Mr. BAR-LEV. Well, I do not think I used the phrase within a hair. I think that there were certain technology fixes that we were working on, and one of the major things that we were working on at that time was trying to get a change in the limitation and size of our projects because we were not allowed to build more than an 80 megawatt project. So we felt as though if we could really build a 200 megawatt project or a 300 megawatt project we were thinking about that in Nevada at that time, and we were working on the technology of the mirrors so that they could follow the winter sun as well as just going east and west so that they would be essentially dual axis.

We felt that that was going to get us very, very close. It is true the prices today are not that far but I think that in order to get the technology say within the next 10 years to in fact a competitive level, the industry needs a push, and that push needs to come from a consistent policy that would encourage as the Western Governors have encouraged. A sort of a push of at least four gigawatts of this kind of technology which would provide thousands of jobs, millions of voided carbon emissions.

Mr. PEARCE. Let me if I could.

Mr. BAR-LEV. Sorry.

Mr. PEARCE. We are all kind of limited on time. Mr. Swisher, when you quote that Denmark has 20 percent of their power is presented by wind, is that a net 20 percent? In other words, because do they not have a problem? I think I have read where they have a problem because they have to generate the base load. What kind of a net power production are they having?

Mr. SWISHER. I think there is a misunderstanding about the impact that wind's variability has on the system. Any power plant is going to go offline in an unplanned way, and the value of the grid is providing backup for the entire system, and every power plant on it. So 20 percent of Denmark's electricity coming from wind does not mean that you have to have 20 percent backup generation to be ready all the time.

Mr. PEARCE. Let us say they are at 100 percent capacity.

Mr. SWISHER. Yes.

Mr. PEARCE. Say that you barely have enough. You just barely have enough energy. Twenty percent is wind, 80 percent is something else.

Mr. SWISHER. Correct.

Mr. PEARCE. You are telling me that you do not have to have a 20 percent backup?

Mr. SWISHER. I am saying the way the system works——

Mr. PEARCE. No. I just want to stay on that one question.

Mr. SWISHER. Yes. That is correct.

Mr. PEARCE. You do not have to?

Mr. SWISHER. Well any electric system has a reserve of I think 18 percent. It used to be what the standard reserve was.

Mr. PEARCE. Yes. All I know is that if you turn on a gas generator or a coal fired generator, they do not have the variability. In other words——

Mr. SWISHER. That is correct.

Mr. PEARCE.—you just keep feeding the fuel but now as a pilot of an airplane I can tell you that I am very conscious of wind blowing and cross winds especially, and the wind can go from 50 knot cross wind down to 2 knots in a matter of an hour. I can be headed somewhere thinking how in the world am I going to get this thing on the ground, and by the time I get there, there is no wind.

And so if you are at 100 percent capacity, you do not have any excess generation, you tell me that that 20 percent reduction does not present some requirement for a greater backup than if I just have a standard 100 percent gas or 100 percent coal fired plants?

Mr. SWISHER. One of the things that we have noticed is that the geographic distribution of wind plants across a service territory has a moderating influence on the variability, and so if you have a large utility like Xcel with a large service territory, the variability of the wind is not nearly as big a deal as when you have a single wind turbine in a single location.

Mr. PEARCE. New Mexico, I suspect, probably has as many wind generators as anywhere, and I am very supportive of it. However, when I asked can we put in more because New Mexico has tremendous capabilities, P and M, a public service company of New Mexico, told me No. They cannot do any more because they have to have a backup for every single kilowatt, and they have to have a backup capability to generate. Otherwise they cannot sell into California because it is not predictable.

And so to them they have reached their threshold. They cannot invest any more, and this is them, and when I look at the facts what I am told is that and Denmark instead of producing 20 percent of the power that when you deduct out the backup power we are actually closer to 8.3 percent, and I do not mind the fact that we have to do it but those factors have to be included.

Mr. Lutgen, at some point hydroelectric has been a very big component of our energy production yet I think two years ago we began to have discussions about not renewing any of the hydroelectric in the country. What sort of discussions are going on right now about habitat? What sort of discussions are going on about just shutting

down the hydroelectric energy, and how much percentage of the national energy does that produce?

Mr. LUTGEN. In the northwest on the west coast, there is certainly some discussion about possibly breaching the Snake River Dam.

Mr. PEARCE. Can you pull your mic a little bit closer?

Mr. LUTGEN. Sure.

Mr. PEARCE. And maybe turn it on if you have not.

Mr. LUTGEN. Yes, it is on.

Mr. PEARCE. OK. Yes.

Mr. LUTGEN. And the Northwest Power Planning Council and an independent commission has taken a look at that possibility, and both of those organizations have reported back that there would be no advantage to the region in breaching those dams. Certainly there is other discussion about climate change as it impacts the hydroelectric system. The Bonneville Power Administration and our members served by the Bonneville Power Administration are cognizant of this and are certainly taking a look at the impact that that change might have on the system are discussing plans like pump storage and other kinds of things to accommodate that.

Mr. PEARCE. OK. Mr. Gough, you seem to be kind of chomping at the bit to get in on that discussion about the backup. In your projects for the tribal lands, do you all have a backup source of energy or do you just depend? In other words, if the wind generation drops down, do you go out and then you can address anything that you would like about the whole discussion I was having with Mr. Swisher there? In other words, trying to figure out as best we can how this stuff all interrelates.

Mr. GOUGH. Well the interrelation for tribes; within their boundaries, tribes have great geothermal resources. Rosebud does. It was one of the tribes on the map we saw in the earlier panel. We have a tremendous wind resource. Within Todd County, one of the counties on the reservation, 30 by 90 miles we have estimates of up to 50 gigawatts of wind power potential just within that one county.

Mr. PEARCE. Do you have backup?

Mr. GOUGH. We have hydropower in the Missouri River, and that is why working with wind and hydro together the opportunity for regionally the northern plains looking at coupling wind and hydro together as a dynamo where each one complements the other is a model that could work in many places throughout the west, and we are seeing that the competition that we have in that price point was the other concern I had. The competition for wind for reservations we have the same problems.

We do not have the production tax credit coming for the tribes, and when that market we are selling into, we are selling into a market that is 1.4 cents avoided cost. So with the cost of wind power being about 4 cents, 5 cents and having the utilities assume that you get the production tax credit when it is available and we do not get it, we are going in with a penalty basically.

So looking at backup, looking at how to rethink the system in a larger sense, the backup that we have depended upon has been coal but we are seeing now that the coal plants are being curtailed from Wyoming to St. Louis because of the lack of water availability in the Missouri River. So we have to look at all of these clusters.

So we are looking at solar. We are looking at biodiesel on the reservation. To have biodiesel generators there as backup to complement the wind we have.

Mr. PEARCE. Mr. Bar-Lev, I am looking at figures that the DOE provides, and if you are going to make a construction of different types of facility, the cost per kilowatt hours is sort of significant, and I just wanted to see if this sounds like what you find or if these numbers are not quite accurate but to build a coal generating plant about $1,290 per kilowatt hour, and that would compare at about $4,751 per KW produced out of solar. Is that something that——

Mr. BAR-LEV. I am sorry. What was the amount for the solar?

Mr. PEARCE. Yes. About $4,751, and we could throw wind in at about $1,200. Geothermal about $1,880. Hydro at $1,500. Anyway, it is very helpful considering large-scale projects. Can you address that pretty large, about four times the entry costs it looks like? Does that fit with your experiences I guess? This is DOE numbers. So I am always suspect when——

Mr. BAR-LEV. Well, we are more expensive than coal. There is no question about that but I cannot vouch for the accuracy of those numbers, and I would like to supplement the record.

Mr. PEARCE. Sure. Think about it and take another look.

Mr. BAR-LEV. That is about four times as much as coal. That may not be that far off.

Mr. PEARCE. OK.

Mr. BAR-LEV. But I will have to supplement the record.

Mr. PEARCE. You bet. If it changes the conclusion, because those are sort of significant numbers when we as policymakers begin to think about it. When I look at these large arrays of solar, in New Mexico we have a fairly brisk dispute between the public agencies and the ranchers, is it possible to continue growing grass underneath there and continue grazing or is that an improbability?

Mr. BAR-LEV. Well what is interesting about those maps is that they have chosen areas——

Mr. PEARCE. No, not the maps. I am looking at the picture. I am sorry.

Mr. BAR-LEV. I am sorry.

Mr. PEARCE. I am visualizing these out through New Mexico, and frankly we have some really neat big projects on different things. However, I am wondering is this compatible with the ranchers because ranchers have a significant conflict in grazing applications on public lands. I am wondering if we could be producing solar energy and still do the grazing underneath. It looks like those are fairly tall.

Mr. BAR-LEV. Yes. But I think that the cattle would generate dust. Dust and mirrors do not mix. We would have to be washing these things very often.

Mr. PEARCE. New Mexico generates dust I tell you. A baseball game when I was growing up if you could see the second baseman something was wrong.

Mr. BAR-LEV. But there is so much excellent solar radiation in New Mexico. There is so much.

Mr. PEARCE. Yes.

Mr. BAR-LEV. That NREL says that there is room for both.

Mr. PEARCE. OK. Real fine. I see the Chairman coming back in. I am going to yield back to him, and we do appreciate you all's indulgence. Great discussions with everyone here.

Mr. COSTA. I thought you were doing well. I did not want to stop you when you were on a roll. All right. We try to run an amicable committee here. I wanted to get back to the biomass efforts because since we are both Californians, we have had some similar experiences over the last 15, 20 years. It is really very similar to some of the comments that I see as a common weave in your testimony, and that is that inconsistent policy, government policy over the last 20 years, both at the state and the Federal level, has made a lot of these efforts difficult. When you are trying to attract venture capital and you are trying to get things going—and then the rules change and the process changes—then people say well gee, maybe they are not really serious about this.

And in the case of biomass, we had as you may know, Ms. Jungwirth, a number of facilities that were primarily ag related in my portion of the San Joaquin Valley in a number of communities that used as the bio waste stream much of the ag products from permanent crops, both vineyards, orchards and the like and, of course, there was a favorable credit with the California Energy Commission that provided the incentive, and then there was an agreement with the utility companies that my friend from PG&E may remember, and we were able to use that byproduct.

Now, of course, in the valley we have now issues of CO2 and other air quality related matters that make that more difficult. We have one of those plants left. I think at one time down at Delano Way at one time I think we had nine, if my memory serves me correctly. And there is this facility that has continued to operate as new ownership. They want me to come down and view it. I have not done so but they believe they have a technology that allows them to deal with the air quality issues.

We are moving from potentially severe to an extreme status as it relates to the EPA in the valley, as you may know, on air quality which is a real problem. How do you see biomass being able to deal with those challenges as it relates to that element of the waste stream?

Ms. JUNGWIRTH. Well just burning green wood and turning a turbine with steam to make electricity is a pretty inefficient thing to do, and you have to put an electrostatic precipitator and clean the air if you are going to do that. As a replacement for coal fired plants, of course, it is a good idea because it does not put out the sulfur that the coal plants put out.

California Air Quality expects that in the cement plants which put out a lot of the carbon. They are the second largest contributor of carbon because when they crack limestone to make cement, it releases carbon. They also put out carbon and affect air quality because they burn coal to heat the stuff to make cement from. California Air Quality is recommending that they co-fire those with wood pellets for the thermal energy to reduce those emissions. Biomass has a potential to reduce emissions, and to help clean up the air if it is used properly with proper policy.

Mr. COSTA. Well it continues to be a challenge, and obviously we thought there were a combination of benefits that were taking

place. Not only the benefit of the energy but also that waste product is something that we have to deal with regardless, and hopefully with the new technologies we will be able—notwithstanding the air quality challenges we have—to be able to continue to in some fashion use that biomass material in a way that is cost effective of course.

Ms. JUNGWIRTH. I think it is the dirty air from the forest fires that you are going to find the biggest advantage.

Mr. COSTA. And you support cap and trade in that instance?

Ms. JUNGWIRTH. As long as we can get God to sign off on that.

Mr. COSTA. I do not know how you do that. Anyway Mr. Bar-Lev, I do not know if you are in a position with your experience, obviously it is significant, but compare the state of the United States solar power industry with incentives for solar in the U.S. with other countries, and I mean I assume you have a sense of what is going on in other parts of the world to incentify solar power, and what recommendations would you advise this Subcommittee as we try to add value to an energy package that we may consider later this year?

Mr. BAR-LEV. Well Spain is the most interesting country because in fact they do not have anywhere near the excellent radiation or the space that we have here in the western states, and yet Spain has encouraged with a rather high what is called feed-in tariff, it is sort of a price that would have to be paid for solar energy, very high, and for a limited size projects. And so a lot of companies came in with different technologies which was good because then they would compete and everyone would learn from everybody else, and so there are a lot of different technologies that are competing in Spain, getting the benefits of this feed-in tariff.

You see some that look good, that might be applicable here. Others maybe not. And the other thing that has been very interesting about Spain is transmission. Here it takes probably two times, three times longer to connect up to the transmission grid because of all the strange rules.

Mr. COSTA. Our strange rules?

Mr. BAR-LEV. Yes. The strange, large generator interconnection procedures.

Mr. COSTA. That is an interesting description. I am going to add that to the legislative generic of terminology we have. Strange rules we are dealing with.

Mr. BAR-LEV. Strange rules and strange cost allocations but in Spain again they cut through that. They built——

Mr. COSTA. In Spain they are not strange?

Mr. BAR-LEV. In certain ways they might be but not on transmission or on solar energy. So that is the best example but I think the real lesson to be learned from Spain is that if we were to set aside some Federal land, identify the optimal solar zones, and set aside a bunch of BLM land, say enough for four gigawatts which is what the Western Governors are recommending, you would bring the cost down of solar dramatically.

You would have competition among the different technologies, and if you build transmission out to those, that would benefit everybody. That would be a great win-win, and that is what we are

recommending. We are recommending a program that is not that different from what Spain did.

Mr. COSTA. Well I am intrigued by that idea, which is where I wanted to end with in my questions to you, because it seems to me that if you want to set up—for lack of a better term—a pilot project of significance where you could really make a mark and do it in a way that would be environmentally acceptable, the map that you have up there surely clearly indicates that there has got to be in all of that area and I have traveled through a lot of it over the years, and knowing how some of that area exists, I would think this would be a wonderful use.

I do not think it would adversely impact to a large degree the sort of wildlife corridors and other kinds of things that often are raised as issues. I am sure that to the degree it was even within an area that someone thought would impact their aesthetics as it relates to site of line and those kinds of things, they would raise issues, of course, because you are always going to have that. I mean people do that about wind power in a couple of areas in California that I am very familiar with.

Describe the footprint again of this significant pilot project that we are discussing that would provide the four did you say——

Mr. BAR-LEV. Four gigawatts.

Mr. COSTA. Four gigawatts.

Mr. BAR-LEV. Which is 4,000 megawatts, which is roughly say about 8 percent, maybe 7 percent of California's peak load.

Mr. COSTA. Right.

Mr. BAR-LEV. Would cover an area of perhaps 40 square miles. So that is five miles by eight miles, and there are many areas right within California or near Las Vegas or near Phoenix that are ideal for that.

Mr. COSTA. Absolutely. I concur.

Mr. BAR-LEV. And it is not us but really the Western Governors has estimated that the employment benefits alone for four gigawatts——

Mr. COSTA. How quickly could something like that be installed?

Mr. BAR-LEV. Well that is a really good question because——

Mr. COSTA. That is not a fair question. Let me add a little more information. If we made this of the significance of a pilot project, and therefore we cleared a lot of the process or expedited the process because I know time is money and when I asked you the question you are not just thinking about the construction, you are thinking about how do we get through the maze of the process.

Mr. BAR-LEV. That is right.

Mr. COSTA. But if we could somehow expedite in some sort of a fast tracked way that would be within a 12-month time period, and I am just picking a number, how long would it take to construct such a pilot project?

Mr. BAR-LEV. Well the contracts we are negotiating right now are going to require us to produce about 100 megawatts about every nine months to a year. Now what I assume is it in such a solar park that we are talking about here different companies would be invited to bid.

Mr. COSTA. So you would want that. You would actually want a multiple.

Mr. BAR-LEV. Absolutely.

Mr. COSTA. Right.

Mr. BAR-LEV. That is the idea.

Mr. COSTA. And if you cleared that part of the process, then you think this is kind of like Field of Dreams?

Mr. BAR-LEV. It is exactly Field of Dreams. If you build it, they will come. They will arrive, and there are probably six or eight companies in the United States right now, maybe a little bit more, that are very actively looking at these technologies. Say if each one of them said I will take a square mile, I will take a square mile, then these could be built very quickly.

Mr. COSTA. As an aside, Apollo Alliance in the U.S. used to be the leading producer of photovoltaics. I mean a lot of the stuff has gone to Japan and elsewhere, right?

Mr. BAR-LEV. That is right.

Mr. COSTA. Do we have much of an industry left here in the United States?

Mr. BAR-LEV. There is one project that is being actively built and almost finished near Boulder City new Las Vegas. There are not any others. We were the last one, and we went out of business in 1991. So the answer is we do not really have the parts right now.

Mr. COSTA. If we required buy American and that it be manufactured here in the United States, would that create a few jobs?

Mr. BAR-LEV. It would create a lot of jobs. Four gigawatts would create—as I was saying before—12,000, 13,000 construction jobs, 1,100 permanent operations jobs, tremendous increase in gross state output because of all the dollars that are being generated, and an industry would be built. I always use sort of Detroit or Silicon Valley as an example. We have the resources in this country and the brain power to create literally a whole new industry in the west.

Mr. COSTA. Well I want to try to be a partner on a bipartisan basis with whoever would like to join in this effort, because I think it has a lot of potential. Last question and then unless my friend the gentleman from New Mexico wants to add any further, we will close the hearing. You mentioned, our friend from Washington, that hydropower ought to be treated as renewable, and if this question has been asked while I was out I will get the answers from those who you answered. What is the single largest or single biggest impediment in your opinion from hydropower being considered among other renewable sources?

Mr. LUTGEN. By impediment, I am not sure what you mean.

Mr. COSTA. Well you laid out a list of why it should be included as a renewable resource but you said under the Energy Act it is not treated as one, and I am asking you what you think is the largest impediment from treating it as such.

Mr. LUTGEN. I think the largest impediment is the view that hydropower is an existing resource and that what renewables are all about is developing new kinds of resources and new kinds of technologies, and I am not sure if I am answering your question.

Mr. COSTA. No, no. I think you are going along those lines. I mean there is also a conflict clearly. I mean hydropower is everything you said it was. I mean at least I believe it is. That does not make it so but it means that you and I agree.

Mr. LUTGEN. Sure.

Mr. COSTA. But there are some folks who really have an aversion to how hydropower is developed and would prefer not to see those dams that allow that hydropower to take place. So therein lies a conundrum. I do not know if you see it that way.

Mr. LUTGEN. Frankly, I am having a hard time understanding.

Mr. COSTA. Are we building any new hydropower? Let us put it that way.

Mr. LUTGEN. I do not know. I would have to——

Mr. COSTA. That is very limited.

Mr. LUTGEN. Yes.

Mr. COSTA. I mean we have some facilities that we have refitted that did not have hydro.

Mr. LUTGEN. Sure.

Mr. COSTA. Now that electricity rates have gone up, we have put hydroelectric plants, turbines in them but the notion that we are going to putting any more facilities in the near term of significance is I would submit to you less likely. I say that as a westerner and a person who deals with water policy all the time in California.

Mr. LUTGEN. Sure. I think that what the industry is looking for is incremental improvements in existing hydro facilities.

Mr. COSTA. OK. The way the process works here we ask the questions and you answer them but I will allow my friend to make a point.

Mr. GOUGH. I appreciate that.

Mr. COSTA. And we are going to close.

Mr. GOUGH. There is a possible answer actually. The Federal government is in a unique position with the Western Area Power Administration in Bonneville and TVA in its control over hydropower to really optimize the hydropower we do have, working it in combinations and a demonstration wind project, wind-hydro has been authorized but never funded for the northern plains to see how the Missouri working with our largest storage capacity of the dams in the country up on the Missouri River with the greatest wind resource. Finding ways to direct WAPA to couple those resources and optimize the resources we have could make a tremendous difference in making some of the points that you have been seeking to get from the other renewable resources.

A demonstration project could be up and running in 12 months and really demonstrate the compatibilities of renewables working together.

Mr. COSTA. Well I think that is a good point, and we should look into that. I am going to close here but the gentleman from New Mexico, ask one quick question.

Mr. PEARCE. You bet, and we are going to walk our way down through it now. I have to question if you think short term. We will call short term 0 to 5 years, medium term 5 to 20, long term 20 to beyond or never, and all I want to know is let us say that we have the capacity to stop coal production or stop energy from coal as we get the replacement energy. Fifty percent of our power comes from coal today.

Can we do it in short term, middle term, long term or never? And we will just go down. Mr. Lutgen. Yes. Give me your view.

This is not very scientific, and the Chairman is waiting to adjourn. So do not think very long.

Mr. LUTGEN. Short term.

Mr. PEARCE. Short term. We could reduce 50 percent of the power with the short term from wind, solar or geothermal? Those three. All of them together or just the three?

Mr. LUTGEN. I would say all of them together.

Mr. PEARCE. All put together, short term. Yes, sir. Mr. Bar-Lev?

Mr. BAR-LEV. Medium term.

Mr. PEARCE. OK. Ms. Jungwirth?

Ms. JUNGWIRTH. I have no idea.

Mr. PEARCE. Thanks.

Mr. GOUGH. Short term with wind I think you can get 20 percent. Short term.

Mr. PEARCE. OK. Mr. Swisher?

Mr. SWISHER. I would say 20 to 30 timeframe.

Mr. PEARCE. OK. Yes. I tend to think Mr. Swisher is right but it is good information. Thank you, Mr. Chairman.

Mr. COSTA. Thank you, gentleman from New Mexico. Thank the witnesses for your interesting and I believe encouraging testimony, and we will look forward to continuing to work with you as we continue this process. This Subcommittee is now adjourned.

[Whereupon, at 5:15 p.m., the Subcommittee was adjourned.]

[Additional material submitted for the record follows:]

[A statement submitted for the record by UTC Power follows:]

Statement submitted for the record by UTC POWER

UTC Power appreciates the opportunity to submit a statement for the hearing record on issues related to renewable energy opportunities on federal lands.

Company Background

UTC Power, a business unit of United Technologies Corporation (UTC) is a world leader in commercial stationary fuel cell development and deployment. UTC Power also develops innovative combined cooling, heating and power applications for the distributed energy market. UTC Power is developing organic Rankine cycle technology known as the PureCycle® system for geothermal and other energy resources. This technology is in the development stage. We are partners with Chena Hot Springs Resort outside of Fairbanks Alaska, the Department of Energy and Alaskan authorities in validating this exciting new geothermal technology. Operating with geothermal hot water at 165° F, this project has featured the use of the lowest temperature geothermal energy resource in the world. On April 12, 2007 UTC Power announced a series of agreements with Raser Technologies of Provo, Utah to provide up to 135 PureCycle® systems for three Raser power plants. In total, these systems will generate approximately 30 megawatts of renewable electrical power.

Summary

Geothermal energy addresses many of our national concerns, but its potential is largely untapped. UTC Power's PureCycle® system represents an innovative advancement in geothermal energy production and is operating successfully today in Alaska as part of a demonstration effort. This geothermal energy breakthrough offers the possibility of tapping significant U.S. geothermal reserves including oil and gas resources for a domestic, renewable, continuously available source of power to meet our growing energy demands. Congressional action is needed, however, to continue research and development funding; characterize our national geothermal resources, including low and moderate temperature sources; and extend the production tax credit. While not all of these issues fall under the jurisdiction of the House Natural Resources Committee, the Committee can play a key role in helping to develop and ensure implementation of a comprehensive geothermal energy strategy to ensure we take maximum advantage of these important resources to address energy security and environmental concerns.

Geothermal Energy Addresses Many National Concerns, but Huge Potential is Largely Untapped

Our nation is faced with air quality and global climate change challenges, ever-increasing fuel costs and a desire to be less dependent on energy sources from politically unstable areas of the world. The United States is blessed with an abundance of geothermal energy resources that offer a renewable, continuously available, largely untapped domestic resource. The country generates approximately 2,800 MWe of geothermal energy for power production in California, Nevada, Utah and Hawaii (and now Alaska) and another 2,400 MWe is under development.

While estimates vary, the Geothermal Energy Association indicates that with effective federal and state support, as much as 20 percent of U.S. power needs could be met by geothermal energy sources by 2030. The National Renewable Energy Laboratory's report "Geothermal: The Energy Under Our Feet" concludes: "Domestic resources are equivalent to a 30,000-year energy supply at our current rate for the United States." The study also notes: "New low-temperature electric generation technology (referencing UTC Power's PureCycle® system) may greatly expand the geothermal resources that can be developed economically today." In addition, the Massachusetts Institute of Technology recently released its report "The Future for Geothermal Energy" and concluded that enhanced geothermal system technology could provide 100,000 megawatts of base-load power, without any greenhouse gas emissions, by 2050 if the federal government increases its research commitment to resource characterization and assessment.

Description of PureCvcle® *Technology*

The PureCycle® system is based on organic Rankine cycle (ORC) technology—a closed loop process that in this case uses geothermal water to generate 225 kW of electrical power. Think of an air conditioner that uses electricity to generate cooling. The PureCycle® system reverses this process and uses heat to produce electricity. The system is driven by a simple evaporation process and is entirely enclosed, which means it produces no emissions. The only byproduct is electricity, and the fuel—hot water—is a free renewable resource. In fact, after the heat is extracted for power, the water is returned to the earth for reheating, resulting in the ultimate recycling loop.

What is the Significance of Low Temperature Geothermal Energy?

In the past, geothermal energy for power production was concentrated in only four Western U.S. states where the highest temperature geothermal resources are located. The need for high temperature steam previously limited the use of geothermal resources and increased the life cycle cost.

The ability to use small power units at lower temperature geothermal resources will make distributed generation much more viable in many different regions of the country. Simply put, PureCycle® technology could result in significant new domestic, continuously available renewable energy resources—not just in Alaska, but across the country. The capability to operate with a low temperature resource allows the UTC Power PureCycle® System to utilize existing lower temperature wells and to "bottom" higher temperature geothermal steam and flash plants as well as many existing ORC binary power plants. A "bottoming" application with the PureCycle® product would utilize hot water exiting from existing geothermal plants to produce additional power. This water would normally be re-injected to the earth or otherwise discarded since use of this water was previously not practical for power production with conventional recovery systems.

Oil and Gas Geothermal and Other Applications

There are more than 500,000 oil and gas wells in the United States, many of which are unprofitable. The use of geothermal hot water, which is abundant at many oil and gas well sites, to produce a renewable source of electrical power could extend the life of many of these assets. This would result in significant environmental, energy efficiency, climate change, economic and other benefits associated with the development of geothermal oil and gas electrical power.

We appreciate efforts by this Committee last year to pursue the oil and gas geothermal energy production application. The Deep Ocean Energy Resources Act of 2006 (HR 4761) included a provision that would create a Department of Interior demonstration program to assess the use of innovative geothermal technologies, such as our PureCycle® system, at new and existing oil and gas wells. This initiative would validate technology that would enable the United States to capture the heat in oil and gas wastewater to produce electricity and allow fields to produce longer while co-producing electrical power with no emissions. As Congress proceeds with its deliberations on measures to enhance our nation's energy independence and

security, we urge the inclusion of a geothermal demonstration provision based on last year's language and would be happy to work with the Committee in this regard.

In addition, PureCycle® technology has other potential applications including the use of industrial or other electrical generating technologies that produce waste heat in the form of hot water at greater than 165s F and with sufficient volume can generate electricity as well. Examples include: waste heat recovery from the water used to provide cooling for industrial reciprocating engines as well as exhaust from these engines; production plant and landfill flares used to burn off waste or exhaust gases; and heat generation from biomass burners.

Need for Resource Characterization

One of the key barriers to full utilization of our nation's geothermal resources is the lack of up-to-date survey information. The most recent U.S. Geological Survey for geothermal energy was conducted in 1979. This survey used techniques that are outdated and was based on technology available 30 years ago. It did not consider low to moderate temperature resources since there was no technology available at the time that could utilize these resources in a cost-effective manner. The exploration and drilling phase of any geothermal project generates considerable risk and expense. An up to date survey is essential to identify potential resources with more precision thus helping to minimize risk and expense. The 2005 Energy Policy Act (EPAct) authorized such surveys and an update was underway, but funding shortfalls at both the Department of Interior (DOI) and Department of Energy (DOE) and uncertainty regarding the future of DOE's geothermal program have stalled the effort. We urge Congress to direct the Departments of Interior and Energy to expedite this initiative and to ensure that low and moderate temperature resources are addressed.

Recommended Actions

It is unfortunate that at this moment in time when there are exciting innovative developments in the world of geothermal technology, the federal government is cutting off research and development funding and stalling resource characterization efforts. The rationale given is that the technology is mature and represents a resource with limited value since it is confined to only a few Western states.

We have only scratched the surface regarding our nation's geothermal energy potential. We have not exhausted the R&D possibilities and this is not a resource that is limited to only a few Western states. There are advances in low-temperature geothermal energy alone that prove otherwise.

The National Research Council report "Renewable Power Pathways" recognized the importance of geothermal energy and stated: "In light of the significant advantages of geothermal energy as a resource for power generation, it may be undervalued in the DOE's renewable energy portfolio."

UTC Power recommends that Congress pass legislation requiring DOE and DOI to enter into cost-shared partnerships to enhance the performance of existing successful systems, increase the size of the low temperature units to one megawatt, boost system efficiency to extract as much energy as possible from the source water, improve working fluid characterization, evaluate different feed stocks as fuel and demonstrate benefits for the oil and gas market. We also recommend continued federal funding for resource assessment and identification, exploration, and drilling and incentives for the exploration, drilling and deployment activities.

As our Chena project and recent Raser Technologies arrangement demonstrate, far from being a mature technology with limited geographic reach, geothermal energy has the potential to satisfy a significant portion of our growing energy needs with a renewable, continuously available domestic resource. But appropriate government policies must be adopted and implemented to make this a reality. Congress can help to ensure we realize the full potential of geothermal energy. Attached is a position paper by the Geothermal Energy Association that outlines key industry recommendations and action items including:

- Extension of the geothermal production tax credit and revised "placed in service" rules;
- Robust funding for DOE's Geothermal Research Program;
- Incentives for geothermal exploration; and
- Comprehensive nationwide geothermal resources assessment.

We also recommend that Congress enact legislation creating a demonstration program to assess the use of innovative geothermal technology, including organic Rankine cycle systems, at new and existing oil and gas wells, such as the provision in the Deep Ocean Energy Resources (DOER) Act approved by the Committee on June 21, 2006. This initiative presents a significant opportunity for clean, renewable energy at more than 500,000 oil and gas wells in the United States.

We thank you for the past support Congress and this Committee have provided for geothermal energy and look forward to working with you to translate the exciting promise of geothermal technology into reality.

Achieving a 20% National Geothermal Goal

The United States, as the world's largest producer of geothermal electricity, generates an average of 16 billion kilowatt hours of energy per year. While substantial, U.S. geothermal power is still only a fraction of the known potential. Today, roughly sixty new geothermal energy projects are under development in over a dozen states that will double current geothermal power production. With effective federal and state support, recent reports indicate that as much as 20% of U.S. power needs could be met by geothermal energy sources by 2030.

To achieve this, the Administration and Congress should adopt the following National Geothermal Goals for federal agencies: Characterize the entire hydrothermal resource base by 2010; sustain double digit annual growth in geothermal power, direct use and heat pump applications; demonstrate state-of-the-art energy production from the full range of geothermal resources; achieve new power or commercial heat production in at least 25 states; and, develop the tools and techniques to build an engineered geothermal system (EGS) power plant by 2015.

To support these goals and accelerate the production and development of energy from our geothermal resources, the following priority actions are needed:

Revise the Section 45 Production Tax Credit (PTC) to support sustained geothermal power development. The PTC timeframe is too short for most geothermal projects to be completed by the current placed in service deadline. To achieve sustained geothermal development, Congress should immediately amend the law to allow facilities under construction by the placed in service date of the law to qualify, and extend the placed in service deadline by at least 5 years, to January 1, 2014, before its expiration.

Fund a strong and effective DOE Geothermal Research Program that prioritizes the discovery and definition of geothermal resources; expands GRED funding; develops new exploration technologies; supports state-based programs to expand knowledge of the resource base and its potential applications; improves drilling technology; demonstrates geothermal applications in presently non-commercial settings; and develops and demonstrates of Enhanced Geothermal Systems techniques. DOE's geothermal program should be expanded to meet today's challenges and funded at $75 million annually.

Provide incentives for geothermal exploration through renewed DOE cost-shared funding and other measures. Ninety percent of geothermal resources are hidden, having no surface manifestations. Exploration is therefore essential to expand production, but exploration is expensive and risky. Cost-shared support for exploration drilling has been provided through DOE's Geothermal Resource Exploration and Definition (GRED) program. GRED should be continued and expanded, with at least one-half of DOE's effort supporting exploration, and an exploration tax credit should be established.

Expand and accelerate geothermal initiatives on the public lands. USGS should conduct a comprehensive nationwide geothermal resource assessment that examines the full range of geothermal resources and technologies; USGS should collect and make available to the public geologic and geophysical data to support exploration activities; BLM's Programmatic Environmental Impact Statement (PEIS) should be completed as a top priority; planning, leasing and permitting activities on BLM and National Forest lands should be adequately funded and conducted promptly. Appropriations (and dedicated funding) of $25 million annually should be provided for these agency efforts.

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