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HEARINGS

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

ON

ENHANCING OIL AND GAS PRODUCTION; GEOTHERMAL ENERGY AND OTHER RENEWABLES; AND HYDROGEN AND FUEL CELL RESEARCH AND DEVELOPMENT

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ENHANCING OIL AND GAS PRODUCTION

TUESDAY, JUNE 27, 2006

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 10:03 a.m. in room SD–366, Dirksen Senate Office Building, Hon. Craig Thomas presiding.

OPENING STATEMENT OF HON. CRAIG THOMAS, U.S. SENATOR FROM WYOMING

Senator THOMAS. The meeting will come to order, please.

The chairman, I'm sure, will be here soon. He's asked me to go ahead and get us started while he's completing his work with the appropriations.

Let me first thank the witnesses for appearing here today. Kathleen and Tom, nice to see you here. It was good to sit down with you yesterday and discuss the topics. Mary, welcome, glad to have you, and thanks for making the trip from Cheyenne.

I'm a strong supporter of oil and gas development. It's brought a tremendous amount of good for the State of Wyoming, and, obviously, to the Nation, a challenge we have in keeping our energy program moving and using the public lands and so on to be able to use those resources. I do believe we have to do this in a responsible way. And, of course, I know all of you do that. And I think the energy policy tries to establish that proposal, that we can do it.

One of the most significant parts of the energy bill is the creation of the pilot offices to improve Federal permit coordination. There are two of these in Wyoming—one in Buffalo and the other in Rawlins. These pilot offices are not just a way to get more permits out the door, but to do it in a way that is sensitive to the needs of the areas that are producing energy. And, of course, as you know, in a State like ours, half of the State belongs to the Federal Government. Much of it is BLM land, of course, which is open for all kinds of development, and should be. Some of it is national parks, and some of it is national forests. So, we want to be able to use that energy, to the extent that we can. At the same time, we have to preserve those things that are fundamental to the future, and be making decisions now so that we'll be where we want to be 30 years from now, in terms of our resources and so on.

I believe BLM and other agencies are doing a good job at this. And it's not easy to balance our needs between energy and the desire to protect open space in the natural resources. So, that's really

what we're asking about here today. And we look forward to these hearings and to talk a little bit about how we can best do that to achieve the kind of energy production we need; and at the same time, maintain the resources that we want and to look forward to the kind of country we want to have in the future.

Senator Bingaman.

STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

Senator BINGAMAN. Thank you very much, Senator Thomas. Thank you for chairing the hearing. And thank you all for being here.

I'll just underscore what Senator Thomas said, and that is about the importance of seeing the provisions in last year's energy bill carried out in a way that recognizes the important multiple-use mandate for our public lands. Obviously, oil and gas production is important, but we obviously also know that we have a lot of other uses—grazing and mining and recreation, and fish and wildlife, and other uses of the public lands and the forests that are important, as well. So, I think we're interested in being sure that is properly carried out.

One other point I want to just mention, in opening here, is that I understand there are over 26 million acres of onshore Federal lands that are currently under lease but are not producing. In the National Petroleum Reserve Alaska, there are 11 million acres available for leasing and 2.8 million acres that are currently under lease. I'm told that there was only one well drilled during the past drilling season. I'm sure there are many reasons for the fact that we have so much Federal land under lease that is not being drilled. I think we need to understand that better, and I hope we can get some insights into that during the course of this hearing.

Thank you, Mr. Chairman.

Senator THOMAS. Thank you, Senator.

Welcome, to our witnesses this morning. Kathleen Clarke, of course, is the Director of the Bureau of Land Management. We're delighted to have you here. Mr. Hall, you're not on my list—I'm glad you're here—Director of the Fish and Wildlife Service. Mary Flanderka, who's the State planning coordinator for the State of Wyoming—delighted, of course, to have you here. I've been there, I believe. Tom Reed—I guess I skipped down there—Tom is the field organizer for Trout Unlimited. And, let's see, who do we have here? Duane Zavadil, vice president, Bill Barrett Corporation, on behalf of the Independent Petroleum Producers. And Jeff Eppink, vice president, Advanced Resources International, of Arlington, Virginia.

So, we'll start with you, Kathleen, please.

STATEMENT OF KATHLEEN CLARKE, DIRECTOR, BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR, ACCOMPANIED BY DALE HALL, DIRECTOR, U.S. FISH AND WILDLIFE SERVICE

Ms. CLARKE. Thank you very much.

I have submitted a joint statement for the record that represents the thoughts of both Dale Hall and myself as it relates to our

shared efforts, and those, really, of other Federal agencies and State partners, to move forward with the creation of the pilot offices.

BLM is an agency that is really quite small, but with a huge mission. We manage over 260 million acres of Federal lands in the West, and over 700 million acres of subsurface land. And the vision that we bring to the BLM is that we should manage these lands to sustain and enhance the quality of life for Americans. And we recognize that the multiple-use mission that we have requires that we pay attention to many resource values and to all of the ways that the public relate to those lands and benefit from their uses. And clearly an important element of our mission is managing the energy resources to serve the needs of the public, particularly at this time.

BLM lands produce about 18 percent of the natural gas that is consumed in this Nation. Our inventory of five key Western States tells us that we have nearly 140 trillion cubic feet of natural gas, which is enough to heat 55 million homes for nearly 40 years. So, there is a very significant natural gas resource that we are working in partnership with the Fish and Wildlife Service, Forest Service, the Corps of Engineers, with EPA, and with State partners to make available and provide access for development.

The demand for access to oil and gas resources in the Rockies has certainly resulted in an increase in the request for applications for permits to drill, commonly known as APDs, coming in from industry. And there has been much discussion about the backlog of APDs. And we refer to that backlog as "pending APDs," those applications that have come in the door and have not yet been through a complete process of approvals.

I put up a chart here so that you can see that the rate at which the applications are coming in is growing rapidly. Now, I want to show you another chart that shows you how fast we are increasing the processing of permits to drill, and let you see that we are also ramping up significantly. In fact, if you were to total the total number of applications for permits to drill that were granted between 1996 and the year 2000, it comes in to something a little over 12,000. It you take the next 4 years and measure from 2001 to 2005, BLM has approved over 24,000. We have actually had a 104-percent increase in our productivity in granting permits to drill. But, as you'll recall, we are also getting a huge ramp up in the applications coming in the door. And so, indeed, we find ourselves constantly climbing an uphill battle to get on top of the workload.

Clearly, as we watch this demand increase and we all understand the challenges of meeting the demands of this Nation for energy resources, it's important that we continue to improve our processes and that we do everything we can to meet that demand. But it's equally important that we are also sensitive to the impacts of this ramp-up in energy production, and that we pay commensurate attention to the issues of inspection and enforcement and environmental monitoring. And that is one of the reasons we are very grateful for the partnerships that were envisioned by the Congress in the establishment of the energy pilot offices.

I am very pleased today to have Dale Hall with me. When we took a look at the many responsibilities that were laid at BLM's

feet in the Energy Policy Act of 2005, it was clear to us that one of the key provisions was the creation of the energy pilot offices, in section 365. And as we better understood what that mandate was, I was grateful that it recognized the partnerships that were necessary for BLM to be able to improve its production of APDs and improve its management of oil and gas development in the West. I went to Dale Hall, and invited Dale to join with me in a set of visits to Western pilot offices, to meet with the staff, to understand what their challenges were, to make sure that the many partners had a shared vision of what we were undertaking together. And I want to give Dale a minute here to talk about what his reactions were and some of the messages that he shared, both with BLM people and the other partners that were there.

Mr. HALL. Thank you, Kathleen.

In our view, these pilot officers are really, really good offices, with a lot of potential not only to help us move forward in working through oil and gas permitting, but also to learn how to do proper oil and gas extraction, learn through experimentation and working with the oil and gas industry to figure some of these things out. You know, good government, in our view, means that we work together as one government. And so, working with Director Clarke has been a real pleasure for me. And I do believe that the Fish and Wildlife Service is really there, and our role should be to help the BLM accomplish its mission, but in a way that meets the other laws and takes care of fish and wildlife resources. And I think that these offices are exemplifying that.

Our people on the ground are really working together. And if I had to point out two major things that I think are the most critical accomplishments already of the two—of the seven offices that we've established, one of them is that we're working as a team to get the job done. And, as many of you know through history, where there are conflicts with Fish and Wildlife resources, Endangered Species Act, and other issues, it usually is because we're not involved from the beginning to help plan, to help work through the issues. Our people are sitting right in the office with BLM folks, and they're planning, from the beginning, to avoid the issues and to still allow the projects to move forward.

And the second thing is, the ability to work together in one office to come up with means such as programmatic biological consultations, so that we can have overarching consultations, so that only minor consultation for incidental take may be required later.

Those two things, in and of themselves, are extremely important. Working together and coming up with techniques and approaches that help us get the job done and protect the natural resources while getting oil and gas extraction out is really important to all of us, and I think these offices are outstanding. And I look forward to what they can do in the future in helping us learn how to do it in other areas.

[The prepared statement of Ms. Clarke follows:]

PREPARED STATEMENT OF KATHLEEN CLARKE, DIRECTOR, BUREAU OF LAND MANAGEMENT AND H. DALE HALL, DIRECTOR, U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear here today to discuss the Bureau of Land Management's (BLM) and U.S.

Fish and Wildlife Service's (Service) efforts to improve oil and gas permitting pursuant to the Energy Policy Act of 2005 (EPAct). Our testimony today will highlight our efforts and achievements to date implementing the Pilot Project to Improve Federal Permit Coordination under Section 365 of the EPAct.

BUREAU OF LAND MANAGEMENT

At the BLM, we are dedicated to ensuring that the American people—regardless of where they live—benefit from the agency's multiple-use mandate. Recent natural disasters and the price of energy serve as reminders of the extent to which the availability of energy affects our quality of life. Our agency plays an important role in providing an appropriate mix of both renewable and conventional energy supplies from the public lands and, in turn, contributes to a more secure and reliable energy future for our Country.

We can accomplish all that we do only by involving the public through partnerships and working with our cooperating agencies. Our track record in developing and maintaining partnerships is second to none and in each community across the West you will find the men and women of the BLM hard at work to ensure that our decisions are based on the principles of multiple-use.

The BLM manages significant oil and gas resources on the public lands. Over the next decade, demand for natural gas is anticipated to increase by more than 25 percent. Public lands and the BLM play a key role here, as they currently provide 18 percent of the Nation's natural gas production. Our inventory of public lands in five key western basins identified nearly 140 trillion cubic feet (TCF) of natural gas, enough to heat more than 55 million homes for nearly 40 years. In the Pinedale area of Wyoming, industry expects to produce 15 TCF of gas over the life of the field. This would supply nearly 10 million homes for 20 years. Natural gas reserves of this magnitude are relatively rare. For example, Alaska's Prudhoe Bay field, the largest oil and gas field on the North American continent, contains 35 TCF of gas. Although much of the Nation's domestic oil production takes place offshore, oil production from the onshore public lands is still significant, totaling more than five percent of all domestic production.

U.S. FISH AND WILDLIFE SERVICE

The Mission of the U.S. Fish & Wildlife Service is to work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The agency's role regarding energy development is multifaceted. For example, the Service facilitates the environmentally sound exploration and production of privately held minerals on National Wildlife Refuge System lands in order to minimize impacts to those resources. We work in partnership with oil and gas operators to streamline this process so that the financial and operational needs of the operator are met, while fulfilling our role in protecting species and ecosystems for the enjoyment of the American public. We also work closely with other entities, such as the BLM, Environmental Protection Agency, and the Army Corp of Engineers, in the assessment of potential impacts to natural resources, when the requirements of the National Environmental Policy Act (NEPA) apply, and we consult with state and local agencies to ensure their regulatory requirements are met. The Service participates in necessary clearances for protected resources, such as Endangered Species Act consultation for threatened and endangered species, monitoring and compliance activities, and establishing mitigation and reclamation standards for individual projects. The Service consults with the oil and gas operators on all phases of exploration. This has helped in establishing effective relationships with the oil and gas community, and has effectively reduced delays and/or issues that may arise for either side. The Service works with partners to streamline regulatory processes, while fully supporting the conservation, protection and enhancement of wildlife and wildlife habitat.

BACKGROUND

The demand for onshore oil and gas is reflected in the dramatic increase in the number of applications for permit to drill (APDs) the BLM receives from one year to the next. The number of APDs received by the BLM has increased every year since 2002, and we anticipate this trend to continue into 2007 and beyond. A recitation of the numbers illustrates this dramatic trend. The BLM received 4,585 APDs in 2002; 5,063 in 2003; 6,979 in 2004; and 8,351 in 2005. Our current projection is that we will receive over 9,300 in 2006 and over 10,500 in 2007. We are proud of the progress we have made in response to this increasing demand; in 2005, we processed 7,736 APDs, a record number. However, despite this significant achievement, it is clear that more needs to be done to improve the APD process.

By signing the EPAct into law, and again more recently in the State of the Union Address, President Bush declared his continuing intention to secure America's energy future, which includes promoting dependable, affordable, and environmentally-responsible domestic energy production while reducing U.S. dependence on foreign oil. In passing the EPAct, Congress also signaled that it shares the President's goal of providing access to reliable domestic energy supplies that are crucial to the economic health and security of every American household and business. The EPAct creates an innovative way for Federal resource management agencies to cooperate in meeting this challenge through the Pilot Project.

In order to address the increasing demand for drilling permits, Section 365 of the EPAct authorized the creation of the seven Pilot Project Offices, where interagency coordination improvements can be developed and tested, along with other methods to improve permit processing. These Pilot Project Offices (Buffalo and Rawlins, Wyoming; Carlsbad and Farmington, New Mexico; Grand Junction/Glenwood Springs, Colorado; Miles City, Montana; and Vernal, Utah) are existing BLM offices within the five key western basins that have processed about 70 percent of the APDs received by the BLM in the last three years. Their workload and location makes them ideal for permit processing innovations.

In addition, Section 365 authorized an estimated $20 million in mandatory funding for these offices from the Federal share of rental receipts from onshore oil and gas leasing. The Treasury Account for the Permit Processing Improvement Fund for the Pilot Project Offices was established on November 1, 2005, and the authorized receipts are now being placed in that account.

The track record of the BLM and the Service for cooperation will serve as a solid foundation for the efforts underway in the Pilot Project Offices. We understand that your interests today are in the progress made by the BLM and the Service in implementing the Pilot Project for improved oil and gas permitting, pursuant to Section 365 of the EPAct. We will now turn to discussion of the efforts underway to implement the Pilot Project.

IMPLEMENTING THE PILOT PROJECT

Together, we recently toured the Pilot Project Offices. Key leaders of many of our Federal and state partnership agencies joined us on these tours. Based upon what we have seen we are pleased to report to you that the BLM and the Service are making considerable progress implementing the Pilot Project.

The Pilot Project provides a vehicle to bring more resources to accomplish permitting, increased inspection and enforcement, foster innovation, test more efficient interagency processes, and try new and emerging technologies. The Pilot Project Offices will be laboratories of efficiency and environmental protection, providing one-stop coordination for review of oil and gas development and for conducting inspection and enforcement activities.

Interagency MOU

An Interagency Memorandum of Understanding (MOU) to implement the oil and gas Pilot Project Offices was signed by the Administrator of the Environmental Protection Agency (EPA), the Secretary of Agriculture, the Assistant Secretary of the Army for Civil Works, and the Secretary of the Interior on October 24, 2005, ahead of the 90-day requirement in the Act. The MOU establishes the roles, responsibilities, and delegations of authority among the Federal agencies. In order to implement the terms of the MOU, BLM managers and their counterparts at partner agencies have been engaged in intensive planning and recruitment efforts to ensure that staff and support are in place in the Pilot Project Offices to meet the responsibilities outlined in the MOU and in the EPAct.

Under the terms of the MOU, the BLM and the Forest Service will continue cooperating closely to administer oil and gas development on lands managed by the Forest Service. Particular attention will be given to improving communication and information-sharing and to field reviews and inspection and enforcement activities. Furthermore, the involvement of the Service will ensure increased cooperation concerning threatened and endangered species during project planning and implementation. Staff from the Forest Service and the Service will be collocated in a number of the BLM Pilot Project Offices.

Together with BLM staff, they will complete environmental analysis required by NEPA; develop necessary clearances for threatened and endangered species and cultural resources; conduct monitoring and compliance activities; and establish mitigation and reclamation requirements for individual projects.

The Service is working with the BLM at all levels to implement Section 365 of the EPAct. A memorandum of understanding between the BLM and the Service identifies six specific responsibilities that, once fully implemented, will allow the

Service to streamline its efforts under the permit review process. The two agencies are customizing the duties of positions at collocated offices to improve permitting processes, while protecting of natural resources. Adaptive, programmatic measures will reduce the Service's permit review time while enhancing stewardship of endangered species and other Federal resources. By integrating Service personnel with BLM staff early in the land use planning process, the Service anticipates greater regulatory flexibility, fewer delays, and an overall reduction in related negative environmental effects.

The Service has filled positions in five of the seven Pilot Offices and has assigned temporary staff to the remaining two offices that will remain in place until the Service can complete the hiring process for those positions. These staffs are supported by three full-time existing Service employees who will oversee the initial stages of implementation of the pilot program. Critical to the Service's long-term success is the identification and application of new and improved procedures to address the high volume of APD workload anticipated by the BLM, and increasing staff in the pilot offices (and elsewhere) as workload increases and additional pilot program funding become available.

The recent increase in approved APDs will lead to increases in the need for inspection and enforcement activities. Accordingly, the BLM will work to focus appropriate resources on inspection and enforcement activities.

State Coordination

We are also working with state governments to bring state wildlife, environmental quality, oil and gas commission, and historic preservation staff into the Pilot Project. This will further coordinate energy development activities and further ensure the protection of important species and cultural resources.

Staffing and Administrative Efforts

One of the very important items for the BLM has been meeting staffing needs for the Pilot Project Offices. To date, a total of 99 BLM Pilot Project Office positions (out of 105 identified) have been filled. The agency has hired a total of 19 Petroleum Engineering Technicians and 21 Natural Resource Specialists for the Pilot Project Offices as well as other subject matter experts and the necessary support staff to meet the goals of the Pilot Project.

On February 23, 2006, the BLM transferred funds to the Forest Service for 6 Pilot Project Office positions, to the Fish and Wildlife Service for 10 Pilot Project Office positions, and to the Army Corps of Engineers for three and one-half Pilot Project Office positions. We also have transferred funds to the Bureau of Indian Affairs to add one position in Farmington, New Mexico, and are working with the Bureau of Reclamation to add one position in Carlsbad, New Mexico.

The BLM, through the Department of the Interior National Business Center, has hired a contractor to assist in the review and reporting of implementation and performance of the Pilot Project streamlining efforts over the next three-year period. This independent review will assure an impartial analysis of our performance on the Pilot Project implementation.

Additionally, the BLM has issued interim guidance for APD processing that incorporates the timeframes required by the EPAct. These processing timeframes will also be incorporated into a reissuance of Oil and Gas Onshore Order No. 1, which will be published in the Federal Register. The BLM has also issued interim guidance to implement the statutory categorical exclusions contained in the EPAct.

RESPONSIBLE DEVELOPMENT

As we implement Section 365, it is important to bear in mind that the EPAct does not change the requirements of the Endangered Species Act, the National Historic Preservation Act, the Clean Water Act, the Clean Air Act, the National Wildlife Refuge Improvement Act, or Federal Land Policy and Management Act. The BLM looks forward to cooperating closely with its Pilot Project partners, such as the Service, in continuing to implement these important laws that protect our environment and cultural resources.

One of the BLM's responsibilities is managing wildlife resources, which is an important aspect of our multiple-use mandate. Some have questioned BLM's practice of using its wildlife biologists in the permitting process, but doing so specifically ensures that wildlife needs are considered in areas slated for energy development.

BLM wildlife biologists are involved in the permitting process from an early stage in order to ensure the best protection for wildlife near proposed well drilling sites. They work with companies to identify areas where there are wildlife concerns; attend onsite meetings with the operator at proposed drilling points; make recommendations regarding necessary Section 7 consultations for threatened or endan-

gered species; and consult with state game and fish agencies concerning species of state interest. They are also an important part of the interdisciplinary NEPA team responsible for the preparation of environmental analysis and development of appropriate mitigation and protective measures.

Through the EPAct, Congress directed the BLM to work on a number of important initiatives relating to energy development. The BLM continually seeks new ways to minimize, mitigate, or compensate for any adverse impacts from development activities.

Innovation of the type envisioned in the Pilot Project is already underway at the BLM. Some examples include a pilot block survey BLM initiated in the Carlsbad Pilot Office to identify cultural resource properties in the area, and the incorporation of advanced technologies and environmental Best Management Practices (BMPs), such as drilling multiple wells from a single location, centralizing production facilities or relocating them offsite, minimizing road construction, and performing interim mitigation. In the Jonah Field, the BLM is evaluating an experimental drilling technique proposed by the operator using temporary wooden pallets for roads and well pads to determine if this technology reduces impacts to surface vegetation and soil.

The BLM is also using performance-based standards to challenge industry to reduce emissions, minimize surface disturbance, and develop quick and effective reclamation techniques to improve restoration of disturbed areas. If on-site mitigation measures do not achieve the desired conditions, companies have the option of undertaking off site mitigation measures. For example, in March of this year, we announced that EnCana is contributing up to $24.5 million over ten years toward an office dedicated to funding offsite mitigation and monitoring in the Jonah Field, Wyoming. We expect that offsite mitigation will become an increasingly useful tool for improving habitats adjacent to natural gas development areas.

In the Pinedale area of Wyoming, for example, concerns about impacts to wildlife have resulted in reduced surface disturbance compared to past development. By implementing such measures as the consolidation of infrastructure, such as roads, pipelines, and production facilities, we have achieved an overall reduction in the footprint of development involved in winter drilling projects in the Pinedale Anticline.

CONCLUSION

In conclusion, Mr. Chairman, energy is vital to expanding our economy and enhancing Americans' quality of life. The Administration is proud of the progress we have made in responding to the increased demand for access to the Federal onshore oil and gas resources we manage. As noted at the beginning of our statement, over the next decade, demand for natural gas alone is anticipated to increase 25 percent. The BLM and the Service plan to help meet this unprecedented demand by using tools provided under the EPAct, such as the Pilot Project, and developing and applying program innovations and process efficiencies that improve inter-agency coordination and effectiveness.

The Pilot Project will further enhance our ability to respond to the demand for oil and natural gas, while meeting the other goals of our multiple-use mandate. In the 10 months that have elapsed since the enactment of the EPAct, we have made substantial progress in our ongoing efforts to respond to this demand.

Thank you for the opportunity to testify today about the Pilot Project. We would be happy to answer any questions you have.

Senator THOMAS. Good. Thank you.

The chairman has returned.

The CHAIRMAN [presiding]. Thank you very much.

Thank you, Mr. Hall. Thank you, Kathleen Clarke. And will you stay, even though you're finished?

Ms. CLARKE. Yes.

The CHAIRMAN. Just so you might fill in for responding to others——

Ms. CLARKE. Absolutely.

The CHAIRMAN [continuing]. Who are making observations. That would be very helpful.

I had some opening remarks. I'll say a little bit about them, because I want to just put the overview, as I see it, on this hearing and what it's about.

STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. These hearings have been called because we had estimates that the inventory of oil and gas on Federal lands, at least in 2003 in the Rocky Mountain region, is considered to have the largest untapped, onshore natural resource reserves in the country. Estimates of 138 trillion cubic feet of natural gas on Federal lands in the interior West is sufficient to heat all the 55 million homes that use natural gas in the United States for 39 years.

Obtaining access to these Federal resources is probably the most often cited issue affecting oil and gas production in the Rocky Mountain West. Among those provisions, one stands out: Section 365 of the Energy Policy Act of 2005, the Pilot Project to Improve Federal Permit Coordination. This section establishes Federal permit streamlining projects in seven BLM field offices in the State of Wyoming, Montana, Colorado, Utah, and New Mexico. This section also provides over $20 million of the new funding for these seven offices. Some assert that, with the volume of natural gas in this region, these provisions may do more to increase production than anything else in the energy bill.

Today, we hope to get an update on what the progress has been, and how good it has been. It's been 10 months since the energy bill was signed, so we are still early in the process. Today, we will hear from five witnesses, four of whom I expect we will gain a clear picture as to how these programs are proceeding.

So, we're going to start, as we already have, with Kathleen leading off, as she has. And she called on Mr. Hall, as she did; and then we will proceed right down the line with the other witness and see where we end up.

With that, let us now proceed.

I know that some Senators have not made a statement of any type. Senator Martinez, would you like to comment?

Senator MARTINEZ. Mr. Chairman, thank you very much for holding the hearing today. I would like to just submit a statement for the record, in the interest of time.

Thank you very much.

The CHAIRMAN. Thank you. That will be done.

[The prepared statement of Senator Martinez follows:]

PREPARED STATEMENT OF HON. MEL MARTINEZ, U.S. SENATOR FROM FLORIDA

Chairman Domenici, I wanted to thank you for holding this hearing today on the development of oil and gas resources from our nation's public lands. Section 365 of the Energy Policy Act directed the Bureau of Land Management (BLM) and other related federal agencies to improve coordination of permitting for the extraction of these resources and ease the backlog of permits waiting for consideration.

According to BLM, public lands provide over 18 percent of our country's supply of natural gas production. This trend can only be expected to go up with the increase in natural gas demand in the U.S.

In 2003, an inventory of resources was conducted on the Rocky Mountain region which concluded that greatest untapped on-shore reserve of natural gas was located there. The study estimated 138 trillion cubic feet of natural gas resided in the region and would heat nearly 55 million homes for almost 40 years. This is truly an astonishing amount of natural gas, considering that it is over 20 times as large as

the natural gas reserves estimated to be in the Lease 181 area off the coast of Florida (6 trillion cubic feet).

Because of the incredible size of reserves and the escalating price of natural gas, applications for permits to drill (APDs) have sky-rocketed from 4,585 in 2002 with projects for 10,500 APDs by 2007.

This rapid increase has concerned many not just in the environmental community, but in the sportsmen groups as well. As a Senator from an environmentally sensitive state, I well understand these concerns when dealing with energy development on federal resources. Florida has very little public land left for hunters and fisherman to enjoy, which is partly a result of the staggering growth the state has experienced.

Economic growth, prosperity, conservation, and our nation's energy needs are not mutually exclusive priorities. Public lands belong to everyone. And what happens on these public resources—be it recreation, preservation, or energy development—it's still vetted and subject to the Endangered Species Act, the Clean Water Act, the Clean Air Act, and a whole host of other environmental, cultural, and historic protection standards.

We also need to remember that our public lands are also our nation's heritage—our inheritance, if you will. The forests, mountains, rivers, streams, the picturesque vistas and solitary wide-open spaces—as we move forward we need to remember that there is an intrinsic public value that can not be measured only in Btu's or kilowatts.

I look forward today to hearing from our agency partners in the Administration, the energy industry, and conservation associations so that we can work collaborative to develop and protect our national public treasures.

The CHAIRMAN. Senator Larry Craig.

STATEMENT OF HON. LARRY E. CRAIG, U.S. SENATOR FROM IDAHO

Senator CRAIG. Mr. Chairman, thank you for another oversight hearing on this critical issue. I know that Kathleen has been working due-diligently for the last good many months, since the passage of EPAct, to accomplish what we feel can be effectively and responsibly accomplished out in the overthrust in certain of those States of the West that you've mentioned. So, I look forward to the balance of the comments, and I have some questions.

Thank you.

The CHAIRMAN. Thank you very much.

Now we will proceed. I think the next witness, Senator Bingaman, if I am correct in order, will be Mrs. Mary Flanderka.

Would you please identify yourself and proceed with your testimony?

STATEMENT OF MARY FLANDERKA, STATE PLANNING COORDINATOR, OFFICE OF THE GOVERNOR, STATE OF WYOMING

Ms. FLANDERKA. Thank you, Senator. Thank you, Mr. Chairman and members of the committee. It's an honor to be here.

I work for the State Planning Office, under Governor Freudenthal. And our office, along with State agencies and local government, have been very involved with the BLM, working on many, many pilot projects, as well as many projects dealing with oil and gas development.

And, at this time, I want to say thank you to Director Bennett, the State director of Wyoming, and his staff and his field offices. One of the goals of the Energy Policy Act was to create partnerships and coordination with many entities, and the director has done that, and he is committed to that. It is not easy, especially when you look at multiple organizations with different missions. Do we agree all the time? No. But there is a commitment to work

together and work through these delicate and difficult multifaceted issues.

There are many steps to successful development. And right now I'd just like to focus on the permitting, especially in the pilot project offices.

They have ramped up, they have gotten people employed there. They're located there. They've issued, I believe, 2,900 permits in Wyoming in 2005, and they're hoping, or expecting, to issue 4,500. Things are going well, but you can't put old heads on young shoulders, and that's going to take time, experience, and training to get these folks up and moving as efficiently as possible.

But there are other components of successful development that I'd like to talk about right now. And the first one is planning.

We have three field offices that have resource management plans that have been delayed for over 2 years. There are other field offices, as well, that have not begun these resource management plans. These plans were developed in the 1980's. They're outdated for the level of development we're seeing.

The importance of these plans is, they outline the pace and place of development, as well as the thresholds that we expect to see on other resources. And part of the problem—and I don't want to pass blame or judgment on the BLM, because, frankly, they've got a lot of pressures right now, but to work through these RMPs and to work through these project EISs takes a skill set that is very specific. It just can't be a specialist that gets along with other people; it takes a very specific skill set and a project manager to complete these.

The other aspect of development is the implementation; of course, development, production, reclamation, and plugging. Right now, Wyoming is really focused on reclamation. We're in a drought. With 12 inches of rain last night, I'm jealous. I wish that we could take some of that back. But reclamation, if it's improperly done, or not done, or not done timely, will affect air-quality issues, permittees, weed management, and habitat issues.

And then, the last leg of the stool, as Director Clarke had mentioned, was inspection and monitoring. And the pilot offices are ramping up for inspection. However, what the Wyoming office has seen is that they've only been able to complete two-thirds of the required 10 percent of inspections. And with development going fast and furious, it's important to make sure, one, that the right things are being done, they're being done in the right way; and, if they are being done, that they're effective. And I don't know that we know that. As we issue more and more APDs, we want to make sure that the right conditions of approval are included in that, in new APDs, so we don't get into an environmental problem.

Finally, the suggestions that have come out of our experience is that it's really important to complete the resource management plans, as well as the project EISs. If they drag out, we get into more and more problems, and then we drag out longer. We need to complete these RMPs, these EISs, get them done, outline the thresholds that need to be met for the other resources. And, although we talk about resources for BLM, which is needed—of course, that's money or people—there is a need to make sure that there is money for EPA, as they do flow-through money for our De-

partment of Environmental Quality, who also has a role and a responsibility in issuing permits to the industry. And then, there is also the National Historic Preservation Grant, which provides a block grant to States to do SHPO clearance. And, frankly, Wyoming is the fourth-busiest State dealing with APDs, and ranks 44th on the list of funding.

And then, finally, a thought is, at the Pinedale Field Office, we were surprised that that was not considered a pilot project office, with everything going on. With deep gas that's going on in Pinedale Field Office, that would be worth considering, also, to take a look at that.

Thank you very much.

[The prepared statement of Ms. Flanderka follows:]

PREPARED STATEMENT OF MARY FLANDERKA, STATE PLANNING COORDINATOR, OFFICE OF THE GOVERNOR, STATE OF WYOMING

Good morning, Mr. Chairman and members of the Committee. I appreciate this opportunity to submit this statement as a part of today's hearing related to the implementation of the Energy Policy Act provisions on enhancing oil and gas production on federal lands in the Rocky Mountain region.

In their role as cooperating agencies, the Wyoming State Planning Office, along with various state agencies, have been involved in Bureau of Land Management (BLM) oil and gas development in Wyoming as well as participating in the implementation of many of the 2005 Energy Policy Act provisions.

For successful energy development to occur, attention needs to be given to these three issues: flexibility in permitting based upon site-specific issues and appropriate available technology; speed in permit issuance; and accountability to ensure that the right practices are implemented in the right way and at the right time. The early implementation of the Energy Policy Act has focused on permit issuance.

My remarks this morning will focus on the impact of the legislation on energy development in Wyoming regarding permitting, planning, monitoring/inspection and reclamation activities.

The opportunity exists for the BLM, with appropriate funding, to maximize the positive impacts and minimize the negative impacts associated with energy development in Wyoming.

There is no question of the need to develop Wyoming's energy resources. As a result of that development, the state of Wyoming receives significant revenue from royalties generated by mineral production. However, concurrently, Wyoming feels the impact of accelerated development through social and economic changes in local communities as well as impacts to wildlife, recreation and air and water resources.

There is support for permit-streamlining efforts that will increase energy production; however, there is equal support for strengthening other aspects of regulating energy development. This includes effective and efficient planning and inspection/monitoring activities. Planning and monitoring require a partnership between the state of Wyoming, the BLM and others. Without improving planning and inspection/monitoring activities, permitting times could continue to languish due to social or even legal constraints related to impacts on other resources.

Bottom line, an increase in permits is not the only element that will increase and maintain energy production. The entire development stream (planning, permitting, monitoring and reclamation) must be fully attended to if energy development is to occur efficiently and effectively.

Project environmental impact statements (EIS) and resource management plans (RMPs) are overdue. These documents are imperative to successful energy development.

Three of the four BLM time-sensitive projects identified in a June 2004 priority list of Wyoming BLM land-use planning projects are yet to be finalized—two years after their initial deadlines. The staff at the state and local field offices find themselves multi-tasking to a remarkable degree and being torn between planning and permitting. Additional resources are needed to allow a planning team to focus on completing RMPs, and project EISs are needed to ensure that there is always a next generation of applications waiting to be processed.

The completion of RMPs is important for reasons other than just permitting; there is a need to address thresholds of protection for other important resources. The current RMPs are outdated. At the time of printing the current RMPs, the current level

of development had never been anticipated and new technology and science have since created additional opportunities for development. The RMP revisions need to identify those areas whose leasing should be deferred for the protection of other resources, while energy-rich areas are fully developed. As an example, the Pinedale Field Office had 92% of its area leased, with a high likelihood of full development. The 8% of remaining land does not seem able to protect other resource values such as sage grouse, mule deer, antelope or recreation opportunities.

Even with additional personnel in the pilot offices, the permitting increase is occurring. The state and local BLM offices are still struggling under increasing workload and high turnover. This will change with training and experience.

I would like, to take just a few minutes, though, to give credit to the state BLM office and Wyoming's field offices. The state agencies, local counties and BLM offices have been working on many issues, either as partners or via cooperating agency status. Although the process is always not smooth, there is a commitment by all to continue to make the relationships more effective and efficient. Wyoming BLM Director Bennett has been a leader in making sure communication continues regardless of impediments.

Permitting is ramping up in Wyoming. The BLM has processed 2900 Applications for Permit to Drill (APD) in 2005 and is anticipating processing 4500-5000 APDs in 2006.

Wyoming BLM, from the state's perspective, has faced serious pressure to lease and permit—both of which are necessary for development. The Buffalo and Rawlins field offices have received almost all personnel to fulfill permitting goals. But throwing money and personnel at a problem does not necessarily make permitting go faster. Experience and coordination are necessary if efficient permitting is to happen. It is ludicrous to expect field offices with up to 20% annual turnover rates to be operating at full speed.

There are currently no state agency employees actively involved in the permitting emphasis in the pilot projects. The state departments of Environmental Quality and Game and Fish see their roles evolving with planning or monitoring/inspection activities. And, again, both areas are suffering. Dialogue is occurring regarding the placement of state employees in these two offices.

Monitoring is vital to validating whether or not development is proceeding properly.

Although the Energy Policy Act refers to the development of best management practices and the need for enforcement, very little attention was directed to those areas during the act's development. Moving ahead quickly on any project is dangerous if there is no monitoring to make sure that the project is being done correctly. BLM energy development in Wyoming is headed in exactly this direction due to a focus on permits above all else and a lack of funding. Without the assurance that development is proceeding appropriately, additional permits could be processed with faulty information, leading to serious environmental problems—which could in turn lead to court injunctions.

BLM monitoring funds have seen limited increases from the national monitoring funding, but that funding is spread continually thinner as more wells are completed. A smaller overall percentage of wells is actually inspected annually. Frankly, the words in the lease become meaningless if there is no accountability, assurance or inspection that the work is getting done. Numbers already indicate that field offices in Wyoming are having a difficult time meeting the existing inspection requirements. Wyoming BLM field offices in 2001 were able to complete 93% of 1750 required environmental inspections, for a total of 15,000 federal permitted wells. In 2005, the BLM completed only 66% of its required 2100 environmental well inspections of a total of 20,000 federal permitted wells; this year, the state office anticipates that it will be able to conduct 66% of required well inspections. The data clearly indicates that an expedited well permitting process coupled with increased drilling applications requires that federal agencies be provided additional adequate resources to fulfill inspection and enforcement guidelines. Some may argue that there is no need, but there was an inspection incident in and adjacent to the Pinedale Field Office Jonah field in 2005, where a reporter uncovered many significant environmental violations. Inspection is far less expensive to industry, the BLM and the state than an injunction stopping additional development. The pilot office initiative has addressed inspection and enforcement capability to the Rawlins and Buffalo Field Offices but is only in the early stages of implementation. Similar assistance needs to be added to other BLM field offices.

A Government Accounting Office (GAO) Oil and Gas Report June 2005 identified the concern that increased permitting activity by the BLM has lessened the agency's ability to meet its environmental protection and liability responsibilities. The report indicates that field managers under pressure to complete permitting processes often

shift workloads from inspection and enforcement to application processing. Examples from the report describe how the Buffalo, Wyoming and Vernal, Utah field offices, the two field offices with the largest amount of permitting activity, were only able to each meet their annual inspection goals once in the past six years. Additionally, the report highlights that the Buffalo Field Office was only able to achieve 27 percent of its required environmental inspection goals during the 2004 fiscal year. Clearly it is in the interest of the public, state agencies, the BLM and industry to ensure that the guidelines of leases and permits are being followed. The GAO recommends acquiring staff who would be dedicated to performing inspection and monitoring activities. Again, Wyoming concurs with this recommendation.

Federal energy development in Wyoming can be accomplished in such a way that meets the nation's energy needs while still protecting the state's social, economic and natural resources. In order to do that, the entire development process from cradle to grave needs attention from planners, decision makers, permitters and inspectors.

Suggestions for improvement:

In an effort to improve the effectiveness and efficiency of oil and gas development the following suggestions are offered:

- Complete RMPs and project EISs.
- Provide performance-based objectives, rather than prescriptive limitations within project and RMP final decisions.
- Continue to obtain and develop the necessary staff in both numbers and expertise to continue to permit.
- Continue to coordinate formally (via cooperating agency status) or informally with local and state governments to address site-specific social, economic and resource concerns in an appropriate manner.
- Stabilize and/or increase the U.S. Environmental Protection Agency's (EPA) funding to states so that existing state staffs can provide equal attention to their portion of the permitting process.
- Increase the funding for EPA's Underground Injection Control program to the Wyoming Oil and Gas Conservation Commission.
- Maintain or increase the National Park Service funding for the Historic Preservation Grant. Wyoming is the busiest state in the nation for Section 106 reviews with over 400 requests for comment from the BLM, but ranks 44th in funding.
- Commit funding to coordinating and procuring the most up-to-date resource data.
- Consider the creation of NEPA teams led by individuals with project management experience to complete RMPs and project EISs.
- Make the Pinedale field office a pilot office.

Finally, there was much controversy in 2005 about whether winter stipulations on BLM land were a hindrance to energy development. I would encourage you to avoid any hasty action that would remove these stipulations. Generally, these stipulations provide crucial protection to wildlife. Our preference is to have BLM outline in advance opportunities to work through stipulations. With proper planning and good communication, more times than not, issues can be worked out appropriately.

Again, thank you for this opportunity to submit my written comments to the record.

The CHAIRMAN. Thank you.

Mr. Zavadil.

STATEMENT OF DUANE ZAVADIL, VICE PRESIDENT OF GOVERNMENT AND REGULATORY AFFAIRS, BILL BARRETT CORPORATION, ON BEHALF OF THE INDEPENDENT PETROLEUM ASSOCIATION OF MOUNTAIN STATES, DENVER, CO

Mr. ZAVADIL. Mr. Chairman, members of the committee, my name is Duane Zavadil. I am the vice president of the Independent Petroleum Association of the Mountain States. I'm also a vice president of government and regulatory affairs for Bill Barrett Corporation, an independent, Denver-based E&P company, exploration and production company.

I'd like to thank the committee for holding a hearing about the benefits of the act. IPAMS has submitted written comments, and I'll be summarizing those.

First, I'd like to thank all the members of this committee for their dedication and hard work in passing the Energy Policy Act of 2000. I want to tell you, the good news is that the committee's work from last summer is, in fact, making a difference in public land development, to help increase supplies from natural gas headed to consumers. Close oversight of the bill's implementation, or the act's implementation, however, is going to be necessary in order to see continued increases in production, going forward.

Public lands contain the largest onshore reserves of natural gas in the Nation. And, as the Director pointed out, 18 percent of our current production is from Federal lands onshore. The Energy Information Administration estimates that Intermountain West natural gas production will need to double over the course of the next two decades, ultimately surpassing the production in the Gulf of Mexico in order to keep pace with the Nation's demand. That doubling number is significant. I'll point out later that some sort of a paradigm change is going to be necessarily, ultimately, to accommodate that growth.

The agency currently responsible for administering energy production on public lands, the Bureau of Land Management, faces a multitude of issues. The critical land-use plans have, in fact—or the completion of those critical plans has slowed to a crawl. Leasing has become divisive, and appeals are the norm. NEPA remains a source of delay and uncertainty for investment. Demand for drilling APDs has outpaced the agency's ability to process them. BLM's management of this dynamic combination of factors has a real effect on the market price of natural gas. Notwithstanding these problems, the act is providing, and will continue to provide, relief for those 62-million households, by our calculation, that consume natural gas.

The act contains provisions to improve the Federal Government's ability to develop its onshore energy resources. Both leasing and permitting on Federal lands were addressed in the legislation. For some provisions, it's really too early to determine whether implementation will yield substantive changes in public-land energy development. However, we are seeing tangible benefits from this legislation, in the form of increased production, that will reduce the impact of another serious supply disruption like we suffered last year.

The act requires agencies to examine their leasing process to determine where improvements can be made. The act requires further coordination between the agencies, as was pointed out earlier, where there are overlapping jurisdictions within the Fish and Wildlife Service, the Environmental Protection Agency, and so forth. And we believe the pilot project offices, with their expanded capacity, will, in fact, aid, ultimately, the nomination, slash, leasing process. These measures will provide the basis for BLM to reduce the delays associated with nominating and issuing leases for energy production.

Permitting remains the most immediate, and perhaps most manageable, element controlling the amount of natural gas to reach

consumers from public lands. Commodity prices tell us that more wells need to be drilled. Both industry and BLM have responded, and drilling is up. The number of permits approved by the BLM, by one statistic, has increased 20 percent over the last 3 years. At the same time, the number of permits that we have submitted as an industry to the BLM has increased by 27 percent. Field offices have, therefore, fallen further behind.

The act created the Pilot Program to Improve Federal Permit Coordination, the busiest offices. We think that is a tremendously valuable asset. We've seen real progress in each of the pilot offices. The number of permits that have been approved, for example, in the Vernal field area office has dramatically improved. Of course, since we're submitting more APDs, the delay is still there, but the throughput has, in fact, increased dramatically.

One very tangible improvement on the permitting front is the use of the section 390 categorical exclusions. We conducted an informal survey of our members, and a third of the respondents had suggested the use of categorical exclusions; 28 percent of those were, in fact, adopted. They seem to be taking as long as the APD process, the normal APD process, but, maybe with a bit more certainty in the outcome.

I have a case in point, from our own company's experience, that illustrates, sort of, both the good and bad. We have a drilling program in a field in Utah that we simply wouldn't be able to be going forward with at this point in time. We expect we'll drill on the order of 30 wells and produce 50-million standard cubic foot of gas by the end of this summer. That simply would not have been possible without the categorical exclusion process.

In closing, I think it's important to recognize the efforts of the BLM and commend them for accommodating the growth that we've seen over the course of the last year or so, or the last several years. The growth has been dramatic. Public-land natural-gas development is vitally important to the Nation. The Government's role in the natural-gas markets today should be apparent, and will only increase with time. And while paradigm changes in the administration of the Federal permit programs are necessary to get to that—twice the level we are today, the Energy Policy Act of 2005 will, in fact, help reduce our dependency on foreign natural gas. We hope that the Federal agencies, at all levels, continue to work with industry to ensure that those opportunities created by the Act continue to increase production on Federal lands.

Thank you.

[The prepared statement of Mr. Zavadil follows:]

PREPARED STATEMENT OF DUANE ZAVADIL, VICE PRESIDENT OF GOVERNMENT AND REGULATORY AFFAIRS, BILL BARRETT CORPORATION, ON BEHALF OF THE INDEPENDENT PETROLEUM ASSOCIATION OF MOUNTAIN STATES, DENVER, CO

Mr. Chairman and members of the Committee, my name is Duane Zavadil and I am Vice President of the Independent Petroleum Association of Mountain States. I want to thank this Committee for holding a hearing about the benefits to the public of the Energy Policy Act of 2005. First, I'd like to thank all members of this Committee for their dedication and hard work in passing the Energy Policy Act of 2005. Second, I want to tell you the good news, that this Committee's hard work from last summer, is making a difference in public land development to help increase supplies of natural gas headed to consumers. The final point I would like to make is that

close oversight of the Act's implementation will be necessary to see continued increases of energy production on federal lands in the Intermountain West.

PUBLIC LAND ENERGY AND THE ENERGY POLICY ACT

Public lands owned and managed by the federal government hold resources that benefit the nation in multiple ways: food, recreation, habitat for wildlife, and last but not least, energy. As the nation's appetite for energy continues to grow and production from traditional sources decline, public lands in the Rockies must play a significant role in the nation's energy security.

The federal government is the largest owner of natural gas reserves in the nation by way of its surface and subsurface management of public lands. The Bureau of Land Management (BLM) and the Forest Service manage 261 million and 193 million acres of surface lands respectively. These lands are located overwhelmingly in the Western states. The federal mineral estate underneath BLM, Forest Service, other agencies and even some private lands, encompasses 699 million acres.

The federal government will play a significant role in the future development of natural gas because demand for natural gas is not expected to decline significantly in the next two decades and likely beyond. According to the Energy Information Administration (EIA), by 2030 U.S. consumption of natural gas will be 27 trillion cubic feet, up from 21.9 Tcf today. It is estimated that federal lands contain nearly 200 trillion cubic feet of technically recoverable natural gas. Public lands contain the largest onshore reserves of natural gas in the nation and currently supply 11 percent of the nation's natural gas. The EIA estimates that Intermountain West natural gas production will double over the next two decades surpassing the Gulf of Mexico. Today, more than half of the natural gas from this region is produced from public lands.

The current bureaucratic process for developing these lands, however, moves slowly and in recent years has not kept pace with the nation's energy demands. Last year, hurricanes Katrina and Rita underscored the lack of secure, excess natural gas. The agency currently responsible for administering energy production on public lands, the Bureau of Land Management faces a multitude of issues. Preparing critical land use plans has slowed to a crawl. Leasing has become divisive, spurring extended administrative processes through protests and appeals of federal agency decisions. NEPA remains a source of delay and uncertainty. Demand for drilling permits has outpaced the agency's ability to process them. BLM's management of this dynamic combination of factors has a real effect on the market price for natural gas. Notwithstanding these problems, the Energy Policy Act of 2005 is providing, and will continue to provide relief to the 62 million households that consume natural gas.

The Act contains provisions to improve the federal government's ability to develop its onshore energy resources in the public interest. Both leasing and permitting on federal lands were addressed in the landmark legislation. For some provisions, it is too early to determine whether the implementation of this legislation will yield substantive changes in public land energy development. However, we are seeing tangible benefits of this legislation in the form of increased production that could reduce the impact of another serious supply disruption.

LEASING, PLANNING AND PERMITTING

Planning

The land use planning process is critical to oil and gas development on public land. Both the BLM and Forest Service are required to prepare planning documents pursuant to federal law. These plans guide multiple-use activities in the areas covered by the plans. The importance of these plans cannot be understated. If land-use plans are not updated with sufficient consideration of the need for expanded energy production, the nation's ability to provide affordable domestic energy is severely limited.

Many of the current plans are outdated and do not reflect the importance of public lands in meeting energy demands. Recognizing this, in 2001 BLM initiated an overhaul of its entire planning base with the goal of updating all 160 RMPs within ten years. Twenty-one "Time Sensitive Plans" (TSP) were identified as high priority because they address energy resource development, respond to nationally significant lawsuits, or have legislatively mandated time frames. With 2006 upon us, six TSPs critical to oil and gas development are not yet final (Table 2) limiting BLM's ability to effectively manage the public's energy resources. Furthermore, some of the plans, in their draft form, contain prescriptions that further limit, rather than expand, the potential for energy production. Simply put, many of these draft plans are inconsiderate of the effect that the government has on natural gas prices and consumers.

If these plans are appropriately updated, BLM managers will be able to more effectively carry out many elements of energy program administration, elements such as leasing and permitting that were addressed by the Act. These plans need to be reviewed for their impact on consumers and completed as soon as possible.

Leasing

Media accounts of oil and natural gas leasing lead one to believe that leasing is galloping along at a break neck pace. In reality, leasing has continued at an even pace through both the Clinton and Bush Administrations. For the last several years, with rising natural gas prices and improved technology, there has been significant interest in areas that were not feasible to develop in the past. As these areas have been nominated for oil and gas leasing by companies, conflicts arise with organizations who want to block all development. As a result, administrative challenges, called "protests," of leases in the Intermountain West have been on the rise over the past few years.

BLM lease sale protests have increased significantly over the past few years. Between 2001 and 2005, 42% of all lease parcels offered in the Intermountain West have been protested. In 2005, 55% of the lease parcels offered were protested (Table 1). Isolating Colorado and Utah, 80% of all offered lease parcels were protested. Protests divert BLM personnel and funding from effectively managing the multiple uses of the land to fighting litigation and administrative processes. Protests further tie up a company's capital that could be used to produce energy.[1] (See Attachments for more information about Leasing Public Lands).[2]

Table 1.—2005 LEASE PROTESTS

State	Parcels offered	Parcels protested	Percent
Colorado	292	234	80%
Montana	442	48	11%
New Mexico	314	197	63%
Utah	329	264	80%
Wyoming	968	542	56%

Table 2.—APPLICATIONS FOR PERMITS TO DRILL (APD)

	Q1-Q3 2004	Q1-Q3 2005	Q1-Q3 2006	Average change
APDs received	4470	5769	7272	27%
APDs approved	3363	4296	4874	20%

The Energy Policy Act of 2005 has the potential to improve the leasing process for public lands. The Act requires agencies to examine their leasing processes to determine where improvements can be made. The Act requires further coordination between agencies where there is overlapping jurisdictions (wildlife, air quality, etc.). Pilot project offices should have expanded capacity to review nominations and offer parcels for leasing. These measures provide the basis for BLM to eliminate many of the delays associated with nominating and issuing leases for public land energy production.

PERMITTING

Permitting remains the most immediate and perhaps manageable element controlling the amount of natural gas to reach consumers. Commodity prices tells us that more wells need to be drilled. Both industry and BLM have responded and drilling is up. The backlog of permits in BLM field offices, however, continues to grow. As Table 2 shows, the number of permits approved by BLM has increased 20% over the last three years. At the same time, the number of permits received by BLM has increased by 27%. Field offices have fallen further behind. For companies juggling tight drill rig availability with seasonal stipulations that allow drilling only during a narrow time frame, permitting delays are very problematic. Approval times are

[1] Companies that successfully bid on a lease are required to pay the entire bonus bid (sometimes upwards of $2,000 per acre in recent sales) and first year's rent within 10 days of the lease sale.

[2] Attachments have been retained in committee files.

unpredictable and often reaching six months or more. An unpredictable permitting process leaves drilling contractors unable to sufficiently respond to market conditions by moving more rigs into the region, and producers are threatened with increased costs by losing drilling rigs or paying for drill rigs that they cannot keep busy. Multiply these pressures by the number of rigs that are working and the need to have multiple permits available to execute a coordinated, flexible drilling program and the need for a more timely permitting process becomes painfully apparent. (See Attachments for more information about Drilling Rigs in the Rockies).

The Energy Policy Act of 2005 created the Pilot Program to Improve Federal Permit Coordination in the busiest BLM field offices throughout the Intermountain West. The provision creating the pilot program also included a funding mechanism that uses one-half of the revenues received from lease rental payments. BLM has diligently implemented this section by hiring and training new personnel in the pilot offices. Although the program is just getting off the ground, IPAMS has great expectations that new personnel will quickly learn their responsibilities to minimize the apparent losses in efficiency that are inherent in any new program.

In addition to improving coordination among the federal agencies, IPAMS is very pleased that the pilot program will examine the permitting process to see where efficiency gains are possible. IPAMS believes this may be the most important step toward improving the permitting process on federal land. A comprehensive look at the current process to identify where the bottlenecks occur will help this Committee determine potential legislative action and oversight opportunities. Without examining the permitting process and making changes to improve its efficiency, BLM will likely continue to fall behind in permit approvals even as the agency's role will grow more important in meeting the nation's energy needs.

One tangible improvement on the permitting front is the use of Section 390 of the Energy Policy Act of 2005 which categorically excludes certain oil and gas operations from redundant analysis under the National Environmental Policy Act. Recently, IPAMS conducted an informal survey of our members regarding their experience with Section 390 of the Energy Policy Act.

Nearly one-third of the respondents had suggested the use of the categorical exclusions to the BLM and 28% were accepted. Another interesting result from IPAMS' survey was that Section 390 categorical exclusions took just as long to complete as the normal process for approving permits. This finding may indicate the need for closer oversight by this Committee to ensure the agency is carrying out the Congressional intent of Section 390.

CONCLUSION

Public land natural gas development is vitally important to the nation. The government's role in the natural gas markets today should be apparent and will increase in over time. While paradigm changes in the administration of the federal minerals program are necessary to avoid increasing dependency on foreign natural gas, the Energy Policy Act of 2005 is helping to address some of the immediate barriers to meeting natural gas demand. IPAMS hopes that federal agencies, at all levels, will continue to work with industry to ensure that the opportunities created by the Energy Policy Act of 2005 continue to increase energy production on federal lands.

Thank you for the opportunity to testify before you today, I am happy to answer any questions you may have.

The CHAIRMAN. Thank you very much.

Let's proceed to our next witness, Jeffrey Eppink.

STATEMENT OF JEFFREY EPPINK, SENIOR VICE PRESIDENT, ADVANCED RESOURCES INTERNATIONAL, INC., ARLINGTON, VA

Mr. EPPINK. Good morning, Chairman Domenici and members of the committee. My name is Jeffrey Eppink. I am a senior vice president with Advanced Resources International, an energy consulting firm based in Arlington, Virginia. I'd like to talk about the EPAct pilot offices and the potential of that program.

As a result of the passage, last summer, of EPAct section 365, the Secretary of the Interior was directed to establish a pilot project to improve Federal drilling permit coordination. The pilot

comprises seven Bureau of Land Management field offices: Miles City, in Montana; Buffalo and Rawlins, in Wyoming; Verna, in Utah; Glenwood Springs, in Colorado; and Farmington and Carlsbad, in New Mexico. These field offices are the locations of some of the richest natural-gas resources in the lower 58 States.

Subsequently, last fall, Advanced Resources was asked by the Secretary's office to perform an analysis of the impacts for processing outstanding applications for permits to drill—so-called APDs—from the pilot offices. Specifically, the Secretary's office asked us to assess the benefits that could accrue from the first 5 years of incremental funding to the BLM pilot offices. The funding for the program is anticipated to be $19 million per year. At the time of the analysis, the backlog of APDs in process in the pilot offices stood at 3,100, upon which our analysis was based.

Since last fall, in the wake of the devastation of Hurricane Katrina, natural-gas prices rose to record highs. Prices have now moderated significantly; although, on a historical basis, they are still quite high. As a consequence of these natural-gas prices, in the areas of the pilot offices, particularly, industry responded to the price signals and increased drilling applications. As a result, the number of BLM APDs in process has grown.

I checked with the BLM in late May, and there were over 4,500 APDs in process for the pilot offices, nearly a 50-percent increase from fiscal year 2005. Of these APDs, BLM indicated that 1,615 are administratively complete, meaning that the applications are not deficient for information that would delay processing. I mention these increased APDs, because the benefits I present below would be larger if the current backlog were considered.

The results from our analysis of last fall indicate that the benefits from the pilot program could be significant for the Nation, given the modest investment. The major effect of the assumed activities is to accelerate production, moving it earlier in time to capture most benefits within 15 years.

The analyses show that there would be a number of positive impacts. Production would be increased up to over 1,000 billion-cubic-feet-equivalent per year. Proved reserves would be increased up to 11,800 BCFe over the 5 years of drilling that would occur. The Federal share of royalties would be increased by $2.1 billion. The amount of incremental economic value developed as a result of the assumed activities could represent a net-present-value of about $20.4 billion. And jobs would be increased, peaking at over 14,000 per year. The cost of the initiatives is negligible, less than 1 cent per thousand cubic feet of added reserve.

In the absence of the increased APD processing capacity by BLM, it is unlikely that the backlog could be worked off as additional APDs are generated. As I have indicated, the backlog has already grown significantly this past winter. Were the backlog to be worked off, production resulting from drilling would act to increase supply and moderate prices for the Nation. It is noteworthy that, in order to accomplish this increased production, land-access issues need to be considered.

Although the results I have presented are robust, implementation of the pilot project will likely present challenges, including

issues of hiring APD-knowledgeable BLM staff, rig availability, the politics of land access, and possible pipeline constraints.

I appreciate the opportunity to present our analysis of the benefits of processing APDs and BLM pilot offices to you, and would be glad to answer any questions that you might have.

[The prepared statement of Mr. Eppink follows:]

PREPARED STATEMENT OF JEFFREY EPPINK, SENIOR VICE PRESIDENT, ADVANCED RESOURCES INTERNATIONAL, INC., ARLINGTON, VA

Good afternoon, Chairman Domenici and members of the Committee. My name is Jeffrey Eppink. I am a senior vice president with Advanced Resources International, an energy consulting firm based in Arlington, Virginia.

As a result of the passage last summer of the Energy Policy Act of 2005 (EPAct), Section 365, the Secretary of the Interior was directed to establish a pilot project to improve Federal drilling permit coordination. The pilot comprises seven Bureau of Land Management (BLM) field offices: Miles City, Buffalo, Rawlins, Vernal, Glenwood Springs, Farmington, and Carlsbad. These field offices are the locations of some of the richest natural gas resources in the lower-48 states.

Subsequently, last fall Advanced Resources was asked by the Secretary's office to perform an analysis* of the impacts for processing outstanding Applications for Permit to Drill (APDs) from the pilot offices. Specifically, the Secretary's Office asked us to assess the benefits that could accrue from the first five years of incremental funding to the BLM pilot field offices. The funding for the program is anticipated to be $19MM per year. At the time of the analysis, the number of APDs in-process in the pilot offices stood at 3100 (at the end of FY2005), upon which our analysis was based.

Since last fall, in the wake of the devastation of Hurricane Katrina, natural gas prices rose to record highs. Natural gas prices now have moderated significantly, although on a historical basis, they still are quite high. As a consequence of these prices, in the areas of the pilot offices particularly, industry responded to the price signals and increased drilling applications. As a result, the number of BLM APDs in-process has grown. I checked with the BLM in late May and there were over 4500 APDs in-process for the pilot offices—nearly a 50 percent increase from FY2005. Of these in-process APDs, BLM indicated that 1615 are "administratively complete" meaning that the applications are not deficient for information that would delay processing.

I mention these increased in-process APDs because the benefits I present below could be larger if the current backlog were considered.

The results of our analysis from last fall indicate that the benefits from the pilot program could be significant for the Nation given the modest investment. The major effect of the assumed activities is to accelerate production, moving it earlier in time to capture most benefits within 15 years. The analyses show that there would be a number of positive impacts:

- Production would be increased, up to over 1,000 billion cubic feet-equivalent (BCFe) per year,
- Proved reserves would be increased, up to 11,800 BCFe over the five years of drilling that the initiatives would affect,
- The Federal share of royalties would be increased by over $2.1 billion,
- The amount of incremental economic value, developed as a result of the assumed activities, would represent a net present value (NPV) of $20.4 billion, and
- Jobs would be increased, peaking at over 14,000 per year.

The costs of the initiatives are very low—less than 10 per thousand cubic feet (MCF) of added reserve, which is negligible compared to current natural gas prices of about $6 per MCF.

In the absence of increased APD processing capacity by BLM, it is unlikely that the backlog could be worked off as additional APDs are generated—as I have indicated, the backlog has already grown significantly this past winter. Were the backlog to be worked off, the increased production resulting from drilling could act to increase supply and moderate prices for the Nation. It is noteworthy that, in order to accomplish this increased production, land access issues need to be considered.

*The analysis has been retained in committee files.

Although the results I have presented are robust, implementation of the pilot project will likely present challenges, including issues of hiring of APD-knowledgeable BLM staff, rig availability, the politics of land access, and possible pipeline constraints.

I appreciate the opportunity to present our analysis of the benefits for processing APDs in BLM pilot offices to you and would be glad to answer any questions you might have.

The CHAIRMAN. Thank you very much.

Now, Mr. Tom Reed.

STATEMENT OF TOM REED, WYOMING FIELD ORGANIZER, TROUT UNLIMITED, ARLINGTON, VA

Mr. REED. Thank you very much. My name is Tom Reed. I work for Trout Unlimited. I also used to work for the Wyoming Game and Fish Department, and I'd like to speak specifically about Wyoming today.

Wyoming is more than carrying its weight for the energy needs of this country. Oil and gas development and exploration is taking place at an unprecedented rate. It is estimated that 25 percent of the State will be impacted by oil and gas development to meet our Nation's demands. That's a land area roughly equivalent to 360 Washington D.C.'s.

At Trout Unlimited, we feel that oil and gas development is appropriate in some places, and inappropriate in others. But even where it is appropriate, there needs to be sound science that protects our fisheries and wildlife, and, as an extension, our fishing and hunting opportunities. Wyoming truly is blessed with natural resources, both below and above the ground. The State's scenic beauty, wildlife, and fisheries are unparalleled. This State is known for its long vistas, its sagebrush deserts, high mountains, deep forests, and crashing rivers. To the hunter and angler, Wyoming offers some of the finest outdoor opportunities in the world, from its abundant pronghorn antelope and mule deer to its elk to its four subspecies of native cutthroat trout, this State sustains a wide variety of game and fish and enough wild country to absorb a lifetime of exploring. I, personally, have hunted Wyoming's deep spruce forests for elk, fished the high mountain lakes for native trout, and crawled through the sagebrush in an attempt to take a nice pronghorn buck. I've ridden my horse in the high country and floated down the wild rivers in the lower deserts. There are a lot of people in Wyoming just like me, they live there for the great outdoors and for the opportunity to hunt and fish and enjoy the time out there with their families.

But these can troubling times for people like me who love the great outdoors. At the current rate of development, scientists, particularly with the Wyoming Game and Fish Department, are having a difficult time keeping up with much-needed research. It is important for Congress to recognize that intensive impacts are occurring, and will continue to occur, as this region is changed from wild, empty country into industrialized zones. Funding for land management agencies, such as the Bureau of Land Management, needs to be secured specifically for scientists who deal with the impacts on wildlife and fisheries. State wildlife agencies, like the Wyoming Game and Fish Department, also need national funding so that biologists can be hired to deal solely with oil and gas. These

biologists would collect data, monitor impacts, and design and implement mitigation, working closely with industry and land management agencies.

There is a willingness among many in industry to move in this direction, but Congress also needs to step up with money so these agencies could take care of our fisheries and wildlife.

How this development is going to impact our wildlife and fisheries heritage is largely unknown, because much of the development has taken place in the last few years. To keep abreast of this, we need more science, and we need more scientists. For example, there are only three people in the Game and Fish Department's Cheyenne office to deal with oil and gas issues. When one realizes that just one corner of Wyoming, the Powder River Basin, faces an estimated 60,000 coalbed methane wells, it is clear that this is too much too fast.

The Department estimates that it needs staff biologists that deal with nothing but oil and gas development to study, understand, and try to mitigate impacts to crucial big game, sagebrush-sensitive species, and fisheries habitats.

I mentioned earlier that there are also places where oil and gas development is inappropriate, and I'd like to personally thank our Senator, Craig Thomas, for his landmark stance against oil and gas drilling on our national forests. We, too, believe that our national forests should be off-limits. These are our headwaters and our hunting grounds. They are places where Wyomingites go to recreate and relax, and to spend time with family and friends. The Wyoming Range, in western Wyoming, is just such a place. It harbors some of the finest mule deer, moose, and elk hunting in the State. It is also home to three important subspecies of native trout. People from all over the country come to this region to fish, hunt, and relax.

Today, we are heavily developing country east of the range for oil and gas. Places like the Pinedale Anticline and the Jonah gas field are helping to fuel this Nation, but they are also places that have been historically used as winter range for our big-game herds. We are very concerned about the amount of development that is taking place on these winter range, but it is also very important to us that we save places like the Wyoming range.

An example of why some places should be off limits is the LaBarge Creek drainage in the Wyoming range. Here is a stream that the Wyoming Game and Fish Department is putting Colorado River cutthroat back into after years of absence. This is a fish that has swum these waters for thousands of years. At an estimated cost of $2 million, the Department is revitalizing 58 miles of stream. Yet, at the same time, there is seismic exploration in the headwaters.

In conclusion, we would like to emphasize to Congress that more money needs to be made available for the States to study wildlife and fisheries. And, also, we would like to see some places kept off-limits.

Thank you very much.

[The prepared statement of Mr. Reed follows:]

PREPARED STATEMENT OF TOM REED, WYOMING FIELD ORGANIZER, TROUT UNLIMITED, ARLINGTON, VA

Chairman Domenici, Senator Bingaman, and Members of the Committee, thank you for giving me the opportunity to speak to you today about oil and gas production on Federal lands in the Rocky Mountain Region.

My name is Tom Reed. I grew up in Colorado and graduated from Arizona State University. I spent several years working as an instructor in Wyoming teaching, among other things, fly fishing and horse-packing. I also worked for the Wyoming Game and Fish Department. I currently serve as the Wyoming Field Coordinator for Trout Unlimited's Public Lands Initiative, the purpose of which is to develop sound scientific and technical information demonstrating the importance of public lands to coldwater fisheries, wildlife, and hunting and fishing opportunities as well as sharing this information with sportsmen across the West.

Our public lands sustain some of the cleanest water, healthiest habitats, and finest fishing and hunting in North America. More than 50 million Americans hunt and fish, however, too often their voices are lost in the din of controversy that has come to define public land management. A significant and growing concern among sportsmen is the impact of energy development on fish and wildlife habitat on our public lands.

Wyoming is at the forefront of these energy and public land issues and is more than carrying its weight for the energy needs of this country. Oil and gas exploration and development is taking place at an unprecedented rate. It is estimated that 25 percent of the state will be impacted by oil and gas development to help meet our nation's demands. That's a land area the equivalent of 360 Washington DCs.

In the Rocky Mountain West, energy development is proceeding at an ever increasing rate. More than 26 million acres of public land managed by the Bureau of Land Management (BLM) in Wyoming, New Mexico, Utah, Colorado, and Montana are open for leasing. In a year's time, BLM approved 5,700 new drilling permits in those states—a 62% increase over the previous year. BLM has a total of nine fisheries biologists in those five states. That's about 3 million acres of leased land per fisheries biologist. Most people agree that is an impossible responsibility to place on nine people.

At Trout Unlimited, we feel that oil and gas development is appropriate in some places and inappropriate in others. But even where it is appropriate, sound science needs to be utilized to protect our fisheries and wildlife, and as an extension, our fishing and hunting opportunities. We are not side-line critics. We believe in rolling up our sleeves and working with industry to minimize the effects of development on fish, game, and water resources. For example, we are working in Wyoming with Dudley and Associates on the Seminoe Road coalbed methane project to try and develop operational protocols for development that minimize effects on ground and surface water and fisheries. Questar has similarly demonstrated a willingness to work with us. We believe it is important to work with companies to ensure that development is done right.

In our view, however, doing development right includes acknowledging when it's being done wrong, and where it shouldn't be done at all. Wyoming truly is blessed with natural resources, both below and above the ground. The state's scenic beauty, wildlife and fisheries are unparalleled. This state is known for its long vistas, sagebrush deserts, high mountains, deep forests and crashing rivers. To the hunter and angler, Wyoming offers some of the finest outdoor opportunities in the world. From its abundant pronghorn antelope and mule deer to its elk to its four subspecies of native cutthroat trout, this state sustains a wide variety of game and fish and enough wild country to absorb a lifetime of exploring. I personally have hunted Wyoming's deep spruce forests for elk, fished the high mountain lakes for native trout, and crawled through the sagebrush in an attempt to take a nice pronghorn buck. I've ridden my horse in the high country, and floated down wild rivers in the lower deserts. There are a lot of people in Wyoming just like me: they live there for the great outdoors and for the opportunity to hunt and fish with their families.

But these can be troubling times for people like me who love the great outdoors. At the current rate of oil and gas exploration, scientists, particularly with the Wyoming Game and Fish Department, are having a difficult time keeping up with the pace of development.

It is important for Congress to recognize that intensive impacts are occurring and will continue to occur as this region is changed from wild, undeveloped country into industrial zones. Funding for land management agencies such as the Bureau of Land Management needs to be secured specifically for scientists who deal with impacts on wildlife and fisheries. State wildlife agencies like the Wyoming Game and

Fish Department also need national funding so that biologists can be hired to deal solely with oil and gas issues.

These biologists should collect data, monitor impacts and design and implement mitigation, working closely with industry and land management agencies. There is a willingness among many in the industry to move in this direction, but Congress also needs to step up with money for these agencies so that our wildlife and fisheries resources are taken care of. We believe that the scale and pace of development on oil and gas fields far outstrips the organizational capacities of both state and federal agencies responsible for managing fish and wildlife and the habitats they depend on.

How this development is going to impact our wildlife and fisheries heritage is largely unknown because much of the development has taken place only in the last few years. To keep abreast of this, we need more science and we need more scientists. We also need to slow down and not allow energy production to outstrip the land's productive capacity.

To clarify how overworked and understaffed our biologists are, consider: there are only three people in the Game and Fish Department's Cheyenne office that deal with oil and gas issues. When one realizes that just one corner of Wyoming the Powder River Basin—faces an estimated 60,000 wells, it is clear that is too much, too fast.

The Department estimates that it needs staff biologists that deal with nothing but oil and gas development to study, understand and try to mitigate impacts to crucial big game, sage grouse, sensitive species and fisheries habitats. That tally is as much as $2 million per year. Similar expenditures will be needed in other states and for federal agencies.

The purpose of this hearing is to determine the effects of the Energy Policy Act's provisions. The fact is that after 11 months it is difficult to determine the effects on fish, wildlife, and water resources from the acceleration of development. As a lifelong hunter and angler, I can say with certainty, it isn't looking good for game and fish. A biologist within the Wyoming Game and Fish Department told me that wildlife and fisheries are going to lose, and the best we can hope for is to minimize the loss.

Along these lines, one aspect of the Energy Policy Act that I would urge the Committee to look into is implementation of Section 1811 of the Act. That section authorized the National Academy of Sciences (NAS) to prepare a report on the impact of coalbed methane development on water. Unfortunately, because NAS is depending on funding from BLM to get this report together, and the BLM has not provided any money to them to do it, the study has not been initiated.

Given the concern of sportsmen and communities in the West over the impact of rapidly expanding coal bed methane development on both water supplies and water quality, an NAS evaluation of the issue would be very helpful to states, local communities, and individual citizens in determining what sort of regulatory regime is appropriate for addressing the impacts on water quality and quantity. We urge the Committee to let the BLM know that it expects the agency to provide the funding necessary to the NAS to get on with this important study.

I mentioned earlier that there are also places where oil and gas development is inappropriate and I'd like to specifically thank our Senator Craig Thomas for his landmark stance against oil and gas drilling on our national forests. We, too, believe that our national forests should be off-limits to oil and gas drilling. These are our headwaters and our hunting grounds. They are places where Wyomingites go to recreate and relax, to spend time with family and friends. These are heirloom places that should be passed down to our children and to their children.

The Wyoming Range in the Bridger-Teton National Forest harbors some of finest mule deer, moose and elk hunting in the state. It also is home to three important subspecies of native trout: the Colorado River, Bonneville and Snake River cutthroat. People from all over the country come to this region to fish, hunt and relax. Today, we are heavily developing country east of the range for oil and gas. Places like the Pinedale Anticline and the Jonah gas field are helping to fuel this nation, but they are also places that have been historically used as winter range for our big game herds.

We are very concerned about the amount of development that is taking place on these winter ranges. It is a virtual certainty that our big game resource, and as an extension, the quality of big game hunting in this region is going to decline. If we develop not only winter ranges, but migration routes and summer ranges as well, we believe it will spell the end of quality hunting in western Wyoming. We'd like to see some very special places such as the Wyoming Range set aside for recreation and relaxation.

An example of why some places should be off-limits to energy development is the La Barge Creek drainage in the Wyoming Range. This stream is the site of a large restoration project being undertaken by the Wyoming Game and Fish Department to bring back a native trout, the Colorado River cutthroat. At a cost of an estimated $2 million, some 58 miles of stream are being reclaimed and revitalized for this native, pure fish that has swum these waters for thousands of years. Yet even while fisheries biologists are hard at work with the restoration process, there are daily flights of helicopters doing seismic testing in the backcountry headwaters of La Barge Creek for potential gas field development.

Oil and gas development in the headwaters would mean roads and roads heavily impact fish by flushing sediment into drainages and blocking the passage of spawning fish. These two things: native pure fish swimming in clear, clean water on our national forests and industrial development cannot make for a happy marriage.

Our public lands sustain the last-best fish and wildlife habitat and hunting and fishing opportunities in the West. We only have one chance to develop our lands for gas and oil responsibly and all indications show that expedited leasing, rushed approvals for application to drill, and a lack of resources for meaningful studies, monitoring, and enforcement are spoiling that chance. Trout Unlimited commissioned a literature review of information describing the effects of energy development on coldwater fisheries. The lack of data is daunting. I would like to submit this report for the record.

I want to share with you a few more examples from the field that help to explain why state fish and game departments, federal fish and wildlife biologists, and hunters and sportsmen across the Rocky Mountain West are so concerned about energy development.

- In the past two years on the Uinta National Forest in Utah, the leasing of National Forest Lands was approved and carried out, and did not take into account the important fisheries restoration work that has occurred or the 2000 Range-wide Conservation Agreement and Strategy for Bonneville Cutthroat Trout. In at least one instance, neither the forest's fisheries biologist nor District Ranger was aware that the resources they are charged with managing would be facing new threats and challenges resulting from leasing that occurred in the Diamond Fork, a watershed that sustains a Conservation Population of native Bonneville Cutthroat Trout and also in the Strawberry Valley, where Utah's most popular trout fishery, Strawberry Reservoir, is located.
- In April, 2006 the Forest Service leased areas of the Wyoming Range. Many of these leases are part of watersheds that sustain core-conservation populations of Colorado River cutthroat trout, a species that is currently regarded as "sensitive" by both State and Federal agencies. However, the Bridger-Teton National Forest is lacking baseline data and inventory information. In addition to other concerns such as air quality, Canada Lynx habitat damage, and cumulative impacts, we don't think it's prudent to lease and develop areas in the absence of baseline data.
- Preliminary results of an ongoing study on mule deer impacts in the Upper Green River Basin of Wyoming by Western EcoSystems Technology, Inc. (WEST), BLM, the energy industry and Wyoming Fish and Game show:

  —Mule deer abundance on the Mesa has declined. The Mesa's overall mule deer population is down 46 percent since 2002.
  —Over-winter fawn survival rates have been slightly lower on the Mesa compared to the control region for four of the five years;
  —Mule deer are moving from previously "high use" winter habitat areas into areas that previously had been of "low use" suggesting that drilling and development has displaced mule deer to less suitable habitats;
  —Sublette County's mule deer are among the most migratory in the West, traveling between 60 to 100 miles between summer and winter ranges. Documented migration routes, such as Trapper's Point Bottleneck, remain important pathways between winter range in the Upper Green and summer range in the surrounding mountains.

A complete and sound understanding through research and continued monitoring of the impacts to our fish, wildlife, lands, waters and air is only prudent before jumping head-first into lease obligations and expedited development.

Thank you again for the opportunity to testify today. I will be happy to answer any questions you may have.

The CHAIRMAN. Thank you very much.

Many of us are very proud to hear you talk about the marvels of hunting and fishing.

Mr. REED. Thank you.

The CHAIRMAN. Maybe I don't share it anymore, but I did, at some point in my life, and it's good to hear from you about it.

We are finished with the witnesses. Now we're going to go to Senators. And I would just ask if any Senator has an important series of questions and is on a tough timeframe. Is there anybody that needs to go—if they want to ask any questions, if they need to do it right now—Senator, are you on that kind of time schedule?

Senator MARTINEZ. I'm going to have to move on, but I'm going to forego any questions at this time. I just need to go onto the floor to speak on another matter.

The CHAIRMAN. Thank you very much. Thanks for coming, Senator.

Senator MARTINEZ. Thank you.

The CHAIRMAN. All right.

Senator Bingaman.

Senator BINGAMAN. Thank you very much, Mr. Chairman, for having the hearing.

Let me ask Mr. Hall, since he's here—we have this report from the GAO that's dated last year, June 2005, and it's called "Oil and Gas Development: Increased Permitting Activity Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities." That's the title of the report. And then, it goes on at length, but it basically—I think the operative conclusion is that, "BLM officials in five out of eight field offices GAO visited explained, as a result of the increases in drilling permit workloads, staff had to devote increased time to processing drilling permits, leaving less time for mitigation activities such as environmental inspections, and idle-well reviews."

This was a year ago—this was in June 2005—has this problem been solved? Does it continue? Is it not a problem, in your view? What's your thought on it? It's sort of in your jurisdiction, I would think.

Mr. HALL. Well, thank you, Senator. I think that at least it has been lessened. And this act has really helped us there, because it diverted some funds. It allowed BLM to fund some particular positions in these offices, to focus on APDs, which then freed up our folks and some of the BLM folks to work on some of these other areas.

Senator BINGAMAN. But, now, that's just in the pilot offices, right?

Mr. HALL. That's just in the pilot offices.

Senator BINGAMAN. Now, what about BLM-wide?

Mr. HALL. Oh, I think, BLM-wide, they're still strapped, from a funding standpoint. Director Clarke could answer that better than I could on the workload and funding for them. But our impression is—we have a really good working relationship with the BLM folks on the ground, but a lot of them, and a lot of our folks, feel a little overwhelmed in some areas. But these pilot offices are teaching us a lot about how to get that job done better.

Senator BINGAMAN. Let me ask Director Clarke, Do you agree with the basic conclusion of this GAO study, that the environ-

mental protection responsibilities of BLM are being given short shrift because of all of the other workload that you have, dealing with all these permit applications?

Ms. CLARKE. I believe that the conclusion of the study was that biologists and other people who are on staff, with duties specific to the environment, were being pulled in to work on the oil and gas program. And that is, indeed, correct. And the reason we have them assigned to the oil and gas program is, we needed their expertise. We needed them to help us understand how to avoid specific wildlife conflicts. We were using the archeologists to make sure that we were addressing cultural resource issues in the siting of wells. And so, those folks are part of interdisciplinary teams that serve the oil and gas program, but that also assemble to address impacts on any of the permitted uses that BLM overseas. So, I do believe we are vigilant in maintaining our environmental controls.

Senator BINGAMAN. So, you don't think that there has been a lessening of your ability to meet these environmental protection responsibilities.

Ms. CLARKE. We are working very diligently right now to ramp up inspections and enforcement and to make sure that we do not fall behind on those commitments. The workload has been tremendous, but, of the some-110-plus positions in the pilot offices that are being hired, over 50 of those are specialists that will assist us in the environmental inspection and monitoring arena.

Our 2007 budget proposal would put additional funds into the non-pilot offices to make sure that we also are well balanced in those areas and that we can make sure that we are matching our commitment to development of oil and gas resources with a robust commitment to monitoring and inspection and environmental management.

Senator BINGAMAN. Let me change the subject a little bit. We were in a discussion, Senator Domenici and I, with someone who has substantial background with oil and gas activity, and the point was made—I don't know if it's valid; I'm asking you, Director Clarke, if you would have an opinion on this—the point was made that the royalty rates the Federal Government is receiving on its leases on Federal land are less than those that private landowners are receiving normally these days, and less than States are receiving on State land. Do you have an opinion on that? Is that something you've looked into?

Ms. CLARKE. I have not looked into that, so I couldn't answer. You may have other folks here on the panel that would have some experience.

Senator BINGAMAN. Mr. Zavadil, did you have a view on that?

Mr. ZAVADIL. I do. The royalty rates range from—anywhere from 8 percent, in some sliding scales that are less, to—our company pays up to 18 percent for some leases on certain State lands. I find that the Federal royalty rate is essentially right in the middle of—and very close to, and consistent with—call it the "traditional" royalty rate that we see. But, clearly, mineral owners, mineral holders, are free to select, ultimately, the royalty rate and, kind of, take the consequences of that, that if the royalty rates are high, you have lesser development; royalty rates are lower, you have more development.

Senator BINGAMAN. Let me ask about abandoned and orphaned wells. I'm advised that New Mexico has 4,224 abandoned wells on public land. That's the largest number of any State. There is a program, as I understand it, for remediation of abandoned and orphaned wells. Can you tell me the status of that, Director Clarke?

Ms. CLARKE. There is a very positive effort which is taking place in New Mexico in conjunction with industry, and they are working, on a voluntary basis, to take under their wing, if you would, some of those abandoned wells and help us in the remediation. And the Energy Policy Act also gives us provisions to offset royalties to offset the costs of them doing that work for us. So, I believe we're going to be able to expand our commitment to remediation of legacy and orphan wells. It certainly is an important item on our agenda, and one that we want to see expand.

We've also got some significant legacy well problems in Alaska, so it would——

Senator BINGAMAN. Is there some kind of timeframe for actually remediating these wells? I mean, is this something that has an endpoint?

Ms. CLARKE. I do believe that we have a program laid out which would get to an endpoint. Let me get with you and give you a more detailed briefing on that.

Senator BINGAMAN. Thank you very much.

Let me ask, also, about coordination on oil and gas activities between the BLM and the Forest Service. We've had complaints in New Mexico—particularly, I've heard them in the San Juan Basin—about how the BLM has one policy and one set of procedures and policies, the Forest Service had a totally different set. Is that problem a real one? Is it getting fixed? Has it been fixed?

Ms. CLARKE. Another direction we received from the Energy Policy Act was for us to work with the Forest Service on an MOU that would set forth our coordinated approach to development. And we have done that. The Forest Service has also been very forthcoming in working with us on the establishment of the pilot offices. Dale Bosworth made sure that we had good support at the visits that we made, and I think we are all committed to working together and having a shared commitment to the dual goal of improved development and solid environmental stewardship as we move forward. So, I want to comment the work of the Forest Service. They have been very responsive to the dictates under the Energy Policy Act and are working very closely with us, at this point.

Senator BINGAMAN. Thank you, Mr. Chairman. Appreciate it.

The CHAIRMAN. Thank you, Senator.

Senator Thomas.

Senator THOMAS. Thank you, Mr. Chairman.

Ms. Flanderka, you indicated something about the State's role. Would you comment on—is there a further role the States ought to play in these pilot projects?

Ms. FLANDERKA. Senator, thank you. Yes. And through your office and your supportive cooperating agency, that's primarily the role in which we function with BLM and Forest Service, in front-end project EIS work. We also—the county commissioners, conservation districts, they're also very involved, and we each play a role. It's a little messy, at first, to outline our roles and objectives,

and to make sure that we can be as efficient as possible, but I think that the bottom line, the Jonah EIS record of decision, I think, is an example. We worked with Questar on year-round drilling. We're also working on all the resource management plans. So, yes, the State and local governments definitely have a role, and they—I think there is agreement that the end decision ends up with a great product.

Senator THOMAS. That's good. I think, really, what we're faced with here is, there need to be a lot of decisions made with respect to these permittings, but there needs—it needs to be done in a manner in which all the interested parties can get together in the beginning. I think, Ms. Clarke—don't you?—that one of the things that has extended all these is, one agency will make a decision, and then, after that's made, another agency moves in to make a decision, and so on and so on, so that if we can consolidate that, isn't that really the purpose and—of the pilot projects?

Ms. CLARKE. Absolutely. That is absolutely the purpose. I also appreciate Mary mentioning the cooperating agency status and am proud to advise the committee that BLM was the first Federal agency to make the cooperating agency provisions of NEPA a rule. And so, it is mandated that all of our field managers reach out, and, when they are doing any kind of a NEPA activity or a planning activity, they need to invite local counties and State governments and other elected officials to join us at the table. And the pilot offices allow us to take that a step further. And, actually, we have offered to bring State officials into those offices, and we have the capacity, with the funding that was provided, to support the salaries of those people. So, we actually have some DEQ people that are co-locating with us up in our Miles City office. We are working with various States to get oil and gas commission representatives in to get the Fish and Game representatives in the offices with us so that we anticipate the challenges before we get in the middle of them. And I think it—we have seen some slowdown in our plans as we have gotten into this effort, because it does take a while to establish relationships and get people working together.

Senator THOMAS. Do you have the NEPA people working there, from the other agencies, as well?

Ms. CLARKE. They're all working on the NEPA documents together, they're working on planning, we're working on mitigation, and we're also discovering that, as we bring these people from different agencies with different backgrounds together, we're creating laboratories for innovation and improvement, and we're seeing new ideas that are forthcoming. We expect to pull some representation from all of these pilot offices together later in the fall to sort of pull out of them what they're learning. What are some of the best practices that are being employed, and how can we share good ideas with the other offices and the non-pilot offices to really advance our stewardship activities, as well as our development activities?

Senator THOMAS. OK. Thank you.

Mr. Reed, you were talking about people being involved. Do you think you're—you represent, kind of, the other uses of these lands—do you feel like this process is including your interests, as well?

Mr. REED. Somewhat, Senator. We think that certainly the State wildlife agency could be a little bit more involved. And, as you know, the funding for Fish and Game, the model comes from sportsmen—sportsmen's dollars. So, it's not coming from much Federal money at all. So, what's happening there is, there's a shortage of manpower and money for those agencies to cooperate very closely.

Senator THOMAS. Well, that's great. I just think—you know, in Wyoming we've very concerned about our lands and the future and where we're going to be 30 years from now, in terms of it. I—that's overstated a little, one time, when I said we shouldn't do any forest lands. I didn't mean that, really. Grasslands, for example, are managed by the forest, and they ought to be available. Only 2 percent of the forest lands are being used now for production. We need to be very careful about them. But I do look forward to that.

You mentioned, Mr. Eppink, the production we're having now in the Midwest and the West is—much more than the gulf coast?

Mr. EPPINK. It wasn't I who mentioned it, but I'm familiar with the situation.

Senator THOMAS. Oh.

Mr. EPPINK. The production for the Rockies will exceed the gulf.

Senator THOMAS. The gulf. But the fact is, the gulf has a lot of potential that we haven't yet reached, isn't that true?

Mr. ZAVADIL. It's interesting that the gulf production has, in fact, been on the decline over the course of the last two decades. There is potential in the deep water. We are——

Senator THOMAS. We are changing some things. They're talking about making some changes there, however, aren't we?

Mr. ZAVADIL. I hope for the Nation's sake, that we start to produce some of our offshore resources.

Senator THOMAS. Great. Thank you.

Thank you, sir.

The CHAIRMAN. Thank you.

Senator Craig.

Senator CRAIG. Thank you very much, Mr. Chairman.

As I said briefly in my opening remarks, I'm pleased that we are following through with our oversight on EPAct, and this particular area of it, and what we effectively established when—in the passage of that, dominantly in the sections that are referring now to—I guess, section 365. But let me ask several questions, I think, collectively, of all of you, because a combination of forces are at work. We are clearly focused on these cooperative groups that you've put together, Kathleen, and it's pleasing to hear that out of that is coming some synergy. That oftentimes happens when you cause people to come together who once thought they all had to operate independently of each other. And you can do that, I hope, without compromising the concerns of Mr. Reed and other conservation and environmental groups that—really, putting a variety of agencies together to work collectively instead of individually oftentimes is a very productive thing to do in that respects—in that respect.

At the same time, I don't think it necessary that you defend the Forest Service. They've got a lot to learn from you, when it comes to mineral management and how you utilize the lands. Forest Service is much defensive, I think, with less experience with subsurface

rights and responsibilities than the BLM. And in most instances, I think they can learn from you.

I say that, and I may be stepping on the toes of my Wyoming friend and Mr. Reed. A good number of years ago, I was overflighting some area of Wyoming, and stopping and looking at drill sites and that kind of thing. And I'll not forget—not far from Jackson, but in between Jackson, probably that area we were talking about, Craig—we landed at what was a former drill pad—not all react this way, environmentally, because of the—all of the circumstances of the situation—and we couldn't find it. The reason was, the rehabilitation had been so effectively done on the part, and I believe—while I've just criticized the Forest Service, I have to give them a little credit—I think was Forest Service property. A big cow elk and her calf jumped up out of the tall grass and ran off as the helicopter was landing, and we had a hard time finding the drill pad.

Having said that, how much trouble are you running into with this circumstance? In these resource management plans that we put together in the 1980's, when gas was less than $2, one of the easy ways to avoid some of the conflicts that Mr. Reed might have put forth was simply to say, "During certain periods of time, it's off-limits, go away for 4 months or 5 months and come back later?" When, in fact, if gas had been $10, we might have worked our way through a plan that would have said, "Yes, under certain mitigations and certain procedures, you can continue to operate, to drill, to discover." But we're stuck in the mode of the 1980's. Driven economically, we just avoided it. And we didn't do the hard work at the time to cause us to continue to explore and develop under circumstances and under conditions that it's possible Mr. Reed might have agreed with.

How much of that are we running into now with these obsolete plans, or plans that are still in effect that we've not had time to get to, to modernize and bring online?

Ms. CLARKE. We certainly have inherited the practices and policies that were created in the 1980's in our plans to impose upon oil and gas activities, timing stipulations, and winter drilling limitations. And those continue. As we are dealing with the imperative that we expand natural gas and oil production, but also our very solid commitment to good stewardship, we are beginning to question whether those practices are, indeed, the best for wildlife and the best for energy development.

And we have, ongoing, an activity in Wyoming, in the Pinedale area, that is testing out some theories that we can really minimize the impacts to wildlife if we do very wise winter year-round drilling. And we are checking the postulate, so to speak, to see if, indeed, that may be the case. And one of the benefits of really starting to develop some positive relationships with the Fish and Game offices from all the Western States and also with the Fish and Wildlife service is that we can benefit from their science and their wisdom as we really understand what are the impacts and what scenarios are going to be best over time.

I also believe that industry is recognizing that they need to work with us and to find less invasive ways to conduct their business. And I've been very pleased to see that they are coming in with new

technologies that are leaving much smaller footprints. We're doing interim reclamation. It is an evolving industry, and our science is evolving. I think we're all committed to the dual goal of good development activities, but sound stewardship, that will leave the country, that we love so much, for the next generation.

Senator CRAIG. Mr. Chairman, I see my time is up. Let me make one comment and also a question of Dale and Mary.

My guess is, the greatest dislocation for elk and nonpredator wildlife today in Wyoming, Idaho, and Montana are wolves and not oil rigs. Let me repeat that for the press: are wolves and not oil rigs. I believe that. While our great elk herds in Idaho have crashed in part because of habitat, it's also in part because of dramatic predation that they had historically not experienced that are very, very frustrating to me, Dale, that we cannot come in that three- to four-State area with a regional management plan because of the—not the arrogance of the law, but the absolute requirement that every "i" be dotted and every "t" be crossed. And we've not had that happen yet. As a result, the wolf lives in Shangri-la and continues to populate at an ever-spreading rapid rate against predation. That's the bad news. The good news is, they're starting to take dogs and pets and animals of campers. And when that happens, the public outcry will become so loud, not in fear of the pet, but in fear of the child, which may be unrealistic, but is going to be real by character of the fear itself, that maybe collectively we can get our heads together and solve a problem that should have been solved 4 or 5 years ago. That's not the question.

The question is, Dale and Mary: Is the Forest Service using the cooperative agency rule, or the cooperative agency status, as effectively as the BLM is using it, at this time?

Mr. HALL. I think that there is a lot of work that we're doing with the Forest Service through their collaborative process and through their cooperation with us. I work with Dale Bosworth quite a bit, and our regional foresters on the ground work with our regional directors. So, I think a lot of coordination is taking place. To compare it to BLM, you know, I don't know how to do that, exactly.

Senator CRAIG. Okay.

Mr. HALL. But I can tell you that I believe the Forest Service leadership is really trying to work collaboratively, as well.

Senator CRAIG. Good.

Mary, is the Forest Service as engaging with you as the BLM in the State level?

Ms. FLANDERKA. They are. There's two different tracks, and there's different issues. But, yes, they're doing a great job.

Senator CRAIG. Thank you.

Thank you all very much.

The CHAIRMAN. Larry, let me say—you ran out of time, but you wouldn't have got cut off. You were right on. It took a long time for this hearing to get to the point. You finally got to it here, right here at the end, and thank you for getting to that issue.

Senator CRAIG. Wolves.

The CHAIRMAN. Wolves. Well, actually, the plans that involve predators and other things.

Senator CRAIG. Mr. Chairman, thank you very much. Sometimes, as analytical as we like to be, we also like to show just a little emotion, and there's a great deal of emotion out there in Idaho today.

And I just got a transcript from a young fellow who's done a brilliant job of training hunting dogs in Idaho, up in Idaho County, in Grangeville, and he took—he and his friend, as they normally take their dogs out to operate and train, just had them wiped out by a group of wolves the other day, a pack of wolves, and he was—you could hear him, feel him crying inside this transcript that he offered to my office. And, you know, it's those kinds of emotions that are beginning to impact Idahoans ever-increasingly. While we recognize the value of the wolf in the habitat, we don't recognize its uncontrolled impacts.

The CHAIRMAN. Very good.

Senator Salazar? You follow the wolf, here.

[Laughter.]

Senator SALAZAR. Well, I hope I don't catch him.

The CHAIRMAN. Yes, sir.

Senator SALAZAR. It could be a violation of the Endangered Species Act, right, Mr. Chairman?

The CHAIRMAN. Right.

Senator SALAZAR. Let me, first of all, thank you and Senator Bingaman for holding this oversight hearing.

I have a fuller statement for the record that I'll submit for the record, and then I will just have several questions that I want to ask, Mr. Chairman.

The CHAIRMAN. Please.

[The prepared statement of Senator Salazar follows:]

PREPARED STATEMENT OF HON. KEN SALAZAR, U.S. SENATOR FROM COLORADO

Thank you Chairman Domenici and Senator Bingaman. As always, I am excited about the opportunity to attend hearings on subjects that are critical to Colorado.

I am especially happy to have Director Clarke of the BLM here today. In Colorado, the BLM is the landlord of 8.4 million surface acres as well as 27.3 million sub-surface acres.

The Energy Policy Act of 2005 contained many provisions to enhance domestic oil and gas production. Glenwood Springs in my State of Colorado is home to one of the pilot project offices to increase the efficiency of the APD process, and I welcome that effort.

While the timely processing of APD's is important to industry, I would like to focus on a related issue, leasing, that is important to me and our local communities.

I think it is necessary to recognize that, as we seek to expand our domestic energy production, land use conflicts are increasing. The search for energy is taking companies to land that is closer to, or neighboring, local communities as well as onto lands that generations of westerners have grown up fishing, hunting, and recreating on. There are also a sizable number of split-estate situations that are affecting family farms and ranches across the west. These lands are essential to our natural heritage and must be treated accordingly.

I am increasingly concerned about the BLM's rush to lease every acre of land as quickly as possible without regard to local communities. This rush is often at the expense of local communities with real, substantive concerns as to how this activity will affect their communities and the natural heritage of their area. I am further alarmed at the BLM's willingness to brush these concerns aside and the contentious atmosphere that is being created.

In the west, we believe in multiple-use on our lands, but we realize that every use on every acre is not a sustainable approach. It seems, though, that the BLM has elevated energy exploration and development above every other use when multiple uses conflict.

There are two good examples in Colorado I would like to talk about.

On Colorado's Western Slope the City of Grand Junction and the Town of Palisade learned that mineral leases underlying their watersheds were to be leased. Both Grand Junction and Palisade protested the inclusion of these parcels in the lease sale, asking the BLM to delay their leasing so that the local communities could work with the BLM to assess the situation and to address their concerns prior to leasing. Along with Congressman John Salazar, who represents the district, I supported the local governments' protests. The BLM went ahead anyway, ignoring the legitimate concerns of a pro-growth and pro-development community who simply needed more time to work with the agency.

Also in western Colorado is the Roan Plateau. The Roan Plateau has been a contentious topic as the BLM develops the resource management plan for the area that is highly valued by local communities and sportsmen in Colorado. The final EIS is likely to contain provisions that have not been previously addressed in the process. I asked the BLM to commit to re-submit the plan for further public comment, if that proves to be the case, only to be flatly told "no".

As a United States Senator who is having difficulty working with the BLM is his own state, I can empathize with the local communities who feel that their concerns are being brushed aside in a mad rush to lease every acre for oil and gas exploration and development. Of course, none of this is meant to say that Colorado is not helping to address our country's energy needs. In 2005 Colorado produced over 1 trillion cubic feet of natural gas and is a net energy provider to the United States, something we are very proud of.

I thank the Chairman and Ranking Member for the opportunity to share my thoughts on these important issues to Colorado.

Senator SALAZAR. My first questions are to Ms. Clarke. You know, as much as we appreciate the fact that we have abundant oil and gas resources in my State of Colorado, I also recognize that we are seeing the potential of a revolution in the West against oil and gas exploration and drilling activity. In Colorado, in 2004, there were approximately 2,000 drilling permits that were issued. In 2006, there were 4,800 permits that were issued. We had 28,944 active wells in 2005. By this year's end, 2006, it's projected to be at 31,000. And what I hear, in places like Grand Junction and Palisade and Gunnison, and many places around the West, is that the BLM simply is not taking into account the community input and the concerns that the community has with respect to the leasing and permitting decisions that the BLM is making.

Two specific examples of that for me have been the Grand Junction and Palisade watershed areas, where the BLM made a decision to move forward with the leasing of those properties, against the wishes of Grand Junction and Palisade, against my own protests about that leasing decision and wanting the BLM to take more time; concerns also with respect to the drilling decisions—leasing decisions that have been made on top of the Roan Plateau, near Glenwood Springs, where I specifically asked the BLM to delay decisions on leasing until they had an opportunity to receive public input on a dramatic shift in approach in the leasing program on top of the Roan Plateau.

So, my question for you is this. How do you, as Director of the Bureau of Land Management, take into account what affected communities are telling you and the people who work with you, prior to making your decisions on leasing or on permits that are issued by the BLM? How important is that community input to you?

Ms. CLARKE. Absolutely, we seek out community leaders and elected officials, and want them engaged in the processes involved with setting up plans and making decisions under the National Environmental Policy Act. And we routinely reach out to them.

We have the very difficult challenge of managing lands for multiple use and acknowledging that there are both local issues to be dealt with, as well as national needs and national perspectives. That is a challenge. And someone told me that the job of the BLM director was measured by whether or not you had everyone equally mad at you on a given day, because it is difficult to please all of the different interests, because there are so many.

But we have made it a policy—we've made it a rule at BLM that we do invite State and local officials to be with us at the table, and they don't just come in and comment, they can be behind the scenes and help us craft the alternatives, help us make decisions. And so, we do try to balance those perspectives and the desires of local communities with the national needs and the mandates that we have, under law, at the BLM.

Like I say, we try to make decisions that accommodate those interests, and balance them. We try, always, to strive for good stewardship while we're accommodating uses that are appropriate.

Senator SALAZAR. I appreciate the policy directive, Ms. Clarke, that you are describing there, in terms of reaching out to local communities. In the case of Grand Junction and Palisade and the watershed that could potentially be affected by the drilling activities in those watersheds, it's my view that the BLM did not take into account the concerns of the local communities. And when you are dealing with drilling within the watersheds themselves, that provide the water supply to these very important communities, I think the request that was made, that we have a delay in the leasing decision, was something which was a very simple, rational request that we were making of the BLM. And to receive what essentially was a flat no from the BLM is something that I think was wrong on the part of the BLM. Seems to me that, when you are dealing with something that is as critical as the water supply of a local community, that it is important for you to give additional opportunity to try to bring about the kind of buy-in that, perhaps with best management practices and other kinds of things that could be accommodated, you'd have those local communities in support.

The converse has, in fact, happened there, and what we find ourselves now in is a situation where the local communities and the residents of those local communities are very, very much against the decisions that have been made by the BLM.

So, on that one, I'm going to ask you, here on the record, Ms. Clarke, if you would take another look at the decisions that have been made on the ground with respect to the Palisade and Grand Junction watershed and the leasing decisions that have been made there.

Ms. CLARKE. It is my understanding that those decisions are under protest right now and are being reviewed at headquarters at the BLM. The solicitors are looking at them. So, we are giving those another look before those leases are issued.

Senator SALAZAR. Mr. Chairman, I have several other questions that I want to pursue, but I see my time is up, on this round.

The CHAIRMAN. Senator, if you'd like to submit them, they obviously will be answered.

We're pleased that you came by. I think you see before us our best effort to show you, and show the Senate, how this—in a short

time, this section of our law is working. It's not a miracle on the ground yet. Everybody here finds fault with it, obviously. The gentleman who's the independent producer, sitting among these others, feels sort of like a thorn in the midst of a patch of blueberries——

Senator THOMAS. Roses.

The CHAIRMAN [continuing]. Roses, because he's got a terrible job of trying to make this program sound good, when, as a matter of fact, it's tough for the producer. On the other hand—is that not right, sir?

Mr. ZAVADIL. I do see benefits in the program and in the act, and you've got to start somewhere.

The CHAIRMAN. Right.

Senator SALAZAR. Mr. Chairman, if there's not going to be another round of questioning, could I have another couple of minutes to——

The CHAIRMAN. You have it right now. I'm going to close up here shortly, whenever you finish.

Senator SALAZAR. Absolutely.

Let me just—continuing that—and this is a question for Ms. Clarke and also for Mr. Zavadil. And welcome here from Douglas County, Colorado. It's good to see you.

Mr. ZAVADIL. Good morning.

Senator SALAZAR. I have a concern that part of what's happening is with the rush that we're seeing for oil and gas exploration, is that we're seeing the local communities standing up and taking it upon themselves to address many of the conflicts that occur between local land use and oil and gas exploration in Colorado. For example, we'll see an initiative on the ballot, I think, this November, that will address the issues of surface damage compensation. I think you're going to continue to see that resistance from local communities that are affected when you have this kind of drilling activity. In your testimony, Ms. Clarke, one of the things that you say in your testimony is that the BLM is using performance-based standards to challenge industry to reduce emissions, minimize surface damage disturbance, and develop quick and effective reclamation techniques to improve restoration of disturbed areas. I'd like you to comment on specifically what it is that you're doing on that; and, Mr. Zavadil, you, for the independent—IPAMS to do the same thing.

To put it into context—let me just give you the context. When I go to Glenwood Springs, Garfield County, and I meet with a company by the name of Antero, they have brought the whole community with them—communities like Rifle and Silt, who are supporting—supportive of the drilling program, that has included consultation with the local community on the siting of the well sites, has included discussions on the kind of chemicals that are being used with respect to hydraulic fracking. And we have a very peaceful situation there.

The converse is true with many of the companies that are operating on the Western Slope, where the communities are in an all-out fight with the oil and gas companies that are engaged in these activities.

So, I would ask you to comment on these performance-based standards, Ms. Clarke, that you included in your testimony; and, Mr. Zavadil, for the producers, what you think that the companies are doing out there, in terms of trying to make sure that they're avoiding as many of these conflicts as they can with the local communities.

Ms. CLARKE. Thank you. We are moving ahead with a vision of sitting down with community partners, with Fish and Wildlife, with the State Fish and Game, EPA, and the partners identified in the pilot offices, but also those who come together in other communities, to determine what it is that we care about and what other resource values or uses are important in an area that's identified for oil and gas development, and working with the industry to ask them to put forth proposals that allow them to access and develop a resource, but finding ways to diminish the impacts to other resources and allow us to protect those resources that are of great interest and concern to communities and that we want to leave as a legacy for future generations.

So, instead of just going in and saying, "Well, here's the oil and gas resource, so traditionally that would mean you ought to have this many wells, spaced like this," we're saying, "Get creative. If you want to extract those resources, we need you to figure out how to do that and—understand that we need to protect the sage grass while we're doing it. So, how are we going to do that together? Or to understand that there is an elk herd in this area that's very important to the community, and we want to maintain that." So, we are working to complement——

Senator SALAZAR. Ms. Clarke, if you were to identify best management practices for companies that are involved in oil and gas exploration and drilling activities, would you have a list of what those best management practices would be?

Ms. CLARKE. We do have that list. I'll be happy to get a copy of that to you.

Senator SALAZAR. If you would get that to me, I would appreciate it. And it may be something that we want to visit with you concerning whether or not there are any improvements that we might suggest for those best management practices.

Ms. CLARKE. We'd welcome that dialogue.

Senator SALAZAR. Mr. Zavadil.

Mr. ZAVADIL. Good morning.

I'd like to say that, although not all the operators within IPAMS' organization have the same opportunity as Antero, in that their activity isn't within an incorporated municipality, such as the town of Silt, where IPAMS or Antero is developing, I think there are a number of things that operators are doing. I've been involved with companies that have been operating in the Piceance Basin for about 20 years now. And we fought, tooth and nail, 15 years ago, directional drilling. And now, essentially, 80 to 90 percent of the wells that we drill in the Piceance Basin are, in fact, directional, multiple well pads, where we're drilling six and eight well bores from one individual site. So, that's one thing that we can do to significantly reduce impacts to the surface owners.

I think industry is working hard. We're not wildlife biologists, but I think we do recognize now that the American people want

their gas, and they want their wildlife, too. And while we're looking for opportunities for mitigation, unfortunately we're not wildlife biologists, so we do have to develop the partnerships with wildlife organizations, such as Trout Unlimited, Rocky Mountain Elk Foundation and so forth. So, you're seeing more and more of those kinds of efforts to mitigate—in some cases, offsite—the impacts associated with oil and gas development. And IPAMS' members recognize that that's the reality of today, that, again, Americans want their energy, and they want their wildlife, at the same time.

On split-estate issues, I think that responsible operators, and certainly IPAMS', position is that reasonable compensation in split-estate situations is necessary and part of business, as well. I think that you'd find a very remarkably small proportion of situations where there are, in fact, conflicts between the split-estate—in the split-estate situation.

And, on the community front, in the case where—we immediately offset, for example, Antero. Our situation is slightly different in that we're in a rural residential subdivision. We're not working with a municipality, such as the town of Silt. So, we have to respect those individual surface owners and what their desires and needs are for development on their lands, and how we mitigate those things. But we do pull together the community, about every 6 months—the folks in the subdivisions where we work—and field questions, input, and modify our operations accordingly.

It's not a very public process, but it is something that goes on. And I think you find other operators, on a day-to-day basis, doing that in those kinds of communities where you have a lot of individual surface owners, versus the Federal land type of situation where you have one owner, the Bureau of Land Management.

Senator SALAZAR. Well, I appreciate the comments. And, just to close off on this point, I think some of the work that can go on with the communities beforehand and before the decisions are made could have—avoid many of the conflicts and the backlash that we're getting from these conflicts. I'll give you the example, again, back to Palisade and to Grand Junction. You know, it may not be that the leasing decision is one that ought to be reversed, but that with the kinds of management practices that would include siting decisions, directional drilling, you know, moving away from where the watersheds are located, in terms of where the drill sites are located, using some best management practices with respect to hydraulic fracking, all of those kinds of things might, in fact, have avoided the kind of conflict that we're seeing in that area right now, which I don't think is going to go away.

So, my only suggestion here, Director Clarke, to you and to the Federal agencies that are involved, as well as to the companies who work on this every day, having that community involvement and input up front avoids major problems on down the road.

Thank you very much for your testimony today.

Ms. CLARKE. Appreciate that.

The CHAIRMAN. Thank you very much, Senator.

Let me close this by saying to all of you that we very much appreciate your efforts to try to make this project work in the very short period of time that you've been involved.

Dale Hall, first of all, this is my first opportunity to have you before us here, and at the table with your big hat on, and we're very proud of your new job, and we hope that you've enjoying it.

Mr. HALL. I am, sir.

The CHAIRMAN. Are you?

Mr. HALL. Yes, sir, I am. I still feel like it's a privilege to be here.

The CHAIRMAN. It's good. I wish it would last for the whole term. Sometimes it doesn't. But if it doesn't, you know and understand that's rather human, too.

I don't know where we got you—I was just wondering, Ms. Clarke—but it appears to me that we're very fortunate to have you heading up the BLM. And I think you know that we have a marvelous leader in New Mexico heading up BLM there. I guess you know Linda.

Ms. CLARKE. I certainly do.

The CHAIRMAN. Linda Rundell.

Ms. CLARKE. Yes.

The CHAIRMAN. I don't think you could find a better leader.

Ms. CLARKE. She's doing a great job.

The CHAIRMAN. And I'm glad that you said that, because it just confirms what I know. I hope you're not saying it just because of me. I hope it is true. It is true, is it not?

Ms. CLARKE. It is absolutely true.

[Laughter.]

The CHAIRMAN. Right. It's too bad she suffered the family problem of losing her husband, which I am very sorry for her. But she seems not to be struggling too much. She's doing her work well. And that's very exciting for me. And I'm proud of her.

Ms. CLARKE. Doing very, very well.

The CHAIRMAN. The rest of you, well, let me just say, we understand this is a terribly difficult job. It varies from State to State. The Senator from Colorado is bringing forth the very difficult situations in his State. They're not quite as difficult in other States. But, clearly, the best of each of you is required as you put on your hat to try to negotiate for what we have really asked—Congress has asked, in that section of the law—that these offices be set up not to run roughshod, but neither to just sit down and do nothing. I mean, it's really an effort to get things done in a reasonable manner and to flush out those delays which don't make sense. And there certainly are plenty of delays that don't make sense, and there are plenty of delays that are justified. And you have a difficult job of finding out which they are, Ms. Clarke, as you put this together, with others working with you.

The State is involved, and we're delighted. That happens all the time. And it looks like, in the State of Wyoming, as usual, you have somebody that really knows about it. I'm hoping the same is true nationally, as you work your way through the other States, Director Clarke, that you find the same in New Mexico, you find the same in other States, with really strong local representation.

Independent involvement by independent drillers, it's obvious that some choose to be involved. And it seems like you're one, with your company. Some choose to sit on the sideline and complain. And I have plenty of those. And we all do. No offense. Nobody's going to know which one it is up there in the part of New Mexico

where there are hundreds of them, so that they aren't going to guess which ones are that way. And the same with Mr. Reed and his interest. We have some States where they seem to be over-represented; and others, they seem to be under-represented. I won't tell you which I think is the case, but we're somewhere in the middle in New Mexico.

But I think you've all shown us that by breaking down just the physical barrier of not being together while you're doing things, not being off alone, but being put in that one room with somebody in charge—is certainly an advantage. You would agree with that, would you not, Mary?

Ms. FLANDERKA. Absolutely. Appreciate the participation of our many partners.

The CHAIRMAN. The only thing we'd like to know, in due course—a couple or 3-4 more months—is if there's something we can add to the process—because we'll have another bill one of these days—is there something we can add to the process that would push a little more vigorously on those who are still slowing the process up, even though they're in this same operation with you? There must be something that's not quite working as well as you would like. And, in fact——

Ms. FLANDERKA. Well, we look forward to the opportunity to work with the committee as we assess the effectiveness of the pilot offices and discover opportunities to improve our stewardship and our development activity.

The CHAIRMAN. Good, that's what I'm asking, and that's the answer. Thank you.

Unless any Senator has something else to say, we're in recess.

Thank you all very much.

[Whereupon, at 11:30 a.m., the hearing was recessed, to be reconvened on July 11, 2006.]

[The following statement was received for the record:]

STATEMENT OF WESTERN COLORADO CONGRESS; WYOMING OUTDOOR COUNCIL EARTHJUSTICE; SOUTHERN UTAH WILDERNESS ALLIANCE; OIL & GAS ACCOUNTABILITY PROJECT; WESTERN RESOURCE ADVOCATES AMIGOS BRAVOS; SUSTAINABLE OBTAINABLE SOLUTIONS; CALIFORNIANS FOR WESTERN WILDERNESS; COLORADO ENVIRONMENTAL COALITION; POWDER RIVER BASIN RESOURCE COUNCIL; SAN JUAN CITIZENS ALLIANCE; THE WILDERNESS SOCIETY; COALITION FOR THE VALLE VIDAL; NORTHERN PLAINS RESOURCE COUNCIL; NATURAL RESOURCES DEFENSE COUNCIL; WESTERN ORGANIZATION OF RESOURCE COUNCILS

Dear Chairman Domenici and Ranking Member Bingaman: On behalf of our members and supporters, we submit for the record our comments on two specific provisions of the Energy Policy Act of 2005: (1) Section 323—Addressing Stormwater Pollution from Oil and Gas Activities, and; (2) Section 322—Hydraulic Fracturing Exemption from the Safe Drinking Water Act.

Our lives and communities continue to suffer damage from oil and gas activities. We do not oppose all exploration and drilling, but we want it to be done responsibly in the places where it is appropriate. We urge the Senate Energy and Natural Resources Committee to work with the Environmental Protection Agency (EPA), the Bureau of Land Management (BLM), as well as state and local governments, to ensure that pollution from oil and gas development is addressed and not simply ignored.

A. DAMAGE TO WATER QUALITY—BEST MANAGEMENT PRACTICES SHOULD BE MANDATORY

Landowners and communities across the West are suffering from erosion and runoff of large amounts of sediment from oil and gas activities. Sediment increases

water-treatment costs for municipalities responsible for delivering drinking water to its residents. It can cause a loss of storage in reservoirs and increase agricultural ditch maintenance. It impacts recreation. It harms fish and other aquatic life. It decreases property values. The U.S. Environmental Protection Agency has determined that "siltation is the largest cause of impaired water quality in rivers." National Pollutant Discharge Elimination System—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges, 64 Fed. Reg. 68722, 68724 (Dec. 8, 1999). We have enclosed additional evidence of the harm excessive erosion and sediment from energy development is causing in the West.

Simple, inexpensive measures exist to prevent erosion and runoff of sediment from oil and gas sites. These include silt fences and revegetation. Unfortunately, EPA's recent final rule implementing Section 323 of the Energy Policy Act of 2005 removes the legal incentive for companies to put these simple best management practices in place. EPA's rule excuses oil and gas companies from permits for storm water controls even when their runoff contributes to violations of state water quality standards. This is inconsistent with the Clean Water Act and the Energy Policy Act of 2005.

B. DAMAGE FROM TOXIC CHEMICALS—MONITORING AND DISCLOSURE IS NECESSARY

We urge the Committee to press the Bureau of Land Management and Forest Service to disclose and regulate toxic chemicals used in oil and gas development. Where potentially toxic chemicals are used during oil and gas exploration and development operations, responsible agencies should monitor the levels and effects of these chemicals. The groups believe such complete disclosure and monitoring requirements are necessary for several reasons.

1. Toxic chemicals with known health effects are being used

Many of the products used in the exploration, drilling, and production phases of the natural gas and oil industry contain toxic chemicals with known human health effects. A recent analysis of products and ingredients used in natural gas development in western Colorado shows that oil and gas operators are using toxic chemicals throughout the development process, including during hydraulic fracturing. Of the 192 chemicals on the list, 53 percent are toxic to skin and sense organs, 48 percent cause gastrointestinal and liver damage, and 43 percent are neurotoxins. More than 26 percent of the chemicals are reproductive, kidney, or cardiovascular/blood toxicants, and 22 percent are carcinogens.

2. Toxic chemicals are being released into the environment

Toxic chemical products, as well as harmful hydrocarbons produced during oil and gas production, can and do escape into the environment via a number of pathways. For example, spills release chemicals into the air through volatilization, and spills can enter the water and soil. Additionally, chemicals injected into the ground may come in contact with drinking water aquifers; chemicals may escape from recovery fluids that are stored or placed in pits or tanks on the surface; and flammable chemicals may burn, releasing a host of toxic by-products into the air.

3. Disclosure of these chemicals must be required

Despite the widespread use of toxic chemicals, emergency preparedness staff, state environmental staff, medical professionals, health departments, and people living in close proximity to oil and gas facilities often do not have access to complete information concerning what chemicals are being transported through, stored, and used in their communities or on their private property. Without such information, not only are communities and citizens kept in the dark about potential health impacts, but the regulatory agencies do not know what chemicals to sample for in the event of a spill or release.

4. No agency has comprehensive jurisdiction over disclosure and monitoring of the chemicals in products used in oil and gas development

On the federal level, toxic chemicals associated with oil and gas operations and wastes enjoy a wide range of exemptions and exclusions from EPA oversight. Releases of toxic chemicals and wastes are excluded from reporting under the Toxics Release Inventory; wastes are exempt under the Resource Conservation and Recovery Act; hydraulic fracturing is now exempt from regulation under the Safe Drinking Water Act; and completion operations are exempt under the Clean Air Act.

As a consequence of these exemptions and gaps in agency jurisdiction, public health in oil and gas field communities is increasingly at risk from chemical exposure. There is currently no federal or state agency that is requiring the comprehensive disclosure of the make-up and volumes of the chemicals in products used in oil

and gas development or the comprehensive monitoring for levels of, and impacts from, these chemicals. We believe that protection of public health and safety requires full disclosure of the make-up and volumes of the chemicals in products used in oil and gas development and the monitoring of their use because chemicals with known human toxicity are being used by the oil and gas industry in the West.

CONCLUSION

We urge the Committee to press the BLM and Forest Service to require disclosure of chemicals used during operations when federal lessees submit plans for federal leases. Such disclosure will provide federal, state, and local health officials, as well as local residents, an opportunity for an informed evaluation of the risks to water quality and human health that may accompany oil and gas activities on federal lands.

GEOTHERMAL ENERGY AND OTHER RENEWABLES

TUESDAY, JULY 11, 2006

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 2:30 p.m., in room SD–366, Dirksen Senate Office Building, Hon. Larry E. Craig presiding.

OPENING STATEMENT OF HON. LARRY E. CRAIG, U.S. SENATOR FROM IDAHO

Senator CRAIG. Good afternoon, and welcome. We're here today to receive testimony on geothermal and other renewable energy production from our Federal lands.

Our energy bill last summer included a number of measures to address renewable energy. We hope to learn how these provisions may be bringing about new energy production.

The American West has become our Nation's energy storehouse. This applies as much for renewable energy as to other conventional sources, with vast amounts of geothermal, biomass, wind, and solar resource development opportunities.

As is the case with oil and gas development, much of this energy resource is on public lands, and obtaining access to these Federal resources is probably the most often cited issue affecting new development. It's my hope that from today's testimony we will gain a better perspective of the current status of renewable energy development and what else needs to be done.

I have purposely kept my testimony short so that we may have more time for our witnesses. Today we have two panels. First, we will hear from the administration and from the Government Accountability Office, and the second panel consists of representatives from industry and public-interest groups. We are eager to hear your perspectives and concerns.

And before I do that, let me recognize my colleagues before us and the committee. Let me turn to our ranking member, Senator Bingaman, for any opening comments he would want to make.

Senator Bingaman.

STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

Senator BINGAMAN. Thank you very much, Senator Craig, for having this hearing. I think this is very useful. And I appreciate the administration being here to give us their perspective on the

provisions related to renewable energy development on Federal lands. Those were provisions we spent a lot of time on during the drafting of that legislation.

I agree with your comments, that energy development on Federal lands is a great opportunity for us, and geothermal, of course, and other renewable energy development, as well.

Let me also just indicate that I appreciate very much GAO being here to provide their information to us. I had requested a GAO report on several aspects of Federal geothermal leasing some time ago, and that is now ready to go, and I appreciate them being here to tell us about it.

With that, I will look forward to the testimony. Thank you.

Senator CRAIG. Senator, thank you.

Senator Craig Thomas.

STATEMENT OF HON. CRAIG THOMAS, U.S. SENATOR FROM WYOMING

Senator THOMAS. Thank you, Mr. Chairman. I, too, want to hear from the panels. Obviously, this Energy Policy Act implementation is where we are. I still think we're very, you know, concerned about what we can do in the fairly short term to get volumes of energy out there. But we're also looking at the long term for new ways to do that. And, of course, perhaps there are some things here. The energy—or the wind energy on public lands is something of a concern that we all have, and how we handle that.

So, I'm anxious to hear from the panel. Thank you.

Senator CRAIG. Thank you very much.

So, we will now turn to our first panel. With us today is Ms. Lynn Scarlett, Deputy Secretary for the Department of the Interior. Lynn, thank you. Sally Collins, Associate Chief for the Forest Service. Sally, we appreciate you being with us. Jim Wells, Director of Natural Resources and Environment for the Government Accountability Office. And he's accompanied by Ron Belak, who may assist and respond to questions.

So, with that, first of all, Lynn, we will turn to you. Welcome to the committee.

STATEMENT OF LYNN SCARLETT, DEPUTY SECRETARY, DEPARTMENT OF THE INTERIOR

Ms. SCARLETT. Thank you very much, Mr. Chairman and Senator Bingaman and members of the committee, for this opportunity to talk about our renewable energy work on public lands.

In the 2006 State of the Union Address, President Bush reaffirmed his intention to secure America's energy future, and the Congress, in passing the Energy Policy Act, also signaled the importance of providing access to reliable domestic energy supplies. And we thank you for that.

While there is no single answer to our energy needs, our energy portfolio, we believe, must include renewable and other alternative energy. The Department of the Interior, as manager of one in every 5 acres of the United States, plays a significant role in increasing domestic renewable energy production. Lands managed by the Bureau of Land Management supply almost half of the Nation's geothermal generation and over 5 percent of domestically installed

wind capacity. The potential for more renewable energy production is high, especially in seven Western States.

The Bureau of Land Management manages approximately 100 wind energy right-of-way authorizations, and, since 2001, the BLM has issued more than 90 wind energy right-of-way authorizations, compared, for example, to less than five issued in the preceding 5 years. Approximately 25 of these authorizations are active wind farms with production capacity of 500 megawatts of electricity. That, by the way, is enough to meet the need of about 420,000 homes, based on average consumption.

In response to increased demand for wind energy, the BLM completed a programmatic wind energy environmental impact statement in 2005 amending 52 land-use plans in nine Western States. This should provide the foundation for authorization of more than 3,200 megawatts of wind energy, enough to meet the needs of some 2 and a half million homes.

In addition to wind power activities, the BLM has received two right-of-way applications for large concentrated solar-power commercial generating facilities. The BLM also manages 354 geothermal leases, 55 of which are producing and provide geothermal energy to 35 powerplants. And I'm pleased to announce today that the Minerals Management Service and the BLM geothermal proposed regs did go to the *Federal Register,* I believe, today or last night.

Since 2001, the BLM has processed more than 200 geothermal lease applications, compared to 20 lease applications received in the preceding 5 years. Over the past 5 years, the BLM has reduced the number of pending geothermal lease applications on public lands. Since 2001, it has issued 199 leases, compared to 25 leases from 1996 to 2001.

The USGS is updating a nationwide geothermal resource assessment, which will include estimates of electric power production potential from identified geothermal systems.

As you all well know, biomass from public lands also offers additional energy opportunities. Utilization of biomass byproducts from timber harvest and fuels treatments both reduce wildfire risks and expand economic opportunities for local communities to develop energy generation.

In 2004, the BLM offered nearly 30,000 tons of biomass, mostly through stewardship contracts, which was the first full year that BLM had this authority. In 2005, 71,000 tons of wood byproducts were offered through contracts by the BLM. Our goal for 2006 is to offer biomass in 10 percent of BLM's mechanical fuels treatment projects, which we expect to increase to 50 percent in 2008.

The BLM has also established six demonstration sites with the potential generation capability of 66 megawatts.

I want to note one particular MOU with the Confederated Tribes of Warm Springs. Through that, the BLM and the Forest Service in central Oregon agreed to offer, annually, 80,000 dry tons on 8,000 acres of woody biomass material. The competitive offerings will be available beginning in 2008, and, based on that MOU, the tribe is now seeking a power purchase agreement and bank financing to develop a 15½ megawatt cogen plant.

The DOI is also facilitating the development of alternative sources of energy from unconventional fossil fuel resources such as gas hydrates, which, while currently uneconomic, present enormous potential for domestic energy production in the years to come.

Energy production is just one aspect of energy—of the energy equation. And I want to close by mentioning a little bit on consumption.

The Department of the Interior advances the role of renewable energy resources not only by providing access to its production, but by using technology, where practicable, at numerous facilities. Interior agencies rank second only to the Department of Defense as the Nation's leading users of photovoltaics. The BLM generates a total of 185 megawatt hours of electricity from photovoltaic systems each year from over 600 installations.

The National Park Service and Fish and Wildlife Service are also utilizing alternative energies at many facilities. For example, at Zion National Park Visitor Center, designed with a variety of alternative energy sources, the project is resulting in cost savings of more than $10,000 a year, as well as significant energy savings from traditional sources.

Mr. Chairman, renewable and other alternative domestic resources are important components of the Nation's energy portfolio. I thank you for the opportunity for us to highlight our development of renewables and other alternative energy resources on public lands, and would be happy to answer any questions.

Thank you.

[The prepared statement of Ms. Scarlett follows:]

PREPARED STATEMENT OF LYNN SCARLETT, DEPUTY SECRETARY, DEPARTMENT OF THE INTERIOR

Mr. Chairman, thank you for the opportunity to appear here today to discuss with you the Department of the Interior's role in managing renewable energy resources on the public lands.

BACKGROUND

Rising gasoline prices and home heating and cooling bills are reminding Americans of how dependent we are on secure, reliable supplies of energy. Energy is vital to expanding our economy and enhancing Americans' quality of life. The Energy Policy Act of 2005 (EPAct) encourages the development of renewable energy resources as part of an overall strategy to develop a diverse portfolio of domestic energy supplies for our future. In fact, public and private wind and other renewable energy generating sectors of our economy are the fastest growing energy sources in the United States.

However, an imbalance exists between our energy consumption and domestic energy production. We are looking at ways to narrow the gap between the amount of energy we use and the amount we produce. Earlier this year, in the State of the Union Address, President Bush declared his continuing intention to secure America's energy future, which includes promoting dependable, affordable, and environmentally-responsible domestic energy production while reducing U.S. dependency on foreign oil. In passing the EPAct, Congress also signaled that it shares the President's goal of providing access to reliable domestic energy supplies that are crucial to the economic health and security of every American household and business. The EPAct creates incentives and streamlined procedures for Federal resource agencies to cooperate in meeting this challenge. The Department of the Interior (DOI) is doing its part in implementing these incentives. There is no single solution, but renewable and other alternative energy sources are integral components of our energy future.

While the quantity of domestic energy produced from renewable resources on Federal lands is small in comparison to conventional resources, the growing cost of conventional energy resources and the need to diversify our energy portfolio has

spurred an increased interest and growth in renewable energy development: The Energy Information Administration's (EIA's) recently released 2006 Annual Energy Outlook estimates that our consumption of renewable fuels will grow approximately 60 percent from 6 quadrillion BTUs in 2004 to 9.6 quadrillion BTUs in 2025 as a result of advancements in renewable energy technologies, higher fossil fuel prices, State requirements to produce renewable energy, and incentives provided by the EPAct. The EIA estimates that in 2030 renewable energy will account for over ten percent of our domestic energy production and about seven percent of our consumption.

DOI, as the manager of over one fifth of the nation's land, has a significant role to play in this projected increase in domestic renewable energy production. Lands managed by the Bureau of Land Management (BLM) currently supply almost half of the nation's geothermal generation and over 5 percent of domestically-installed wind capacity. The potential for more renewable energy production is high according to the 2003 assessment by the BLM and Department of Energy's National Renewable Energy Laboratory of the potential for renewable energy production from public lands. The assessment indicated that 20 BLM planning units in seven western states have high potential for power production from three or more renewable energy sources.

New authorities and provisions in the EPAct have given DOI bureaus, such as the Minerals Management Service (MMS), the BLM, and the U.S. Geological Survey (USGS), the ability to explore the future development of promising new energy sources such as onshore and offshore wind, solar, and biomass energy; the EPAct also has provided bureaus, such as the U.S. Fish and Wildlife Service (USFWS), additional resources to help ensure these technologies are developed in an environmentally responsible manner.

I will discuss each of these energy sources, as well as alternative sources of fossil energy, and how they are integrated into DOT's energy programs. I also will discuss how DOI agencies are playing a leadership role in utilizing renewable energy resources at existing and new DOI facilities.

PRODUCTION OF RENEWABLE ENERGY RESOURCES

Wind

The BLM manages approximately 100 wind energy right-of-way (ROW) authorizations. Since 2001, the BLM has issued more than 90 wind energy ROW authorizations, compared to less than 5 issued from 1996-2000. Most of these authorizations are for testing and monitoring. Approximately 25 of the ROW authorizations are producing windfarms, with the capacity to produce 500 Megawatts (MW) of electricity—enough to meet annual electricity consumption of 420,000 homes based on EIA's average consumption statistics that a 1 MW plant running continuously at full power for a year could produce the amount of electricity consumed annually by 804 U.S. households.

In response to increased demand for wind energy, the BLM and the USFWS completed a programmatic wind energy EIS and a programmatic biological opinion in 2005 allowing 52 land-use plans in 9 western states to be amended. Completion of this EIS and the biological opinion was a significant accomplishment that should provide the foundation for the authorization of more than 3,200 MW of wind energy in an environmentally responsible manner. The BLM is reviewing several proposals that would more than double the capacity of wind generation on public lands. It is anticipated that applications or authorizations for 300-500 MWs—of the 3,200 MW wind capacity identified in the EIS—will be processed in the next two years.

With the new authority under the EPAct, the MMS is working diligently to develop a regulatory program to authorize offshore alternative energy proposals, such as wind, solar, wave, and ocean current technologies. The Renewable Energy and Alternate Use Programmatic EIS, developed by the MMS, is currently open for public scoping. The EIS will form the foundation for the new alternative energy program and for future applications. The MMS expects to complete the programmatic EIS and rulemaking process by November 2007.

Solar

The BLM has received two ROW applications for large concentrated solar power commercial generating facilities encompassing 12,800 acres with an estimated output of 1,750 MW. The BLM is prepared to respond to additional industry interest for concentrated solar power use of the public lands based on a BLM Solar Energy Development Policy issued in 2004.

Geothermal

The BLM currently manages 354 geothermal leases, 55 of which are producing and provide geothermal energy to 34 power plants. Since 2001, the BLM has processed more than 200 geothermal lease applications, compared to 20 lease applications received from 1997-2001. Since the enactment of the EPAct, Nevada BLM has issued 25 geothermal leases. Another 97 applications filed prior to enactment are pending approval. 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 expected to increase.

Over the past 5 years, the BLM has diligently worked to expedite the processing to pending geothermal lease applications on public lands. Since 2001, 199 leases have been issued, compared to 25 leases from 1996-2001. In 2004, the BLM completed a strategic plan to guide the agency in allocating resources for high priority geothermal activities.

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 MMS are rewriting their geothermal rules to conform to the statutory changes. The BLM authorizes geothermal development on Federal lands, and the MMS collects revenues owed to the Federal government and ensures these payments comply with applicable statutes and regulations.

To improve coordination in the geothermal leasing and permitting process, address pending leases, and develop a joint data system for geothermal activity, the BLM and Forest Service (FS) signed an Interagency Memorandum of Understanding (MOU) in April 2006.

This year, the USGS began a three-year effort to update a nationwide geothermal resource assessment completed in the 1970's. The assessment will include estimates of electric power production potential from identified geothermal systems; estimates of the magnitude and general location of undiscovered geothermal systems; and evaluations of the impact of new geothermal technologies, such as Enhanced Geothermal Systems. The USGS is collaborating with other Federal, State, and local government agencies and the geothermal industry on a number of specific geothermal research projects, including new geothermal technologies, consulting with States developing and implementing Renewable Portfolio Standards (RPS), and providing technical advice to local agencies, Indian tribes and others seeking to develop geothermal projects.

Biomass

Utilization of biomass by-products from timber harvests and other activities on the public lands is an innovative market solution for reducing recurrent wildfire danger, disposing of wood waste, and expanding economic opportunities for local communities to develop energy generation industries. The BLM offered nearly 30,000 tons of biomass mostly through stewardship contracts in 2004, the first full year the BLM had this authority. In 2005, 71,000 tons of wood by-products were offered through contracts by the BLM. The target for 2006 is to offer 60,000 tons of biomass through contracts or agreements.

When treating areas for hazardous fuels reduction, the goal for 2006 is to offer biomass in 10 percent of the BLM's mechanical treatment projects, increasing to 50 percent by 2008. The BLM has also established six demonstration sites, which have a potential generation capability of 66 MW.

We have been working to sponsor conferences, participate in workgroups, and form partnerships to identify and remove barriers to biomass utilization. For example, BLM entered into a Memorandum of Understanding (MOU) with the Confederated Tribes of Warm Springs and FS in Central Oregon under which 80,000 dry tons (8,000 acres) of woody biomass material would be offered each year. The competitive offerings will be available beginning in FY 2008. Based on this MOU, the Tribe is seeking a power purchase agreement and bank financing to develop a 15.5 MW cogeneration plant.

A Declaration of Cooperation was signed in mid-January, 2006 in support of a Lakeview, Oregon Biomass Energy Facility. The BLM Lakeview District was one of 22 signatories, including businesses, governments, and non-profit organizations in support of this project. Some hurdles still need to be cleared before there are any ground-breaking activities to build the proposed power plant, which is planned to be 10-15 megawatts in size. The Oregon governor's office is touting this agreement as a prototype for other potential agreements throughout the state to achieve multiple objectives, including sustaining rural communities, dealing with high fire prone

forests, and encouraging utilization of biomass in lieu of burning. One noteworthy item about this agreement is that it garnered support from a broad cross-section of stakeholders from industry and conservation groups.

To aid in the utilization of biomass, in 2003, the Departments of the Interior, Agriculture, and Energy signed a Memorandum of Understanding agreeing to work together to promote the use of wood biomass. An interagency working group has been established under this Memorandum of Understanding and will report to the Biomass Research and Development Board.

Early in 2004, the Secretary of the Interior charged DOI bureaus with development of a coordinated biomass implementation strategy. Under this direction, and using the authorities provided in the Healthy Forests Initiative, the National Fire Plan, stewardship contracting, and the Healthy Forest Restoration Act, the BLM implemented its strategy for increasing biomass utilization from BLM-managed lands.

DOI also adopted a standard contract provision that allows for the removal of biomass as part of all forest and rangeland thinning projects or any other contracts that cut vegetation. This contract option is for use by all DOI bureaus. In addition, Section 210 of the EPAct authorizes Federal grants for biomass use. The BLM is working with the FS to implement a joint biomass action plan and foster new markets in biomass utilization. To help increase the market for materials made of small wood and wood biomass, the agency has added a factor to their procurement solicitations to encourage the purchase of bio-based materials.

ALTERNATIVE SOURCES OF FOSSIL ENERGY

DOI is also facilitating the development of alternative sources of energy from unconventional fossil fuel resources, such as gas hydrates, which, while currently uneconomic to commercially develop, present enormous potential for domestic energy production in the years to come.

Gas Hydrates

Gas hydrates are naturally occurring solids in which water molecules trap gas molecules (usually methane) in a cage-like structure. Gas hydrates are widespread in permafrost regions and areas offshore and have the potential to contribute significantly to the world's gas supply. The most recent assessment of gas hydrate potential for the United States was conducted by the USGS in 1995. The USGS estimated that the United States had more than 200,000 Trillion Cubic Feet (TCF) of in-place gas hydrate resources, compared to current estimates of approximately 1,200 TCF of natural gas from conventional sources. More than 98 percent of this potential resource is believed to exist offshore. Currently, the nation consumes approximately 24 TCF on an annual basis.

Although there is no current commercial production of gas from known gas hydrates deposits, recent studies have demonstrated that production of these resources is technologically feasible.

Research into gas hydrates has been conducted for approximately 25 years, and the level of knowledge about the occurrence and potential recoverability of gas hydrates has evolved. Promising results have been shown in Alaska. With this new knowledge, the MMS, in co-operation with the USGS and leading academic researchers, is currently in the process of reassessing the extent of potential quantities of in-place gas hydrates on the Outer Continental Shelf and MMS will be the first to assess the technically recoverable resource.

The MMS has focused its hydrate activities on assessing and evaluating hydrate resources and assuring that industry hydrate exploration and development activities can occur in a safe and an environmentally sound manner. In addition to partnering with USGS in developing a methodology for assessing offshore gas hydrates and performing a new resource assessment, the MMS is also developing a detailed tract-specific methodology that would be used as the basis to determine fair market value assuming production of this resource eventually becomes economic. The methodology will provide significantly more specificity on the location of the resource.

The USGS, the BLM, and the State of Alaska are currently in the process of reassessing the potential quantities of technically recoverable gas hydrates on the North Slope of Alaska—the first ever technically recoverable resource estimate of its kind. This estimate will support the BLM and the Alaska Department of Natural Resources resource management responsibilities.

Working with other Federal agencies, DOI has established goals to (1) improve our understanding of the various aspects of gas hydrate occurrence in the natural environment, (2) improve our detection abilities via various geophysical techniques, including remote sensing, and (3) improve our understanding of potential production

techniques and the behavior of hydrates during production, including reservoir performance and fluid behavior.

DOI is evaluating the need for rulemaking to encourage natural gas production from gas hydrates as directed by Section 353 of EPAct.

UTILIZATION OF RENEWABLE ENERGY RESOURCES AT DOI FACILITIES

In addition to DOI's significant role in domestic renewable energy production, bureaus within DOI are taking on 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 DOI facilities.

The BLM generates a total of 185 Megawatt-hours of electricity from photovoltaic systems each year from over 600 installations. Varied uses of photovoltaics include water pumping, outdoor lighting, communication sites, weather and water monitoring, remote field stations, 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. Some examples of solar photovoltaic projects undertaken at the BLM facilities include:

- Grid-connected systems at the Cannonville and Big Water Visitor Centers (Utah); and the Vale Fire Dispatch Center (Oregon);
- Outdoor lighting systems at various recreation sites along the Colorado River near Yuma and on Lake Havasu (Arizona);
- Upgrades to the Nixon system (Arizona) to meet the needs of the new 3,000 sq. ft. fire station;
- Water pumping and water treatment at the Clay Creek Recreation Site (Oregon);
- Water pumping on a remote stock and wildlife site water system (Idaho);
- Off-grid system (3 kW) at the Washburn Ranch, Carrizo Plain National Monument (California); and
- Grid-connected system (7.5 kW) at Escalante Science Center, Grand Staircase-Escalante National Monument (Utah).

The National Park Service (NPS) also is utilizing innovations in solar power at facilities throughout the National Park System. The Zion National Park Visitor Center, designed collaboratively by the NPS and the Department of Energy's National Renewable Energy Laboratory, uses 66 percent less energy than code and is virtually immune to the frequent power outages in the region. The project represents a synthesis of passive heating, cooling and daylighting, energy efficiency, and photovoltaic technology. Shading, natural ventilation, passive evaporative cool-towers, clerestories, trompe walls, direct solar gain, thermal mass, high efficiency lights, and 7 kilowatts of photovoltaics all work together to nearly eliminate loads. The project resulted in cost savings of more than $10,000 and 309 million BTU in site energy and 1 billion BTU in source energy.

At Mojave National Preserve, the NPS has constructed a new Wildland Fire Center that is highly functional, energy efficient, and cost effective. The Center features an 11 kilowatt hybrid system with 85 thin flexible photovoltaic panels placed on the roof, eliminating the expense of a solar panel array frame. In interior spaces without windows, solar light tubes practically eliminate the need for electrical lighting during the day. A solar-powered radiant floor heating system prevents the water lines in the fire engine bays from freezing. The project has achieved an energy savings of 624 million BTU and a cost savings of more than $16,000 in one year. At the White River Entrance of Mount Rainier National Park, the NPS has constructed a 20-kilowatt solar hybrid system, which brings reliable electrical power to a remote area without a connection to an electric utility. The new system is saving the White River installation more than $9,000 in fuel costs and approximately 776 million BTU annually.

The Bureau of Indian Affairs improved energy conservation at Sherman Indian High School by installing new lighting, heating, ventilation, and a renewable energy photovoltaic system. These and other improvements helped achieve a savings of more than 8 billion BTU and more than $179,000.

At Missisquoi National Wildlife Refuge, the FWS has worked collaboratively with community partners, Efficiency Vermont, the State of Vermont, the Town of Swanton, and a design team led by Centerbrook Associates on a new headquarters and visitor contact station that exemplifies the principles of sustainable design. This facility, dedicated on October 15, 2005, minimizes energy use, makes efficient use of resources, and reflects sensitivity to the site. Achievements of the project include se-

lection of recycled-content materials, passive solar energy design, energy efficiency, water conservation and runoff treatment, and sustainable architecture. Its renewable energy systems capture geothermal, solar, and wind energy with a geothermal heating, ventilation, and air conditioning (HVAC) system; a 15 kW photovoltaic solar array; a Bergey 10 kW wind turbine; and an energy-efficient lighting and controls system.

At the Parker River National Wildlife Refuge, the USFWS incorporated the use of recycled building materials and low-VOC building materials, including engineered wood, plastic lumber, linoleum flooring, fiberboard, sheetrock, exterior decking, tile, deck piers, and carpet with high recycled content in the construction of the visitor center and administrative headquarters. Water conservation technologies, including directing roof runoff to groundwater recharge, installing low-flush toilets, and implementing other best water management practices, save thousands of gallons of water per year. Passive solar techniques such as southeast building orientation and daylighting, along with super insulation of the building envelope and high-efficiency lighting with self-adjusting dimmers significantly reduce energy use over a traditional office building.

CONCLUSION

In conclusion, Mr. Chairman, energy is vital to expanding our economy and enhancing Americans' quality of life, and producing energy from renewable and other alternative domestic resources is a critical component of the Nation's energy portfolio. Lands managed by DOI have a major role to play in the diversification of the Nation's energy sources while ensuring protection of habitat and mitigating impacts to wildlife, cultural and natural resources. DOI also will continue to lead by example, utilizing renewable energy resources at existing and new DOI facilities.

DOI has been working with other agencies and has taken steps in a variety of scientific endeavors to understand renewable and other alternative energy resources and to help bring them to a place where they may contribute to the energy mix of the country. Even the development of renewable energy resources requires surface acreage, and DOI manages millions of acres of land, many of which have energy potential. The BLM and MMS have been working on a variety of fronts to meet industry demand for renewable and other alternative sources of energy. The USGS has been leading scientific investigations to improve our understanding of these energy resources. We stand ready to respond to the ever-increasing need for energy development from the resources we manage on behalf of the Nation.

Thank you for the opportunity to highlight a few of the steps the Department of the Interior has taken to encourage the development of renewable and other alternative energy resources on the public lands.

Renewable energy will be extremely important in delivering larger supplies of clean, domestic power for America's growing economy. This concludes my testimony. I would be happy to answer any questions you have.

Senator CRAIG. Lynn, thank you very much.

Now we turn to Sally Collins.

Sally.

STATEMENT OF SALLY COLLINS, ASSOCIATE CHIEF, FOREST SERVICE, DEPARTMENT OF AGRICULTURE

Ms. COLLINS. Mr. Chairman and members of the committee, I thank you, also, for the opportunity to discuss renewable energy production on the national forest and national grasslands.

The U.S. Forest Service is fully committed to moving the country toward energy independence, and we view increasing opportunities for renewable energy as a key part of this.

I'll submit my full testimony in writing, so let me just do a quick summary here for you today.

We have accomplished a lot through the Energy Policy Act of 2005, a law that we believe increases energy supplies while protecting the environment, fosters greater competition in the marketplace, and reduces risks to entrepreneurs seeking and entering renewable energy enterprises.

Under the law, so far we have completed three MOUs with BLM related to expediting oil and gas and geothermal leasing, as well as field operations. We have established pilot offices throughout the West to ensure better coordination of those field operations. Backlogs of permits and leases have been significantly reduced. And close to 100 percent of permit applications for electric transmission lines, oil and gas pipelines, and renewable energy generation facilities have been processed within the timeframes established by that law.

More specifically, renewable energy has huge potential on national forests. Of the 354 geothermal leases, 116 are on national forest land, five of which are producing—we have two geothermal powerplants that contribute a 12- and a 45-megawatt plant—together, combined enough—produce enough energy to service close to 60,000 households.

The nature of geothermal development makes reducing risk to the developer critically important, as the GAO report alludes to. One way the Policy Act addresses this is to promote interagency coordination in leasing and in permit operations. And, in response to that, the Forest Service is developing a 5-year schedule to expedite the processing of geothermal lease applications. We're also amending our forest plans to address geothermal development.

Now, for woody biomass development, the Forest Service and other Federal agencies expect to treat more than 13 million acres over the next 3 years, yielding massive quantities of biomass as a byproduct, as well as, of course, reducing the risk to communities.

The lion's share of the biomass from Federal lands comes from our national forests. So far this year, about 50 percent of the almost half a million acres that have been mechanically treated by the Forest Service have yielded woody biomass for utilization in some manner.

The energy potential is huge, especially as markets for wood increase. And, as you all know, it takes energy to make energy. Even with today's energy and today's technology, biofuels from wood materials are significantly less energy intensive to manufacture than our other sources of biofuels, including corn ethanol, and all are more energy efficient to produce than gasoline.

The energy ratio for ethanol for wood products can be even higher as science and technology advance, and we are doing our research on this at our research lab in Madison, Wisconsin. In addition to this, we're working with local communities to promote local investments in biomass utilization. Currently, approximately 38 million megawatts of electricity are produced from woody biomass nationwide.

And, finally, just a few words about solar and wind energy.

In 2005, together with the Department of Energy, the Forest Service identified 99 units of National Forest System with high wind or solar potential. To date, we haven't received any applications for solar development on the national forests, but we have received two applications for wind energy.

Right now, we're developing some guidelines for wind energy production, and these guidelines will help facilitate and expedite the processing of these permits, which we expect these guidelines to be completed in this fall sometime.

And we anticipate that as interest in solar on the national forests increases, we will also have a similar policy for solar.

In conclusion, Mr. Chairman, the Forest Service is firmly committed to the development of renewable energies on National Forest System lands. These lands are one of the largest producers of hydropower and woody biomass, and will play an increasing role as a source of geothermal wind and solar energy in the future.

I appreciate the opportunity to be here today, and look forward to answering any questions you might have.

[The prepared statement of Ms. Collins follows:]

PREPARED STATEMENT OF SALLY COLLINS, ASSOCIATE CHIEF, FOREST SERVICE, DEPARTMENT OF AGRICULTURE

Mr. Chairman and members of the Committee, thank you for this opportunity to discuss renewable energy production on National Forest System lands.

I understand this hearing is one of a series the committee is holding regarding implementation of the Energy Policy Act of 2005, Public Law 109-58. Renewable energy development plays a significant role in the agency's implementation of the Energy Policy Act of 2005 (EPAct 2005). As you know, that law significantly benefits consumers by increasing energy supplies while protecting the environment and fostering greater competition in the marketplace. The Act also improves the Nation's energy security and reduces our dependence on foreign sources of oil by increasing the use and diversity of renewable energy sources and by reducing energy consumption through greater conservation and energy efficiency.

First, a quick synopsis of what we've done under the EPAct 2005 to date. To meet the provisions of titles II and III of the Act, we have completed three Memorandums of Understanding (MOUs). One, under section 365, improves energy permit coordination on Federal lands and which assigns agency personnel to pilot project offices. The second, with the Bureau of Land Management (BLM) for timely processing of pending geothermal lease requests under section 225 was completed in April 2006. The third with the BLM under 363 improves oil and gas leasing and permitting procedures between the BLM and Forest Service. We also worked cooperatively with BLM to revise the Oil and Gas Onshore Order No. 1 regulation on the approval of oil and gas onshore lease operations.

In addition, we have processed 254 special use authorizations (97 percent) within established timeframes for electric transmission lines, oil or gas pipelines, and renewable energy generation facilities. We, along with other Federal agencies developed and published an interagency rule making for expedited trial-type hearings for applicants or other parties contesting conditions for hydropower facilities. We have begun implementing section 368, which calls for designating energy corridors on Federal lands. This effort included public scoping meetings in 11 Western states. The public comment period started with the publication of the preliminary draft corridor map (June 9, 2006) and ran until July 10, 2006.

I will now discuss each renewable energy source separately.

GEOTHERMAL ENERGY

Nearly 50 percent of the nation's geothermal energy production comes from Federal lands. There are currently 354 Federal geothermal leases, 116 on NFS lands. At the present time, there are 5 producing leases on NFS lands contributing to a 12 mega-watt power plant and a 45 mega-watt power plant. Generally, one mega-watt provides enough electricity for about 1,000 homes.

A joint report prepared by the Department of Energy's (DOE) National Renewable Energy Laboratory and the Department of the Interior (DOI) describes the potential for geothermal development on public lands in the 7 states that have geothermal resources. The report is entitled *Opportunities for Near-Term Geothermal Development on Public Lands in the United States.* While no specific geothermal resource assessment analysis has been completed to date addressing NFS lands, the report provides a synopsis of geothermal activity and site specific facts related to this activity for NFS lands by State.

The BLM and the Forest Service coordinate geothermal resource leasing activities on NFS lands. The Forest Service provides the consent to lease and the BLM issues the leases. The Forest Service serves as lead agency for geothermal leasing availability analyses and decisions and conducts analysis on geothermal activities on NFS lands. Also, we develop lease stipulations for NFS lands that are only as re-

strictive as necessary to protect the resources for which they are applied. The Forest Service and the BLM coordinate the signing and release of decision documents in leasing of NFS lands. Despite the environmental benefits of geothermal energy, there have been barriers to development of these resources on NFS lands. The study conducted jointly by the DOE and DOI concluded there is a need to streamline environmental reviews. The EPAct 2005 addresses this and other issues. The Act calls for streamlining the permitting process, changes the royalty structure to provide payments to local governments, and directs the U.S. Geological Survey to update the assessment of geothermal resources made during 1978 and submit this updated assessment to Congress. It also provides a production tax credit. These changes have spurred increased interest in developing geothermal resources.

The Forest Service concurrence is pending on 65 lease applications in Oregon, Washington, California, Arizona, Nevada, and Idaho. Issues to be addressed include requirements associated with threatened and endangered species and the need to amend land management plans that do not presently address geothermal development. Under section 225 of the EPAct 2005, the Forest Service has signed an MOU with BLM that provides administrative procedures for processing geothermal lease applications, establishes a program to reduce the backlog of lease applications by 90 percent within five years, and provides for a joint data retrieval system for tracking lease and permit applications.

WOODY BIOMASS

Biomass has surpassed hydropower as the largest domestic source of renewable energy. A recent joint U.S. Forest Service—Department of Energy report, *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply,* commonly known as the "Billion Ton Report," projects that there are over 1.3 billion dry tons per year of biomass potential—enough to produce biofuels sufficient to meet more than one-third of the nation's current demand for transportation fuels by 2030. About one-quarter of that total, roughly 400 million dry tons of biomass could be produced in a sustainable manner from all forest and rangelands—including private, state, tribal and federal lands.

Woody biomass is woody materials removed from National Forest System, other Federal, State and private lands as a byproduct of forest management activities. Woody biomass includes tree stems, limbs, tops, needles, leaves and other woody parts. Currently most of this material is underutilized, commercial value is low, markets are small to non-existent and the infrastructure needed to process this material is insufficient or nonexistent in many parts of the country.

The Administration's Healthy Forests Initiative has significant potential to increase the availability of woody biomass from Federal lands. As the committee is aware, the Forest Service and the Department of the Interior last year treated hazardous fuels on more than 2.9 million acres of land, and reduced hazardous fuels on an additional 1.4 million acres through other land management actions. Roughly one-quarter of the acres treated resulted in biomass utilization for forest products, bio-based or bio-energy purposes, but the potential exists for substantial expansion of biomass use. Federal agencies plan to treat 2.9 million more acres in 2006, and accomplish hazardous fuels reduction on an additional 1.6 million acres through landscape restoration activities, with an additional 4.6 million acres planned for 2007, which includes 3 million acres of hazardous fuels treatments and 1.6 million acres through landscape restoration activities.

To put this material to productive use requires an integrated strategy involving federal, state, tribal and private forest owners along with communities and other private interests. The public benefits of diverting this material from other disposal options such as open burning or expensive landfilling, and the positive environmental consequences of a clean and renewable energy source are just beginning to be articulated and valued in the market through renewable energy credits, carbon credits and pollution credits.

Local areas and regions of the country have unique opportunities and challenges related to biomass utilization. Hurricane damage in the South, fuels treatments needs around communities, and insect outbreaks all provide cross-ownership woody biomass utilization challenges.

The Forest Service is also increasing our Research and Development efforts at the Forest Products Laboratory and at our Research Stations to provide renewable energy and alternatives to fossil fuels from woody biomass. This effort includes improved in-woods operations, transportation and handling, processing and new bio-based products.

The restoration of our nation's forest to be more resilient to natural disturbance, such as catastrophic wildfires is a primary objective for a significant portion of our

timber sale program. These restoration efforts are dramatically affected by biomass utilization and the global timber market.

Therefore, biomass utilization is critical to our ability to meet our restoration needs. The FY 2007 President's Budget addresses this need by dedicating $610 million to implementing the Healthy Forest Initiative. This includes $5 million to foster markets in biomass utilization. Additionally, the President's Healthy Forests Initiative, the Healthy Forests Restoration Act, and stewardship contracting, allow the Forest Service to work more effectively and efficiently with the local community in treating hazardous fuels, and to promote investment in the local timber infrastructure.

In summary, the Forest Service's biomass energy activities are aimed at providing a predictable and sustainable supply, improving utilization through technical assistance and science, and developing partnerships across woody biomass interests.

WIND AND SOLAR ENERGY

In 2005, the Forest Service and the Department of Energy's National Renewable Energy Laboratory established a partnership to conduct an assessment of renewable energy resources on National Forest System lands in the continental United States, including administrative and physical limitations on access to them. One goal of the resulting report was to identify those National Forest and Grassland units that have the highest potential for private-sector development of wind, concentrating solar power and photovoltaic energy resources.

Using geographic information system (GIS) data, the interagency team developed screening criteria for each of the solar and wind resources to produce maps of the 25 NFS sites with the highest potential for development of each energy source. Sites had to be relatively flat and not near urban areas and were excluded if they were not accessible to appropriate transmission capacity or a major road. Inventoried Roadless Areas and other Specially Designated Areas were also excluded. The assessment found that 99 NFS Units have high potential for power production from solar or wind sources and 20 have high potential for power production from two or more wind or solar sources.

Energy facilities qualify as one of the potential uses of National Forest System lands. (Mining and Minerals Policy Act and Forest Service Manual 2802). The Forest Service processes proposals for solar and wind energy facilities using existing Special Uses regulations and policies. Proposals to use National Forest System Lands are submitted to the District Ranger or Forest Supervisor having jurisdiction over the affected lands. The authorized officer then initiates pre-application actions that involve initial and second-level screening which are followed by a formal application in the event that a proposal meets the screening criteria.

The processing of recent wind energy proposals on the Green Mountain National Forest in Vermont and on the Huron-Manistee National Forest in Michigan has revealed that policy needs to be developed related to wind energy projects due to the unique factors, such as the impact on migratory birds, associated with this energy resource.

In response, Joel Holtrop, Deputy Chief for the National Forest System, announced the creation of an ad hoc wind Energy Guidance Team on February 24, 2006. The team is developing policy to addressing the factors associated with wind energy facilities on National Forest System lands.

The primary goal of the team is to provide local Forest Service officials with the information and tools necessary to efficiently process proposals for wind energy facilities. A specific wind energy policy will ensure that local officials can make well-informed decisions and will ensure that adequate and consistent analyses and procedures are implemented to assess and evaluate proposals.

The team will determine whether any special considerations should be made when screening wind energy proposals, the type and term of authorizations, and the methodology for calculating the fees associated with the authorization. The team is also considering guidance for potential visual, scenery, recreation, or wildlife impacts and measures to mitigate those impacts.

The recent BLM Programmatic Environmental Impact Statement on Wind Energy Development is being used as a resource to allow for interagency consistency in policy. The ad hoc team has directly consulted with BLM employees concerning certain text and procedures of the BLM Programmatic Environmental Impact Statement (PEIS). The Forest Service intends to adopt many of the best management practices provided in the PEIS. In those instances where the Forest Service's legal authority, management practices and procedures do not allow us to completely align with the BLM, we are developing direction that is better suited to our agency's particular needs.

Our guidance also differs from the BLM due to continuing advances in wind energy technology, as well as new information on its affects on wildlife and civilian and military radar. Our direction will address these emerging issues to ensure it is based on the available best science. The Forest Service expects to publish the wind energy policy and handbook direction in the Federal Register this fall. The policy will call for the evaluation of wind energy proposals to be done at the Forest level using public comment processes due to the differing landscapes, habitats, wildlife populations, and public concerns unique to each site.

To date, the Forest Service has received no applications to construct a concentrating solar power or photovoltaic project.

In conclusion, Mr. Chairman, the Forest Service is firmly committed to the development of renewable energy sources on National Forest System lands. These lands are already one of the nation's larger sources of hydropower and geothermal energy. The agency will play a leading role in increasing the utilization of woody biomass as a renewable energy source. We are confident we can accomplish all of this within the statutory and regulatory framework under which the Forest Service manages 193 million acres of forests and grasslands.

I would be glad to answer any questions you may have.

Senator CRAIG. Sally, thank you very much.

Now let's turn to Jim Wells, Director of Natural Resources and the Environment for the Government Accountability Office.

Jim, Ron, thank you for being with us.

STATEMENT OF JIM WELLS, DIRECTOR, NATURAL RESOURCES AND ENVIRONMENT, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. WELLS. Thank you, Mr. Chairman and members of the committee.

We, today, as Senator Bingaman referred to, are releasing to the public our most recent work on the challenges facing geothermal development. We're pleased today to talk about the successes of EPAct of 2005 as it relates to geothermal energy.

In today's world, energy in any form has, and is, becoming more valuable. As prices of oil, natural gas, and electricity rise, interest in renewable energy, like geothermal, rises. Most will agree, in the room today, that we, as a Nation, have a need to develop renewable sources. The passage of EPAct 2005 last year served notice that the Federal Government is, in fact, a major participant and is uniquely involved by owning huge amounts of Federal land with the potential for future geothermal development.

The GAO report gives you a geothermal status, if you will, of what we have to date, what we know about the potential for the future. It also addresses the challenges to expansion, describes the Federal, State, and local governments' activities, and finally, tries to explain how the royalty payments are collected for the use of these Federal resources, which has always been a complicated process.

What we are currently getting from geothermal sources is not huge, by electricity production standards, but it is locally important. If you live in Hawaii, California, Nevada, Utah, or Idaho, you will know how important geothermal is.

Mr. Chairman, you may have noticed we used a picture of the Boise district heating system in our report. Another 2,300 businesses, jobs, and consumers, with over 1 million existing geothermal heat pumps, know how important the source of energy is.

The statistics show that this source of energy is producing 2,500 megawatts of electricity, enough to run about 2.5 million homes. Fifty percent of that energy is coming from the Federal lands. How-

ever, in a perspective, this is still only .3 percent of our Nation's total electricity production.

Our report title, perhaps, tells the story best. The potential of geothermal will depend on the ability to overcome some pretty significant challenges. Harassing—excuse me—harnessing—I don't want to harass geothermal——

[Laughter.]

Mr. WELLS [continuing]. I want to harness geothermal energy—it is not easy, and it's not easy to say that word, either. The GAO report describes capital-intensive business—risky business environment that they have to deal with, exploration and drilling technology hurdles that have to be overcome, transmission inadequacies, lengthy administrative and regulatory lease and permit reviews, lawsuits, and a very complex royalty payment system. The list of challenges is longer than what I've described here.

Some, if not all, of these challenges are being addressed either by existing programs or planned actions as a result of the passage of EPAct 2005. The State, the local governments, they are giving incentives with tax credits, grants, and they are mandating renewable portfolio standards to encourage production of geothermal energy. And it appears to be working.

The Federal Government, in EPAct 2005, also grants developers a Federal tax credit to recoup investments quicker. It instructs DOI, Department of the Interior, to simplify the royalty payments with the lower fee structures. It lowers exploration risk by getting the U.S. Geological Survey to update a 1978 study of the assessment of the locations of these resources. And it authorizes FERC new authorities to issue permits for transmission rights-of-ways in the national interest.

I want to leave you with an impression that a lot has been done to provide incentives to this industry.

Lastly, EPAct 2005 significantly changed how royalties are to be paid and disbursed. Half will go to the States, 25 percent to the counties in which these projects are located, and another—the remaining 25 percent to the Federal Government.

The Department of the Interior was charged with designing a simpler method for charging for the resource use while seeking to lower the cost and design rules to maintain the same level of royalty collections as before the act over the next 10 years. Our analysis is going to suggest that this is going to be a challenge for the Department of the Interior.

Mr. Chairman, in summary, today's geothermal usage is relatively small. Geothermal is clearly a unique energy offering of an environmental friendly alternative to fossil fuels; yet, where and how far we can stretch and expand this industry is still unknown. EPAct 2005 and at least half of the States have stepped up to the plate with incentives to grow this industry. Many of these efforts are showing promise, but it's too early for GAO to give you an assessment to declare success.

There's a children's book that talks about a little train engine that wanted to climb a hill. "I think I can, I think I can," is like the geothermal industry today. Industry is optimistic for the future. Encouragement has been provided. Now that the Federal agencies have the task, they've got to step to the plate to use this

expanded authority that the Congress has given them, and the industry and the marketplace also must take advantage of these offers. They need to reduce their operating cost and gain market share.

The bottom line is: Going to the 21st century, we're going to need a diverse supply of energy, and we will need an ever-increasing amount from all energy sources, including renewables.

Mr. Chairman, I'll stop here and would be glad to answer any questions.

[The prepared statement of Mr. Wells follows:]

PREPARED STATEMENT OF JIM WELLS, DIRECTOR, NATURAL RESOURCES AND ENVIRONMENT, GOVERNMENT ACCOUNTABILITY OFFICE

RENEWABLE ENERGY

INCREASED GEOTHERMAL DEVELOPMENT WILL DEPEND ON OVERCOMING MANY CHALLENGES

WHY GAO DID THIS STUDY

The Energy Policy Act of 2005 (Act) contains provisions that address challenges to developing geothermal resources, including the high risk and uncertainty of developing geothermal power plants, lack of sufficient transmission capacity, and delays in federal leasing. Among the provisions are means to simplify federal royalties on geothermal resources while overall collecting the same level of royalty revenues. This testimony summarizes the results of a recent GAO report, GAO-06-629. In this testimony, GAO describes: (1) the current extent of and potential for geothermal development, (2) challenges faced by developers of geothermal resources, (3) federal, state, and local government actions to address these challenges, and (4) how provisions of the Act are likely to affect federal geothermal royalty disbursement and collections.

WHAT GAO RECOMMENDS

GAO concluded that it will be difficult for the Department of the Interior (DOI) to demonstrate that it intends to collect the same level of geothermal royalties as called for in the Energy Policy Act because the Minerals Management Service (MMS) does not systematically collect sales revenue data from electricity sales. Therefore, GAO recommends that the Secretary of the Interior instruct the appropriate managers within MMS to systematically collect these data, and DOI agreed.

WHAT GAO FOUND

Geothermal resources currently produce about 0.3 percent of our nation's total electricity and heating needs and supply heat and hot water to about 2,300 direct-use businesses, such as heating systems, fish farms, greenhouses, food-drying plants, spas, and resorts. Recent assessments conclude that future electricity production from geothermal resources could increase by 25 to 367 percent by 2017. The potential for additional direct-use businesses is largely unknown because the lower temperature geothermal resources that they exploit are abundant and commercial applications are diverse. One study identified at least 400 undeveloped wells and hot springs that have the potential for development. In addition, the sales of geothermal heat pumps are increasing.

The challenges to developing geothermal electricity plants include a capital-intensive and risky business environment, technological shortcomings, insufficient transmission capacity, lengthy federal review processes for approving permits and applications, and a complex federal royalty system. Direct-use businesses face numerous challenges, including challenges that are unique to their industry, remote locations, water rights issues, and high federal royalties. The Act addresses many of these challenges through tax credits for geothermal production, new authorities for the Federal Energy Regulatory Commission, and measures to streamline federal leasing and simplify federal royalties, which totaled $12.3 million in 2005. In addition, the Department of Energy and the state of California provide grants for addressing technology challenges. Furthermore, some state governments offer financial incentives, including investment tax credits, property tax exclusions, sales tax exemp-

tions, and mandates that certain percentages of electricity within the state be generated from renewable resources.

Under the Act, federal royalty disbursement will significantly change because half of the federal government's share will now go to the counties where leases are located. Although the Act directs the Secretary of the Interior to seek to maintain the same level of royalty collections, GAO's analysis suggests this will be difficult because changing electricity prices could significantly affect royalty revenues. Finally, MMS does not collect sales data that are necessary to monitor these royalty collections.

Mr. Chairman and Members of the Committee:

We are pleased to participate in the Committee's hearing to discuss the development of geothermal energy on federal lands and the role of geothermal resources in the nation's portfolio of alternative energy sources. We previously testified that fossil fuels, such as coal, oil, and natural gas, provide about 86 percent of our nation's total energy consumption, with the rest coming from other sources, including nuclear energy and renewable resources, such as hydroelectric energy; wind, solar energy, and geothermal resources.[1] Our nations' long-standing reliance on imported crude oil and natural gas and disruptions in their supply highlight the need to develop renewable energy sources. Among these sources is geothermal energy. Geothermal energy is a unique renewable resource in that it can provide power that is independent of weather and climate, thereby enabling a consistent and uninterrupted supply of heat and electricity. Geothermal energy also creates fewer environmental impacts than the production of natural gas and other conventional fossil fuels. Because many areas that have the potential to produce additional geothermal energy are located on federal lands, the federal government plays a major role in the future development of geothermal energy.

Harnessing geothermal energy, however, is not easy. Developers of geothermal energy face many challenges, including the high risk and uncertainty of developing geothermal power plants, lack of sufficient capacity to transmit electricity from these plants to consumers, inadequate technology, and delays in leasing federal lands, which supply about 50 percent of the geothermal resources used to generate electricity. To address these and other challenges, the Congress included detailed provisions in the Energy Policy Act of 2005.

My testimony today is based on a report we recently completed entitled *"Renewable Energy: Increased Geothermal Development Will Depend on Overcoming Many Challenges."* In this report, we addressed: (1) the current extent of and potential for geothermal development; (2) challenges faced by developers of geothermal resources; (3) federal, state, and local government actions to address these challenges; and (4) how provisions of the Energy Policy Act are likely to affect federal geothermal royalty disbursements and collections. In addressing these issues, we reviewed key studies on the extent and potential of geothermal development, interviewed a variety of government and industry officials, reviewed substantial supporting documentation and the Energy Policy Act, analyzed geothermal royalty data, and toured geothermal electricity plants and other facilities in California, Idaho, Nevada, and Oregon.

In summary, we found the following:

- Although locally important, geothermal resources produce a very small portion of our nation's total electricity and heating needs. In 2004, geothermal resources generated about 0.3 percent of the nation's total electricity and supplied heat and hot water directly to about 2,300 district heating systems, fish farms, greenhouses, food drying plants, spas, and resorts. The most recent estimates of future electricity generation from geothermal resources suggest that the current production of 2,500 megawatts of electricity—enough to supply 2.5 million homes—could increase to as much as 12,000 megawatts in 11 years. Although the future potential of other geothermal applications is less known, about 400 undeveloped geothermal wells and hot springs could supply heat and hot water directly to a variety of businesses and other organizations.
- The developers of geothermal resources face significant financial, technical, and logistical challenges. Geothermal electric power plant developers face a capital intensive and risky business environment in which obtaining financing and securing a contract with a utility are difficult, where recouping the initial investment takes many years, and where transmission expenses could be costly due to remote locations or capacity constraints on the electric grid. These developers must also use exploration and drilling technologies that are inadequate for the

[1] See *Meeting Energy Demand in the 21st Century: Many Challenges and Key Questions,* GAO-05-414T (Washington, D.C.: March 16, 2005).

unique attributes of geothermal reservoirs. Developers of electric power plants on federal lands face additional administrative and regulatory challenges and a complicated royalty payment system. Businesses and individuals trying to tap geothermal resources for direct use face unique marketing, financing, and technical challenges and, in some cases, must contend with remote locations, restrictive state water rights, and high royalties.

- To address the many challenges of developing geothermal resources, federal, state, and local governments have implemented a number of incentives and initiatives, many of which show promise. However, it is too early to assess their overall effectiveness. To address the capital intensive and risky nature of developing geothermal power plants, the Energy Policy Act grants developers a federal tax credit. Some states also encourage the production of electricity from renewable energy by granting various tax credits or by passing laws or adopting policies requiring that public utilities provide a minimum percentage of their electricity from renewable energy. To address technological challenges, the federal government and the state of California awarded research and development grants through the Department of Energy's Geothermal Technologies Program and the California Energy Commission, respectively. The Energy Policy Act gives the Federal Energy Regulatory Commission new authorities to address transmission limitations and contains provisions designed to improve the efficiency of federal geothermal leasing and to simplify or reduce federal geothermal royalties.
- How federal royalties are shared will change significantly since passage of the Act, and the total amount of royalties collected could change significantly if electricity prices also change. While the Act continues to provide that 50 percent of federal geothermal royalties will be disbursed to the states in which the federal leases are located, an additional 25 percent will now be disbursed to the counties in which the leases are located, leaving only 25 percent to the federal government. The Act also directs for most leases that the Secretary of the Interior seek to maintain the same level of royalty revenues as before the Act, but our analysis suggests that this will be difficult because of two factors. First, because lessees in certain situations will have the option of choosing a different formula for calculating royalties, changing electricity prices could significantly affect the percentage of future royalty revenues that they pay. Second, the Minerals Management Service (MMS) does not routinely collect from royalty payors the gross sales revenue figures for the electricity they sell so MMS cannot determine if or how these future royalty revenues differ from what lessees would have paid before the Act. We have made recommendations to the Secretary of the Interior to instruct the appropriate managers within MMS to collect from royalty payors the gross sales revenue figures from electricity sales. MMS has agreed to do so.

BACKGROUND

Geothermal energy is literally the heat of the earth. This heat is abnormally high where hot and molten rocks exist at shallow depths below the earth's surface. Water, brines, and steam circulating within these hot rocks are collectively referred to as geothermal resources. Geothermal resources often rise naturally to the surface along fractures to form hot springs, geysers, and fumaroles. For centuries, people have used naturally occurring hot springs as places to bathe, swim, and relax. More recently, some individuals have constructed buildings over these springs, transforming them into elaborate spas and resorts, thereby establishing the first direct use of geothermal resources for business purposes. Businesses have also established other direct uses of geothermal resources by drilling wells into the earth to tap the hot water for heating buildings, drying food, raising fish, and growing plants. Where the earth's temperature is not high enough to supply businesses with geothermal resources for direct use, people have made use of the ground's heat by installing geothermal heat pumps. Geothermal heat pumps consist of a heat exchanger and a loop of pipe extending into the ground to draw on the relatively constant temperature there for heat in the winter and air conditioning in the summer.

Geothermal resources can also generate electricity, and this is their most economically valuable use today. Only the highest temperature geothermal resources, generally above 200 degrees Fahrenheit, are suitable for electricity generation. When companies are satisfied that sufficient quantifies of geothermal resources are present below the surface at a specific location, they will drill wells to bring the geothermal fluids and steam to the surface. Upon reaching the surface, steam separates from the fluids as their pressure drops, and the steam is used to spin the blades of a turbine that generates electricity. The electricity is then sold to utilities in a

manner similar to sales of electricity generated by hydroelectric, coal-fired, and gas-fired power plants.

In the United States, geothermal resources are concentrated in Alaska, Hawaii, and the western half of the country, primarily on public lands managed by the Bureau of Land Management (BLM). The Congress set forth procedures in the Geothermal Steam Act of 1970 for leasing these public lands, developing the geothermal resources, and collecting federal royalties. Today, BLM leases these lands and sets the royalty rate, and the Minerals Management Service (MMS)—another agency within the Department of the Interior (DOI)—collects the federal geothermal royalties and disburses to the state governments its share of these royalties as required by law. In 2005, MMS collected $12.3 million in geothermal royalties, almost all of which was derived from the production of electricity.

CURRENT GEOTHERMAL DEVELOPMENT IS LIMITED, AND ESTIMATED POTENTIAL FOR ADDITIONAL DEVELOPMENT VARIES

Geothermal resources currently account for about 0.3 percent of the annual electricity produced in the United States, or 2,534 megawatts—enough electricity to supply 2.5 million homes. Even though the percentage of electricity generated from geothermal resources is small nationwide, it is locally important. For example, geothermal resources provide about 25 percent of Hawaii's electricity, 5 percent of California's electricity, and 9 percent of northern Nevada's electricity. As of January 2006, 54 geothermal power plants were producing electricity, and companies were constructing 6 additional geothermal power plants in California, Nevada, and Idaho that collectively will produce another 390 megawatts of electricity. Over half of the nation's electricity generated from geothermal resources comes from geothermal resources located on federal lands in The Geysers Geothermal Field of northern California; in and near the Sierra Nevada Mountains of eastern California; near the Salton Sea in the southern California desert; in southwestern Utah; and scattered throughout Nevada.

Industry and government estimates of the potential for electricity generation from geothermal resources vary widely, due to differences in the date by which forecasters believe the electricity will be generated, the methodology used to make the forecast, assumptions about electricity prices, and the emphasis placed on different factors that can affect electricity generation. Estimates published since 1999 by the Department of Energy, the California Energy Commission, the Geothermal Energy Association, the Western Governor's Association, and the Geo-Heat Center at the Oregon Institute of Technology indicate that the potential for electrical generation from known geothermal resources over the next 9 to 11 years is from about 3,100 to almost 12,000 megawatts. A more comprehensive and detailed study of electricity generation from all geothermal resources in the United States was published in 1978 by the U.S. Geological Survey (USGS). This assessment estimated that known geothermal resources could generate 23,000 megawatts if all of them were developed. The USGS estimate is greater because it did not consider how much electricity could be economically produced, given competing commercial sources of electricity. In addition, the USGS estimated that undiscovered resources could generate an additional 72,000 to 127,000 megawatts. In short, geothermal resources that could generate electricity are potentially significant but largely untapped.

In 2005, over 2,300 businesses and heating districts in 21 states used geothermal resources directly for heat and hot water. Nearly all of these are on private lands. About 85 percent of these users are employing geothermal resources to heat homes, businesses, and government buildings. While most users heat one or several buildings, some users have formally organized heating districts that pipe hot water from geothermal wells to a central facility that then distributes it to heat many buildings. The next most plentiful direct use application is for use by resorts and spas, accounting for over 10 percent of sites. About 244 geothermally heated resorts and spas offer relaxation and therapeutic treatments to customers in 19 states. Two percent of geothermal direct use applications consist of heated greenhouses in which flowers, bedding plants, and trees are grown. Another two percent of geothermal direct use applications are for aquaculture operations that heat water for raising aquarium fishes for pet shops; catfish, tilapia, freshwater shrimp and crayfish for human consumption; and alligators for leather products and food. Other direct use geothermal applications include dehydrating vegetables, like onions and garlic, and melting snow on city streets and sidewalks.

The potential for additional direct use of geothermal resources in the United States is uncertain due to the geographically widespread nature of low-temperature geothermal resources and the many different types of applications. USGS preformed the first national study of low-temperature geothermal sites in 1982, but this study

was not specific enough to identify individual sites for development. In 2005, the Geo-Heat Center at the Oregon Institute of Technology identified 404 wells and springs that might be commercially developed for direct use applications—sites that had the appropriate temperatures and are within 5 miles of communities.

Geothermal heat pumps have become a major growth segment of the geothermal industry. They make use of the earth's warmer temperature in the winter to heat buildings and use the earth's cooler temperature in the summer for air conditioning. The Geothermal Heat Pump Consortium estimated that 1 million units were in operation in all 50 states as of January 2006. Because geothermal heat pumps are effective where ground temperatures are between 40 and 70 degrees F, they can be installed in almost any location in the United States and, therefore, constitute the most widespread geothermal application and represent the greatest potential for future development.

GEOTHERMAL DEVELOPMENT FACES MANY CHALLENGES

The development of geothermal resources for electricity production faces major challenges, including high risk and financial uncertainty, insufficient transmission capacity, and inadequate technology. Geothermal groups reported that most attempts to develop geothermal resources for electricity generation are unsuccessful, that costs to develop geothermal power plants can surpass $100 million, and that it can take 3 to 5 years for plants to first produce and sell electricity. Although some geothermal resources are easy to find because they produce tell-tale signs such as hot springs, most resources are buried deep within the earth—at depths sometimes exceeding 10,000 feet—and finding them often requires an in-depth knowledge of the area's geology, geophysical surveys, remote sensing techniques, and at least one test well. The risks and high initial costs associated with exploring for and developing geothermal resources limit financing. Moreover, few lenders will finance a geothermal project until a contract has been signed by a utility or energy marketer to purchase the anticipated electricity. Geothermal industry officials describe the process of securing a contract to sell electricity as complicated and costly. In addition, lack of available transmission creates a significant impediment to developing geothermal resources for electricity production. In the West where most geothermal resources are located, many geothermal resources are far from existing transmission lines, making the construction of additional lines economically prohibitive, according to federal, state, and industry officials. Finally, inadequate technology adds to the high costs and risky nature of geothermal development. For example, geothermal resources are hot and corrosive and often located in very hard and fractured rocks that wear out and corrode drilling equipment and production casing.

Developing geothermal resources for direct use also faces a variety of business challenges, including obtaining capital, overcoming specific challenges unique to their industry, securing a competitive advantage, distant locations, and obtaining water rights. While the amount of capital to start a direct-use business that relies on geothermal resources is small compared to the amount of capital necessary to build a geothermal power plant, this capital can be substantial relative to the financial assets of the small business owner or individual, and commercial banks are often reluctant to loan them money. Challenges that are unique to certain industries include avoiding diseases in fish farms; combating corrosive waters used in space heating; and controlling temperature, humidity, and light according to the specifications of the various plant species grown in greenhouses. Even when overcoming these unique challenges, successful operators of direct use businesses may need to secure a competitive advantage, and some developers have done so by entering specialty niches, such as selling alligator meat to restaurants and constructing an "ice museum" in Alaska where guests can spend the night with interior furnishings sculptured from ice. Furthermore, developing direct uses of geothermal resources is also constrained because geothermal waters cannot be economically transported over long distances without a significant loss of heat. Even when these resources need not be moved, obtaining the necessary state water rights to geothermal resources can be problematic. In areas of high groundwater use, the western states generally regulate geothermal water according to some form of the doctrine of prior appropriations, under which specific amounts of water may have already been appropriated to prior users, and additional water may not be available.

Developing geothermal power plants on federal lands faces additional challenges. Power plant developers state that the process for approving leases and issuing permits to drill wells and construct power plants has become excessively bureaucratic. BLM and Forest Service officials often have to amend or rewrite resource or forest management plans, which can add up to 3 years to the approval process. Delays in finalizing the resource and forest management plans and in conducting other envi-

ronmental reviews have resulted in backlogs of lease applications in California and Nevada, particularly when the public has raised more environmental issues. Geothermal applications, permits, and environmental reviews are also delayed by a lack of staff and budgetary resources at the BLM state and field offices that conduct the necessary work and when BLM must coordinate with the Forest Service, which manages land in some project areas. In addition, developers of geothermal resources for both power plants and direct uses faced a challenging federal royalty system prior to the Energy Policy Act. While developers of geothermal power plants generally did not consider the federal royalty system to be a major obstacle in constructing a geothermal power plant, some described paying royalties as burdensome and reported expending considerable time and expense on royalty audits. On the other hand, some developers of geothermal resources for direct use stated that the federal royalty system was a major obstacle and no longer economically feasible.

EFFORTS BY FEDERAL, STATE, AND LOCAL GOVERNMENTS TO ADDRESS THE CHALLENGES OF DEVELOPING GEOTHERMAL RESOURCES SHOW PROMISE

The Energy Policy Act of 2005 includes a variety of provisions designed to help address the challenges of developing geothermal resources, including the high risk and financial uncertainty of developing renewable energy projects and the lack of sufficient transmission capacity. Provisions within the Act address high risk and financial uncertainty by providing tax credits and other incentives. For example, starting on January 1, 2005, the Act extends for 10 years a tax credit on the production of electricity from geothermal resources for already existing plants and for any new plants producing by December 31, 2007. The Act also provides a financial incentive for tax-exempt entities, such as municipalities and rural electric cooperatives, by allowing the issuance of clean renewable energy bonds for the construction of certain renewable energy projects, including geothermal electricity plants. Investors can purchase the bonds, which pay back the original principal and also provide a federal tax credit instead of an interest payment. Another provision in the Act may decrease the high risk of geothermal exploration by directing the Secretary of the Interior to update USGS's 1978 Assessment of Geothermal Resources, which is in need of revision because significant advancements in technology have occurred since its publication. The Act addresses transmission challenges by providing the Federal Energy Regulatory Commission (FERC) with new authorities in permitting transmission facilities and in developing incentive-based rates for electricity transmission in interstate commerce. FERC can now approve new transmission lines in certain instances when a state fails to issue a permit within 1 year of a company's filing of an application, and companies that acquire FERC permits for transmission facilities can acquire rights of way through eminent domain proceedings. In November 2005, FERC initiated the rulemaking process for establishing these rates.

State governments are also addressing the financial uncertainty of developing renewable energy projects by creating additional markets for their electricity through Renewable Portfolio Standards (RPS). An RPS is a state policy directed at electricity retailers, including utilities, that either mandates or encourages them to provide a specific amount of electricity from renewable energy sources, which may include geothermal resources. To date, 22 states plus the District of Columbia have RPSs, and three other states have set RPS targets, although not all states have significant geothermal resources. Additional state programs also provide tax credits and other financial incentives for renewable energy development, including electricity generation from geothermal resources. These incentives include property tax incentives, sales tax incentives, and business tax credits.

To address technological challenges, the state of California and the Department of Energy provide financial assistance and grants to the geothermal industry. California's Geothermal Resources Development Account competitively awards grants to promote research, development, demonstration, and commercialization of geothermal resources. California's Public Interest Energy Research Program also funds awards for renewable resource projects, including geothermal projects. On the federal side, the Department of Energy's Geothermal Technologies Program competitively awards cost-sharing grants to industry for research and development. In the past, program funds have been used to pioneer new drill bits, demonstrate the large scale use of low-temperature geothermal resources to generate electricity, produce new seismic interpretation methods, commercialize geothermal heat pumps, develop slimhole (reduced diameter) drilling for exploration, and produce a strategy for reinjection at The Geysers Geothermal Field. The program's budget was $23 million in fiscal year 2006. However, the President's budget contains no funding for fiscal year 2007, and the House's proposal for fiscal year 2007 is to appropriate a substantially reduced amount of $5 million. In contrast to these funding decisions, the Sen-

ate Energy and Water Appropriations Subcommittee just recently approved a budget of $22.5 million for geothermal research and development. While the future impacts of reduced or eliminated funding for geothermal technology is uncertain, industry representatives believe that this funding is necessary to address the near-term need to expand domestic energy production and the long-term need to find the breakthroughs in technology that could revolutionize geothermal power production.

The Energy Policy Act also contains provisions aimed at addressing the challenges of developing geothermal resources on federal lands. Specific provisions are aimed at streamlining or simplifying the federal leasing system, combining prospective federal lands into a single lease, and improving coordination between DOI and the Department of Agriculture. The Act also requires the Secretary of the Interior and the Secretary of Agriculture to enter into a memorandum of understanding that establishes an administrative procedure for processing geothermal lease applications and that establishes a 5-year program for leasing of Forest Service lands and reducing its backlog of lease applications, as well as establishing a joint data retrieval system for tracking lease and permit applications. Finally, the Act also contains provisions that simplify and/or reduce federal geothermal royalties on resources that generate electricity and on resources put to direct use. MMS is in the early stages of implementing these provisions, and hence it is too early to assess their overall effectiveness.

GEOTHERMAL ROYALTY DISBURSEMENTS WILL CHANGE SIGNIFICANTLY, AND CHANGES IN ELECTRICITY PRICES COULD ALTER TOTAL ROYALTY COLLECTIONS

A royalty provision of the Energy Policy Act redistributes the federal royalties collected from geothermal resources—cutting in half the overall geothermal royalties previously retained by the federal government. Established by the Geothermal Steam Act of 1970, as amended, the prior distribution provided that 50 percent of geothermal royalties be retained by the federal government and the other 50 percent be disbursed to the states in which the federal leases are located.[2] While the Energy Policy Act continues to provide that 50 percent of federal geothermal royalties be disbursed to the states in which the federal leases are located, an additional 25 percent will now be disbursed to the counties in which the leases are located, leaving only 25 percent to the federal government. The Act also changes how the federal government's share of geothermal royalties can be used. Prior to passage of the Act, 40 percent of the federal government's share was deposited into the reclamation fund created by the Reclamation Act of 1902, and 10 percent was deposited into the general fund of the Department of the Treasury. For the first 5 fiscal years after passage of the Act, the federal government's share is, now to be deposited into a separate account within the Department of the Treasury that the Secretary of the Interior can use without further appropriation and fiscal year limitation to implement both the Geothermal Steam Act and the Energy Policy Act.

While, for most leases, the Energy Policy Act directs that the Secretary of the Interior seek to maintain the same level of royalty revenues as before the Act, our analysis suggests that this will be difficult because changing electricity prices could significantly affect the percentage of future royalty revenues collected. Electricity prices are not possible to predict with certainty, and as discussed below, changing prices could significantly impact royalty revenues because electricity sales account for about 99 percent of total geothermal royalty revenues. The Act contains provisions for each of three specific types of leases that generate electricity: (1) leases that currently produce electricity, (2) leases that were issued prior to passage of the Act and will first produce electricity within 6 years following the Act's passage, and (3) leases that have not yet been issued.

For leases that currently produce electricity, future geothermal royalty revenues will depend on electricity prices. The Act specifies that the Secretary of the Interior is to seek to collect the same level of royalties from these leases over the next 10 years as it had before the Act's passage but under a simpler process. Prior to passage of the Act, lessees of most geothermal electricity projects paid federal royalties according to a provision within MMS's geothermal valuation regulations referred to as the "netback process." To arrive at royalties due under this process, lessees are to first subtract from the electricity's gross sales revenue[3] their expenses for generation and transmission and then multiply that figure by the royalty rate specified

[2] 30 U.S.C. § 191(a). The State of Alaska is an exception to this provision, receiving 90 percent.

[3] The valuation regulations 30 C.F.R. § 206.352(c)(1)(ii) actually call for using gross proceeds, not sales revenue, in this calculation. The Energy Policy Act also refers to the term gross proceeds. Gross proceeds are all financial compensation accruing to the lessee from the sales of electricity. Since sales revenues are generally the largest component of gross proceeds, we use the two terms synonymously in this report for simplicity.

in the geothermal lease, which is from 10 to 15 percent.[4] The Act simplifies the process by allowing lessees, within a certain time period, the option to request a modification to their royalty terms if they were producing electricity prior to passage of the Act. This modification allows for royalties to be computed as a smaller percentage of the gross rather than the net sales revenues from the electricity so long as this percentage is expected to yield total royalty payments equal to what would have been received before passage of the Act. Royalty revenues from a geothermal lease currently producing electricity will remain the same if the lessee elects not to convert to the new provision of the Act. On the other hand, if the lessee converts to the new provision, royalty revenues should remain about the same only if DOI negotiates with the lessee a future royalty percentage based on past royalty history and if electricity prices remain relatively constant. If royalties are based on historic percentages of gross sales revenues and electricity prices increase, however, royalty revenues will actually decrease relative to what the federal government would have collected prior to passage of the Act. The federal government will receive less revenue under this situation because expenses for generation and transmission do not increase when electricity prices increase, and the higher royalty rate specified in the lease is not applied to the increase in sales revenues.

For the second type of lease—leases that were issued before the Act and that will first produce electricity within 6 years after the Act's passage—royalty revenues are likely to drop somewhat because lessees are likely to take advantage of an incentive within the Act. The Act allows for a 50 percent decrease in royalties for the first 4 years of production so long as the lessee continues to use the netback process.[5] Because of the substantial reduction in royalties, it is likely that lessees owning leases issued before passage of the Act will elect to pay only 50 percent of the royalties due on new production for the 4-year period allowed by the Act. This incentive also applies to sales revenues from the expansion of a geothermal electricity plant, so long as the expansion exceeds 10 percent of the plant's original production capacity. Owners of geothermal electricity plants currently paying royalties under the netback process may elect to take the production incentive for new plant expansions if they perceive that the royalty reduction is worth the additional effort and expense in calculating payments under the netback process and worth the possibility of being audited.

It is difficult to predict exactly how royalty revenue from the third type of lease—leases that have not yet been issued—will change, but it appears that revenue impacts are likely to be minor, based on our review of historic royalty data. The Act specifies that the Secretary of the Interior should seek to collect the same level of royalty revenues over a 10-year period as before passage of the Act. The Act also simplifies the calculation of royalty payments by providing that, for future leases, royalties on electricity produced from federal geothermal resources should be not less than 1 percent and not greater than 2.5 percent of the sales revenue from the electricity generated in the first 10 years of production. After 10 years, royalties should be not less than 2 percent and not greater than 5 percent of the sales revenue from the electricity. Our analysis of data for seven geothermal projects showed that lessees were paying a wide range of percentages after 10 years of production—from 0.2 to 6.3 percent. Three of the seven projects paid under the minimum 2 percent royalty rate prescribed in the Act, suggesting that some projects in the future could pay more under the Act's new provisions than they would otherwise have paid. On the other hand, one project paid greater than the maximum 5 percent prescribed in the Act, suggesting that it is possible for a plant to pay less in the future than it would otherwise have paid. However, neither the amount that the one plant would have overpaid nor the amounts that the three plants would have underpaid are significant.

Even though provisions of the Energy Policy Act may decrease royalties on direct use applications, the impact of these provisions is likely to be small because total royalty collections from direct use applications are minimal. In fiscal years 2000 through 2004, MMS reported collecting annually about $79,000 from two direct use projects, or less than 1 percent of total geothermal royalties. While a provision of the Act may encourage the use of federal geothermal resources for direct use by lowering the federal royalty rate, we believe based on challenges facing developers that it is unlikely that this royalty incentive alone will stimulate substantial new revenues to compensate for the loss in revenue due to the lower royalty rate. We believe that in order to substantially increase the development of federal direct use applica-

[4] Deductions are estimates that are to be recalculated at the beginning of each year. Prior year's deductions are to be adjusted based on actual costs during that year.

[5] Pub. L. No. 109-58 § 224 (2005).

tions, developers must overcome the relatively high capital costs for investors, unique business challenges, and water rights issues.

Finally, MMS does not routinely collect data from the sales of electricity that are necessary to demonstrate that MMS is seeking to maintain the same level of royalty collections from geothermal resources, as directed by the Energy Policy Act. For most geothermal leases, MMS will need to calculate the percentage of gross sales revenues that lessees will pay in future royalties from electricity sales and compare this to what lessees would have paid prior to the Act. However, MMS does not routinely collect these data. Accordingly, we are recommending that the Secretary of the Interior instruct the appropriate managers within MMS to collect from royalty payors the gross sales revenues from the electricity they sell. MMS has agreed to do so.

CONCLUSIONS

The Energy Policy Act of 2005 addresses a wide variety of challenges facing developers of geothermal resources. The Act incorporates many of the lessons learned by state governments and federal agencies in an attempt to provide financial incentives for further development and make federal processes more efficient. However, the Act was only recently adopted, and insufficient time has passed to assess its effectiveness. Several of the Act's major provisions will be left to the federal agencies within DOI for implementation, and the drafting and public comment period for regulations that implement these provisions will not occur overnight. Agencies will also need to spend considerable time and effort in working out the details for implementation and securing the necessary budgets. Hence, the fate of a significant portion of our nation's geothermal resources depends on the actions of these federal agencies.

Mr. Chairman, this concludes my prepared statement. I would be pleased to respond to any questions that you or other Members of the Committee may have at this time.

CONTACT AND ACKNOWLEDGEMENTS

For further information about this testimony, please contact me, Jim Wells, at 202-512-3841 or wellsj@gao.gov. Contributors to this testimony include Ron Belak, John Delicath, Dan Haas, Randy Jones, Frank Rusco, Anne Stevens, and Barbara Timmerman.

Senator CRAIG. Jim, thank you very much.

Let me turn to our panel, then, for questions. And I'll start the round.

Lynn, in your testimony, you discussed new rulemaking to address geothermal changes made by the energy bill. How long before BLM issues a proposed rulemaking?

Ms. SCARLETT. We went out with the proposed rule today, for both the Minerals Management Service and Bureau of Land Management, on that proposed rulemaking.

Senator CRAIG. Excellent.

Ms. SCARLETT. Yes.

Senator CRAIG. When might you expect to see final rules?

Ms. SCARLETT. Well, we would have to go through the normal comment period, and so forth, but I would hope towards the end of the year.

Senator CRAIG. OK.

I understand that the Fish and Wildlife Service issued guidelines on how wind turbines can avoid wildlife impacts. Apparently, these guidelines were developed, I am told, without public involvement, and have been widely criticized by both industry and the environmental community. Why has the Fish and Wildlife Service not involved affected stakeholders in their process? And does the Department plan on developing new, revised guidelines for wind power?

Ms. SCARLETT. Yes, Senator, the interim guidelines that were issued were issued several years ago, when we were wanting to get something out as voluntary guidance only—they were voluntary—

but to get something out so that folks could have, kind of, a benchmark as they worked on wind projects as it related to protection of birds and so forth. We did get criticism on those guidelines, although I want to underscore they were voluntary. We committed to a collaborative process.

We are working to develop that process. Initially, we hoped to move forward right away, but we find that we face some Federal advisory committee constraints. And so, we have to figure out whether we have to go a FACA route or some other collaborative process. And that's what we have under discussion right now.

Senator CRAIG. How long before you expect this process to commence?

Ms. SCARLETT. We would hope as soon as we could work out the legal details on the mechanism. Obviously, if it's a FACA, it takes longer. We're hoping that we can find some other mechanism so that we can engage in some kind of dialogue and get the underway quickly. Dale Hall, the head of the Fish and Wildlife Service, is actively involved in making that happen.

Senator CRAIG. Well, we hope it will be sooner rather than later, but I also hope that we can, in that process, make it as public and transparent as possible. All stakeholders ought to be involved in this.

Sally, you mentioned the Forest Service's 65 pending geothermal lease applications that the agency must concur on. When will you have those leases issued?

Ms. COLLINS. Our largest barrier in getting our backlog of geothermal lease applications completed is forest planning processes. We have forest plans that are not up to date relative to geothermal development. So, that's why we put together the 5-year schedule, to look at what it—what it's going to take to get those forest plans online. And it really varies, depending on the forest plan and the forest we're talking about, the schedule that those are on.

Senator CRAIG. You're suggesting you won't do anything until a plan comes up for renewal and——

Ms. COLLINS. We can amend a forest plan in the interim. And that is possible. And one of the things that they are looking at, on a case-by-case, forest-by-forest basis, is how to complete that NEPA analysis—again, in conjunction with BLM looking at their priorities.

One of the things that we've found—and BLM has found, in going back to many of these old lease applications—is that they are—they've gone back to the applicants and said, "Do you still want to keep these leases?" And a number of them have relinquished the lease applications. And so, a lot of it is just updating these, because some of them are very old. And there was not an interest in continuing on with that development.

Senator CRAIG. Well, I'm glad that process is diligent and well underway, because, you know, those leases that might have occurred in the 1970's, or even in the 1960's or in the 1980's, technologies are changing, and, therefore, some geologies would yield where others may not. And I hope you're looking at it on that kind of a sensitive basis instead of just the normal plan rotation. If that's the case, some of these may have valuable geologic resources, in the sense of geothermal, but they may be 5 years out.

Ms. COLLINS. You know, you're absolutely right, we need to bringing in the new information. One of the reasons why we're very excited about the USGS data and this mapping project is that we'll have a better feel for where the resources are and where we need to prioritize that work to get those projects moving forward.

Senator CRAIG. You mentioned the formation of an ad hoc wind energy guidance team. Why is the agency developing its own guidelines for wind power, when the BLM just completed an exhaustive process on the very subject? Or should I say, Are you collaborating and working together? And, if you aren't, why aren't you?

Ms. COLLINS. We actually have used a lot of the best management practices that came out of that process that BLM just completed as part of these guidelines that we're developing that this team is looking at. So, yes, we are collaborating quite closely, we're using that information as we develop our guidelines. But, remember, we only have two applications. BLM has 22 existing facilities. We have a lot to learn from them; and yet, we do have our own procedures that we need to go through in order to get those permits completed. We have the authorities now to do it. We just need better guidelines to expedite the process in the future.

Senator CRAIG. It's also my understanding that the Forest Service is not involving affected stakeholders in their process. If that's true, why is it?

Ms. COLLINS. I would disagree with that, because I think that as we go through—as this group is going through the process of developing these procedures, they're working very closely and informally with a number of entities, including the industry. Actually, they're on their way to Florida, in the next couple of weeks, to visit one of the wind energy facilities there. They've been trying to understand the perspective of the developer as we develop these guidelines. And so, I would say we are. And by fall we expect to have a policy out so that we'll have something for people to look at.

But at this point in time, we feel like the informal process of working with the industry is working quite well.

Senator CRAIG. Thank you.

Senator Bingaman.

Senator BINGAMAN. Well, thank you all very much.

Let me ask about one issue that we've heard about, some in this committee, and also in the Finance Committee. We put in place these provisions that intend to stimulate these renewable energy projects on Federal land. We also put in place production tax credits for renewable energy. The production tax credits are going to expire at the end of 2007. And much of the other preparation for doing projects on Federal land is sort of still in the works. Do we have a real danger here, if we let those production tax credits expire at the end of 2007, that we will have had such a narrow window of opportunity that we're not going to really have a lot of renewable energy projects brought into service on Federal land. Is that a real concern? Does anybody have that concern? Secretary Scarlett, did you have any——

Ms. SCARLETT. I think, in the later testimony by those in industry, they may have some additional thoughts, but let me offer a couple of thoughts.

We have seen an explosion in investment in renewable energy on public lands, whether it be geothermal, or wind, in particular, as well as, now, some biomass. Those are driven by multiple factors. Certainly, the acts of Congress and those incentives are a part of that, but I would also say that, with the continued high prices of fossil fuels, these particular energy sources are also more competitive than they might have been in the past; and, therefore, I would imagine that some of that investment will continue. But the specific effect of those tax benefits, I think, I'd look forward to hearing the hearing the industry views on that.

Senator BINGAMAN. Ms. Collins, did you have a view?

Ms. COLLINS. Well, the only thing I can say is, the GAO report, I think, addressed that quite well, and projecting that we would look at—a couple-of-year extension would help that situation, but, because I don't really deal with the royalty side of the issue, or the tax credit side of the issue, you know, I think I would defer to GAO on that.

Mr. WELLS. Senator, clearly that was raised by the industry as a concern or a challenge that needed to be addressed, and perhaps changed. We have seen statistics and evidence that many of these leases could be 2 to 3 years in process before they're actually approved. So, you are correct in assuming that for some activity the tax credit will expire in 2007 before a final decision can be made; therefore, that industry recipient would not benefit from that incentive.

Senator BINGAMAN. Yes, my understanding is that the way we wrote the tax credits, you've got to have your facility in service by the end of 2007 in order to get the advantage of the tax credit. Is that your understanding?

Mr. WELLS. That is correct.

Senator BINGAMAN. OK. Secretary Scarlett, let me ask about—one of the GAO findings, as I understanding it, is that 40 percent of Minerals Management Service geothermal royalty data reviewed by the GAO was erroneous or missing. Did you have any comments on that and whether that is a problem that is getting fixed?

Ms. SCARLETT. Yes, Senator. We thank the GAO for its report, and we did concur with them that we had some challenges with respect to that data. However, the new rules—one of the issues that they pointed to was the lack of information on gross electricity sales—the new rules that we are proposing through MMS on royalties actually peg the fees to, in fact, the gross electricity sales. So, we will now be gathering those data on a routine basis, and that will, I think, significantly help and address some of the issues that they raised.

In addition, though, as a result of that report, we are enhancing our auditing and our efforts at data collection.

Senator BINGAMAN. Let me ask Mr. Wells. Again, you refer, I believe, to the renewable portfolio standards that have been adopted in various States as one of the factors stimulating some of this development. Did you have any additional comments on any of that as to how big a factor that was?

Mr. WELLS. Clearly, we put it in the report, Senator, because the evidence shows us that the proliferation of these energy—renewable portfolio standards, at least in 22 States and the District of

Columbia, has, in fact, caused utilities to start looking for additional sources of energy that they had not been getting. And some of those inquires are going to geothermal projects. So, the evidence is suggesting that these renewable mandates are, in fact, causing increased interest in supply issues.

I will say, from a Federal perspective, EPAct 2005 did have provisions, that are in the process of being implemented, to address new, increased requirements for the Federal sector, including Federal buildings. To increase the amount of renewable energy that they use in Federal buildings to 3 percent initially and to go as high as 7½ percent, the energy consumed in Federal buildings is mandated to be renewable-type energy. So, all evidence suggests that that is a positive influence on increasing usage of renewables.

Senator BINGAMAN. One other issue, Mr. Wells, that you refer to here is the importance of the technical challenges involved with geothermal development and the role the Federal Government can play there. Did you get into the question of funding levels? I notice the Department of Energy, the way I read their budget proposal to us this year, was for zero funding for geothermal technology research and development. Did you look into that? Am I accurate in my reading of that?

Mr. WELLS. We are aware, and it is an accurate statement, that the administration did zero out that program, and we've been monitoring the results of the Congress, and—and just within the last week, have indicated their willingness to put back at least 99 percent of that funding because of its importance to the industry.

Senator BINGAMAN. OK.

Mr. WELLS. We do not know what the administration's motivation was for zeroing out the program.

Senator BINGAMAN. Okay. I'll stop with that, Mr. Chairman.

Senator CRAIG. Thank you very much, Jeff.

Now let me turn to Senator Thomas.

Senator THOMAS. Thank you, Mr. Chairman.

Ms. Scarlett, where does the process for geothermal leases differ from those needed for gas and oil development?

Ms. SCARLETT. Well, we're in a period of transition. Let me say that first. In the past, with geothermal uses, there—or leases—there were designated geothermal areas, and we had noncompetitive leasing in many instances. There was also what we called direct leases—that is, not for—geothermal for commercial sale, but, rather, for direct use.

The new rules that we are promulgating and that we sent to the *Federal Register* today changed that leasing process, per the direction of the Energy Policy Act, and essentially migrate the process to a competitive process, although there are provisions for noncompetitive. If no one bids on specific tracts, there is a provision for noncompetitive leasing. But that would be the primary difference between the traditional oil and gas leasing and the geothermal, as it has been practiced in the past.

Senator THOMAS. But there are, I presume, some criteria with respect to the use of the land and the impact on the land.

Ms. SCARLETT. Absolutely. In terms of the energy/land interface, whether it be wind, whether it be geothermal or otherwise, we, of course, abide by, and take very seriously, our responsibilities under

the Endangered Species Act, under the National Environmental Policy Act, to look at environmental impacts and alternatives for reducing those impacts. So, in that regard, that would be the same.

Senator THOMAS. I see.

I guess this is tough to answer, but what do you see as the potential here? We're now producing, totally, about 1 percent of our energy out of wind. Do you see this as becoming a significant—obviously, we all want to work at whatever is available, but in terms of really dealing with the total, in the end, what do you see happening?

Ms. SCARLETT. Well, I'm going to defer to the experts on that, but my understanding is that right now the utilization of—or, excuse me, the production of the composite of renewables is the fastest-growing energy sector, something like a 60-percent growth just in recent years——

Senator THOMAS. But it's still less than 6 percent——

Ms. SCARLETT. Exactly. I think the projections that I have read are, by about 2025 or 2030, it could represent 10 percent of production and about 7 percent of consumption, actually.

Senator THOMAS. That's not hydro.

Ms. SCARLETT. So, it's still very small.

Senator THOMAS. That doesn't include hydro, then.

Ms. SCARLETT. That does not include hydro.

Senator THOMAS. OK.

Ms. Collins, the Forest Service has a little different criteria for the development on your lands. Is that right?

Ms. COLLINS. Well——

Senator THOMAS. Some of them, at least.

Ms. COLLINS. We have some different processes and procedures we go through, but, on geothermal development, we work together on the recommendation to lease, and we work together on the recommendation for how to develop that geothermal project on the ground.

And let me just add a little bit to Lynn's answer on your previous question. The biggest difference that we've seen between oil and gas, for example, that you have a lot of in Wyoming, and geothermal development is that you need a lot more transmission facilities, because you've got to have the infrastructure close to the heat source, because geothermal is geothermal, it's not as easy to pipe, for example, as oil or gas. So, you do see a different kind of infrastructure around geothermal than you do around oil and gas.

Senator THOMAS. That's true. And bio thing, what potential do you see there, in terms of——

Ms. COLLINS. For biofuels?

Senator THOMAS. Yes.

Ms. COLLINS. I actually think biofuels has huge potential. And I think biofuels—I can't say what percentage potential it has, but, when you look at—I think somebody has projected, in the billion-ton report, that 30 percent of the gasoline we use to run cars could be run on an ethanol from biomass—a portion of which would be biofuels from woody——

Senator THOMAS. The extraction of the timber comes off the forests, but the conversion to gas is not normally done in the forest. Isn't that right?

Ms. COLLINS. Right, that would be true.

Senator THOMAS. OK.

Ms. COLLINS. That would be true.

Senator THOMAS. Now—of course, there's still impact from those. And you have highways involved, and all those kinds of things, so you have to——

Ms. COLLINS. Well, you'd have to—you'd have to, of course, process the biofuel someplace, and then transport them like you would with gasoline.

Senator THOMAS. OK. Mr. Wells, you mentioned charges based on—like on wind. What are the charges based on?

Mr. WELLS. The charges for geothermal, for instance, is—the program we looked at—is based on gross revenues. In the past, before EPAct, it was based on gross revenues minus expenses, and then a certain percentage, anywhere between 10 and 15 percent of that amount, was paid in royalties. And that was the cost of using the Federal resource. Under EPAct, there was the proposed rulemaking that's underway, that will be completed, hopefully, by the end of the year, and will provide a new royalty fee structure, which will deal with simplifying a process where you just take the gross receipts from the sale of electricity from the geothermal resource. And a smaller percentage will be applied to that amount—in the range of 1 to 5 to 6 percent of that will be charged as a fee for the using of the Federal resource. This will eliminate some of the netbacking and the expense calculations that were always controversially involving a lot of audits. So, its schedule is based on a certain percentage based on gross sales.

Senator THOMAS. I see. So, it's not on the lease of the land, but it's on revenue.

Mr. WELLS. It's on revenue, in terms of the fee, once it's produced—once the drilling is done and the production occurs.

Senator THOMAS. What about wind?

Mr. WELLS. Prior to that, it's a——

Senator THOMAS. What about wind energy? There's not drilling there.

Mr. WELLS. Anybody want to talk to the fee structure for wind?

Ms. SCARLETT. My understanding is that the fee structure for wind is a royalty based on percentage of the gross electricity sales.

Senator THOMAS. They said, somewhere in here, the 10-year projection is 10,000 megawatts. Does that sound reasonable to any of you?

Ms. SCARLETT. In—are you talking—any particular——

Senator THOMAS. Renewables, nonhydric-hydrogen—or water minerals.

Ms. SCARLETT. Well, I'd have to tally that up. I know we have, for wind alone, a projection of—potential right-of-way authorizations for 3200 megawatts. We have two solar projects right-of-way applications that would be about 1700. So, I guess we could tally that up, and we might come to that 10,000, or close to it.

Mr. WELLS. We can give you the calculation for geothermal, in terms of 2500 megawatts today, and the estimates are anywhere from 25 percent to 400-percent potential increase in 10 or 11 years. We're cautiously optimistic that the industry can step to the plate and expand and gain market share. However, the verdict is still

out, in terms of whether they can achieve those types of numbers. I can give you a comparison. We mention, in our report, existing geothermal production provides 2.5 million homes with the capacity to run. And wind, we understand, today, was around the neighborhood of 400,000 homes. So, there's a little comparison of what you're actually getting from wind with geothermal today.

Senator THOMAS. One of the real problems, particularly with wind, is the transmission idea. You've got relatively small—over time, we're going to have to start getting a little more efficiency out of those. There's not a lot of production out of a wind machine, and you have to get some transmission out of there. And so——

Mr. WELLS. It's also an intermittent source. Sometimes the wind blows, and sometimes it doesn't. Geothermal is running 24/7.

Senator THOMAS. Come to Wyoming; it blows most of the time.

[Laughter.]

Senator THOMAS. Thank you.

Senator CRAIG. Craig, thank you.

About Wyoming and wind, I'll leave that one alone. We have our share, but it's not as strong.

Senator THOMAS. No, it's the State, not the Senator.

Senator CRAIG. Oh, I see.

[Laughter.]

Senator CRAIG. All right. There is no wind on the slopes of the Rockies. That's not true.

Let me turn to Senator Salazar for any opening comment and questions he would like to make at this time.

Senator SALAZAR. Thank you. Thank you very much, Senator Craig.

Let me ask Ms. Collins a question concerning biomass and what's happening with respect to the bark beetle problem and the huge infestations that we see throughout the West.

I know this is very much the case also in Senator Craig's State, in Idaho, and, I think, an issue affecting Oregon, also affecting Wyoming. But in my State, when I look at Colorado and I look at the Western Slope, I would say that 75 percent of all our mountain areas, which is most of the western half of the State, is owned by the Federal Government, owned by the Forest Service. And on those lands, about 1½ million acres, as I understand it, are acres which have been infested by the bark beetle. So, you see great swaths of Forest Service lands that essentially are brown and have become a tinderbox and create a huge fire hazard for Colorado.

My question to you is, What opportunity do we have with respect to using those fuels for biomass energy kinds of projects? And what is it that the Forest Service is doing to try to encourage those kinds of projects from taking place?

Ms. COLLINS. Well, you're absolutely right that you can almost blink and you've got 1,000 more acres dead in the central Rockies, Colorado high country. And we are doing a lot. Part of the problem right now is infrastructure. We don't have the traditional mills in Colorado—just a couple of them that actually can process materials. So, biomass really is the hope we have for the future, in terms of thinning those stands and protecting those communities.

That is one of our objectives, and that's one of the reasons why we've spent a lot of time working with grants to communities to

look at that woody biomass projects. And we've done that throughout the West over the last 5 years. We've also done a lot of research on woody biomass, and given some grants out through our Forest Products Lab to try to reduce the cost of these kind of forest-health treatments and convert those into woody biomass energy.

But it's just a drop in the bucket. There is so much more that can be done. And we get groups, from Colorado, in particular, coming in here to meet with us, and they're just very concerned about the safety of their communities and wanting to do something to save these lands. And I think, collectively, there's a lot of energy to do that; we just need to get our resources together to do that.

Senator CRAIG. Ken, could I interrupt to ask a technical question? How long is a bug-killed tree of value to the biomass community? Do you know that, Sally?

Ms. COLLINS. I do not know, and I—it's probably dependent on the species, and it's probably—you know, dependent on a lot of things like that the size of the tree. But we know that lodgepole—a lot of those lodgepole pine that are up there in the central area north of, you know, Dillon and that area, those are mostly lodgepole, and they're probably not good for 10 years after they die.

Senator SALAZAR. Sally, let me following up on—I think both Senator Craig and—many of us are going to have an ongoing concern about this issue. And what really is troubling to me is that we don't seem to have a strategic plan on how we deal with this huge problem that we see across the West. Someone tells me that somewhere between 75 and 90 percent of all those great forests in Colorado are going to be infected by the bark beetle within the next 5 to 10 years, and that one way of trying to address a part of the problem is to use that timber as part of our biomass renewable energy efforts in Colorado. And yet, I don't see how it is that we can get that done. And so, I guess my question to you is, Do we recognize the problem?

Ms. COLLINS. Yes.

Senator SALAZAR. We know that the communities out there are very concerned about it. So, you, as one of our leaders of our U.S. Forest Service, what would you say is our strategic plan for addressing the biomass opportunity that we have in these bark-beetle-infested acreages?

Ms. COLLINS. Well, I think we need to look to partnerships like the one that Lynn talked about in Oregon, where the tribes have come together with industry and with BLM and the Forest Service to put together a small—and the communities—to put together a 15-megawatt biomass powerplant. Communities can come together. And I think what we've done in Oregon and other places is show, with a sort of proof of concept, that this is economical, that it pays, over time, to do this. And so, what we've got to do—and the—probably the most important thing the Federal Government can do is assure a levelized supply of product to an investor. And one of the things that we've been finding is that we haven't necessarily been coordinating as well as we can across agency boundaries and ownership boundaries, working with private landowners within a geographic area, say 100-mile radius of a potential facility. If we can provide a levelized supply over 10 years, an investor is going to want to come in and spend some money on a biomass plant. But

they're not going to want to, unless they can be assured of a supply.

We've got about five or six projects around the country that are looking at levelized supply so that we can make sure, in drawing these sort of—like we used to do in the timber program, with quality circles for looking at infrastructure in mills—we're doing the same with biomass as a way to draw investment into an area. So, I—probably, that's the most important thing we can do.

Senator SALAZAR. You know, it would be useful to me, and perhaps other members of the committee that are interested in this biomass opportunity, to have examples of where those partnerships have, in fact, been put together, as communities contact us about what they can do, we can say, "Well, in Oregon, they were able to put together this kind of program." So, I——

Ms. COLLINS. That would be good.

Senator SALAZAR. In fact, I would ask you, Ms. Collins, if you could provide that information to us so that we can share it with some of our communities.

Senator Allard and I, by the way, have most of those communities from Colorado coming in to see us, I think, in 2 days, and it's going to be important for us to be able to show them what's happening in other parts of the country.

Just one final question. Last year, when this committee, when this Congress, passed the Energy Policy Act, we created a program for grants to improve the commercial value of forest biomass. And I know that one of the big problems the local communities face is finding money to be able to move forward with these biomass projects. The President zeroed out any money at all, even though there was a $60 million authorization for that. There are a number of us on this committee, including Senator Bingaman, Senator Craig, and Senator Gordon and others, who have written to our appropriators saying we would like to put some more money into this program to address the issue. And I hope—and we're hopeful that there will be some money set aside for that grant program.

But let me tell you that, from my perspective, we need to have those kinds of resources if we're going to make some honest, realistic headway with respect to this biomass opportunity.

Ms. COLLINS. Appreciate that comment. Thank you.

Senator SALAZAR. Thank you, Mr. Chairman.

Senator CRAIG. Senator Salazar, thank you very much.

Now let me turn to my colleague from Oregon, Gordon Smith.

Senator SMITH. Thank you, Mr. Chairman. Thank you for this hearing.

I understand, Mr. Wells, that the Bureau of Land Management has yet to promulgate rules for new geothermal leasing processes established under the act. It's a year gone by now, and I wonder if you have any updates you want to give us on that.

Mr. WELLS. We understand——

Ms. SCARLETT. We issued them today.

Senator SMITH. You did?

Ms. SCARLETT. Yes.

Senator CRAIG. See what the onslaught of a hearing brings?

[Laughter.]

Senator SMITH. That's great.

Senator CRAIG. I won't let Lynn off quite that easily.

Ms. SCARLETT. Or, I should clarify, we sent them to the *Federal Register* today.

Senator CRAIG. All right.

Mr. WELLS. It also agreed with our recommendation in our report, so it's been a good day for both of us today.

Senator SMITH. Oh, that's great. It moots my question. But I—obviously, I hope it is going to move forward now, because there are geothermal resources in the State of Oregon, and I think there is potential development there that will be of great advantage to the country and to my State.

Lynn Scarlett, I understand that the U.S. Geologic Service is updating the assessment of geothermal resources. Is this going to include resources that are on lands with protected designations?

Ms. SCARLETT. Senator, I will have to look into what the scope of the lands are. They're doing it in phases, and I know it's a 3-year process. But whether they're excluding certain lands or not, I'd have to get that detail for you.

Senator SMITH. Yes, I'd like to know that, and what are the percentage of resources on such restricted lands? I'd like to know, and I think it's important.

Sally Collins, I'm interested in making more biomass available. And I know, obviously, the Forest Service has treatments for burning and for mechanical thinning. What is the Forest Service's mix between mechanical and controlled burn? And what does that impact have, potentially, on creating biomass?

Ms. COLLINS. Well, whenever we can capture value off any acre of land, as opposed to using burning, prescribed burning, we will capture that value. And that's why I say 50 percent of the acres that we've treated mechanically, so far this year—and there have been about a half a million acres—we've captured value off of those lands. So, you know, I would say that when we can, that's exactly what we do, because it offsets the costs of having to—and wanting to—do fuels treatment.

Senator SMITH. And obviously there's a value, environmentally, to burn as well, in a controlled fashion, anyway.

Ms. COLLINS. Right.

Senator SMITH. But I'm just curious as to what the percentage is. And is there a policy that emphasizes producing biomass?

Ms. COLLINS. I'll have to get you the precise percentage. I can actually get you that fairly quickly, but in terms of a policy, I would say, in general, what we do try to do—if there is value on that land, it's always better to thin it—almost always better to thin it and prescribe-burn later, because so many of these stands are so dense.

Senator SMITH. But they're not exclusive activities.

Ms. COLLINS. Yeah.

Ms. SCARLETT. Senator, if I might just add for the Department of the Interior, we have a definite policy of trying to increase the amount of mechanical treatment relative to prescribed burn, part of that is reflected in the significant increases towards wildland/urban interface treatments, the majority of which are mechanical. And then, within that policy, we project, for 2008, a requirement

of 50 percent of all mechanical treatment projects having biomass components. So, it's a very deliberate effort.

Senator SMITH. And you've got a lot of takers in the marketplace wanting to receive the material, I'm sure.

Ms. SCARLETT. We have some of the get-the-material-to-marketplace challenges that have been discussed here, but increasingly we have a—we have a biomass—a woody biomass utilization group that is working on both products and energy utilization to try and stimulate that demand.

Senator SMITH. Very good.

I want to commend the Forest Service for establishing a wind energy guidance team. I think that that's important. But I understand, from one of our witnesses, Chris Taylor, that no representatives from stakeholders—not the wind industry, the power sector, consumers, and environmentalists—are not being consulted. Is that the case? And if that's the case, is there some problem with including their input in——

Ms. COLLINS. Because we're in this informal process of building this policy that we intend to have in the *Federal Register* by the fall, we are talking to a whole lot of people, not through a formal structured process, but through a much more informal process. That team has been to a number of wind energy facilities and looked at them to try to understand what an industry goes through to put a facility together. So, I would say they're doing their best to try to get that perspective in the process. And there'll be opportunities for people to get involved later on, as well.

Senator SMITH. So, if my constituent, Chris Taylor, from Oregon, who's here—and I'm grateful for his presence—if he's not been consulted, he can be, and will be, I guess.

Ms. COLLINS. I'm sure that he could give a call to the team, and they'd be happy to talk to him.

Senator SMITH. Well, as long as there's not some——

Ms. COLLINS. Or they could call him.

Senator SMITH [continuing]. Inherent conflict of interest—I mean, it does seem to me that, to develop these guidelines best, including not just industry folks, but all of the stakeholders, including the environmentalists, is of value.

Ms. COLLINS. Let me just add one thing about that, because the BLM did go through a pretty extensive process of developing an EIS, a programmatic EIS, and, in that process, developed best management practices, which we are really incorporating in our guidelines. So, a lot of that input that they received is being reflected in these guidelines we're developing.

Senator SMITH. Very good.

Thank you, Mr. Chairman.

Senator CRAIG. Gordon, thank you very much.

Now let me turn to Senator Lisa Murkowski.

Lisa.

STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

Senator MURKOWSKI. Thank you, Mr. Chairman. I appreciate you holding this hearing this afternoon. I think it is important that we be really looking to those areas, particularly on our public lands,

where we can make a difference when it comes to renewable energy sources.

This hearing is particularly important to my State of Alaska. We have—we are so typically viewed as the production State for oil and gas and coal and the like, but the reality is, is our renewable potential is enormous, with the wind and with the ocean energy, and certainly with the geothermal.

We've got a gentleman who will be with us on the second panel, Mr. Bernie Karl, from an area outside of Fairbanks, Alaska, who owns the Chena Hot Springs Resort. He's going to be speaking to the promise of the lower-temperature geothermal, which we look at as, quite honestly, very, very exciting, and are pleased that we're pioneering this in the State. They're installing a geothermal powerplant that will convert the geothermal water as low as 165 degrees Fahrenheit into electricity. And what this means to us in Alaska is absolutely enormous. They are hopeful that they're going to see power generated at about 5 to 7 cents per kilowatt hour, and, in many of our villages out there, we're looking at 40 to 50 cents per kilowatt hour in villages that right now are being run off diesel. So, if we can make this happen, again, the potential is enormous. And when I asked, they said, "Well, in Alaska, where we are a land that is sitting on top of volcano after volcano after volcano." What's our potential here? And we've got areas where I understand we've got high-heated water flows under about 70 to 80 percent of the State, sometimes at depths of less than 1,000 meters. So, the potential there, whether it's up at Chena Hot Springs in the interior, or out near Katmai National Park. The Chugach Electric Association is looking at the potential for the south-central area. We've got a volcano, an active volcano, Mount Spur, 15 miles from our major transmission areas. We've got Makushin Volcano near Unalaska. So, our opportunity out there is enormous.

And I was more than just a little bit concerned to read that the administration was proposing to zero out the funding for the DOE's Office of Geothermal Energy, but I'm pleased, as I think all of you are, that we're seeing a restoration of that money.

So, for us, the geothermal is just so promising. So, I'm pleased that we're able to focus a little bit more attention on it this afternoon.

Secretary Scarlett, I wanted to ask you a question not related to geothermal. You didn't mention anything in your written statement—and I apologize, I wasn't here for your oral testimony—but in your written statement, you didn't refer to any opportunities for hydropower. And small hydro, as you know, in the State of Alaska, offers enormous opportunities for us. And for us it's going to require Interior to lease certain sites and to actually utilize some of that power that's produced. And I know that you're familiar with the area just near Glacier Bay National Park, where we've got power for the park that's currently being generated by diesel. So, you've got a beautiful park, and we're keeping it running off of diesel, but we've got an opportunity, with the Falls Creek small hydro project, to power that area through the use of the small hydro, but we're going to need—we're going to need the park to utilize that. Can you speak a little bit as to what the National Park Service can do, what the Department can do, to move towards utilization of

more small hydro? I notice, in your written testimony, you speak to those specific projects on DOE lands—DOI lands—where you are utilizing renewables, and it's good to look to those examples, but can you speak a little bit about the small hydro, as well?

Ms. SCARLETT. Yes, thank you, Senator.

Let me speak generally, and then specifically to the small hydro. In general, the Department of the Interior, with all of our land management agencies, has a policy to drive towards the increased utilization of renewables, whether they be solar, wind, geothermal, passive solar, biomass, and so forth. And we have more and more facilities; and, indeed, for photovoltaic utilization, I believe we're second only to Department of Defense in our usage.

With respect to the small hydro, I do not have available for me any specifics on whether we have any such projects. What I will do is look to see if we have utilized small hydro on our lands, and, in particular, look at whether there are any issues or challenges as it relates to doing so in Alaska. I simply have not looked at that specific energy opportunity.

Senator MURKOWSKI. I would appreciate it if you would.

I notice, in your testimony, the reference to the "sense of the Congress" regarding the renewable generation, and you speak to the goal of nonhydro renewable energy generation capacity. And I know we want to certainly expand the focus in other areas, but is there a purposeful exclusion of the hydro?

Ms. SCARLETT. No, that statement is not intended to be a purposeful exclusion, it simply was our understanding of the focus of the particular hearing, rather than anything particularly intended by that.

Senator MURKOWSKI. Well, if you can look into the specifics for me, particularly as it relates to Glacier Bay National Bay, I'd appreciate it.

Ms. SCARLETT. We'll do that.

Senator MURKOWSKI. Thank you.

Thank you, Mr. Chairman.

Senator CRAIG. I'm ready to conclude this panel. Are there any further questions by the members?

[No response.]

Senator CRAIG. If not, let me thank you all for being here. Jim, and the GAO, let me thank you for your work. I'm pleased that you can come in under the general sense of a job well done and work in progress. That's usually not what we get from the GAO, and we appreciate it, in this instance. It tends to make us believe that EPAct got most of it right, but there's more to be done.

Mr. WELLS. Absolutely. Thank you, Mr. Chairman, for the compliment.

Senator CRAIG. Thank you all very much—Lynn, Sally.

[Pause.]

Senator CRAIG. Well, let me thank all of the panelists for being here. We have a large panel, so we'll ask you, as we will attempt, to move speedily through so we can get all of your testimony and get questions back toward you.

Let me first recognize Dr. Walter Snyder, director, Intermountain West Geothermal Consortium, of Boise. We're glad you're here. Appreciate it, Walt. We have Paul Thomsen, public policy ad-

ministrator, ORMAT Technologies, testifying on behalf of the Geothermal Energy Association, from Reno, Nevada; Chris Taylor, director of project development, northwest region, Horizon Wind Energy, testifying on behalf of the American Wind Energy Association, from Gordon's home State of Oregon, from Portland; Bob Liden—Bob is vice president and general manager of Stirling Energy Systems, testifying on behalf of the Solar Energy Industry Association, from Phoenix, Arizona; Bernie Karl, proprietor of the Chena Hot Springs Resort, from Fairbanks, Alaska, Lisa's constituent; and V. John White, executive director, Center for Energy Efficiency and Renewable Technologies, Sacramento, California.

With that, we'll turn to you, Walt, for your testimony. Please proceed.

STATEMENT OF WALTER S. SNYDER, DIRECTOR, INTERMOUNTAIN WEST GEOTHERMAL CONSORTIUM, BOISE, ID

Dr. SNYDER. Thank you, Mr. Chairman and members of the committee.

I am Walter Snyder. I'm a professor at Boise State University, as well as being director of the Intermountain West Geothermal Consortium. This consortium was established by the Energy Policy Act explicitly to focus on various aspects of research on geothermal resources. Presently, it's comprised of members from Utah, Idaho, of course, Nevada, and Oregon, and we have partners of other organizations and universities, as well. So, I'm really honored to be able to talk a little bit today about research and it's important to bringing more geothermal resources online.

From the previous testimony and what you're going to hear from the people that follow me, I really do not have to beat on the issue of the importance of geothermal resources to the Nation's energy portfolio. I think we know that. There have been many, many reports written on it. In fact, a couple of the most important ones have come from the Western Governors Association.

And, Mr. Chairman, if I could, I'd like to, for the sake of completeness, enter into the record copies of those two recent reports from the Western Governors Association dealing with geothermal energy. One was January 2006, from the Geothermal Task Force, that they submitted. And another just came out last month, in June 2006, on Clean Energy, a Strong——

Senator CRAIG. Without objection, they will become a part of the file of the record. I need to say that so that we don't enter their total transcript into the record, but they're a part of it on file. Thank you.

Dr. SNYDER. Great. Thank you.

I think the testimony you heard before, and, again, what you're going to hear after me, really underscores my first point about research. I think that the next generation of geothermal research has to be done in very, very close collaboration with all the stakeholders. And that's because we have both near-term and long-term needs, and, really, to be able to define those and address those as scientists, we need to have very, very close working relationships. And that's certainly what the consortium is dedicated to, and I think all such research for geothermal should follow the same track.

Those stakeholders, by the way, that we have to work with is more than just industries, it's our Federal agencies, but it's also our State agencies, it's also the municipalities out there, and it's also small businesses, as well.

But that does not answer the question, Is research really necessary? And I think the short answer to that, of course, is yes. And the reason it's important is, to be able to fully utilize, economically, the geothermal resources, we have to better understand the full context of these complex systems, the full geological, geophysical, hydrologic, and geochemical context.

Right now, our knowledge is simply insufficient not only to give a proper assessment of the geothermal potential of the West, but certainly it's insufficient to help industries and others do a better targeted effort of bringing these resources online. We need to provide the information that makes all this more viable.

You've heard a lot about the power generation. And, of course, that's extremely important. But we also want to make sure we emphasize direct use. Direct use is very important, and it's a woefully underutilized part of the geothermal energy portfolio. If you think about it, using lower-temperature or moderate-temperature geothermal resources helps reduce power consumption. And that's a savings that can be very, very important. It's also been very important for a lot of small businesses that otherwise wouldn't exist, small businesses from greenhouses to food dehydration or aquaculture or—alligators—that forms, I think, a potentially important part of our local States' economies. And we need to think about that.

Boise, of course, is a prime example of a slightly larger-scale use—direct use of moderate temperature resources, because the city has been heating many homes and buildings for quite a long time. We know a lot about the system. We've got it balanced, so we can utilize it in a sustainable way. But we don't yet completely understand the system so that we can export that knowledge to other places, other municipalities that could use it. Two big places that come into mind would be, of course, Reno and Salt Lake City. Other large metropolitan areas are pretty much unassessed with respect to the potential of direct use near them. And there are certainly smaller municipalities, like Klamath Falls and whatnot, that could really tap in if we have a better understanding of the geological situations behind it.

So, we can't forget direct use either. We have to be able to fully characterize those systems, as well as those that generate higher-temperature power-generating resources.

Another compelling reason, I think, why we have to pursue research through academic institutions, of course, I would argue, is that the geothermal development companies do not have the staffing and the resources to do the research themselves. They're not oil companies. All right? But the resources they're targeting are equally complex as an oil reservoir, and they have some, of course, particular quirks about them that even make them more difficult. And so, somebody has to provide that research. And this consortium and others out there are trying to put ourselves in a position to provide that help.

Before I conclude, I want to add one more thing about not necessarily why research is important, but how we should do research. And I think one of the—it's very, very important that our research results get to the stakeholders as quickly as possible, and an understandable way as possible. That's not always the case with academic research. We are very aware of that, and we want to turn that around. This is a complex issue. Some of it's being debated on the Hill today—or, not today, but recently. But we've got to get—we've got to maximize the return on the investment of the Federal research dollar. So, not only are publications necessary, but we've got to get all our information into a digital information system so people can get at it, the stakeholders can get at it, in an understandable way, so the nonspecialists can understand it. That's very important.

Second, we've got to make sure that the physical samples that we get from cores and physical rock samples are equally available. The Energy Science Institute at University of Utah presently has such a repository. We plan to fully utilize that and make sure that all those samples are available to everybody who wants to see them and utilize them as they move forward. And the last component of that is that we, as researchers, cannot isolate ourselves from the stakeholders, and we need to interface with them on a regular and a continuous basis. And, again, not just including the agencies, State and Federal, the municipalities, the larger development companies, but the small business. We have to be aware of that, and move forward on that. And that makes a package for research, I think, that's fairly—well, in my mind, fairly compelling, and it's certainly the way we have to go.

So, I think the parting shot is that to understand these complex resources, we really need an ongoing sustained research program to help bring these resources online.

And I'll leave it there, and I want to thank you for the opportunity. I'd be happy to answer any questions later.

[The prepared statement of Dr. Snyder follows:]

PREPARED STATEMENT OF WALTER S. SNYDER, DIRECTOR, INTERMOUNTAIN WEST GEOTHERMAL CONSORTIUM, BOISE, ID

Mr. Chairman and distinguished members of the Energy and Natural Resources Committee, I am Professor Walter S. Snyder from Boise State University and Director of the Intermountain West Geothermal Consortium (IWGC). The IWGC is comprised of members from academic institutions in Idaho, Nevada, Utah and Oregon and from DOE's Idaho National Laboratory; our members conduct geothermal research throughout the West. I am honored to have this opportunity to testify today about the importance of geothermal energy production and use on Federal lands in the Western States on behalf of all members of the IWGC.

As has been articulated by the President and Congress, the United States faces a pressing need for the diversification of the national energy portfolio to promote national energy security, lower energy costs, increase reliability, and decrease foreign dependence. Geothermal resources are a key component of this portfolio both for the generation of electricity and the direct use of geothermal heat. This diversification requires the full utilization of high and low temperature geothermal resources, including increased geothermal power generation, expansion of existing geothermal sites, and the development of resources in urban environments close to end users. This is particularly opportune for the West where geothermal resources are sufficient to allow for their economic utilization by our rapidly growing urban centers.

To be able to fully and economically utilize geothermal resources, we must better understand the geological, geophysical, geochemical, and hydrologic nature of these complex systems. Our existing geologic knowledge is insufficient for an accurate as-

sessment of the West's geothermal resource potential. To find new resources, increase the productivity of known resources, and bring these resources online and sustain them, we must improve our ability to fully delineate and characterize both deep and shallow geothermal resources through improved scientific methodology and understanding. That is, we must continue to conduct the basic research that is required to develop this crucial natural and renewable resource.

Through a strategic research program, the Intermountain West Geothermal Consortium (IWGC), authorized by EPACT 2005, is poised to aid federal agencies, industry, state governments, and municipalities to address a wide variety of issues related to geothermal resources. The Consortium is unique in the geothermal community by being the only true multi-institution geothermal research entity. We have moved quickly since EPACT became law and this reflects the collaborative spirit that is our underpinning. The Consortium will bring to the geothermal research community and industry the first coherent, integrated research program and plan for geothermal energy development. My comments, from the perspective of the IWGC, reflect needs and concerns of all geothermal researchers, and research centers from other universities and national laboratories, such as the Geothermal Energy Program at New Mexico State University, Sandia National Laboratories, the Great Basin Center for Geothermal Energy, the National Renewal Energy Laboratory, and others.

THE CONSORTIUM'S GOAL

Our central position is that expanded use of geothermal within the Nation's energy portfolio requires a better understanding of the complex geologic context of these resources. This complexity is due to their natural heterogeneity, the complexly interrelated processes that have produced these geothermal systems, the impact of production on the natural conditions of the reservoirs, and the need to integrate studies at scales ranging from regional down to the specific details of an individual well. This understanding requires improved geology, geophysics, hydrodynamic modeling, and geochemistry. This knowledge can be used by industry to explore for and find new prospective geothermal regions, maximize the production at sustainable levels from existing sites, and develop procedures to assess the extent and sustainability of direct use geothermal resources. A sustained research program, one that is collaborative in nature and strategic in design, will greatly help expand the geothermal component in the Nation's and West's energy portfolio.

GEOTHERMAL IN THE WEST'S ENERGY PORTFOLIO

Perhaps one of the most powerful statements on the importance of geothermal resources is provided by the Western Governors' Association Geothermal Task Force report of January, 2006 and the recent ancillary report by the WGA's Clean and Diversified Energy Advisory Committee (June, 2006). Several of the highlights of these reports that are relevant to my testimony are:

- The Western States share a capacity of almost 13,000 megawatts of geothermal energy that can be developed on specific sites within a reasonable time frame. This is a commercially achievable capacity for new generation and does not include the much larger potential of unknown, undiscovered resources.
- Geothermal power can be a major contributor to the power infrastructure and economic well-being of the Western States. New geothermal power capacity could add nearly 10,000 jobs, and also generate about 36,000 person-years of construction and manufacturing business.
- Geothermal power is a reliable, continuously available (24 hours per day—7 days per week) baseload energy source that typically operates 90 to 98 percent of the time.
- Insulated from conventional fossil fuel market volatility, geothermal power supports energy price stability and boosts energy security because it is a domestic resource.
- Geothermal power can help fulfill Renewable Portfolio Standards (RPS) that strive to diversify the states' and nation's energy supply.
- Geothermal energy is a clean electricity source, discharging far less emissions, including greenhouse gases, than equivalent fossil-fueled generation.

These are powerful, compelling conclusions and have been supported and expanded by others, including the Geothermal Energy Association, the Geothermal Research Council, and the Sustainable Energy Network. The 13,000 megawatts of capacity noted above is the equivalent of about 15 nuclear power plants or 30 coal-fired plants. The Geothermal Energy Association suggests that the potential may actually be two or more times greater, and we agree with that assessment. The 13,000

megawatt estimate is based on current knowledge of the geology, geophysics, hydrology, geochemistry, and reservoir and production engineering. With a more rigorous and complete assessment of the details of this geology, there is no reason that geothermal power output capacity cannot be doubled or even tripled above the 13 gigawatt base estimate. But to reach this output requires continued, indeed expanded, and more targeted research.

Direct use is another important, but often overlooked, part of geothermal energy portfolio. Expanded direct use can significantly reduce our power consumption, but it is a woefully underutilized resource. Direct use includes heating of buildings, greenhouses, aquaculture, and food dehydration. Its utilization has allowed local business enterprises to flourish that would not have otherwise been possible. Direct use for these and other purposes should and could become much more widespread. Boise, Idaho is a prime example within the U.S. of a city that utilizes direct geothermal heat to reduce power consumption. For over 100 years, this moderate temperature geothermal system has provided heat to homes and businesses and since 1983 has been utilized by the City of Boise to heat over 50 downtown buildings. It is estimated that the use of the Boise geothermal system saves the equivalent of about 40,000 megawatt hours per year. What we can learn from a much needed detailed study of the Boise system (that does not currently exist) could be transferred to other metropolitan areas where there are similar systems; for example Reno, Nevada and Salt Lake City, Utah. The potential in these and other Western metropolitan areas is effectively unassessed at this time.

THE ROLE OF RESEARCH

The West is rich in geothermal resources, this is common knowledge. This is amply documented by the regional maps depicting high heat flow, the reports of the Western Governors' Association, Geothermal Energy Association, Geothermal Research Council, and other organizations. However, the challenge to changing prospects into reality lies in the details—the geologic, geophysical, geochemical and modeling research that must be conducted to fully understand and produce these complex geothermal systems. Compounding this challenge is the fact that many geothermal systems do not have obvious surface expressions, such as hot springs; they are hidden and require a new approach to find them. This information can be made available to federal agencies as they manage geothermal resources on our federal lands, to state agencies as they pursue their mandates, to counties and municipalities as they attempt to assess potential use of geothermal, and to industry as they seek new geothermal resources and ways to better use existing ones. A major hindrance to understanding geothermal systems is that none of the geothermal development companies have in-house research capabilities and thus they, and the nation must rely on university and national laboratories to conduct the needed research. For power generation, whereas operating costs are comparatively low once a producing field is established, perhaps the major impediment to expanding geothermal's contribution to the energy portfolio is the relatively high up-front cost of bringing power on-line. One of the best remedies to this impediment is improving resource information through efficient exploration and maintaining successful wellbore logs. The geothermal industry agrees with this, and it is the academic and national laboratory research community that must address ways to increase the rate of successful drilling by providing industry with necessary basic geoscience facts and models.

For direct use, the main issues are the extent and size of the resource and the sustainable rate at which it can be used. States, counties, municipalities, and small direct-use companies simply do not have the resources to conduct the level of studies necessary to fully delineate and characterize potential direct use resources. Again, the academic and national laboratory research groups need to step in.

As with most resource industries, ours finds that there is a shortage of trained professionals available to meet personnel needs in both government and industry. This shortage will only become worse without concerted efforts to educate the next generation of science and engineering professionals. Only those universities involved in research will be able to adequately train the students who must become the next generation of state, federal and private industry professionals working on geothermal and related activities.

THE INTERMOUNTAIN WEST GEOTHERMAL CONSORTIUM

The Intermountain West Geothermal Consortium (IWGC) is comprised of six institutions from four states and will be conducting targeted studies of low-, moderate-, and high-temperature geothermal systems in Idaho, Oregon, Utah, Nevada, California, and elsewhere. As recently stressed in letters to Congress by the Geothermal

Energy Association, the knowledge gained by IWGC-type activities is necessary for the continued expansion of geothermal development throughout the West, and indeed, nationally.

The Energy Policy Act of 2005 authorized the creation of the Intermountain West Geothermal Consortium. The IWGC is initially comprised of the Idaho National Laboratory, the Idaho Water Resources Research Institute at the University of Idaho, the Geo-Heat Center at Oregon Institute of Technology, the Desert Research Institute (Nevada), the Energy and Geoscience Institute at the University of Utah, and Boise State University.

We have moved quickly to implement the IWGC once EPACT became law. The IWGC works closely with industry and state and federal agencies to assist in bringing geothermal resources online for direct use and power generation. The consortium proposes to conduct targeted studies of low-temperature systems of importance to municipalities and small companies. It will conduct critical studies of high- and moderate-temperature resources to better aid industry in bringing these resources online for power generation. By working with the Geothermal Research Council, the Geothermal Energy Association, state geothermal working groups, state geological surveys, the USGS, Forest Service, Bureau of Land Management, and by partnering with other geothermal groups and institutions, we will be able to broaden the scope and impact of our work. Although IWGC focuses regionally, the knowledge and technology developed will be used to enhance utilization of geothermal energy as a resource throughout the West and the United States.

IWGC is and will address numerous research questions including the following: To better assist exploration and development efforts, can we better couple geophysical signals with reservoir simulation, including forward and backlooking (inverse) modeling? "What geophysical techniques can be used to identify and characterize hidden geothermal systems such as the Raft River geothermal system in Idaho? What geoscience information on geothermal systems is required to allow geothermal systems to be engineered to enhance and maintain permeability and long-term reservoir productivity? How can we assess and reduce the predictive uncertainty in geothermal reservoir performance? How can energy conversion be improved and operation and maintenance costs reduced? Are there new non-power generation uses of geothermal fluids? And, can we develop better methodologies to monitor the reservoir for exploration, production and long term maintenance using new methodologies and a more complete understanding of the system? The list of questions go on but this serves as an example of the geothermal resource research needs.

RESEARCH AND KNOWLEDGE TRANSFER

There is an growing awareness of the need to maximize the return on the federal research dollar investment by making research results more readily available. Traditionally, part of that return is reinvested in the science research process itself—typically through publications. However, for a subject such as geothermal, publications alone are an insufficient outcome. What is needed is better method of knowledge transfer to geothermal stakeholders—the relevant federal and state agencies, state, county, and municipality governments, and industry. There are several ways to accomplish this that taken together constitute a new paradigm for research: 1) publication of results, 2) open access to all relevant data through a digital information system, 3) open access to physical geologic samples and logs, and 4) directly working and communicating with stakeholders.

It is important to note that items 1 and 2 are significantly different. What hinders public policy decision making, agency management decisions and activities, knowledgeable use by state and local governmental bodies and industry, and the science itself is not access to published papers, but the lack of complete access to relevant data and metadata. Item 3 highlights the fact that far too often in the geological sciences physical samples, that still have great value are not properly stored or made available to all interested parties—samples that were paid for by federal research dollars. IWGC will make those data available. Finally, item 4 requires that research organizations persistently engage in stakeholder communication.

The IWGC is adopting this new paradigm for research operations. Publications will continue to be written, for that is the golden frank of the researcher. But we are also developing a digital information system that will host all data generated by IWGC researchers and make these data openly available in understandable format after a reasonable moratorium period. The Energy and Geoscience Institute at the University of Utah, currently houses the largest collection of geothermal cores and samples, and the IWGC is committed to continue to support that effort. The IWGC will work with stakeholders not only through our website, but by hosting and

participating in conferences, seminars, and workshops and engaging in other outreach efforts. We will work directly with stakeholders on specific issues of importance to them. We will also partner with organizations already engaged in community outreach, including the Geothermal Energy Association, Geothermal Research Council, GeothermalBiz, the Geothermal Education Office, the Sustainable Energy Network, the Environmental and Energy Studies Institute, GeoPowering the West, and others. Separately, these four approaches are not revolutionary, but taken together they represent a new approach to research and knowledge transfer to better serve the geothermal stakeholders.

FUNDING

The Senate Appropriations Committee has approved $22.5 million in FY07 to the Department of Energy budget for geothermal research and development. The House approved $5 million. The members of the Intermountain West Geothermal Consortium want to express their support for the Senate's mark. Although EPACT authorizes geothermal research and the IWGC, without funding it will be impossible to implement the Act's provisions. More fundamentally, without ongoing and sustained research and therefore research funding, the continued expansion of geothermal energy within our nation's energy portfolio will be severely curtailed.

All members of the IWGC want to thank the Senate Energy and Natural Resources Committee for holding this hearing addressing geothermal and renewable energy resources in the Western U.S. The decisions made by this Committee can have a very real impact on the nation's energy supply and we appreciate and ask for your continued support.

Thank you.

Senator CRAIG. Well, Doctor, thank you very much. It was stated to the earlier panel, and for the committee, that it had been zeroed out in the executive budget. We've put back dollars to sustain a research program of about $22 million, for all of the reasons you've just articulated, because we think that it's a resource that's technology is changing, and our knowledge is limited of it. So, we'll move forward with that and hope the consortium will be a valuable partner in that.

Now let me turn to Paul Thomsen, public policy administrator, ORMAT Technologies, Reno.

Paul.

STATEMENT OF PAUL A. THOMSEN, PUBLIC POLICY ADMINISTRATOR, ORMAT TECHNOLOGIES, ON BEHALF OF THE GEOTHERMAL ENERGY ASSOCIATION, RENO, NV

Mr. THOMSEN. Mr. Chairman, members of the committee, it's my honor to testify today, not only on behalf of my company, ORMAT Technologies, but also on behalf of the Geothermal Energy Association, whose testimony has been reviewed and approved by the entire board and will be submitted, along with my testimony, for the record.

By way of introduction, ORMAT Technologies is a New York Stock Exchange registered company. ORMAT Technologies develops, owns, and operates, geothermal and recovered-energy facilities throughout the world. ORMAT has supplied 800 megawatts of geothermal powerplants in 21 countries throughout the world. Here in the United States, ORMAT owns and operates 250 megawatts of geothermal powerplants in the States of California, Hawaii, Nevada, and we are pleased to be providing US Geothermal Company with the technology needed to bring online Idaho's first geothermal powerplant.

To date, ORMAT has arranged over $1 billion in geothermal projects and corporate financing, which is particularly significant

since geothermal projects require the upfront financing of a continuous lifetime supply of fuel. So, when GAO says, "We think we can," ORMAT would disagree and say, "We are."

On to the impacts of the EPAct. From the industry perspective, we agree with the GAO report and feel that it is too early to accurately assess the impact of the EPAct. Why is that? Because only one operating 20-megawatt facility, which happens to be ORMAT's, has qualified to date for the production tax credit. The new regulations, as we heard earlier, to implement the Rishel amendment to the Steam Act, have yet to be drafted, or have just been turned in to the *Federal Registry*. And, finally, the DOE geothermal research program funding for fiscal year 2007, as you well know, has been zeroed out by the administration, causing some uncertainty and delay.

With that being said, the industry truly believes that despite the fact that geothermal power provides approximately 50 percent of the kilowatts of renewable energy produced in the United States, the impact of the production tax credit and the EPAct will enhance the ability of geothermal projects to compete with fossil fuel technologies. The production tax credit can effectively lower the price of geothermal energy by 1.9 cents a kilowatt hour, making more resources of geothermal energy cost competitive, enabling the full development of the 5600-megawatt capacity that is considered available in the Western United States over the next decade.

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, enabling expanded geothermal production.

And the significant increase in funding authorized by the EPAct for the Department of Energy's renewable energy research programs, including geothermal energy, will facilitate collaboration between researchers and industry to harness the underutilized geothermal resources of the West.

So, how do we make this committee's and the geothermal industry's will a reality? ORMAT believes that the production tax credit should be extended more effectively to geothermal facilities. This may be accomplished by qualifying geothermal facilities' further production tax credit before the operational placed-in-service date, as earlier discussed. We feel that if the facility has a power purchase agreement, and if the facility has begun construction, this could be—this could allow for this. This is not without precedent. For some other tax provisions with similar time-certain requirements, the law allows investments to quality, based upon having binding contracts in place.

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

Finally, ORMAT believes that the full geothermal potential of the Western United States can be brought online in the near term with the assistance of the Department of Energy. In the next decade, ORMAT feels that the Department of Energy research budget can benefit by focusing its funding in the following areas: We need to improve the accuracy of exploration technology to reduce risk; we need to improve drilling technology to reduce risk and cost; we need to improve identification and characterizations of geothermal resource areas; we need to share in the cost of exploration in drilling in these new areas; and continue the investigations into future technologies, such as enhanced geothermal systems. These three considerations are crucial to the future of geothermal energy.

On behalf of ORMAT and the Geothermal Energy Association, 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 Nation's energy security.

This concludes my prepared comments, and I'm happy to respond to any questions that the committee might have.

Thank you.

[The prepared statement of Mr. Thomsen follows:]

PREPARED STATEMENT OF PAUL A. THOMSEN, PUBLIC POLICY ADMINISTRATOR, ORMAT TECHNOLOGIES, ON BEHALF OF THE GEOTHERMAL ENERGY ASSOCIATION, RENO, NV

Mr. Chairman, members of the committee, it is my honor to testify today on behalf of not only ORMAT Nevada, but also on behalf of the Geothermal Energy Association which has an attached statement that has been reviewed and approved by the Board of Directors and will be submitted into the record.

By way of introduction ORMAT Nevada is a subsidiary of ORMAT Technologies, which is a New York Stock Exchange registered company (symbol "ORA"). ORMAT is a technology based company which develops, owns, and operates geothermal and recovered energy facilities as well as manufacturers and supplies geothermal and renewable energy power plants to third parties. ORMAT has supplied 800 MWs of geothermal power plants in 21 countries throughout the world. We own and operate geothermal power plants producing over 250 MW in the United States and more specifically in California, Hawaii, and Nevada, and is pleased to provide US Geothermal Company with technology to bring Idaho's first geothermal power plant online. To date ORMAT has arranged over $1.5 billion in geothermal projects and corporate financing.

THE IMPACT OF THE EPACT

From the industry prospective we feel it is too early to assess the impact of the EPACT on the geothermal Industry because: (i) only one operating 20 MW project, which happens to be the ORMAT Richard Burdette Project 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 has been zeroed out by the administrations current 2007 budget.

THE POTENTIAL IMPACT OF THE EPACT

That being said the Industry truly believes that despite the fact that geothermal power currently provides approximately 50% of the KWhs of renewable energy produced in the United States, the PTC will enhance the ability of geothermal projects to compete with other fossil fuel technologies. The PTC can effectively lower the price of geothermal energy by 1.9c/KWh making geothermal energy cost competitive with fossil fuels, enabling the development of the potential 5,600 MW capacity available in the Western United States over the next decade.

The John Rishell 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 for DOE's renewable research programs, including geothermal energy will facilitate collaboration between researchers and industry to harness the underutilized geothermal resource in the West.

AS CONSIDERATIONS FOR THE FUTURE

ORMAT believes that the Production Tax Credit should be extended more effectively 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 feels 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 best 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 new areas; (v) continue investigations into future technologies such as Enhanced Geothermal Systems (EGS).

On behalf of ORMAT, and the Geothermal Energy Association, 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.

STATEMENT OF THE GEOTHERMAL ENERGY ASSOCIATION

Mr. Chairman, Members of the Committee, the Geothermal Energy Association (GEA) appreciates the Committee's interest in the development and use of geothermal and other renewable energy resources on the public lands. Mr. Paul Thomsen of ORMAT Technologies will be testifying today as a witness for both his company and the Association. The GEA Board of Directors has reviewed this statement to be submitted for the record of the hearings along with his testimony.

The Energy Policy Act of 2005 has had a major, positive impact on geothermal energy. In March of this year, GEA conducted a survey of industry activity. The survey showed a substantial surge in developing geothermal power projects in the U.S. Some 45 projects are under development. These projects could nearly double U.S. geothermal power output to a total capacity of roughly 5,000 MW. The U.S. had 2,828 MW of geothermal power capacity on-line in 2005.

The survey identified new power projects in Alaska, Arizona, California, Hawaii, Idaho, New Mexico, Nevada, Oregon and Utah. These projects, when developed, would provide between 1778 MW and 2055 MW of new electric power for the grid. This would be enough electricity to meet the needs of cities the size of Albuquerque, Las Vegas, Sacramento and Seattle combined.

Results of the survey provide dramatic evidence that new federal and state initiatives to promote geothermal energy are paying off. The most significant catalyst behind this new industry activity has been passage of the Energy Policy Act by Congress (EPAct) in 2005. EPAct made new geothermal plants eligible for the full federal production tax credit, previously available only to wind and closed-loop biomass projects. It also authorized and directed increased funding for research by the Department of Energy (DOE), and gave the Bureau of Land Management (BLM) new legal guidance and secure funding to address its backlog of geothermal leases and permits.

If we can build and sustain the momentum that EPAct has given the industry, geothermal energy can become a major U.S. energy source. The untapped potential of this resource is enormous. Today, geothermal energy provides nearly 3,000 MW of reliable electric power in the U.S. 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 Re-

sources 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 potential of 22,000 MW and an undiscovered, unidentified potential for geothermal production of an additional 72,000 to 127,000 MW from hydrothermal resources alone.

We want to thank Members of this Committee for helping us turn back some of the early challenges to this new momentum. The FY 2007 Budget could have undermined several of EPAct's initiatives, which would have been major setbacks to progress. We were pleased to see Chairman Domenici state his support for directed funding for BLM's geothermal program in his letter to the Budget Committee. These funds are critically needed to ensure that the backlog of leases and permits is addressed. Also, we were very pleased that the Senate Energy and Water Appropriations Subcommittee and the full Senate Appropriations Committee restored FY 2007 funding for DOE's geothermal research program.

BUILDING UPON THE ENERGY POLICY ACT

The Energy Policy Act has helped launch a new era for the geothermal industry. But, as this Committee knows, it's only the beginning. Consistent federal and state policies over a longer period of time will be needed to develop a new industry. The roller-coaster of federal and state energy policies has undermined development of many clean technologies. As the Preface to the report of the Western Governors' Association's (WGA) Clean and Diversified Energy Advisory Committee (CDEAC) states, "A strong, overarching theme . . . is the need for stable, long-term policies at both the federal and state levels. . . ."

The Chairman and Members of the Senate Energy Committee know well that energy is too often an issue of the moment, or the latest crisis. But to address U.S. energy needs the nation needs sustained longer-term energy policies. GEA has supported the work of this Committee to develop such policies, including the landmark Energy Policy Act of 2005. We hope that the Committee will consider new energy legislation this session to build upon this success, and we make the following suggestions and observations to assist your efforts to expand the future contribution from our nation's largely untapped geothermal resources.

TAX INCENTIVES AND STATE RENEWABLE INITIATIVES

Because of the high initial cost and risk of developing new geothermal power projects, geothermal, one of the largest renewable energy resources in the western U.S., has not been developed to its full potential. The CEC recently estimated that the initial capital cost of a typical geothermal facility was roughly $2700 per kilowatt, which is 4-6 times greater than the capital cost of a comparable-output combined cycle natural gas power plant as shown in the following table. (The CEC estimate does not reflect recent increases in steel and drilling costs discussed later in this statement, and does not include "site specific" costs such as permitting and transmission.)

Table 1.—CAPITAL COSTS OF NATURAL GAS AND GEOTHERMAL FACILITIES

[CEC estimates]

Capital costs	Installed costs		In-service cost
Combined cycle natural gas	542	592	616
Geothermal flash	2128	2410	2558
Geothermal binary	3210	3618	3839

Source: Comparative Cost of California Central Station Electricity Generation Options, Magdy Badr and Richard Benjamin, California Energy Commission, 2003.

Because a geothermal facility has very low fuel costs and no fuel market volatility, in the long run, over 30-50 years, the "levelized" cost of a facility might be quite reasonable. But without the Section 45 Production Tax Credit (PTC), the initial risks, long lead times, and high capital cost will compel many investors to choose other alternatives that have shorter lead times, less risk, and lower front-end costs.

The Energy Policy Act amended the Section 45 PTC to include new geothermal facilities on the same basis as new wind facilities. The PTC gives the developer the incentive needed to choose an investment in geothermal energy. However, given the longer construction lead-time for geothermal plants, 2-3 years, the short period the law allows for new plants to be placed in service undercuts its effectiveness. The

short timeframe also means that some of the largest new geothermal facilities may not go forward because they face unacceptable risks trying to meet the rigid deadline.

Ideally, the placed in service deadline for the Section 45 PTC should be extended an additional 3 to 5 years and geothermal facilities should be given greater flexibility in meeting the placed in service requirement. If geothermal facilities that secure binding contracts and are under construction by the placed in service deadline could be certain to qualify for the credit, substantial additional geothermal generation would be developed in the next few years. Otherwise, many developers may balk at taking an all-or-nothing gamble on future extensions of the credit.

We also urge Congress to consider extending to geothermal energy the favorable tax treatment provided for oil and gas exploration in EPAct. The cost and risk of exploration for new geothermal resources is as high or higher than those in the oil and gas industry, and the ability to attract capital to finance geothermal exploration is far more difficult. We understand that the DOE has also completed a study examining the potential for a targeted loan guarantee program to address exploration risk, and would urge the Committee to examine this report when it is released.

Further, we should point out that state initiatives to use more renewable resources, particularly Renewable Portfolio Standards (RPS), are critical complements to these federal incentives. These state efforts ensure that renewable power developers will be able to sell their power after undertaking the considerable expense and risk to build a power plant. Power purchase contracts that meet developer, consumer and utility needs for clean, reliable and affordable power are vital. Today, the combination of state initiatives and federal incentives makes this possible. We also know that this Committee has considered and supported adopting a national RPS, which GEA has also supported. However, we caution the Committee that the states are still learning how to make these standards work effectively, and that the lessons they learn should be examined as the Committee considers any future federal initiative. It has been our position that any federal effort should build upon these state initiatives and be careful not to undermine them, and we appreciate the effort the Energy Committee has taken to address this issue in the past.

BLM LEASING AND PERMITTING

The Energy Policy Act included an extensive re-write of the Geothermal Steam Act of 1970. In its provisions, DOI is directed to place a priority on clearing up its large pending lease backlog. For new leasing, regular lease sales must be held at least every two years in states with geothermal resources, and all leases will be subject to competitive bidding. BLM and Forest Service (FS) are directed to adopt a 5-year leasing plan for National Forests with geothermal potential. The royalty provisions of the law are completely rewritten. For new leases royalties will be determined on a "gross proceeds" basis. Royalties for existing leases are reduced for expanded production in the next four years (following enactment). County governments will receive 25% of the royalty income, and the federal share of the royalties is dedicated to BLM's geothermal program for the next five years to provide the resources needed to address the lease and permit backlog and implement amendments to the law.

GEA supports many of the changes made by the Energy Policy Act to the Geothermal Steam Act. We are, however, concerned about the long lead-time involved in putting the new program in place, and are aware that in the intervening time there have been concerns and fears expressed about how the new leasing system might work. GEA believes that the new leasing law should be put into place as quickly as possible, and once it is operating Congress should plan an oversight hearing to determine whether there are changes needed in the law or the implementing regulations.

Earlier this year, U.S. Senators Harry Reid and John Ensign were joined by Senators Bingaman, Murkowski, Wyden, Craig, Crapo, Cantwell, Akaka, Feinstein, Murray, Allard, Inouye, and Salazar in a letter to the Interior Secretary nominee Dick Kempthorne, Acting Interior Secretary Lynn Scarlett, and Bureau of Land Management Director Kathleen Clark urging them to move forward expeditiously on geothermal energy leasing and permitting.

On June 16th BLM Director Kathleen Clarke replied saying, in part:

> We understand and share your concern about the need to provide access to Federal lands for the development of geothermal power. Currently there are 354 geothermal leases on BLM and U.S. Forest Service (FS) lands. Of these, approximately 50 are producing geothermal resources, which contribute over 45 percent of the Nation's geothermal power. Over the past five years, the BLM has issued over 200 geothermal leases, compared to less

than 10 issued in the previous five years. Increased demand for alternative energy has resulted in a significant increase in the number of new applications filed, leaving the BLM with 130 pending applications and the FS with 64 pending applications. As mandated by the Section 225 of the Energy Policy Act of 2005 (EPAct), the BLM and the FS have finalized a Memorandum of Understanding to work together to eliminate the inventory of pending lease applications over the next five years.

Many of these lease applications cannot be issued because the applicable BLM or FS land use plan did not analyze the potential impacts of geothermal energy production. To resolve this problem, the BLM has prioritized areas that have the greatest geothermal potential and number of pending applications and directed resources to revise the land use plans to allow the issuance of geothermal leases. In addition, the BLM and FS will prepare a programmatic environmental impact statement to amend or revise those land use plans that have the greatest potential for geothermal energy production.

The BLM and Minerals Management Service (MMS) are also drafting proposed regulations to address significant changes to the Federal geothermal program as mandated by the EPAct. The EPAct does not authorize the BLM to issue new competitive leases in the absence of regulations. The BLM and MMS have established an aggressive timetable that meets the legal requirements for rulemaking, with plans to publish proposed regulations by early July and final regulations by December 2006. Although the EPAct did not place a deadline on the agencies, expeditious completion of these regulations is a priority.

The BLM Director's response to the fourteen Senators indicates several causes of delay in developing geothermal resources on federal lands. First, it appears that EPAct should have given the agencies deadlines, since that would ensure faster implementation. Second, there is more demand for geothermal leases than the agencies can process with existing resources, which creates a backlog. And, third, a fundamental cause for delays is the need to meet land use planning and National Environmental Policy Act (NEPA) requirements and the associated need for the agencies to have the resources to do so.

Land use plan amendments and associated NEPA documents are posing serious and continuing obstacle and delays, particularly in California where these federal requirements are routinely interpreted broadly and add to already cumbersome state processes. But, the problem is not just the planning and analysis, it is the double-bind that is created when agencies do not have the millions of dollars needed to conduct these studies and, as a result, no action gets taken.

Although California has extensive untapped geothermal resources, California's BLM offices have not issued a geothermal lease in some 20 years. People applying for geothermal leases in California have been more likely to die while waiting in line than receive a lease. The impact this has had on whether companies want to even consider applying for a federal lease, or making nominations under the new law, is, is simply incalculable.

Further, the economic impact of delays can simply wipe away any incentives that Congress or the states might provide. In a recent report, GEA examined what the cost of a 20 year delay could mean for a project. If a rate of return of 17% is applied to a specific exploration cost of 150$/kW during 20 years, the resulting cost of exploration would be 3466$/kW. This cost corresponds to the total capital costs for the most expensive projects currently under development. Figure 1 shows the evolution of exploration cost when long delays take place.*

Reaching NEPA decisions in a timely manner is critical to the future development of geothermal energy. Adding mandatory timelines for the completion of NEPA documents would be one of the most beneficial actions that Congress could take to address the inordinate delays created by agency implementation of NEPA. While it is unfortunate that Congress may have to take this step, there does not appear to be any more reasonable approach than establishing statutory requirements for NEPA compliance.

DOE RESEARCH AND DEVELOPMENT

EPAct included a significant increase in the funding authorized for DOE's renewable research programs, including geothermal energy. It also included specific direction and goals for their geothermal research efforts and created an "Intermountain

*Figure 1 has been retained in committee files.

West Geothermal Consortium" to facilitate collaboration between researchers and industry to harness the underutilized geothermal resource in the West.

There are substantial needs for improvements in geothermal technology, information, and efficiencies for which federal research is vital. The range of near-term needs is broad. Knowledge of the geothermal resource base is limited and largely outdated. The technology available today to identify and characterize the resource is too unreliable to effectively mitigate the high risk of development. Drilling is expensive and faces a range of difficulties in harsh geothermal environments. While power cycles are improving, there is always room for additional efficiencies. Where the resource does support commercial production, "we need to be able to apply the techniques under development to engineer it to achieve power generation.

A recent workshop was conducted by the National Renewable Energy Laboratory (NREL) to examine the simple question: *What is the total "potential" accessible geothermal resource in the U.S.?* That workshop went beyond the identified and undiscovered hydrothermal resources mentioned earlier to examine the potential from direct uses, co-production from oil and gas fields, geopressured resources, distributed generation, engineered geothermal systems, and geothermal heat pumps. The workshop concluded that the energy potential from the full range of geothermal resources was in the millions of megawatts!

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. But, we believe DOE needs some encouragement to re-examine the potential of geothermal energy and its role in meeting U.S. energy needs. We strongly urge this Committee to hold a separate hearing on research priorities for geothermal energy and invite witnesses from DOE, leading laboratories, industry, and university research centers to provide testimony to help structure an effective federal effort.

THE WESTERN GOVERNORS' CLEAN ENERGY INITIATIVE

As Congress considers its next steps after EPAct, we call to the Committee's attention the recent recommendations from the Western Governors' Association (WGA) Clean and Diversified Energy Advisory Committee (CDEAC), and specifically the CDEAC Geothermal Task Force Report and recommendations. The CDEAC effort is unquestionably the most systematic, thorough, and contemporary examination available of the potential for geothermal energy and other clean energy technologies to contribute to the energy needs of the West. The CDEAC effort concluded that clean technologies can meet or exceed the West's need for new energy sources, but that sustained federal and state support is needed to achieve this goal.

The CDEAC Geothermal Task Force made the following specific recommendations, which we recommend to the Committee:

E. Geothermal Priority Recommendations

Market Development—The marketplace needs to support the continued development of geothermal resources.

1. Federal and state tax credits are important to reduce the risk and high capital cost of new projects. The federal production tax credit (and clean renewable bonding authority) should be made permanent, or at least extended ten years.

2. State laws and regulations should promote a continuing series of opportunities for power purchase agreements between developers and utilities. Whether generated through Renewable Portfolio Standards, Integrated Resource Planning, or other mechanisms, power purchase contracts are fundamental drivers of the market.

3. Federal and state laws and regulations should provide incentives for utilities and others to enter into long-term contracts for renewable power. Accounting and regulatory standards should treat renewable power contracts as benefits instead of liabilities, and power purchase contracts should have the backing of the government to ensure their credit worthiness.

Timely Permitting and Environmental Reviews—Geothermal projects should be prioritized to ensure that permitting, leasing, and environmental reviews are completed in a timely and efficient manner.

1. Federal, state, and local agencies should coordinate resources and requirements. Agencies should be designated to take the lead on specific issues to avoid duplication, and once issues are resolved, they should not be revisited without cause.

2. A critical path for new projects should be defined as part of this cooperative effort, and timeframes for key agency decisions along the pathway should be established

Transmission Access and Adequacy—The Western Governors should lead the process to ensure that adequate transmission is available for the identified resources.

1. There should be consistent Western state policies on inter-connection to the grid that facilitate new geothermal (and other renewable) power development.
2. A fee to support the cost of new transmission could be set that would spread the cost across all states, parties and technologies on a capacity basis.
3. Both inter- and intra-state transmission is needed to support the identified resources and should be fast-tracked for permitting and environmental reviews.

Federal Program Support—Continuing support from key federal programs is needed to achieve the 2015 goals. Federal programs should be coordinated with state agencies.

1. As the National Research Council concluded (Renewable Power Pathways, 2002), given the enormous potential of the resource base, geothermal research by the U. S. Department of Energy should be increased, particularly into technologies that can reduce risk, reduce costs, or expand the accessible resource base.
2. Better resource information is needed. The new USGS resource assessment and DOE's cost-shared drilling and exploration technology efforts should be priorities.
3. The U.S. Department of Energy's GeoPowering the West initiative should continue to support state and local governments, Indian Tribes, and others seeking to utilize the West's untapped geothermal resources.

(From the Executive Summary of the Geothermal Task Force Report, available at: http://www.westgov.org/wga/initiatives/cdeac/geothermal.htm)

GEOTHERMAL ENERGY'S FUTURE POTENTIAL

While only a small fraction of the geothermal resource base is utilized today, it already provides significant energy for our nation. The United States, as the world's largest producer of geothermal electricity, generates an average of 16 billion kilowatt hours of energy per year—more than wind and solar combined. With continued federal and state support, much more geothermal generation is possible. The U.S. Geological Survey (USES), in its Circular 790, estimated a hydrothermal resource base of between 95,000 and 150,000 MW, combining both the identified and estimated undiscovered resources. As the recent NREL workshop concluded, the full range of geothermal resources has even greater potential to serve our nation's energy needs.

Within the next ten years, it is estimated that with continued federal and state support geothermal resources could be providing between 8 and 15 Gigawatts of electric power to help meet national energy needs. With advances in technology, even more of the largely untapped domestic resource base could be developed. Geothermal's role among clean energy technologies is important to recognize. It is one of the few technologies that can supply, clean, reliable, low emission fuel that is also a baseload resource providing power 24-hours a day, 365 days a year. This power could also support our national hydrogen initiative and nation ethanol goals, both of which will require significant amounts of energy to produce alternative domestic transportation fuels.

In addition to significant electric power generation, direct uses of geothermal resources by businesses, farms, and communities have substantial potential for energy, economic, and environmental benefits. While geothermal resources have been used in communities and homes for decades—for example Boise, Idaho has been using geothermal resources for space heating for over 100 years—the extensive potential for direct use has been largely ignored and underutilized. Direct use resources span the entire country—from New York to Hawaii—and their increased use would displace fossil fuels.

The benefits of expanding new geothermal production will be substantial. Geothermal power can be a major contributor to the power infrastructure and economic well-being of the United States. Geothermal power is a reliable, 24/7 baseload energy source that typically operates 90 to 98 percent of the time. Insulated from mar-

ket price volatility, geothermal power supports energy price stability and boosts energy security because it is a domestic resource. Geothermal power can help diversify the nation's energy supply and is a clean, renewable energy source.

We appreciate the interest of the Senate Energy Committee in geothermal energy and are prepared to work with the Committee and its staff to achieve the enormous potential of this renewable resource.

Thank you.

Senator CRAIG. Paul, thank you very much.

Now let us turn to Chris Taylor, director of project development, northwest region, Horizon Wind Energy, testifying on behalf of the American Wind Energy Association, in Portland.

Gordon, any additional comment in introduction?

Senator SMITH. No, just—good to have you here, Chris. Thank you for traveling here and for your company's work in eastern Oregon. Got lots of windmills around me now, and I guess you're looking at some in Union County, as well.

Mr. TAYLOR. Thank you very much.

Senator CRAIG. Chris, please proceed.

STATEMENT OF CHRIS TAYLOR, DIRECTOR OF DEVELOPMENT, HORIZON WIND ENERGY, LLC, ON BEHALF OF THE AMERICAN WIND ENERGY ASSOCIATION

Mr. TAYLOR. Thank you very much, and thank you for the introduction, Senator Smith. I'm here to testify on behalf of the American Wind Energy Association.

Very brief background: Horizon Wind Energy is the third largest wind developer in the United States. We're building about 700 megawatts of projects this year all across the country, and we have another 600 megawatts slated for construction next year, including about 100 megawatts in Senator Smith's district, in eastern Oregon, that will be serving Idaho Power under contract, in Senator Craig's——

Senator CRAIG. Did you hear that, Gordon? You've got the wind, but we get the power.

[Laughter.]

Senator SMITH. At least our wind is being put to some use.

Senator CRAIG. All right.

Mr. TAYLOR. And so, we're very happy to have this activity going on, and happy to have this opportunity.

I'd like to start, very briefly, by thanking the committee for your past support of renewable energy. I think you've heard, from a lot of the people today, some of the critical provisions of EPAct 2005; and, particularly, the 2-year extension of the PTC has been vital to the continued growth of all of our industries. And this year and next, it is expected to lead to new record levels of construction of new wind farms. And we thank you very much for that extension and hope that a longer extension will be adopted in the near future so that developers, manufacturers, and others in our industry can make the kind of long-term commitments that are necessary, so far as procurement and construction, to allow us to continue to increase sufficiency and reduce costs of our technology.

I'd like to talk very briefly about the three main Federal land agencies—or Federal resource agencies whose decisions and policies most directly impact our agency. That's the BLM, the Forest Service, and the Fish and Wildlife Service. And I think it—several peo-

ple have mentioned, today, President Bush's stated goal, the 20—reaching 20 percent of our energy supply from renewable sources, and I think it's—it's certainly my opinion, and I believe most people would agree, that the only way we're going to reach that goal is by tapping the significant resources on Federal lands. The part of the country where I live, most of the land is owned by the Federal Government. We just aren't going to get there without tapping those resources.

We've heard a fair bit about the BLM today. I'll try to keep my remarks very brief.

The wind industry is generally very pleased with the outcome of the programmatic EIS that the BLM released. We believe that they're workable, that they're realistic, that they provide adequate environmental protection while still allowing for cost-effective and economically viable development on Federal lands, as evidenced by the fact that there are operating projects on BLM lands. My company has applications pending with BLM. We've had, by and large, very successful experience. Like any large bureaucracy, you occasionally encounter individual staff in the field that don't want to follow the rules, but we've always been able to find supportive management within BLM, and we really, overall, commend the agency for taking the directive from Secretary Norton and President Bush and really implementing it as rapidly as they could. And we believe that they, overall, do an excellent job of facilitating that type of development.

Another Interior agency, the Fish and Wildlife Service—there were some questions from Senators on the panel today about those guidelines. Again, you heard from Lynn Scarlett, and we've also heard from the Director of the Fish and Wildlife Service, that they're committed to revising those guidelines. Our emphasis here is just that that needs to be done quickly. Three years may seem like a rapid timeframe to them, but, to us, that's more than one whole production tax credit cycle, and that's a long time for us, and a lot of missed opportunities. So, we encourage them to get going on that sooner rather than later.

One other comment I'd like to make about both the Fish and Wildlife Service guidelines and the Forest Service guidelines that are under review, which is that this industry has matured and evolved tremendously in the past several years. Now that the leading developers of wind power projects—most of the megawatts that are going in the ground are being built by publicly-traded, big companies. My company is owned by Goldman Sachs. You've got Florida Power & Light, energy companies like GE. This is a serious business. And all of these companies take these wildlife issues seriously. You don't put a $200 million investment in the ground without a lot of environmental due diligence. And I think that perhaps some of the agency folks need to appreciate just how seriously we take these issues. Irrespective of the regulations that are in place, we develop projects everywhere from California to Texas, where the regulatory schemes couldn't be more different, but we still—there's a baseline level of wildlife study that we do, because that's the appropriate thing to do, whether the Government tells us to, or not.

I want to really thank Senator Smith for the advocacy with the Forest Service. And I—just to clarify, we have made repeated re-

quests. I wouldn't go to the trouble of bothering the good Senator on this issue if we hadn't tried on our own. We have been repeatedly rebuffed in our attempts to get involved. I suspect that our phone calls will get answered now, and I'm tremendously appreciative of that.

Our concern—they may be developing a great set of guidelines, and I have no knowledge of what those guidelines that they're developing look like. They may be fantastic. I might find myself here, 2 years from now, saying that we love them. But we just get nervous when things are being developed in a vacuum without the involvement of the people that do this every day. And, you know, we have—my company spends probably a million dollars every year on wildlife studies. We have a lot of expertise. We employ the best consultants—we believe, the best consultants in the business. And we'd like to bring that knowledge and that expertise to bear, to help in developing a public policy that works for everyone. And we know that that means involving other stakeholders, as well.

So, I'm one of those two applications that they have, by the way, so we're very interested in the potential on Forest Service lands, and we look forward to participating in that. And we thank the committee for your continued support of renewable energy.

[The prepared statement of Mr. Taylor follows:]

PREPARED STATEMENT OF CHRIS TAYLOR, DIRECTOR OF DEVELOPMENT, HORIZON WIND ENERGY, LLC, ON BEHALF OF THE AMERICAN WIND ENERGY ASSOCIATION

INTRODUCTION

Mr. Chairman (and members of the committee), my name is Chris Taylor. I am Director of Development for Horizon Wind Energy (Horizon). Horizon is one of the nation's largest wind energy development firms. We develop, build and operate wind power projects across the U.S. from upstate New York to Southern California. We currently have over 700 MW of wind projects under construction in Washington, New York, Illinois and Texas and expect to construct another 600 MW in 2007. These projects represent an investment of nearly $2 billion in 2006 and 2007 alone. Horizon Wind Energy is a wholly owned subsidiary of Goldman Sachs, a leading international financial services firm. I direct Horizon's development efforts in the Northwest region and have projects under development and/or construction in Washington, Oregon and Montana.

I also serve on a variety of committees for the American Wind Energy Association, a trade association representing every aspect of the wind industry, and I have been an active participant in the development of state, regional and national siting policies related to wind power. For example, I represented the wind industry in negotiations with the Washington Department of Fish and Wildlife which resulted in the issuance of the state's wind power siting guidelines in 2003; I was appointed by Governor Kulongoski in 2005 to the Oregon Renewable Energy Working Group; and I am a member of the National Wind Coordinating Committee's Wildlife Core Group, which is a diverse group of experts from industry, environmental NGO's, state and federal agencies and independent biologists.

Horizon Wind Energy and the American Wind Energy Association (AWEA) greatly appreciate this opportunity to provide testimony before the Senate Energy Committee today.

I'd like to start by thanking the committee for its past support of renewable energy and wind energy in particular. The Energy Policy Act of 2005 contained a critical 2 year extension of the Production Tax Credit (PTC) which has fueled the continued rapid growth of the wind industry and is expected to lead to record levels of new wind plant construction in 2006 and 2007. We thank you for this extension and hope that a longer term extension will be adopted in the near future so that manufacturers, developers and others in our industry can make the type of firm, long term commitments for procurement and construction that will drive further cost reductions.

With respect to the subject of today's hearing, I would like to provide a very brief overview of our perspective of the current regulatory climate for development of

wind power on federal lands. The three federal resource agencies that have the greatest effect on our industry are the Bureau of Land Management (BLM), the Fish and Wildlife Service (USFWS), and the Forest Service (USFS), and I will try to touch briefly on each agency today.

BLM

The wind industry is generally very pleased with the outcome of the BLM's recent (2005) Programmatic Environmental Impact Statement (PEIS) process for wind energy development. The process the BLM followed was very open and involved participation from a wide variety of stakeholders (including representatives of both the wind industry and environmental organizations) and resulted in practical, common sense rules. As a result, the BLM produced a set of successful guidelines featuring "Best Management Practices" for wind power development on federal lands. These guidelines have been widely accepted by both the wind power industry and the environmental community. These BLM guidelines allow for commercially successful development of wind power facilities on federal lands while protecting habitat, wildlife and other resources.

The BLM has a fairly long history of leasing land for wind power generation in California and Wyoming and there are many operating wind projects on BLM land in these two states. My firm and many of our competitors are now actively seeking Rights of Way (ROWs) from BLM for wind testing and monitoring as well as for actual wind project development. As with any large bureaucracy, we occasionally encounter individual BLM staff at the local field office level who are resistant to our requests, but overall, we believe the BLM does an excellent job of facilitating wind power development on lands under its jurisdiction.

USFWS

In July 2003, the USFWS issued a document it called "Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines". While these guidelines are in theory voluntary, the reality is that wind energy developers are increasingly being asked to follow these guidelines by USFWS field personnel offering comments on proposed projects being reviewed under NEPA or its state equivalents and by state and local agencies. We have very serious concerns with this guidance document, which we have shared with the USFWS on many occasions. These guidelines were developed with little to no stakeholder involvement, despite requests from members of our industry and others to participate before the document was issued. As a result, the guidelines have been widely criticized by both wind energy developers and the environmental community. In addition, more than a full year of effort was required to even begin correcting the factual and practical problems with the first set of guidelines.

It is my understanding that senior managers within the USFWS have acknowledged the need to revise and correct these guidelines and that a collaborative process to do so will be initiated in the near future. My company and AWEA hope to be actively involved in that effort. We thank the leadership of USFWS and the Department of the Interior for their willingness to correct the current guidance document. I do want to emphasize, however, the urgency of getting the current, flawed USFWS guidelines revised and corrected. Over the past 3 years, the current document has caused countless delays in the permitting and review of proposed wind energy projects with no appreciable benefit in terms of wildlife protection. We can not afford to spend another three years correcting this document.

The reality is that the vast majority of the wind power projects that are being built today are built by large, responsible, well-capitalized firms that understand the importance of proper siting and are sensitive to the needs of birds and other wildlife. Firms like FPL Energy, PPM Energy, and Horizon (the three largest developers in the U.S. today) take these siting issues very seriously and have experts on staff and consultants under contract specifically to address them. We spend millions of dollars a year on wildlife related studies and mitigation efforts, most of it totally voluntary. This is both the responsible thing to do and a logical business decision, since our future growth depends on being able to permit and construct lots of new wind projects. Even for those projects developed by smaller firms, it is increasingly difficult to obtain financing to construct a new wind project without having conducted appropriate studies to evaluate potential impacts to birds and other wildlife.

USFS

It is my understanding that the United States Forest Service is currently in the process of drafting national guidelines for wind energy development on Forest Service lands. The wind industry first learned of this informally at a meeting with wild-

life groups and agencies in Washington DC in March 2006. We immediately asked the Forest Service personnel involved in the guidelines process to allow us to participate in the development of this document which will likely have a substantial impact on our industry. My company and several others have applications pending with the USFS for ROW's for wind testing and monitoring in states from Vermont to California. Given how much of the western U.S. is administered by the Forest Service, it is vital that whatever guidelines are developed regarding wind development on National Forest lands be realistic and informed by the latest science.

To date, no wind developers or other parties have been involved—despite their repeated requests—to lend their expertise in helping to draft the proposed Forest Service guidelines. Given that the USFS has virtually no experience or expertise in the issues surrounding wind power and wildlife, it seems unwise to reject input from those parties with the greatest experience and expertise in these issues.

We urge the Forest Service to open up this process to allow input by wind energy developers and other groups who have knowledge and experience vital to forming sound, practical policies that encourage wind energy development while also protecting Forest Service lands. Given the considerable expenditure of time and federal funds that go into such efforts, we also urge the Forest Service to follow the BLM approach in developing guidelines for wind power development on Forest Service lands.

To that end, we strongly encourage the Forest Service to immediately open up the wind power guidelines development process and to allow for meaningful participation and input from all interested groups.

Senator THOMAS. Mr. Chairman?

Senator CRAIG. Please.

Senator THOMAS. For the record, while Idaho gets the power, we're pleased that Oregon will keep the tax revenues from the sale of that power.

[Laughter.]

Senator CRAIG. You would have to erect a reasonably good scenario here.

[Laughter.]

Senator CRAIG. I was asked the inquisitive question the other day by another Senator who happens to be downwind of Idaho, "As we use the wind, is used wind as productive as pre-used wind?"

[Laughter.]

Senator CRAIG. I'll leave—no, you don't need to answer that.

Mr. TAYLOR. I think it is. It's renewable.

Senator CRAIG. Yes, it is renewable, isn't it? All right. So, it is reusable, then, by definition.

Now let me introduce Bob Liden, executive vice president and general manager, Stirling Energy Systems, testifying on behalf of the Solar Energy Industry Association from Phoenix.

Bob, welcome to the committee.

STATEMENT OF ROBERT B. LIDEN, EXECUTIVE VICE PRESIDENT AND GENERAL MANAGER, STIRLING ENERGY SYSTEMS, ON BEHALF OF THE SOLAR ENERGY INDUSTRIES ASSOCIATION

Mr. LIDEN. Good afternoon, Mr. Chairman and members of the committee. I appreciate the opportunity to offer testimony on this vitally important issue.

Stirling Energy Systems, Inc., or SES, is a concentrating solar energy development company headquartered in Phoenix, Arizona. We also have engineering offices at Sandia National Laboratories, in Albuquerque, New Mexico, and a small satellite office in Tustin, California.

I would also like to express my personal thanks for your continued support for solar energy, and, in particular, for concentrating solar power. The incentives provided in the Energy Policy Act of 2005, including an increase in the investment tax credit and the loan guarantee program, would not have been possible without your able leadership. Frankly, without the committee's support, we would not have been in a position to bring into commercial deployment the technology that is the fruit of over 20 years of research and development by private industry, the U.S. Department of Energy, and the national laboratories, particularly Sandia National Laboratory.

Our company has signed contracts with two large utilities in southern California, and are in negotiations for two other projects to develop the world's largest solar powerplants. What is particularly relevant here is that these projects will be sited primarily on Federal land. And this should be not very surprising to anybody on this committee. I did put a map up there, on—which is almost impossible to see because of the glare, I'm afraid—but the map there shows, kind of, a light green. All that light green area is federally owned land. And you'll notice that in the Southwestern United States, which is where the sweet spot is for concentrating solar power, almost all of the land outside of the cities themselves is owned by the Federal Government or, in some cases, by State governments.

Regarding the two large solar contracts in California, both are 20-year power purchase agreements, one with Southern California Edison, the other with San Diego Gas & Electric. The SCE contract is for 500 megawatts peak output, with an expansion option for an additional 350 megawatts. The plant will be sited in the Mojave Desert, east of Barstow, California. The SDG&E contract is for an initial 300 megawatt plant with options to expand by another 600 megawatts. This project will be sited in the Imperial Valley, near El Centro, California. The two contracts, when fully built out, including the expansion options, will result in 1,750 megawatts of peak power generation capacity. The solar technology being employed for these projects is a concentrating dish engine system that was initially developed in the mid 1980's by McDonnell Douglas, later purchased and further tested by SCE, and, in 1996, purchased by SES. We have spent the past 10 years testing and modifying the dish system design for high volume manufacturing and deployment. You can see a picture of two of those dishes that are located at Sandia National Laboratories in the picture that's at the top on that poster.

It's important to note that this technology does not use water for cooling, so it's well suited for the hot arid desert locations where we find it's most appropriate to site this type of technology.

For these two contracts, we will be deploying as many as 70,000 dishes, each about 35 feet in diameter, that will be installed on a total of 11 to 13 square miles of desert land. The specific land requirement is partly dependent on local siting issues, such as washes, rock outcroppings. In essence, though, we will be planning 70,000 technological trees in two large solar forests. As mentioned above, almost all of the land at the selected sites is owned by the Federal Government and administered by BLM.

We are currently in the process of performing environmental impact studies and preparing permit filings required by the Federal Government and by the State of California. I am pleased to report that the two regional BLM offices that are working with us have both provided excellent support and help. This is a continuing experience for us, and we are, in a very real sense, plowing new ground. These will be the first—large solar dish powerplants ever constructed, and it's been nearly 15 years since any large-scale solar plants of any kind have been built in the United States.

I offer the following observations, however, based on the experience to date:

Renewable energy projects, particularly solar and wind, require large amounts of land. However, to put this in perspective, a solar dish farm covering about 11 square miles of land in the solar-rich Southwest United States can generate as much energy each year as the Hoover Dam, which requires 247 square miles of Lake Mead.

The Mojave Desert is the prime site for large-scale solar project development in California. There are persistent efforts by environmentalists and conservationists, however, to get legislation enacted to preserve all of the Mojave Desert and not allow any development.

Third, endangered species, such as the desert tortoises that seem prevalent throughout the Southwest deserts, require mitigation efforts, including securing up to six times the amount of land actually required for the project. This is expensive, and, in many cases, is a real deal-stopper. At times, the BLM requires the developer to purchase non-BLM land for this mitigation and deed it over to the BLM for use in providing a protective habitat for the displaced tortoises. This is also problematic, since BLM no longer has enough staffing to handle the real estate acquisitions, and the private landowners approached by a developer like us generally seizes the opportunity to hike, significantly, the price of their land.

In fact, just as an aside, what we have observed, while we've gotten good support from the regional offices of BLM, we've noted that these offices, particularly, at least, in Barstow and El Centro, are understaffed and stretched too thin, even providing emergency medical services to people injured on government lands is a challenge, given the few people and the vast amount of land they're required to oversee.

Now, how Congress could help encourage the development of renewable resources on Federal lands, besides perhaps helping staffing of the BLM, one would be to encourage landholding agencies, such as the Department of the Interior, Department of Defense, and so forth, to establish set-aside lands in their resource plans that are specifically for the development of solar, wind, et cetera. Now, NREL—that's the National Renewable Energy Laboratories—has well-developed maps showing the primaries for development of solar and wind, at least, and some other maps that are perhaps not quite as well developed for the other renewable resources, that could assist the agencies in this effort.

To further encourage the development of renewable energy projects on these lands, environmental impact studies should be undertaken by the Federal Government resulting in the identifica-

tion of, for example, solar or wind enterprise zones where solar or wind developers can more rapidly and efficiently bring their projects online. Doing an environmental impact study oftentimes requires anywhere from 1½ years to 3 years.

Second recommendation is to encourage FERC, WAPA, and other Federal power transmission authorities to develop a master plan for upgrading and expanding the transmission network to facilitate getting the power from Federal lands to the major load centers and population centers. These upgrades are sorely needed, but they're generally very expensive. Requiring developers to finance these upgrades, even if the developers are ultimately repaid their expenses, is onerous, and it discourages all but the most deep-pocketed developers from proceeding with their projects, in many cases.

Finally, establish some ground rules for setting lease rates on Federal lands that encourage the use of these lands for renewable project development, and recognize the need for low-cost land to keep the overall cost of renewable energy as low as possible.

Again, I thank you for this opportunity, and I look forward to any questions that the committee might have.

[The prepared statement of Mr. Liden follows:]

PREPARED STATEMENT OF ROBERT B. LINDEN, EXECUTIVE VICE PRESIDENT AND GENERAL MANAGER, STIRLING ENERGY SYSTEMS, ON BEHALF OF THE SOLAR ENERGY INDUSTRIES ASSOCIATION

Good afternoon. My name is Robert Liden, and I am the executive vice president and general manager of Stirling Energy Systems, Inc. (SES), a solar energy development company headquartered in Phoenix, Arizona. We also have engineering offices at Sandia National Laboratories in Albuquerque, New Mexico, and a small satellite office in Tustin, California.

I want to thank you Mr. Chairman and Senator Bingaman for having this important hearing and allowing SES the opportunity of testifying before this committee. Without this committee's continued support for solar energy and, in particular, for concentrating solar power, we would not have been in a position to proceed with these large contracts, bringing into commercial deployment technology that is the fruit of over 20 years of research and development by private industry, the U.S. Department of Energy, and the national laboratories (particularly Sandia National Laboratory).

I also would like to applaud you for passing the very comprehensive Energy Act of 2005, which, among other things, provides increased tax credits, a loan guarantee program, and other key incentives for the development of clean, renewable energy.

Our company has signed contracts with two large utilities in southern California and are in negotiations in New Mexico for a third project to develop the world's largest solar power plants. What is particularly relevant here is that both of the projects in California will be sited primarily on BLM land.

Regarding the two large solar contracts in California both are 20-year power purchase agreements, one with Southern California Edison (SCE), and the other with San Diego Gas & Electric (SDG&E). The SCE contract is for 500 MW (peak output), with an expansion option for an additional 350 MW. The plant will be sited in the Mojave Desert east of Barstow, CA. the SDG&E contract is for an initial 300-MW plant, with options to expand by another 600 MW. This project will be sited in the Imperial Valley near El Centro, CA. The two contracts, when fully built out (including the expansion options) will result in 1,750 MW of peak power generation capacity.

The solar technology being employed for these projects is a concentrating dish-engine system that was initially developed in the mid 1980's by McDonnell Douglas, later purchased and further tested by SCE, and in 1996, purchased by SES. It is important to note that our dish technology does not require water for cooling. We have spent the past 10 years testing and modifying the dish system design for high-volume manufacturing and deployment.

For these two contracts, we will be deploying as many as 70,000 dishes, which will be installed on a total of 11-13 square miles of desert land and our technology. (The specific land requirement is partly dependent on local siting issues, such as

washes, rock outcroppings, etc.) In essence, we will be planting 70,000 technological trees in two large solar forests. As mentioned above, almost all the land at the selected sites is owned by the Federal Government and administered by the Bureau of Land Management (BLM).

We are currently in the process of performing environmental impact studies and preparing permit filings required by the Federal Government and by the State of California. I am pleased to report that the two regional BLM offices that are working with us have both provided excellent support and help.

This is a continuing experience for us, and we are, in a very real sense, plowing new ground. These will be the first large solar dish power plants ever constructed, and it has been nearly 15 years since any large-scale solar plants of any kind have been built in the U.S. I offer the following observations however, based on our experience to date:

1. Renewable energy projects, particularly solar and wind, require large amounts of land. (However, to put this in perspective, a solar dish farm covering about 11 square miles of land in the solar-rich southwest can generate as much energy each year as the Hoover Dam, which requires 247 square miles of Lake Mead.)

2. The Mojave Desert is the prime site for large-scale solar project development in California. There are persistent efforts by environmentalists and conservationists, however, to get legislation to preserve all of the Mojave Desert and not allow any development.

3. Endangered species (such as desert tortoises) require mitigation efforts, including securing up to 6 times the amount of land actually required for the solar project. This is expensive and, in many cases, is a real "deal-stopper". At times, the BLM requires the developer to purchase non-BLM land for this mitigation and deed it over to the BLM for use in providing a protective habitat for the displaced tortoises. This is also problematic, since BLM no longer has enough staffing to handle the real estate acquisitions, and the private land-owners, approached by a developer, generally seize the opportunity to hike significantly the price of their land. (In fact, what we have seen is that the BLM regional offices—at least the ones in Barstow and El Centro—are understaffed and stretched too thin. Even providing emergency medical services to people injured on the government lands is a challenge, given the few people and the vast amount of land to oversee.)

How Congress can help encourage the development of renewable resources on federal lands:

1. Encourage the land-holding agencies (Department of Interior, Department of Defense, etc.) to establish "set aside" lands in their resource plans specifically for the development of solar, wind, etc. (NREL has well-developed maps showing the prime areas for development of all the renewable resources to assist the agencies in this effort.) To further encourage the development of renewable energy projects on these lands, environmental impact studies should be undertaken by the federal land owners, resulting in the identification of, for example, solar or wind enterprise zones, where solar or wind developers can more rapidly and efficiently bring their projects "on line".

2. Encourage FERC, WAPA, and other federal power transmission authorities to develop a master plan for upgrading and expanding the transmission network to facilitate getting the power from federal lands to the major load centers and population centers. These upgrades are sorely needed, but they are generally very expensive. Requiring developers to finance these upgrades (even if the developers are ultimately repaid their expenses) is onerous, and it discourages all but the most deep-pocketed developers from proceeding with their projects.

3. Establish ground rules for setting lease rates on federal lands that encourage the use of these lands for renewable project development and recognize the need for low-cost land to keep the overall cost of renewable energy as low as possible.

Finally, a brief reminder of why renewable energy development is important:

1. The economic impact of new renewable energy projects is immense—hundreds to thousands of jobs to develop and operate these power plants, bringing new tax dollars into primarily rural communities, where unemployment is high and a boost to the local economies are sorely needed.

2. Renewable power plants reduce the nation's dependence on fossil fuels and imports, enhancing our national security, improving our balance of payments; and stimulating our economy.

3. Renewable power plants improve our environment, reducing greenhouse gases, and cleaning our air. (For example, our two solar projects in California, if built out to their full potential of 1,750 MW, will displace 1.8 million tons of coal consumption

and reduce CO_2 emissions by 400 tons per year compared to a coal-fired plant of the same size.)

Again, I thank you for this opportunity and I look forward to any questions the committee may have.

Senator CRAIG. Bob, thank you very much.

Now let us turn to Bernie Karl, proprietor, Chena Hot Springs Resort, Fairbanks, Alaska.

Senator, do you have any additional introductory comments?

Senator MURKOWSKI. Well, I would just like to personally welcome Mr. Karl. Bernie is not only a constituent, but a friend who has been running a terrific business up in the interior. And I would certainly encourage anyone who has the opportunity to travel to Chena Hot Springs to see what is happening out there. In addition to not only a lovely place to have a weekend and soak in the great waters there, the entire facility is being run off of the geothermal power. What Mr. Karl is doing, in terms of the lower-temperature geothermal technology, is, as I mentioned in my opening statement, really very exciting for the State. So, I'm just very pleased to have him here and thank him for traveling all the distance to speak to the committee today.

Mr. KARL. Thank you, Senator.

Senator CRAIG. Please proceed, Bernie.

STATEMENT OF BERNIE KARL, PROPRIETOR, CHENA HOT SPRINGS RESORT, FAIRBANKS, AK

Mr. KARL. Thank you very much for the opportunity to speak.

Chena Hot Springs is 60 miles northeast of Fairbanks, Alaska. We will be bringing online, this month, the first geothermal powerplant in the State of Alaska, the first geothermal powerplant in the history of the United States to be making electricity off 165-degree water.

I don't really know if people know how significant that is. We have enough geothermal energy in the world to take care of the whole energy. We're 5 percent of the world's population, we're consuming 25 to 35 percent of the world's energy. What's wrong with that equation? We have to start somewhere. We need to start here today. So, what do we do? We cut the geothermal budget so there's no money—no money to work with geothermal. Yet it is the absolute best bang for the buck. If you want to do something great for this country, take the geothermal budget and make it $150 million a year. That's what you need to do to help this country if you want to become self-sufficient. The President of the United States said that we are "addicted to oil." He's absolutely right. We have the worst addiction of any addiction known to man. We think drugs are bad? Drugs are nothing. Look at what we spend for oil. If you don't believe me, go fill your car up sometime—$50. And you know why it's $50? Because it should be $100. It should be $100, because we do not put what it costs to replace that energy. If the actual cost was there to replace the energy, it would be $100. And I guarantee you we would have alternative energy, then.

Right now, you are sitting on top of alternative energy. If you will finance half of the well, I will finance half. We will drill a well right in front of the Department of Energy, 20,000 feet, and I will provide you enough energy to heat the buildings, all of the capital

buildings. I can promise you that. But I think I can also give you enough energy to turn the lights on. I will pay for half of it. So, I challenge you—I challenge you to come up with that money.

We should be the world's leaders in alternative energy. At Chena Hot Springs, we're a little, bitty company. Little bitty. I have $1.7 million of my family's money and the bank's money, not counting some Department of Energy money, and a lot of money from United Technologies. I believe that the technology that's coming out of this powerplant will make the most significant contribution to power generation in the 21st century. There is nothing that's going to compete. Why? Because—a quick example. United Technologies, because they are a company that is committed, committed to this project, you will see 500,000 of these units working in the United States in the next 10 years. You say, How can you make a statement like that? In Texas alone, there's 225,000 producing oil and gas wells. They produce 5 percent oil and gas, 95 percent water, 4 million barrels a day at 265 degrees. There's 125,000 wells that are nonproducing. That's 350,000 wells. Every well should be producing electricity. Every well should be producing refrigeration. At Chena Hot Springs, we keep the largest ice structure in the world cold, frozen, all summer by using absorption chilling. We use 95 gallons a minute of hot water, 75 gallons of cold water. We make 15 tons of refrigeration, minus-29 below in the evaporator. It's the largest ice structure in the world to be up all summer. Forbes magazine voted it the Dumbest Business Idea of the Year in 2004. Forbes can kiss my—it's——

[Laughter.]

Mr. KARL. He might think it's dumb——

Senator CRAIG. Careful, now.

[Laughter.]

Senator CRAIG. Kiss your "cachena"?

[Laughter.]

Mr. KARL. I'm sorry, sir. But I did not say it.

[Laughter.]

Mr. KARL. My wife will kick my—if I——

[Laughter.]

Mr. KARL. Anyway—right now at Chena Hot Springs, this year, we will become as totally close to a self-sustained society in the United States. We have 65 employees that live onsite. We have 445 acres. We built and maintain our own runway, our own landfill, our own water system, our own electric system. By putting this powerplant in, we're going to displace $400,000 a year worth of fuel. I already displaced over $300,000 worth of fuel by heating 44 buildings. We just built our third greenhouse. Everything that you eat there will be growing there on a 365-day basis. We have 165 separate experiments going on in horticulture with the University of Alaska. We have our first hydrogen plant there. Our first hydrogen vehicle will be there in August. By the first quarter of next year, everything I own will be running on hydrogen. Everything. And the only way you get to a hydrogen economy is through geothermal. You have to use alternative resources. To burn fossil fuels is insane. Absolutely insane. We're burning our children's future. We need those fossil fuels to get us to alternative energy, and then we need to use them for the carbon that they have so that we can

build everything with carbon fiber. But if we burn it all now, we're spending the bank account. There's going to be nothing left.

So, if you can do anything at all, you need to increase geothermal's budget to at least $150 million. I'm thankful that you put in the measly $23,000. Don't take it wrong; I'm very appreciative.

Senator CRAIG. Million. There's a difference between thousand and million.

Mr. KARL. I mean, excuse me, million. I'm sorry.

[Laughter.]

Mr. KARL. Thank you for correcting me.

I see my time is up. And I don't want to take any more of your time. But you don't know how much I appreciate your time and how important this is. There's nothing more important in our society today than alternative energy, and we have to start here. And for anyone to think that geothermal is an industry that is so—you know, they say that the industry is already a mature industry. Well, if that was true, why did I have to work so hard to find somebody that wanted to build a turbine on 165-degree water? And if that is true, why isn't everyone on alternative energy?

Thank you, sir.

[The prepared statement of Mr. Karl follows:]

PREPARED STATEMENT OF BERNIE KARL, PROPRIETOR, CHENA HOT SPRINGS RESORT, FAIRBANKS, AK

My name is Bernie Karl. I am the proprietor of Chena Hot Springs outside of Fairbanks, Alaska. Chena Hot Springs will be the site of the only new geothermal power plant installation in the United States this year. It will also be the site of the lowest temperature resource (165 °F) ever used for commercial power generation in the world. Attachments to my written statement contain additional details on this exciting and unique project.*

The power generation project at Chena would not be possible without support from the United States Department of Energy's Geothermal Technologies Program, which is currently threatened with elimination. I am testifying in support of reinstating and expanding the Department of Energy's geothermal budget as well as extending the production tax credit for geothermal resources.

Our country faces a number of critical energy concerns including the need for a diverse portfolio of clean, renewable domestic sources of supply. Additional investment in public private geothermal R&D partnerships can open up extensive new opportunities for domestic production of renewable energy. New technologies that hold tremendous promise for tapping moderate temperature geothermal resources, including those associated with oil and gas production are emerging. Without validation in real world operating conditions and a stable, sustained commitment to financial incentives, the necessary investment will not be made and these technologies will never penetrate the market resulting in lost opportunities for renewable domestic energy production and the associated economic and environmental benefits.

For example, until just a few years ago, it was believed that power generation from geothermal resources lower than 230 °F was uneconomical. However, that picture is changing as the cost of energy rises, and the technology improves. Moderate temperature geothermal resources are by far the most prevalent in the United States and around the world. Estimates indicate there are between 20,000 and 40,000 MW of geothermal electrical energy potential in the U.S. alone in the 190 to 300 degrees Fahrenheit range.

In fact, you could hit those temperatures right here underneath Washington DC if a hole 20,000 feet deep[1] were drilled. Heat from the earth, whether used for power generation or heating buildings and homes is the most reliable form of renewable energy available to us. It doesn't depend on clear skies, windy days, or rainfall, making geothermal a good base load alternative energy. While using the heat from

*The attachment has been retained in committee files.

[1]According to the U.S. Heat Flow Map created by Southern Methodist University. www.smu.corn/geothermal

the earth for heating and cooling is economical throughout the U.S., our best geothermal resources for power generation are in the western states.

4% of power generation in the West today is generated from geothermal resources. However, this existing generation is almost all from high temperature, easily accessible resources. The next step in geothermal power generation will require new technologies, including enhanced geothermal (EGS), exploration for blind systems, and development of improved technologies for moderate temperature power generation. All of these areas are being explored by the Department of Energy's Geothermal Technologies Program and are jeopardized by the Administration's proposed elimination of funding.

I can testify from firsthand experience that the Department of Energy's program, with Dr. Roy Mink, and until recently David Garman, at the helm represents the best our government can offer. They are hands-on managers, who understand the possibilities and are tirelessly working to steer our country in the right direction while keeping a close eye on the bottom line. Without their support, the geothermal projects at Chena Hot Springs, which have attracted $3 million in private investment alone, would never have come to fruition.

In the future, the geothermal industry is also going to need to think outside of the box. There are currently 225,000 producing oil and gas wells[2] in Texas which produce 95% water along with 5% oil and gas. This water is a waste by product of the oil industry. However, at temperatures averaging 265 °F, this water could be used in a power generation cycle before being re-injected into the ground.

If every producing oil and gas well in Texas alone used this technology, the same power generation technology being tested right now at Chena Hot Springs in Alaska, we could generate 5000MW of power from this renewable geothermal resource. This is the equivalent of 5 new nuclear power plants. In addition, this technology could extend the life of currently unprofitable oil and gas wells thus providing additional jobs and energy security benefits. With the modular power plant designed and developed by United Technologies in partnership with Department of Energy, this type of power generation could be brought online within a very short time period after the technology is demonstrated and validated in real world operating conditions.

Geothermal energy is also a potentially vital piece of a future 'hydrogen economy' in which Congress is investing research dollars. Hydrogen production over the long run makes sense only from using renewable energy sources. Therefore, development of those resources should go hand in hand with hydrogen research.

President Bush has stated repeatedly that we are addicted to oil and as a country we need to wean ourselves from this addiction. Geothermal energy is part of that solution. Geothermal development has had success with readily accessible higher temperature sources. The opportunities for geothermal technology development have not been exhausted; there is still huge potential for additional future generation of heat and power by applying new technologies to abundant lower temperature resources.

The Department of Energy has historically been the driving force behind new development and exploration in geothermal—the 'thinking outside the box' that industry is often reluctant and financially unable to undertake alone. I believe that reinstatement, and even expansion of the geothermal technologies program budget is critical for the future of power generation in the Western United States.

In addition, I recommend the Renewable Electricity Production Credit that is due to sunset in 2008 be extended until 12/31/14 as provided in S. 2829. The continued R&D investment via cost shared public private partnerships sponsored by DOE coupled with a longer term production credit will provide the market with more certainty and enable sound investment choices. There are never simple solutions, only intelligent choices. Thank you for the opportunity to speak on this important and timely topic.

Senator CRAIG. Bernie, thank you very much for that very interesting testimony. You've almost convinced me to come. I was in Soldotna last weekend. Do you have fish?

Mr. KARL. Yes, sir.

Senator CRAIG. I'll be there.

[Laughter.]

Senator CRAIG. All right.

[2] There are an additional 125,000 existing wells currently not in use that could also be tapped for power generation.

Mr. KARL. And I'll tell you what. We have the fish there, and I—I'm for sure that Senator Stevens is going to be there. I believe Senator Murkowski will be there. But let me tell you, we have your fish. I mean, they're right there. We've got your fly rod ready. You're going to have one heck of a good time. It's on August 20. We anticipate there'll be 1,000 people there.

Senator CRAIG. I'm not allowing commercializing at this hearing.

[Laughter.]

Senator CRAIG. That's a commercial advertisement. You'll have to pay the committee.

[Laughter.]

Senator CRAIG. All right.

Mr. KARL. I apologize, sir.

Senator CRAIG. All right.

Now let us turn to John White, executive director, Center for Energy Efficiency and Renewable Technologies, in Sacramento.

John.

STATEMENT OF V. JOHN WHITE, EXECUTIVE DIRECTOR, CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES, SACRAMENTO, CA

Mr. WHITE. Thank you, Senator. I appreciate the committee's invitation to be here today.

The Center for Energy Efficiency and Renewable Technologies is a collaborative made up of environmental organizations and companies that are involved with the renewable energy business. Our affiliates include members and companies involved in solar, wind, geothermal, and the major energy and environmental organizations.

I'll be brief, because I know the committee's time is valuable, and we have submitted remarks for the record.

A couple of observations. We have done some work on stakeholder planning efforts regarding renewable resource development and transmission. And I think a couple of things have come from that work that we have done to try to actually facilitate the development of these resources.

The first is, when the lands are sensitive, then there needs to be appropriate amount of time and effort and energy expended with those lands. And if we try to streamline the siting on sensitive lands, we're going to end up having delays down the road, because we'll have litigation. So, we really think involvement and engagement with the parties early is very important.

Second, with regard to the State and Federal agency coordination, we need to see some improvements there. I would share the observation about the budget and staffing issues in the Federal agencies, but also, as the BLM is developing its new guidelines for geothermal, we'd hope that we could have a higher level of coordination between the State environmental process, which, in California, is fairly well developed, and the Federal processes.

We have been working in the Tehachapi wind resource area, near Kern County, with a variety of the parties, including the utilities, the Federal agencies, the environmental community, developing a plan for developing a coordinated approach to transmission and renewable resources. And I think that's a critical thing to rec-

ognize, that for renewables to be successful, they're going to need to have transmission. And the planning of that transmission needs to be coordinated with the procurement and the development of the resource. It's a little bit like a chicken-and-egg problem.

The FERC, Federal Energy Regulatory Commission, needs to be made especially cognizant of its role in providing access to the grid for the—for the existing grid, and to recognize the public benefits of renewable resources when considering new transmission. All of these State renewable portfolio standards that are helping to guide and direct the utility procurement ultimately will be influenced by FERC action on transmission plans, and there needs to be a recognition specifically that there are public benefits associated with renewables to be accomplished with the transmission plans.

The Western Governors Association, as Dr. Snyder mentioned, has done a significant amount of work recently. I commend to you their task force recommendations on efficiency, geothermal, and concentrating solar, all of which represent a contribution from a lot of stakeholders. But one of the key findings of that report is the need to recognize the known renewable resource areas in renewable—in regional transmission planning. There's a lot of talk about regional transmission planning and lines being built from the resource areas to the load centers. Those planning efforts need to involve the renewable resources equally in that process.

Last, I would echo the concerns about the production tax credit. I think one of the reasons we have had a sort of start-and-stop process with regard to siting and difficulty of Federal agency response is that we have had short lead times on the production tax credit. And what we need to figure out a way to do—I think the geothermals suggestion about the in-service date being changed to when there's a contract makes a lot of sense—but we need to provide more certainty, over the long run, for these production tax credits, particularly for geothermal and solar, as well as for wind, in such a way that we can know that these resources are going to be developed, and we can then take upon us some of these suggestions regarding developing set-aside areas, areas that we know are going to be developed, instead of waiting for individual projects to come in one at a time.

So, I would commend to you the work that the Western Governors has done, and the need to link procurement with transmission planning and to provide as much certainty as you're able with regard to the production tax credits.

Thank you very much.

[The prepared statement of Mr. White follows:]

PREPARED STATEMENT OF V. JOHN WHITE, EXECUTIVE DIRECTOR, CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES, SACRAMENTO, CA

The Center for Energy Efficiency and Renewable Technologies (CEERT) greatly appreciates the opportunity to offer testimony to the Senate Energy Committee on the implementation of the Energy Policy Act of 2005 (EPAct) as it pertains to the growth of geothermal and other renewable resources in the Western U.S. While we believe that the legislation provides an excellent opportunity to enhance the growth of these sustainable resources, the Committee is right to realize that the implementation of such policies must be done correctly to achieve the maximum benefit.

CEERT is a non-profit public benefit organization composed of national environmental groups including Natural Resources Defense Council, Environmental Defense and Union of Concerned Scientists as well as technology and energy producers

working to increase the use of renewable energy and energy efficiency. Our organization has become an important forum and a vehicle for these various groups to come together and generate positive action on common issues like global warming, air pollution and environmental and economic sustainability.

Over CEERT's 15 years of existence we have seen renewables grow from a boutique industry to an increasingly significant energy resource. Internationally, the renewable industry has one of the world's fastest growing markets with new capital flowing in all the time. Our home state of California is in many ways the birthplace of this industry, yet as in the rest of the U.S., the growth of renewables has lagged behind many other leading economies. While there are a number of reasons for this, the EPAct affords an excellent opportunity to improve the process for the development of renewable energy in the West and around the U.S.

RESOURCE PLANNING

CEERT has had extensive recent experience in facilitating stakeholder groups for the development of transmission around renewable energy resource areas. Through these processes we have learned a number of valuable lessons which can be readily applied to the implementation of the energy bill. First and perhaps most evident is that areas that are sensitive must always be treated as such. Whether the concerns are environmental sensitivity, proximity to population centers or any one of the other myriad issues that must be addressed when developing energy infrastructure, concerned stakeholders can greatly affect the development of any project if they see sufficient need. Any streamlining of project impact review processes must not come at the expense of a thorough investigation of all potential effects from a project. It has been our experience that any steps skipped or missed early in the process will only lead to delays later on. From the perspective of many of our affiliates, those developing geothermal as well as other renewables, these delays at later stages can be far more costly as those involved will have more to lose. This is very clearly illustrated in a report recently released by the Geothermal Energy Association (GEA) which shows a curve of project cost growing ever steeper with each year of delay.[1]

Despite the clear economic value to an efficient permitting and development process, the Bureau of Land Management (BLM) has seen a massive backlog of geothermal energy lease applications accumulate. In fact California's BLM office has not issued a geothermal permit for 20 years despite the fact that there are substantial known developable geothermal resources in the state.

AGENCY COORDINATION

One major reason for these delays is the insufficient staffing for federal agencies such as the U.S. Forest Service (USFS) and BLM for review of National Environmental Protection Act (NEPA) documents. A great deal of money and hard work is put into the development of these documents by the project developer and a similarly thorough review process by the requisite agency should be expected in compliance with federal laws. A renewed commitment from the Department of the Interior and its sub-agencies should be made to eliminate these inefficiencies and thoroughly evaluate all NEPA documents. Ideally the BLM and other federal agencies should have staffing to take part in the actual studies of these projects as well as assessing their impacts. In our experience this path for permitting, in which the agencies are engaged early in the study process, has resulted in better projects and a more thorough assessment of the impacts.

Related to this inefficiency by the federal agencies are the often overlapping and seemingly cumbersome procedures of various state permitting processes. In California the California Environmental Quality Act (CEQA) demands an extremely rigorous environmental investigation. A higher level of coordination between the various state and federal agencies responsible for evaluating these project proposals could be very helpful in speeding the process along. As the BLM enters into a rulemaking for regulations to address the changes in the Federal Geothermal Program as mandated by the EPAct, careful considerations should be made to ensure that any new rules can work together with existing state permitting processes without slowing down the approval process.

Under CEERT's leadership, the Tehachapi Collaborative Working Group worked to find innovative ways to address these inefficiencies through an open stakeholder

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[1] See Appendix 1 for graphic illustration. From: *Factors Affecting Costs of Geothermal Power Development,* by Cédric Nathanael Hance, Geothermal Energy Association, August, 2005. Available for download at http://www.geo-energy.org/publications/reports/Factors%20Affecting%20Cost%20of%20Geothermal%20Power%20Development%20-%20August%202005.pdf

process. The study group was organized with the mission of developing a transmission plan to access the considerable known resources in the Tehachapi Wind Resource Area. The stakeholders included utilities such as Southern California Edison and Pacific Gas & Electric, wind developers such as PPM Energy, and EnXco Inc., state and federal land use agencies including USFS, private land owners and other important stakeholders. Though this can appear unwieldy, the early involvement of these numerous stakeholders ensures that potential problems are addressed early and more costly delays are avoided later in the development process. After a year of work by TCSG, all stakeholders are nearing agreement on a comprehensive, multiphase transmission project that will provide access to over 4000MW of wind energy in the Tehachapi region. Given the scale and complexity of the project this is an important step forward for all of those involved in its development.

This process also highlights an important aspect of most large scale renewable development including geothermal, wind and utility scale solar. All of these resources are tied directly to the location where the energy is generated. The wind blows where the wind blows, the sun shines where the sun shines and there is no way to change those characteristics. The mobile nature of gas, oil and coal through trains pipelines and tankers give those types of power plants and added flexibility in their siting and development process and offer those resources easier access to the existing electricity grid. As the West's transmission system has begun to approach the outer limits of its capacity, renewables have begun to run into a chicken and the egg problem. Without transmission, developers cannot secure financing to build their projects; and without committed projects, regulators cannot approve the transmission to connect them. By following the study group process used in Tehachapi there is now a plan in place to develop the transmission in concert with the procurement of the electricity on a phased, as needed basis. Additional help could also be provided if the FERC process allowed for the public benefits of clean renewable energy to also be considered in the evaluation of new transmission projects.

CEERT is also currently following a similar route in developing transmission plans to access geothermal in Southern California's Imperial Valley as well as a project in the early stages to develop a plan for accessing solar energy from the Mohave Desert. To sufficiently develop the West's renewable energy including the still substantial untapped geothermal, it is important that the planning of transmission run parallel to the development and procurement of renewable resources. These resources are of increasing competitiveness in an open market and offer substantial societal benefits from their increased use. Their growth should not be hindered by public policies that put these resources at a disadvantage while making it easier for utilities and developers to permit and construct fossil fueled plants.

Though the technology has not been at the forefront of renewable energy growth, CEERT would like to draw the committee's attention to the continuing development of the Concentrating Solar Power industry. This technology, which was initially developed in California, has matured considerably with modern installations in Europe producing reliable utility-scale power on demand with exceptionally low environmental impact. CEERT sees this as the next generation of renewable development in the Western U.S. which has considerable solar resources in the desert Southwest. The recent report of the Western Governors' Association (WGA) Solar Task Force estimated that if 4,000 MW of new CSP capacity were to be built the cost of electricity would be competitive with conventional sources.[2] Though the technology currently represents only a small piece of the renewable pie, it is important that it is not forgotten in the resource assessments and transmission planning that will be conducted. This largely untapped resource has huge potential to serve the ever growing electricity needs of the desert Southwest with out having to transmit the energy through massive interstate transmission projects.

WESTERN GOVERNORS' ASSOCIATION

Looking at these problems in the bigger picture of the entire American West, the Western Governor's Association (WGA) offers an excellent venue to address these issues of coordination. The organization's approach to problems that affect the entire Western Region are clearly reflective of the nature of the electricity grid. The development of geothermal in Idaho will ideally be deliverable in California helping to meet renewable needs there and the WGA will undoubtedly be critical in making that happen.

[2] *Clean Energy, a Strong Economy and a Healthy Environment,* a Report of the Clean and Diversified Energy Advisory Committee to the WGA, June 2006, This document can be found online at: http://www.westgov.org/wga/meetings/am2006/CDEAC06.pdf

The WGA recently adopted the recommendations from the Clean and Diversified Energy Advisory Committee (CDEAC) for a current, systematic and thorough examination of the development potential for clean resources in the West. Building on the model used in the California working groups, the federal government's policies should support stakeholder processes being setup by the WGA to develop transmission plans for expansion across the west, ensuring that access to new renewable resources is an important piece of the planning process. In considering the location of known renewable resources in the transmission planning, development of these resources can occur more rapidly. Large transmission projects designed to access renewable resources will make development of those resources more realistic. It will provide access to better project financing by decreasing the risk of the investment and lessening the possibility of delays in the future.

In the interim, close attention should also be paid to the WGA's recommendations regarding the use of the existing transmission in the West. The committee should encourage FERC to implement policies that offer better access for renewables to the existing grid including: short term transmission services and products, and urging utilities to assess available transmission capacity and opportunities to make better use of the existing transmission systems.

CEERT has worked with the WGA to offer input on the various recommendations made by the CDEAC and feel that the situation of California, already a net importer of electricity, is very closely tied to the energy systems of the other Western states. Many of the other recommendations made by the CDEAC echo our concerns and experiences in California. This includes timely permitting and environmental reviews for renewable projects particularly geothermal whose value can suffer greatly due to delays in this process. Additionally the recommendations call for increased coordination among the various states, local and federal agencies in the permitting process. These are all positions that should be supported by the Committee.

PRODUCTION TAX CREDITS

Another disadvantage faced by developers of geothermal and other renewable resources is the short time horizon in which they can receive a Production Tax Credit (PTC) for their project. The nature of renewable energy is such that the primary cost of the resource is paid in upfront financing for the development and construction of a project. Once in operation a renewable energy project demands only the operation and maintenance costs—there is no fuel cost. This is vastly different from a fossil fuel plant, which is cheaper to construct and thus able to turn a profit in a shorter amount of time, making an investment a lower risk and therefore more appealing to investors. It makes little difference that the renewable technology, over its lifecycle, will offer stable electricity rates compared to the gamble over thirty years on a natural gas plant. Moreover, once the initial capital investment has been repaid, these renewable projects can offer wholesale electricity rates below most fossil fuel generation facilities.

To help resolve this situation, production tax credits offered by the federal government have made initial investments in renewable energy much more financially appealing for a broader range of institutional investors. However, with longer lead times for construction of geothermal and other renewable energy facilities, an extension of the PTC would provide a more stable, long-term capital flow to allow projects to be constructed more efficiently. In the end better projects will be built because developers will have the flexibility to address any problems and build the most effective plant for its purpose.

This extension of the PTC will also allow renewable energy developers to create more effective business plans and make more effective business decisions based on long-term market strategy. As the PTC is currently designed, it must be reauthorized every few years leaving these companies in limbo each time the credits reauthorization is in question. Leaving the PTC in place for a longer period of time will allow these companies to develop strategically into more effective players in the larger energy market.

CONCLUSION

CEERT believes that within the next 10 years the renewable energy industry is poised for an unprecedented boom in the U.S. Indeed, this current situation is already due to many innovative and forward looking public policies that have pointed our nation to a sustainable future. However, to ensure that these policies are effective they must be carefully and prudently implemented. CEERT greatly appreciates the interest of the Senate Energy Committee on these important issues for geothermal and other renewable energy resources. We are prepared to offer any help to the committee in achieving the enormous potential of these vast resources.

Thank you.

Senator CRAIG. John, thank you very much. You've broached a question that I was going to ask you as it related to the planning and development—for the future of transmission lines. We've heard not just, from you, but from others, that we've got to make both FERC and States much more aware of the need for connectivity. Obviously, renewables are sometimes only where they are. Obviously, with geothermal. It's also true of siting for solar. And, therefore, the connectivity is critically important, getting the systems into the grid.

One of the reasons DOE did not put money in the budget this time for geothermal—and it's been spoken to here today—was that it was a mature technology. Yet we've heard Bernie talk about 140-plus-degree temperatures. We saw the industry, in the early 1970's, I believe, in the Raft River area of Idaho, walk away from 300-degree temperatures. Now they're back. It obviously demonstrates to me there's a great deal of potential in the technological side of the generating capability of those kinds of temperatures. Could you speak to that?

Dr. SNYDER. Oh, yes, certainly. I think the notion that it was mature—the best word I can think of is "naive." As you mentioned, as our technology advances, then it opens up a whole new suite of potential sites to develop.

One thing I forgot to mention, by the way, in terms of that, is, I think a lot of the future potential is going to be, as it was in Raft River, hidden resources, ones that do not have the obvious surface expression of hot springs, et cetera. And, in that case, you need to understand the geological situation even better so that you can save industry from drilling wells that are not going to be productive. It's going to be tough. There is not now, nor will there ever be, a magic black box that you can take out there and find the perfect place to drill. You're going to have to gather information, and you're going to have to think about it. These are complex heterogenous resources that, each one, you have to study, one after the other, in order to bring them online.

Senator CRAIG. Okay.

Anyone else wish to speak to that general question about mature technology versus future opportunity?

Mr. KARL. Yes, I would like to just——

Senator CRAIG. Bernie.

Mr. KARL. Mr. Chairman, on that mature technology, you know, just recently, just in the last year, has United Technologies come up with the proper gas to even use this hundred and—well, we've been experimenting from 140 to 165 degrees. We have 1,500 hours on the unit up at the research center. And, I might add, it's in Alaska now. And the thing of it is, is that this is just brand new. You know, so, I mean, to say that it's mature is absolute—a falsity. And, once again, you can't expect—you can't expect industry or private sector to take all the risk. I mean, in this case, United Technologies has accepted a tremendous amount of risk. We've accepted a tremendous amount of risk. And so has DOE. And DOE actually was good enough to put all this together. If it hadn't have been for DOE, this consortium wouldn't be put together. And that's what DOE is really good at, is putting together what I would call part-

nerships. And these partnerships are going to be the future of alternative energy. It's not the Government doing it all. It's not industry doing it all. It's, kind of—it's, kind of, a consortium of the end-user, Government, and industry, working together. And that's what's happened here. And to say that it's mature is just not so.

Senator CRAIG. Thank you.

Yes, John.

Mr. WHITE. Senator, I would just say that not only is this not a mature technology, this is probably cutting-edge, what Mr. Karl is talking about. And if you look at the significance of being able to access substantial amount of low-temperature geothermal energy, it's not just in Alaska, it's throughout the West. And——

Senator CRAIG. Very, very true.

Mr. WHITE [continuing]. And I think that the amount of energy that could be extracted, were this technology able to work on a large scale, would be very, very significant.

Senator CRAIG. Chris, it sounds like you are generally satisfied with BLM's approach to permitting, but have serious concerns with existing Fish and Wildlife Service guidelines and guidelines being developed by the U.S. Forest Service. Can you elaborate? And, in your opinion, could BLM policies be successfully applied to Forest Service lands?

Mr. TAYLOR. Thank you, Senator. Yes, we certainly believe that the BLM guidelines looked at many of the issues, if not most of the issues, that would be relevant for Forest Service. Any type of guidelines that attempt to cover a whole swatch of the United States or all the lands under BLM's jurisdiction is going to be local circumstances, and there's going to be sensitive areas, as John described, that are going to require adaptation of any general guidelines. So, I think that by the very nature, any kind of universal guidelines are going to have to be tailored somewhat at—to the local circumstances. And I think, you know, with that in mind, most of what the BLM has recommended would make sense for the Forest Service. I'm not a forester by training, so I wouldn't profess to know if there are some very specific issues related to that. But I think, by and large, I have worked with timber companies, and am working today with a timber company in the Northwest to develop wind energy on private timberland. And typically what we find is that the—we're interested in the ridgetops, where the wind is howling. And that doesn't make for good tree growing. So, typically, they are compatible, in the sense that, one, commercial forest land has roads, and we're not proposing to go into roadless areas; and, two, that those areas that are of greatest interest for wind development don't have great timber potential, because the wind creates relatively low-value timber.

So, yes, I think the BLM guidelines could be adapted. And we hope they will be.

Senator CRAIG. Thank you.

Bob, while you were speaking, I was looking at numbers, and I was already beginning to calculate the equivalency of land coverage of the Hoover Dam in its 1750 megawatts and your 11 to 13 square miles project in the Mojave would produce. I'm glad you came up with those numbers. I think often times we don't look at equal-to or commensurate impacts and what they mean.

Having 20 years' purchase agreements with two large power companies certainly provides the financial certainty necessary to take on a large-scale project like the one you're proposing. How long, do you believe, will it take to complete the permitting and environmental studies necessary to get your project started?

Mr. LIDEN. Good question, sir. The actual permitting process, we believe, will take us into 2008. So, when we'll actually start the construction of the plants will be in early to mid-2008. The buildout of the first 300 megawatts of the San Diego project is estimated to take 18 months to 2 years. And then we'll continue on with the add-ons, the additional 600 megawatts, on the tail of that. And on the SCE project, we have a contract to build the 500 megawatts within 4 years. We are, internally, expecting to do it in something around 3 years. And then, the expansion of another 350 megawatts, about another 2 years beyond that. So, these are projects that will continue through 2014 before they're completed and built out to their entirety.

That being said, it's important to know that, at least with our technology—and this is also true of Chris's wind technology—you don't have to put the entire powerplant, the entire 1750 megawatts, online before you turn the switch on and start generating renewable energy. We'll start turning on, about a megawatt at a time, power onto the grid, and build these things out over that period of time. So, we'll have a very significant amount of renewable energy generation really in place in the 2009-2010 timeframe.

I was once in Barstow and held a hearing on the greater desert issue and the management of that desert. And it was an interesting time. I had, in the last days of Roy Rogers, him strumming his guitar with Trigger there, singing "Don't Fence Me In," and somebody packing a desert tortoise around in a cage, speaking of the life of the desert tortoise. Now I'm looking at a artist's conception of your potential facility, and I see around it a chainlink fence.

Mr. LIDEN. Right.

Senator CRAIG. Does the concentration of this many solar disks in a given area increase the general heat of the area?

Mr. LIDEN. No, it actually doesn't. If anything, it reduces the heat. What we're doing is, we're concentrating heat energy that otherwise would be hitting the surface of the Earth——

Senator CRAIG. So, you're actually creating shade patterns here.

Mr. LIDEN. So, we're actually creating some shade patterns.

Senator CRAIG. I see. So, my recommendation to you is, if you would lift the chainlink fence 6 inches above the ground so the desert tortoise could move under it, you would not be creating an obstructive environment for the desert tortoise, nor would you be taking away from him 11 to 13 square miles of habitat.

Mr. LIDEN. Well, we fully intend to do that. The purpose of the perimeter fencing is for insurance purposes.

Senator CRAIG. Sure.

Mr. LIDEN. But we don't intend to put it with the blockage so that these little critters that are crawling around on the ground, the lizards and the desert tortoises and so on, won't be able to get through. We will have, during the construction phase, probably a need to put a more restrictive type of a fence around the specific area where we've got construction vehicles and cranes and things

like this. But once the area has been built out, then we will actually open up and put the conventional, sort of, 6-foot chainlink fence around, and that—that will also have to be solar-lit. We'll have, probably photovoltaic panels and so on to provide lighting so that somebody riding through on the desert in the middle of the nighttime on one of their off-highway vehicles doesn't run into the fence.

Senator CRAIG. Good idea.

Well, gentlemen, my time is up, and I've kept you long enough. Let me thank you all for your testimony. I think you have brought phenomenally valuable information to the committee today, and to the agencies involved. Agencies have been here listening to your testimony. And I appreciate that very much.

I think the reality is, as was well stated, what you do, you do in an environmentally sensitive way, and that, of course, is in direct connection with all of the stakeholders and the Federal agencies involved, where there's Federal land. I think, also, Bernie, where you're self-contained, the rest of the industries represented here need to be connected. And all of this fits, and fits amazingly well. What many people don't realize is that a large portion of downtown Boise, Idaho, is heated geothermally, and has been for a long time. And that grows with a resource that is a very quiet and clean resource. And that's the very kind of thing you're talking to, Bernie. It isn't just the generating of electricity, it's the kind of space heat and other uses that is extremely valuable in lower temperatures than might otherwise be envisioned by the industry itself, and that can localize it in many instances.

So, we want to thank you all for being here.

I hesitate to give you the last word, Bernie.

Mr. KARL. Just one quick thing, if I could, sir.

Senator CRAIG. Certainly. Go right ahead.

Mr. KARL. I built a powerhouse big enough to hold 20 megawatts. So, the concrete's poured, the building's built. This is the first two turbines. Next year, we hope to have a megawatt—1-megawatt turbine, that hasn't been designed yet. With United Technologies' help and with your help—if you put a bigger budget in with your help, we'll put 20 1-megawatt turbines, Golden Valley, our local utility, has agreed to run the high line. And the high line—they're doing the study on it now. There's actually a letter that I didn't get in here in time to be part of the record. But if——

Senator CRAIG. If you want to send it to us, though, we'll be happy to include it.

Mr. KARL. I will do that, sir.

And so, we will be connected. Golden Valley is a very forward-thinking utility. They want to be—have 50 percent of their grid on alternative energy in 50 years, and they're going to do it in 20 megawatts. That'll be from Chena Hot Springs. And all the reports showed, from back—you know, you talk about technology—they said that Chena Hot Springs would never be able to produce any electricity. Boy, were they wrong. We've drilled 21 holes there. We have her drilled like Swiss cheese. And I bought two of my own drill rigs, and I can tell you that the most important thing you can do is drill a hole.

Senator CRAIG. Okay. Don't get the volcanists upset.

With that, gentlemen, thank you very much for your testimony. The committee will stand in adjournment.

[Whereupon, at 4:35 p.m., the hearing was recessed, to be reconvened on July 17, 2006.]

HYDROGEN AND FUEL CELL RESEARCH AND DEVELOPMENT

MONDAY, JULY 17, 2006

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:33 p.m., in room SD–366, Dirksen Senate Office Building, Hon. Lamar Alexander presiding.

OPENING STATEMENT OF HON. LAMAR ALEXANDER, U.S. SENATOR FROM TENNESSEE

Senator ALEXANDER. The Energy Subcommittee hearing will come to order.

Senator Domenici is on his way. Senator Bingaman's expected to be here. There may be other Senators, but I think we'll try to start on time.

The purpose of this hearing is to take a look at the implementation of the Energy Policy Act provisions on hydrogen and fuel cell research and development. In fact, this is another in a series of Monday afternoon hearings that we've been having this year, during 2006, to make sure that we know what's happening with the provisions of the Energy Policy Act that were enacted last year.

This should be an especially interesting hearing, because it's talking about a possible substitute for the internal combustion engine by the use of hydrogen fuel cells. And, as the price of oil heads toward $80 a barrel and the crisis in the Middle East—people talk about the possibility of $4-a-gallon gasoline—as we see the price of gasoline four times as high as it was in 1997, anything that has promise for reducing our dependence on oil from overseas is welcome.

The United States uses about 25 percent of all the energy in the world. The transportation sector uses the largest amount of our oil. And so, focusing on the transportation sector is what we're primarily going to do today.

In his 2003 State of the Union speech, President Bush announced the creation of a new Hydrogen Fuel Initiative which built on the FreedomCAR Initiative announced in 2002. Together, these two initiatives will develop the technology for a hydrogen-based transportation economy.

Now, a hydrogen-based transportation economy holds out the possibility that automobiles and other vehicles might be able to operate with a different kind of engine, one that uses hydrogen and only emits water at the end. So, that's a very tantalizing prospect

for those who are interested in using less foreign oil, or less oil of any kind, and who are concerned about clean air, as all of us are. This is a real prospect. At least that's what I hear from the American automobile industry. And we have representatives of that industry, both of the automobile manufacturers and suppliers, here today. It's also a real prospect, from what I hear, from people around the world.

General Motors will be testifying today about its progress with hydrogen fuel cells. We welcome that. A couple of years ago, in Yokohama, I went to a hydrogen filling station, where there were hydrogen fuel cell prototype SUVs for nine different automobile companies. And each of them were hard at work on this. General Motors is not the only company interested. Ford and DaimlerChrysler are, as well. Nissan is spending $700 million a year on hydrogen fuel cell research. And Toyota has said that it expects to have a commercially available car perhaps as soon as 10 years from now.

Title VIII of the Energy Policy Act of 2005 authorizes an ambitious program of research, development, and demonstration of hydrogen and fuel cell technologies. It provided over $3.2 billion in authorizations for hydrogen and fuel cell programs.

The National Academy of Sciences has stressed the need for more emphasis on basic exploratory research that could yield breakthroughs in hydrogen production and storage. And the Department of Energy, from whom we'll be hearing in a moment, has responded by expanding the hydrogen program in the Office of Science, and has requested $50 million for fiscal year 2007 to fund basic research efforts, an increase of $17 million over fiscal year 2006. We still need major technological advances to ensure hydrogen can be affordable, safe, cleanly produced, and readily distributed. And we believe it's important to include all participants—the energy companies, the automotive industry, the suppliers, the Department of Energy, everyone who makes automobiles in the United States and others—as we address these changes.

Today's hearings will be focused on what the next steps should be, what the Government can do to create an environment for the possibility of a hydrogen economy to succeed, to talk about obstacles that may stand in the way of a hydrogen economy, and to talk about how we might bring down the price of hydrogen. Those are some of the questions.

We have an excellent panel, and we'll look forward to hearing from them. They include the Under Secretary of Energy, David Garman. Dr. Byron McCormick, executive director of fuel cell activities for General Motors is here. Tim Leuliette, the president and chief executive officer of Metaldyne, Incorporated, in Plymouth, Michigan, is here, a supplier of the automotive industry. Dr. Don Paul, vice president and chief technology officer for Chevron Corporation, and Jim Balcom, president and chief executive officer for PolyFuel.

So, it is a distinguished group. And the first panel includes one person, the Honorable David Garman, the Under Secretary of Energy.

Mr. Garman, I'll ask you to perhaps summarize your testimony in 7 minutes or so. Take the time you need. We'd like to hear from you, whatever your thoughts are.

It's good to be joined by Senator Thomas, and I'll ask him if he has an opening statement that he'd like to make.

STATEMENT OF HON. CRAIG THOMAS, U.S. SENATOR FROM WYOMING

Senator THOMAS. Thank you, Mr. Chairman. Very briefly.

Good morning, Mr. Garman—or—morning—it's not morning. It seems like I left Wyoming not too long ago. But, in any event, I'm glad we're having this hearing today. And, Mr. Chairman, thank you for doing it. We obviously depend heavily on foreign countries for our energy. And so, hydrogen presents an opportunity to reverse that trend somewhat.

We need to pursue, I think, our options in the short term. This whole energy thing is tied to two things, of course. One is, 15-20 years from now there will be lots of different opportunities out there, but the fact is we have needs this year, next year, and 5 years from now. And what we're talking about here are things that we pretty much know how to do, maybe not as sophisticated as we will sometime in the future, but the fact is that we do know how to do this and to produce hydrogen domestically and cleanly. I'm interested in the opportunities to do it through coal gasification. And we're prepared to do that, as a matter of fact. And some of the incentives are in the bill—are in the policy. They haven't been implemented yet through the bureaucracy, but there's people prepared to move forward on this. And, of course, coal being our largest fossil fuel, why, this is an opportunity for us, I think, to do some things.

In any event, the administration's doing some good work on this. I hope we can continue to pursue it and get some incentives out there for the private sector to get moving on the thing.

Thank you, Mr. Chairman.

Senator ALEXANDER. Thank you, Senator Thomas.

Mr. Garman.

STATEMENT OF DAVID GARMAN, UNDER SECRETARY OF ENERGY, DEPARTMENT OF ENERGY

Mr. GARMAN. Thank you, Mr. Chairman. I must begin by thanking this committee for its leadership, and the Congress, as a whole, for passage of title VIII of the Energy Policy Act of 2005, the so-called hydrogen title, containing requirements that we research, develop, validate, and demonstrate hydrogen technologies. And thank you for this opportunity to update the committee on the progress we have made, the challenges we face, and how we intend to overcome those challenges to enable a hydrogen economy.

Since the President launched the Hydrogen Fuel Initiative in 2003, we've made substantial progress toward our technical goals. For example, our research has reduced the high-volume cost of automotive fuel cells from $275 per kilowatt in 2002 to $110 per kilowatt in 2005. We've doubled the lifetime of the automotive fuel stack. We have reduced the cost of producing hydrogen from small distributed natural-gas reformers of a size that could be installed at the corner gas station from $5 per gallon gasoline equivalent to approximately $3 per gallon of gasoline equivalent today. We even appear to be making superb progress on perhaps our most difficult

technical challenge, how to affordably and practically store enough hydrogen aboard the vehicle to power the vehicle for 300 miles without refueling.

Our research program has identified, or developed, some innovative new metal hydrides, chemical hydrides, and carbon-based materials that can store 6 or even 9 percent weight of hydrogen, advancing toward our 2010 and 2015 system targets, respectively. This is significant progress, up from a maximum of 5.5 weight percent a year ago.

In sum, we are on track to meet our 2010 and 2015 technical goals. However, we're not there yet. It is, indeed, an achievement to bring down the high-cost volume of fuel cells to $110 per kilowatt, but we know we must eventually bring the cost down to below $40 a kilowatt to compete with the internal combustion engine. And while we have doubled automotive fuel-cell stack durability from about 1,000 hours to about 2,000 hours, we need to achieve 5,000 hours of durability to achieve parity with today's conventionally powered automobiles.

And while we have brought down the price of hydrogen derived from natural gas to more competitive levels, we know we must do the same for hydrogen from nuclear, renewables, and carbon-sequestered coal if we can ever expect to take full advantage of hydrogen's environmental and energy security benefits, namely, its ability to be produced from a variety of domestically available primary energy resources, and then to produce power for vehicles, stationary power, and other devices with no carbon emissions or criteria pollutants.

And, finally, while it is exciting to successfully identify new materials that appear to be excellent hydrogen storage media, we must still tailor those materials to store and release hydrogen under practical temperature and pressure conditions, and engineer them into an affordable package that can provide consumers with a 300-mile driving range.

We have, indeed, made excellent progress, and most of the credit goes to our partners in the private sector, our national labs, our universities, as well as Congress, for the support that we have received through your appropriations. But that progress must continue if we're to deliver against the President's vision that these vehicles be available in the showroom at a price consumers can afford, by 2020.

The provisions of the Energy Policy Act will help us tremendously in this regard. Apart from codifying our hydrogen and fuel cell research programs, the Energy Policy Act contains important provisions, many of which we have implemented, for coordinating across the Federal Government and for obtaining independent advice on our hydrogen efforts from outside the Department. I'm pleased to report that the Interagency Hydrogen and Fuel Cell Technical Task Force created under the act meets monthly, and, as you may already know, Secretary Bodman announced and selected members of the Hydrogen Technical Advisory Committee just a few weeks ago, on June 20.

The Department has already received critical independent advice in two reviews of the National Academies. In a report of the latest review, released last summer, they recognized our hydrogen effort

as being well planned, and the review committee chair confirmed the program is making significant headway, and that it could have an enormous beneficial impact on energy security and the U.S. economy. Our next review by the National Academies is planned for early calendar year 2007. We're also diligently working on a number of studies and reports required by the Energy Policy Act, and a few more will be finding their way to you very shortly.

Mindful that my full testimony will be included in the hearing record, I'll stop here, and am happy to respond to your questions. But, again, let me thank this committee for its leadership and support in this important work.

[The prepared statement of Mr. Garman follows:]

PREPARED STATEMENT OF DAVID GARMAN, UNDER SECRETARY OF ENERGY, DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee, I appreciate the opportunity to testify on the President's Hydrogen Fuel Initiative. My focus today will be on the provisions of the Energy Policy Act of 2005 (EPACT 2005) which are related to hydrogen and fuel cell technologies, the Department of Energy's activities to support both EPACT 2005 and the President's Initiative, the progress we have made, the challenges we face, and how we intend to overcome those challenges to enable a hydrogen economy.

Hydrogen is an important part of our Nation's strategy for long-term energy and environmental security because it can be made from a variety of domestic resources and, as a transportation fuel, it can result in zero criteria pollutant or carbon emissions from vehicle tailpipes.

Launched in 2003, the President's Hydrogen Fuel Initiative commits $1.2 billion over five years to accelerate the research, development, and demonstration of hydrogen and fuel cell technologies.[1] These technologies may ultimately shift our primary transportation fuel from petroleum, which is increasingly imported, to hydrogen, which can be produced using a wide variety of domestic feedstocks. The development and widespread use of hydrogen can contribute to an abundant, reliable, and affordable supply of clean energy to maintain our Nation's prosperity through the 21st century and beyond.

More than three years after he announced the Initiative, the President's commitment to hydrogen continues to be strong; the $289 million request before Congress reflects a tripling of the budget compared to pre-Initiative levels, and it directly supports the President's Advanced Energy Initiative goal to help break our Nation's dependence on foreign energy sources and our addiction to oil.[2]

The Department of Energy Hydrogen Program supports the President's vision. Our research focuses on pathways to produce and deliver hydrogen from diverse and domestic, fossil, nuclear, and renewable resources while also developing fuel cell technologies that can significantly decrease vehicle greenhouse gas emissions compared to today's vehicles. At the highest level, our program goals and targets are set to ensure that hydrogen fuel cell technologies will be competitive with the projected performance and cost of vehicles and fuels in the United States. For example, our hydrogen cost target of $2.00-$3.00 per gallon gasoline equivalent, untaxed, ties directly to Energy Information Administration gasoline price projections. This would enable the cost of hydrogen at the pump to be equivalent on a cost-per-mile basis to the estimated cost of operating vehicles on gasoline. Similarly, the cost of an automotive fuel cell system must be competitive with the cost of an internal combustion engine drivetrain—$30/kW.

We commend this Committee and the Congress for its strong support of the Hydrogen Program, as demonstrated in Title VIII of the Energy Policy Act of 2005. Title VIII includes requirements that very clearly align with our plans to research, develop, validate, and demonstrate hydrogen technologies. It also includes important provisions, which we have implemented, for coordinating across the Federal Government and for obtaining independent advice on our hydrogen efforts from outside the Department. I am pleased to report that the Interagency Hydrogen and Fuel Cell

[1] Office of the President. "Hydrogen Fuel: A Clean and Secure Energy Future." 30 Jan. 2003. Available on the Web at http://www.whitehouse.gov/news/releases/2003/01/20030130-20.html.

[2] Bush, George W. "2006 State of the Union Address." Capitol, Washington. 28 Jan. 2003. Available on the Web at http://www.whitehouse.gov/stateotheunion/2006/.

Technical Task Force meets monthly, and, as you may already know, Secretary Bodman announced the selected members of the Hydrogen Technical Advisory Committee just a few weeks ago, on June 20.

The Department has already received critical independent advice in two reviews of the National Academies. In a report of the latest review released last summer, they recognized our effort as being well-planned,[3] and the review committee chair stated that the program "is making significant headway" and "it could have an enormous beneficial impact on energy security and the U.S. economy." Our next review by the National Academies is planned for early (calendar year) 2007.

EPACT 2005 requires a number of studies and reports to determine the impact of hydrogen and fuel cell technology deployment. A report mandated under section 1812 of EPACT 2005, the *Solar and Wind Technologies for Hydrogen Production Report to Congress,* published in December 2005, provides information on solar and wind hydrogen projects and recommendations for promoting the availability of solar and wind technologies for production of hydrogen. Section 804 of EPACT 2005 mandates submission of a coordinated five-year plan for the programs authorized under Title VIII. This report is currently under review and will be submitted to Congress shortly.

Over the next year, the Department will focus on completing other hydrogen-related reports required under EPACT 2005. In section 1819, the Department is required to submit a report evaluating the methodologies used to establish goals and milestones for the Hydrogen Program. By February 2007, the Department will report on a study, required in section 1820 of EPACT 2005, of the likely effects of a transition to a hydrogen economy on overall employment in the U.S. The Department issued a competitive solicitation and recently made an award for the completion of this study. The Department will utilize the expertise of the National Academies to complete a study required by section 1825 to provide. a budget roadmap for the development of fuel cell technologies and a transition from petroleum to hydrogen in a significant percentage of the vehicle fleet.

We have made notable progress in the three years since the start of the President's Hydrogen Fuel Initiative. Our research has reduced the high-volume cost of automotive fuel cells from $275 per kilowatt in 2002 to $110 per kilowatt in 2005.[4] DOE-funded research has also doubled the lifetime of the automotive fuel cell stack. We're not at the end-point yet, however. Further research is required to meet our ultimate cost target of $30 per kilowatt and our durability target of 5,000 hours, which is equivalent to the vehicle lifetime that drivers expect today. In FY 2007, the Department will initiate new projects in several areas, including improved fuel cell membranes, cold-weather start-up and operation, advanced cathode catalysts and supports, innovative concepts, and the effects of impurities on fuel cells. Through our investment in these competitively-awarded projects, we expect to make even greater progress in improving fuel cell performance and durability and lowering cost, moving closer toward achieving those ultimate technical targets.

Developing storage technology to carry hydrogen on-board, while still meeting vehicle performance and cost requirements, is one of the most technically-challenging barriers we face. To address the critical need for improved on-board hydrogen storage, the Department has developed a diverse portfolio through three Centers of Excellence and independent projects in both applied and basic science. Together, these efforts tap into vast technical expertise at about 40 universities, 15 companies, and 10 Federal laboratories.

These projects are beginning to produce promising results, with innovative materials being developed in different areas such as metal hydrides, chemical hydrides, and carbon-based materials. Some of these materials can store 6- to even 9-percent by weight of hydrogen, our 2010 and 2015 targets, respectively. This is significant progress, up from a maximum of 5.5 weight percent a year ago. The next step is to tailor these materials to store and release hydrogen under practical temperature and pressure conditions.

Further research on materials and systems engineering is required to meet our hydrogen storage system target to provide consumers with a 300-mile driving range. To help ensure we can meet this aggressive goal, the Department's basic research is carefully coordinated with our applied research in materials development for hydrogen storage.

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[3] National Academies of Science. "'Clean' Vehicle Research Initiative on Track, But Many Challenges Ahead." 2 Aug. 2005. Available on the Web at http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=11406.

[4] Cost Analysis of PEM Fuel Cell Systems for Transportation, September 30, 2005, Carlson, E.J., et. al., Tiax, LLC.

We are also analyzing transition scenarios on how the Nation might initiate early hydrogen production and delivery infrastructure development as vehicle market penetration ramps up, and we plan to submit a transition analysis report to the National Academies in March of 2007. We are pursuing "distributed" options for reforming renewable fuels, such as ethanol, as well as natural gas, to produce hydrogen on-site at the fueling station. This distributed scenario can also be used for on-site electrolyzers that use electricity to split water into hydrogen and oxygen. These methods provide an alternative to large infrastructure investments in a hydrogen delivery system before there are large numbers of hydrogen vehicles on the road.

In terms of hydrogen production, we have already been successful in reducing the cost of producing hydrogen from natural gas—from $5.00/gallon gasoline equivalent (gge) to approximately $3.00/gge today. This status for cost is currently being verified by an independent panel that will release its results later this summer.

We fully recognize that producing hydrogen from natural gas is not a strategy for the long term. All four Department offices that comprise the Hydrogen Program—Energy Efficiency and Renewable Energy, Nuclear Energy, Fossil Energy, and Science—are working together to pursue revolutionary approaches to hydrogen production. For example, heat from nuclear reactors or solar energy can be used to split water into hydrogen and oxygen, with no carbon or criteria emissions. In our nuclear-based hydrogen program, we plan to complete the assembly and preliminary testing of a laboratory system using nuclear heat to drive thermochemical cycles that split water to produce hydrogen. In another approach using nuclear energy, we will demonstrate hydrogen production from a high temperature electrolysis system that is more efficient than the electrolyzers used today.

By 2010, the Department anticipates completing integrated laboratory-scale experiments of thermochemical cycles and high-temperature electrolysis technologies for producing hydrogen with nuclear energy to confirm technical feasibility of the closed loop processes. Results of these experiments will inform the selection of the high-temperature hydrogen production technology required by EPACT 2005 by the end of FY 2011. For the process or processes selected for further development, design activities will be initiated by 2011 for pilot-scale experiments at higher power levels to evaluate scalability of the processes for eventual commercial use.

Also, in a separate activity in support of EPACT 2005, the Department has received industry proposals to conduct a feasibility study of how to produce hydrogen using small-scale equipment at existing nuclear reactors. If the Department selects any of the proposals, it will partner with industry for up to three years to examine the economics of producing hydrogen at an existing reactor, the environmental effects, and the regulatory requirements.

Other high-risk, high pay-off production approaches also involve harnessing the huge potential resource of solar energy. Through a collaboration of our basic and applied research programs, we are developing "photobiological" hydrogen production technology that uses micro-organisms to produce hydrogen and "photoelectro-chemical" hydrogen production technology, in which solid state devices convert photon energy into hydrogen. These approaches may be up to 25 years away from maturity but offer great promise for fully sustainable hydrogen fuel production without environmental impact.

In our coal-based hydrogen program, we plan to scale up membrane reactors for separating carbon dioxide and hydrogen gas streams for zero emission fuel cell vehicles and pollution-free power production. This research is closely coordinated with our FutureGen effort to create the world's first coal-based near-zero atmospheric emissions power plant to produce electricity and hydrogen, incorporating clean coal and carbon sequestration technologies.

We are also demonstrating hydrogen technology in vehicles that are on the road today. Through "50-50" cost-shared partnerships with the automotive and energy industries, four teams are installing hydrogen refueling stations and putting fuel cell vehicles on the road to test the technology as integrated systems in real-world conditions. Through this "National Hydrogen Learning Demonstration," we are collecting data on vehicle performance, durability, and fuel economy and feeding it back into our research program to ensure that we remain focused on the most relevant problems. Consistent with the President's Management Agenda, the results we plan to report later this year will provide a transparent "risk assessment" that allows Congress and taxpayers to evaluate progress toward meeting our established performance-based goals.

As mentioned, hydrogen is critical to our Nation's strategy for long-term energy and environmental security. Developing hydrogen technologies that can be manufactured domestically should improve our economic competitiveness as well. Our manufacturing research and development effort is new in FY 2007 and will address the need for high-volume manufacturing processes for components such as those used

in fuel cells that are currently hand-built. These processes are important to lowering the costs of fuel cells and developing a domestic supplier base. Establishing an early supply base for fuel cell applications such as portable; stationary, remote, and emergency back-up power also lays critical groundwork for the much larger supply chains needed for automotive applications. In January, Secretary Bodman released for public comment a draft roadmap on manufacturing research for the hydrogen economy. This roadmap is being finalized and will be the foundation for executing this important research.

Finally, since the Hydrogen Fuel Initiative was unveiled in 2003, investments have been made not only at the Federal level but also at the state and local levels. From Aiken, South Carolina, to Golden, Colorado, to Sacramento, California, hydrogen research facilities and infrastructure investments have demonstrated a long-term commitment to hydrogen and the beginnings of the hydrogen economy. These diverse investments increase our probability of success in solving technology barriers and in enabling industry to not only make fuel cell vehicles that consumers will want to buy, but also invest in hydrogen refueling infrastructure that is profitable and addresses the root cause of foreign oil dependence and greenhouse gas emissions.

This concludes my testimony, and I would be pleased to respond to any questions you may have.

Senator ALEXANDER. Thank you, Mr. Garman. We appreciate your coming. Your full statement will be included in the record.

We've now been joined by the chairman of our full committee, Senator Domenici, and the ranking member, Senator Bingaman. And Senator Thomas and I each had a chance to make an opening statement. Would you like to go first Senator Domenici, and then Senator Bingaman?

STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. Senator Alexander, Senator Bingaman, first of all, I am very pleased that you're holding this hearing. It is a terribly exciting and apropos hearing about an initiative that is just earthshaking when you consider what could happen if this does work. My opening remarks are basically that kind of statement, excepting I am clearly aware of the fact that title VIII of the Energy Policy Act laid out a balanced R&D program to develop fuel cells for vehicle stationary and portable applications. The President's request for a hydrogen initiative was $289 million this year, and we hit that mark in the Energy and Water Appropriations Subcommittee, as you indicated. That was my subcommittee, and I'm pleased to tell the committee that, and I think you know that. I think it's a very worthwhile expenditure, especially when you consider the marriage that is occurring outside of the Department with those who are putting up their own money, initiative, drive, experience, et cetera.

But even with this level, over a quarter of a billion dollars, we know we cannot support every possible fuel cell technology for every possible application, and we have to have priorities, and that means we get people and institutions who feel let down and who feel like they have a lot to complain about. And they might. They may be right, and those who made our decisions may be less right. But, nonetheless, everything is being done, we think, in good faith and pursuant to good, sensible rules.

So, with level investment, over a quarter of a billion annually, we know we cannot support everyone, as I indicated, but we're trying to do it in a way to give it the best chance of success.

I'm hopeful that today's witnesses are going to advise the committee on whether we are achieving the right balance among the technologies, and I know there is an ongoing argument about research on technologies that are fixed and technologies that are mobile as it applies to the particular fuel cell. We can't resolve that. Both are needed. But we can talk about it and see if there's anything we have to do to make adjustments.

Thank you for conducting the hearing, Senator Alexander. In the usual sense, the committee is heavily indebted to you, and I'm pleased to come and join for a few minutes just to make sure that everybody knows that, on a nonbusy day, we are busy.

Senator ALEXANDER. Thanks, Mr. Chairman. And I had said a little earlier that this was another in a series of hearings that have been held on Monday afternoon for oversight on the Energy Policy Act of last year to make sure that it's beginning to work.

Senator Bingaman.

Senator BINGAMAN. Mr. Chairman, I appreciate you having the hearing. I did not have an opening statement. I'll just wait to ask some questions.

Thank you.

Senator ALEXANDER. In that event, I'll ask a few questions. We'll take 5 minutes each.

Mr. Garman, in your testimony, you described—at least in your written testimony—the importance of high-risk, high-payoff research on hydrogen production technologies such as photobiological production. I wonder what fraction of the hydrogen program's budget supports high-risk—what you would call high-risk research.

Mr. GARMAN. That's a difficult question to answer, in the sense that Federal R&D, by its very nature, is the sort of research that one would not expect the private sector to do by itself. There's not going to be a financial return on investment in the near term. So, in one sense, depending on one definition, everything we do is high-risk research. However, there are clearly some elements, particularly when we're talking about hydrogen production, that we see as more near term. We think that photobiological—or photolytic-type methods of making hydrogen are probably a ways away. And so, we're mindful of that. And, therefore, we balance that with shorter-term efforts that focus on natural gas, on coal, on nuclear, and some of the things that can make contributions sooner, rather than later. So, we think we have a balance between the very long term and things that we expect, and need, to come into play in the 2015-and-beyond timeframe.

Senator ALEXANDER. To follow that up, this committee stimulated a report from the National Academies of Sciences that Norm Augustine chaired in which 70 Senators have cosponsored here, and one of the recommendations of the Augustine Report was that 8 percent of research funding be set aside for high-risk research, including, if I remember right, in the funds of the laboratory directors. Do you agree with that? And, if you don't, why not?

Mr. GARMAN. I would say that our percentage is probably higher than that, when you're talking about the hydrogen program, that this is a high-risk, high-reward proposition. And in an answer for the record that I would like to provide to you, I'd like to enumerate,

in some greater detail, the elements of this program that we do regard as high risk.

[The information follows:]

Several technical challenges must be overcome before hydrogen and fuel cell technologies can meet consumer requirements and be widely commercialized. High-risk research and development (R&D) is required to address the complex and demanding technical and cost requirements needed for commercial viability. This type of R&D is considered too risky an investment for industry to handle alone. Therefore, one could maintain that the Department of Energy's entire Hydrogen Program is a high-risk research area. However, within the Program, there are some elements that are more challenging than others. These involve materials R&D to overcome several challenges. High-risk areas are being addressed through basic and applied research and technology development projects that comprise over 85 percent of the Program's funding. Specific examples of high-risk research include:

(1) Novel hydrogen storage materials to enable at least 300-mile vehicle range

Current "learning demonstration" vehicles have ranges of 120 to 225 miles and use high pressure or liquid storage tanks which may be acceptable for some vehicle platforms. However, hydrogen storage technologies are needed that do not compromise passenger or cargo space and are applicable to many light-duty vehicle models for widespread market penetration. High-risk/high-payoff applied R&D is being conducted to discover *completely* novel materials that can store large amounts of hydrogen at *low* pressure while meeting all weight, volume, cost, safety, and other requirements. Basic research is aimed at greater understanding of hydrogen interactions in materials to enable the design of storage materials with higher capacities and more practical operating characteristics.

(2) Membranes and catalysts for fuel cells to enable lower cost and increased durability

The membrane-electrode assembly (MEA) is the most costly component of the fuel cell and plays a critical role in the durability and performance of fuel cell systems under a range of conditions. Novel, low-cost membranes and catalysts are needed, particularly non-precious metal catalysts to address cost and availability of such materials. R&D is also required to develop a greater understanding of degradation behavior to enable improved MEA design.

(3) Membranes and catalysts for producing low-cost hydrogen from a variety of domestic resources

Reforming and water-gas-shift catalysts with higher activities as well as improved separation membranes are needed to lower the cost of producing hydrogen. Improved catalysts are also needed to increase the efficiency and reduce the cost of photoelectrochemical hydrogen production. Materials research is critical to developing solar and nuclear thermochemical hydrogen production. Another area of high-risk/high-payoff research is in understanding pathways by which hydrogen is made and processed in living organisms to enable breakthroughs in photobiological and biological reactor technologies. Nanoscience is also applicable to virtually all the high-risk areas in the Program.

Senator ALEXANDER. We would welcome that.

One other question. One of the witnesses in the second panel, Mr. Tim Leuliette, is an automotive supplier representing that large group of people. I know, in our State of Tennessee, we're very grateful for the General Motors Saturn plant for the big Nissan plan and the engine plant. Together, they may employ 11,000 or 12,000 people. But the suppliers—there are 800 or 900 suppliers of various kinds—they employ 150,000 people. So, they're important, as well.

Mr. Leuliette says in his testimony that the auto supplier companies are not direct participants in the FreedomCAR Program. I know you haven't heard his testimony, but I wondered, if that's true, why they're not.

Mr. GARMAN. Well, let me say, at the outset, that if I'm looking at the total fiscal year 2006 funding of $234.5 million, and look to where that funding went, the automotive manufacturers, Ford,

Daimler/Chrysler, and GM, got roughly 5 percent of the funding, and the industry suppliers, the tier 1, 2 and 3 suppliers, got 24 percent of the funding. So, they clearly are a participant in the R&D activities. I did read his testimony, and I do understand his point. What he is saying is, they are not direct participants in the FreedomCAR partnership, which is comprised, on the automotive side, by members of USCAR. And part of that's just a practical consideration. There are, as you point out, thousands of tier 1, 2 and 3 automotive suppliers. And how to gather them in a room in such a manner to, you know, have a useful exchange of views is a difficult proposition. But our doors are open to them to comment on pre-solicitation announcements, on go/no-go decisions, and on every other realm that they choose to participate in. And that's our goal. We want to hear from as many folks as we can.

Senator ALEXANDER. Well, I would encourage that.

My time is up.

Senator Thomas.

Senator THOMAS. Thank you.

In order to benefit from a transition to the hydrogen economy, we have to produce gas cleanly and domestically. What do you know about the HydroMax technology for coal gasification to produce hydrogen, electricity, and other products? Is the Department of Energy actively researching and developing those things?

Mr. GARMAN. The Department of Energy is actively researching and developing different methods of coal gasification. I'm not familiar with—and I may be familiar with the specific technology you've mentioned, but perhaps not by that name.

Senator THOMAS. I see.

Mr. GARMAN. But we clearly view coal gasification as a very important—if memory serves, we have a total hydrocarbon endowment in this country of something exceeding 9,000-billion barrels of oil equivalent, a lot of which is in the form of coal. And if we want to use that in a manner that can replace gasoline without adding to the carbon dioxide burden in the atmosphere or criteria pollutants in our cities and towns, hydrogen and gasification of that coal to make hydrogen is a very important technology, and we are—we're looking at that very, very closely, and spending money on it, on a daily basis. And I can give you a breakout of what we have spent on these different technologies, if you care.

[The information follows:]

The total fiscal year 2006 funding (in adjusted budget authority) on coal gasification related research to produce hydrogen, electricity and other products is $95,341,000, and is broken out as follows:

FutureGen: $17,820,000
Advanced Integrated Gasification Combined Cycle: $55,886,000
Fuels (Hydrogen from Coal): $21,635,000

Senator THOMAS. Well, there's different ways of doing things, as you know. I visited the plant down in Florida where they're doing this sort of thing, and they could make some small steps and produce hydrogen out of that, as well. Wyoming's applied for—along with several other States—to host the Department's FutureGen. How much coordination exists between FutureGen program and the hydrofuel?

Mr. GARMAN. A great deal of coordination. The very technologies that one would see in a FutureGen plant—the gasifier, the gas cleanup train—are the same technologies that one would use to produce hydrogen for automotive technologies. So, there is a great deal of coordination going on. Part of the value of this program—and it was, frankly, something new for us at the Department, in that it broke down the stovepipes of having the Office of Fossil Energy, the Office of Energy Efficiency, the Office of Science working together on a common hydrogen posture plan. We have published a version of the posture plan in the past, and we owe the Congress a newer version of that posture plan now, and hope to get it to you soon.

Senator THOMAS. That's good. You know, sometimes you get a little concerned as we move toward some of these things. There's sort of the chicken-and-the-egg thing, and we tend to be focused on the laboratory type of business. And understanding that R&D needs to be done, we need to focus on the infrastructure and the vehicles and the motives to cause the private sector to be able to produce and do some of the things we already know how to do. And there seems to be some delay in implementing some of the incentives that we have out there that we put in the energy bill. Do you hear that?

Mr. GARMAN. I don't know that I would, at some peril here, fully agree with that. I think that we have laid out a very detailed program plan of technical obstacles that need to be overcome, a plan that was developed in concert with both the automotive companies and the fuel suppliers, who would have to develop both the vehicles and the refueling infrastructure to understand what sorts of technologies we have to deal with. Don Paul's testimony, on the next panel, makes a brilliant point about the differences between petroleum and hydrogen, and how the infrastructure situation is a bit more complicated. So, we have some technical obstacles to overcome, and we think that we're going to need some time. I will also tell you that we have been asked in the past, "How could we speed this up?" And we've been asked by folks from the White House to the Congress and elsewhere. And the answer is, we need time, and we need that as much—you know, more money doesn't necessarily help. There is a learning process that needs to happen.

Senator THOMAS. I understand that. But, of course, as you know better than I, we're increasingly needing to move. As the price of oil goes up, as the controversy goes on in the Middle East, and so on, why, we have some incentives to move along, and we can't let our laboratory people just go on doing these tests forever.

Mr. GARMAN. I absolutely agree with you, Senator. And it was our intention from the outset that we would not let this become just another government R&D program, and that we had measurable results and a timeframe.

And let me add—I know our time is short, but our efforts on biofuels, advanced hybrid engines, plug-in hybrids, these are things that we're doing to advance technology in the near term, knowing that the hydrogen is going to take some time. And we think that this is a balanced program and a balanced approach.

Senator THOMAS. Thank you.

Senator ALEXANDER. Senator Bingaman.

Senator BINGAMAN. Thank you very much, Mr. Chairman.

Secretary Garman, let me thank you for your work. I wanted to focus on stationary power production from fuel cells. I visited a small company out in California a few months ago that is in the business of—they've developed a relatively small fuel cell production unit to produce power which they believe is commercially viable. But what they need are someone to buy it. I mean, they need some people to place orders for this. And they were asking me, "Where is the Government, as the first adopter? Why can't the Government agree to assist us in getting from the prototype, which we now have several of, to the manufacturing lines so that we can turn out a few hundred of these and not just go further in debt to do so?" What is available—I know we have a provision in the bill that was passed last year. I think it's section 783, Federal procurement of stationary, portable, and micro fuel cells. What is the status of our efforts, or our programs, to actually procure some of these that are ready to be sold if there would just be someone to buy them?

Mr. GARMAN. Well, let me first make the point that there are manufacturers producing stationary fuel cells that are being sold today. Verizon is a big purchaser of stationary fuel cells for backup power and continuous high-quality power. So, there are buyers, and there are sellers in the market today. And those who are willing to pay more for fuel cells can do so to get value to these purchasers that they can't get from grid-supplied electricity.

Section 783 is something that we are looking at and evaluating, and, in fact, are conducting studies with our interagency task force to evaluate the most promising near-term applications. And we're considering how we might integrate such Federal procurements into our existing efforts. This is something where we want to help Federal purchasers of fuel cells purchase fuel cells, if they're ready to do so. And, of course, section 783 allows us the opportunity to foot the bill for that Federal agency for the difference in the price of the fuel cell and what they might otherwise be able to procure. We have not, to date, sought funding to procure large numbers of fuel cells, nor have we been appropriated funds to do so yet. But it's something that we're open to. I have to put in this note of realistic caution. Given the limits to our discretionary spending, we believe it's important for us, at this juncture, to focus on meeting our technical targets that are likely to help us achieve our ultimate objectives. But we're mindful of the provision, and we're looking for opportunities where the Federal Government might purchase more than they're purchasing today.

Senator BINGAMAN. In a similar vein, let me ask about an issue that's not directly the subject of this hearing. About 5 or 6 weeks ago, I drove one of the plug-in hybrid cars that they had here beside the Russell Building that get over 100 miles per gallon. And the plea of the people who brought those cars here was, "If we could just get an automobile manufacturer to agree to make some of these, then, you know, this could be a tremendous thing for the country." I spoke to Bill Ford, the head of Ford Company, when he was here at some reception, and I asked him, "Why don't you agree to turn out 1,000 of these or something, and maybe we could get the Federal Government to buy them, just to see if these things

will work?" That's not an exorbitant investment of taxpayer dollars, if the benefit were actually achieved. He did not commit himself one way or another, but basically, I think, indicated something to the effect that he didn't think there was a market for them.

Why can't the Federal Government be the market for things like that? I mean, we're going to continue to talk about plug-in hybrid vehicles for the next 10 years, and still not have any on the road, unless the Federal Government steps up and says, "We'll buy 1,000 of them, or we'll buy 10,000 of them, or something, if you bring them in at a certain cost."

Mr. GARMAN. Well, that's actually the pathway that we're on. A plug-in hybrid vehicle needs a very different kind of battery than a traditional hybrid vehicle. It needs to be a high-power battery. We're looking at lithium ion chemistries, primarily, to meet that need. And some auto companies are working with plug-in hybrid vehicles. DaimlerChrysler and Toyota both are working on these, and others that I might not know about. My knowledge is not complete. But we have brought down the cost of lithium ion battery packs for advanced hybrid applications from about $3,000 to about $1,000, and we need to get it down closer to the $500 level. We've made tremendous progress, and we still have some cost issues. We're looking at durability, and we're looking at calendar life, and we're looking at heat produced by lithium ion batteries.

Now, meanwhile—and the next panel can go into more detail, because they're the experts—but they're also looking very closely at consumer acceptance and cost, and they're learning a great deal in the hybrid vehicle market today. I think plug-in hybrids offers a tremendous opportunity; the President does, as well. He's mentioned them. He has been to plug-in hybrid vehicle battery plants in Milwaukee. And it's something that we're paying more attention to. And when they get close enough—again, this is another opportunity for Federal procurements that makes sense, and we will work that with GSA and through the interagency committees to advance that. Because, you're absolutely right, you need a certain base to give us the operating experience that we need and to give the auto companies the experience they need to understand whether they have a viable consumer product. Because, ultimately, if these technologies, whether we're talking about plug-in hybrids or fuel cells, they have to be adopted on a mass basis. The Government procurements are important to get us down the road, but, ultimately, they need to be a significant portion of the 18 million vehicles that are sold in North America each year.

Senator ALEXANDER. Senator Domenici.

The CHAIRMAN. Well, I want to say, for the record, that I think the generic issue raised by Senator Bingaman of creating a market for these kind of research—quasi-research investments—is important enough for us to do something about, because I think if we just leave things like they are, Senator Bingaman, it'll just be a good subject matter for discussion, because: Who's going to put up the money? I mean, I go through appropriations, and if the administration doesn't ask for it, I'm tempted to do it anyway. But, you know, this isn't cheap, and this isn't without risk, by definition.

So, I think it should be a question of policy. When do you decide that you are going to do this and trigger, in some way, the evo-

lution of a fund? I would be very willing, in a broader sense than just this—but I think you are already, in your mind's eye, way beyond just this, because over the areas that we're looking at with this high price of oil, all these breakthroughs are ready, and they're waiting for somebody to buy the prototype, right? And the prototype is generally very, very expensive. There's no question. So, they're not going to just get out there and buy them; somebody's got to be willing to do it. And we have to figure out whether we've got a role. That's, kind of, what I'm saying in response to your observation.

Mr. Garman, the multiyear roadmap for hydrogen fuel cells specifies a 300-mile range for fuel cell vehicles. Now, data from the Bureau of National Transportation Statistics indicates that the average American driver travels only 40 miles per day. Can you explain where the figure 300 miles originated as the key definition of success and why the Department has adopted it? It's difficult—more difficult when you make it 300 than if you make it 40. It's obvious, if—you know, if you can get 300, it's terrific. Should we be taking a one-size-fits-all approach for fuel-cell fuel range?

Mr. GARMAN. No. And let me answer your question this way. We developed that 300-mile metric in partnership with the FreedomCAR partners, because it was the view of the automotive companies, knowing what they know about their customers, that their customers don't like to go to the fueling station on a daily or twice-weekly basis, and they want to minimize those trips to the station. And when they're traveling a long distance, they don't want to have to stop every 70 or 80 miles or so to refuel.

We have 62 fuel cell vehicles on the road today in our Technology Validation Program. And those vehicles are averaging somewhere between 120 and 225 miles between refueling, which is pretty good. But they're using high-pressure hydrogen storage onboard the vehicle to achieve that kind of range, and that's a generally unreasonable intrusion in trunk and passenger space in the vehicle, and probably unacceptable to the consumers, ultimately, which is why we have been working on solid-state methods of storing hydrogen that will give that kind of range.

There are folks that can, today, deliver 300-mile range on a hydrogen vehicle, but it takes big tanks in the chassis and trunk and possibly passenger compartment to do that, and we think that's just not realistic for a consumer vehicle that my kid will want to buy and drive when he's old enough to drive.

The CHAIRMAN. Thank you very much.

Senator ALEXANDER. Thank you very much, Mr. Garman, for your testimony, and for being here.

Now, I'll invite the second panel to come forward, and we'll look forward to their testimony.

The CHAIRMAN. Mr. Chairman, might I say to David, when you came here and took this job, you were excited about it, wanted to do it very much. Are you still excited about it, and do you still see all that potential out there in front of you?

Mr. GARMAN. Yes, sir, I do. And with the leadership of Secretary Bodman at the Department, and Deputy Secretary Sell, it remains an exciting and energizing place to work, and I'm excited to come to work every day. Thank you for asking.

The CHAIRMAN. Thank you.

Thank you very much, Mr. Chairman.

Senator ALEXANDER. We welcome our four witnesses on this panel. I've introduced them earlier, but I'll introduce them again now: Dr. Byron McCormick, from General Motors; Tim Leuliette, Metaldyne, Incorporated; Dr. Paul, vice president and chief technology office from Chevron; Jim Balcom, president of PolyFuel.

What I'd like to do is to ask each of you to take about 5 minutes, if you would, and summarize your testimony. That would give the Senators a little more chance to ask you questions and have a back-and-forth exchange.

Dr. McCormick, we'd like to start with you and just go right down the line, if we may. Thank you very much for coming.

STATEMENT OF J. BYRON McCORMICK, Ph.D., EXECUTIVE DIRECTOR, FUEL CELL ACTIVITIES, GENERAL MOTORS CORPORATION, DETROIT, MI

Dr. MCCORMICK. Thank you, Mr. Chairman and committee members. Thank you for the opportunity to testify.

I'm Byron McCormick, executive director of GM's fuel cell activities. I lead GM's global fuel cell development effort of hydrogen fuel cell vehicles.

This is a critical time in the history of the automotive industry. Automotive technology is clearly and irreversibly changing. Technologies like our new six-speed and variable-valve-timing active fuel management will incrementally improve the fuel economy of internal combustion engines.

Hybrid technology such as our hybrid transit bus, hybrid pickup, and new Saturn VUE Green Line are saving energy by shutting off the engine and recapturing the energy that's lost during breaking. Two million of our on-the-road flex-fuel vehicles are E85 capable, providing immediate opportunity to replace petroleum with renewable fuels.

Taken together, these technologies will have a definite impact on our consumption of petroleum, but we believe that it is hydrogen and fuel cell technology that provides the greatest opportunity.

We are developing fuel cell propulsion systems that unambiguously can compete head to head with internal combustion engine systems, in terms of performance, durability, and cost once deployed at high volume. And I've got to say, high volume is not the thousand kind of thing. You've got to get into the hundreds of thousands before you really hit those kind of economic breakpoints. We are making great progress and increasingly feeling confident we're going to make our goal. For example, in the last 7 years we have improved the power density of our fuel cell stack by a factor of 14. We have significantly improved, and will continue to improve, fuel cell durability, reliability, and cold-start capability, and honestly believe those will be done in the next few years. We are developing safe hydrogen storage systems that approach the range levels for customer acceptance, and we are making really significant progress on cost reduction as the technology improves, but, more importantly, also with systems simplification.

Today, we are demonstrating our vehicles around the world. Here in Washington, D.C., over 4,300 people have driven our fuel-

cell-powered vehicles. The U.S. Postal Service has delivered over a half-million pieces of mail in northern Virginia. And we have similar demonstrations in ride-and-drives underway in California, Japan, Germany, China, and Korea. We have collaborated with the U.S. Army in demonstrating the world's first fuel-cell-powered full-size military truck. We've created the Sequel, the first fuel cell vehicle capable of 300 miles between fill-ups, which will be demonstrated later this year. And we will field 32 of our next-generation fuel cell vehicles as part of the Department of Energy's learning demonstration.

While we have made dramatic progress towards what I'll call first-generation systems, the real volume and benefits will be realized in later generations of designs and improved technologies.

As a result, we recommend four specific areas for continued U.S. policy development:

First, we would like to see a continued and expanded national R&D initiative—and I want to emphasize, on breakthrough fuel cell materials, hydrogen storage, and hydrogen generation, leveraging the creative capabilities of our government labs, university, industrial research facilities, to help us move quickly to later-generation technologies.

Second, we would like to see the Federal Government articulate a clear, consistent, sustained vision that requires agencies beyond the DOE and DOD to make hydrogen fuel cell technology development and application priority areas of engagement.

Third, even after we succeed in developing competitive fuel cells, the transition to hydrogen will take time. It takes about 20 years to sell enough vehicles to change over the entire U.S. fleet. And since low volume equals high cost in the automotive business, early vehicles, even at moderate volumes, will still be very expensive. So, we face the proverbial "valley of death" for new technologies as we attempt to grow this market. This is where we see the need for creative policies incentive and governments as customers to support the development and market creation of a high-volume-capable supply base.

Fourth, although GM is not in the energy business, we have a keen interest in the pathways to creating and distributing hydrogen and the technology and the economics involved. Hydrogen can be made from all of the same sources that can be used to generate electricity, which gives us the power as a society to choose how we want to produce the energy we need. Fundamentally, we do not see an ultimate barrier to making clean hydrogen at prices that can compete with today's price of gasoline. To date, the development of hydrogen fuel cell technology has primarily been an industry-led initiative, but we also face challenges ahead. Clearly, the Government has an important role to play in helping incentivize, reduce investment risk, and achieve the transition to a hydrogen economy. Low-interest financing, appropriate vehicle purchase incentives, tax credits for investment in job-producing industries such as hydrogen fuel cell automotive supply base, hydrogen generation industry, and hydrogen refueling industry, timed regionally, focused to match the rollout of fuel cell vehicles, will be critical.

These policies will be necessary to support the industry's massive investments in transportation systems, supply base, and fuel infra-

structure. We, at GM, are making a very large commitment in dollars and manpower to create a market-ready fuel cell vehicle as soon as possible. Building clean renewable energy pathways will enable America to reduce its dependence on imported oil, increase our energy security, promote creation of new industries, stimulate job creation and sustained economic growth, and ensure our country's ability to compete on a global basis.

Thank you.

[The prepared statement of Dr. McCormick follows:]

PREPARED STATEMENT OF J. BYRON MCCORMICK, PH.D., EXECUTIVE DIRECTOR, FUEL CELLS ACTIVITIES, GENERAL MOTORS CORPORATION

Mr. Chairman and Committee Members, thank you for the opportunity to testify today on behalf of General Motors. I am Byron McCormick, Executive Director of GM's Fuel Cell Activities. I lead GM's global effort to develop hydrogen-powered fuel cell vehicles.

This is an important time in the history of the automotive industry and of General Motors. The world we live and do business in is changing. Automotive technology is clearly changing. Technologies like our new 6-speed transmissions, variable valve timing, and cylinder de-activation—what we call active fuel management—continue to incrementally increase the fuel efficiency of the internal combustion engine. Hybrid technologies—such as our transit bus hybrid system, our hybrid pickup truck, and our new Saturn VUE Green Line hybrid—are saving energy by shutting off the engine while the vehicle is stopped and capturing energy previously wasted during braking. Our two million already fielded FlexFuel vehicles capable of burning E85 ethanol, and diesels running on biodiesel, provide an immediate opportunity to replace petroleum with renewable fuels. And we continue to track new developments in battery technology and believe these could be relevant in a variety of applications.

Taken together, these technologies will have a definite impact on our consumption of petroleum. But, we believe it is hydrogen fuel cell technology that can make the greatest progress.

At General Motors, we believe this technology will simultaneously increase energy independence and security, remove the automobile as a source of emissions, and allow automakers to create better vehicles that customers will want to buy in high volumes.

GM's fuel cell program is focused on four areas:

- Developing a fuel cell propulsion system that can compete head-to-head with future internal combustion engine systems.
- Demonstrating our progress publicly to let key stakeholders experience firsthand the promise of this technology.
- Collaborating with energy companies and governments to ensure that safe, convenient, and affordable hydrogen will be available to our customers in a timely fashion.
- Working with governments worldwide to ensure that appropriate market conditions and incentives are in place to enable a successful market introduction and subsequent sustainable market expansion.

At General Motors, we are targeting to design and validate an automotive fuel cell system that has the performance, durability, and cost, assuming scale volumes, to compete effectively with internal combustion engine-based systems. We are making great progress in developing the necessary technologies, and are increasingly confident that we will reach our goal by 2010. Achieving marketplace volume, however, will depend on a number of factors beyond GM's or any vehicle manufacturer's control, as I will discuss later.

Technically, we have made significant progress:

- In the last seven years, we have improved the power density of our fuel cell stack by a factor of fourteen. This means that for the same amount of power, our fuel cell is 1/14th as large today as it was seven years ago. This allows it to fit nicely within our vehicles while providing excellent driving performance.
- We have significantly improved, and will continue to improve, fuel cell durability, reliability, and cold start capability—all keys to meeting our customers' expectations.

- We are developing safe hydrogen storage systems that approach the range levels required for customer acceptance, and are exploring very promising concepts for the next generation of storage technology.
- We are making significant progress on cost reduction through technology improvement and system simplification.

Today, we are demonstrating our vehicles around the world:

- Here in Washington, D.C., over 4,300 people have participated in a ride or drive over the past four years. And the U.S. Postal Service has delivered over a half million pieces of mail in northern Virginia. We also have similar demonstrations under way in California, Japan, Germany, China, and Korea.
- We have collaborated with the U.S. Army in demonstrating the world's first fuel cell-powered full-size military truck, which is being evaluated and maintained by military personnel at both Ft. Belvoir and Camp Pendleton.
- We will field 32 of our next-generation fuel cell vehicles as part of the Department of Energy's Learning Demonstration.
- And we created the AUTOnomy, Hy-wire, and Sequel concepts, which show how new vehicle architectures based on fuel cells and hydrogen can reinvent the automobile. Sequel is the first fuel cell vehicle capable of driving 300 miles between fill ups. Later this year, we will be holding test drives to demonstrate the capabilities of this truly impressive vehicle.

The development of technically and commercially viable hydrogen fuel cell vehicles is a team effort, and we are working with key partners on virtually every aspect of fuel cell and infrastructure technology. In addition to the military, some major partners include Shell Hydrogen, Sandia National Lab, Dow Chemical, Hydrogenics, QUANTUM Technologies, and the Department of Energy through the FreedomCar and Fuel Partnership.

GM applauds the Department of Energy and the federal government for its hydrogen infrastructure initiatives. However, in our view, more needs to be done if we are to be ready for fuel cell introduction and the sustainable market growth that we envision over the coming decades.

Four specific areas for U.S. policy development should be considered:

First: While we have made dramatic progress toward a first-generation automotive-competitive system, as with any new technology, the real volume and benefits will be realized in second-generation designs and beyond. As such, we would like to see an expanded national R&D initiative on breakthrough fuel cell materials, hydrogen storage, and hydrogen generation—leveraging the creative capabilities of our government labs, universities, and industrial research facilities—to help us move quickly to later-generation technologies and designs.

Second: We would also like to see the federal government articulate a clear, concise, broadly sanctioned vision that requires agencies beyond DOE and DOD to make hydrogen and fuel cell technology development and application priority areas of engagement.

Clear, consistent, ongoing communication to the American people of this vision and the underlying rationale for hydrogen and fuels cells is also vitally important to building public acceptance of fuel cell vehicles.

Third: Even after we succeed in developing "auto-competitive" fuel cells, the transition to hydrogen will take time. It takes about 20 years to sell enough vehicles to change over the entire vehicle fleet. And, since low volume equals high cost in the automotive business, early vehicles even at moderate volumes will still be expensive, even if our technology can compete at high volume. So we face the proverbial "valley of death" for new technologies as we attempt to growth the market. This is where we see the need for creative policies, incentives, and governments as customers to support the development of the market and creation of a high-volume-capable supply base.

Fourth: Although GM is not in the energy business, as we work to commercialize fuel cell vehicles, we have a keen interest in the pathways to creating and distributing hydrogen, and the technologies and economics involved.

We think about hydrogen like we think of electricity. When we switch on a light, we are usually not thinking about how the electricity is being generated. In most cases, how that is done depends on where we are. We may be drawing on a hydroelectric plant, natural gas-fueled generating station, a nuclear or coal-fired power plant, wind turbines, or even solar cells.

Hydrogen can be made from all the same sources that can be used to generate electricity, which gives us the "power" as a society to choose how we want to produce the energy we need. Each region will evaluate the resources it has available—and, as technology progresses, the economics improve, and societal expecta-

tions for environmental and energy sustainability heighten, different options will become preferable in different locations. We do not see an ultimate barrier to making clean hydrogen at prices that can compete with today's price of gasoline. But, coordinating a successful, sustained market transition will require proper government policies.

So, what is the best way to proceed? To date, this has been primarily an industry initiative, but we're facing a larger challenge than technology development, larger than something a single automotive company or industry can accomplish—the federal government has an important role to play in helping to incentivize and reduce investment risk and achieve a sustainable transition.

The federal government has historically played this role in transportation initiatives that have addressed larger societal needs—for example, in the creation of the transcontinental railroad and the federal interstate highway system. Low-interest financing; appropriate vehicle purchase incentives; tax credits for investment in a jobs-producing U.S.-based automotive supply base, hydrogen-generation industry, and hydrogen refueling infrastructure, timed and regionally focused to match the rollout of fuel cell vehicles; or other meaningful policies are necessary to support industry's massive investments in the fundamental underpinnings of our automotive transportation systems, supply base, and fuel infrastructure.

At GM, we are making a very large commitment in dollars and manpower to create a market-ready fuel cell vehicle as soon as possible. Our fuel cell program expects to develop clean, affordable, full-performance fuel cell vehicles that will excite and delight our customers. We believe that with the support of a well-conceived set of policies to incentivize and sustain market and industry development, our customers will buy these vehicles in large numbers and that society will reap the economic, energy, and environmental benefits.

Similarly, we believe that building clean, renewable energy pathways will enable America to reduce its dependence on imported oil, increase our energy security, promote the creation of new industries, stimulate jobs creation and sustainable economic growth, and ensure our country's ability to compete on a global basis.

General Motors is ready and eager to work collaboratively with government, energy companies, and suppliers to help drive the Hydrogen Economy to reality.

Senator ALEXANDER. Thank you.

Mr. Leuliette.

STATEMENT OF TIMOTHY D. LEULIETTE, CHAIRMAN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, METALDYNE CORPORATION, PLYMOUTH, MI

Mr. LEULIETTE. Mr. Chairman and members of the committee, thank you for this opportunity to testify before you today on the need for this Nation to move quickly to a hydrogen economy.

I am Tim Leuliette, chairman, president, and chief executive officer of Metaldyne Corporation. Metaldyne is a leading global supplier of metal-based components, assemblies, and modules for the transportation industry in the power-train and chassis area.

Let me make it very simple. Ninety-eight percent of all the vehicles produced in this country rely upon us in the engine or the transmission or the chassis, if not all three, for our components, to build their vehicles. We have annual revenues of $2 billion. We have more than 6500 employees in 38 facilities in 14 countries.

I've had the privilege of working in the auto industry for more than 30 years, most of which I spent in the supplier community. I have served as president of Penske Corporation, ITT Automotive, and Siemens Automotive. I also held executive positions at Bendix and various engineering and planning positions at Ford and American Motors. In addition, I am a partner in a private equity fund, which I used to help build Metaldyne in the first place.

In these roles, I have been witness to, and part of, many restructuring strategies, new business models, and makeovers in the automotive industry. These were minor compared to the transformation

our industry is going through today as it grapples with globalization and soaring energy costs.

Remember the term "creative destruction," from economist Joseph Schumpeter? The transformation in creative destruction—this is transformation, in all its glory, in creative destruction. Creative destruction is, according to Schumpeter, the process of replacing good things with better things. The hydrogen economy is the "better thing."

I'm here today to share my views on how we can use this transformation to move more quickly to a hydrogen economy. By doing so, we will boost our Nation's economy, improve the environment, maintain, if not enhance, our national security, and bring jobs to the automotive industry and its supporting infrastructure.

I want to address three issues: first, the need for a national energy policy; second, the role private equity can play in bringing this energy policy to life; and, third, what happens if we don't move quickly to alleviate our dependence on foreign oil.

First, we must create a national energy policy that mandates collaboration with every part of the U.S. auto industry to develop alternative energy such as hydrogen. This energy policy must include suppliers and all automakers, both domestic- and foreign-based, with a strong U.S. presence. Involving automotive suppliers in the hydrogen movement is near and dear to my heart, and it needs to become near and dear to the hearts of all stakeholders. U.S. automotive suppliers are a $384-billion industry. Overall, the U.S. automotive supplier industry employs more than 1.2 million people. There are 2.9 jobs created in the auto industry supply base for every OEM job, meaning that 75 percent of the people employed in the auto industry work for suppliers today.

Suppliers play a key role in automotive R&D and innovation. According to a recent National Science Foundation report, the auto industry spent $16.9 billion on R&D in the United States in 2003. Of that, supplier R&D accounted for 40 percent. So, let me, again, go through the numbers: 75 percent of the employment is in the supplier community, 40 percent of the R&D is done by suppliers, and, by the way, 50 percent of the capital invested in the auto industry is done by suppliers today, and 60 percent of the patents are held by the suppliers today in the auto industry. This is no small group. Under Secretary Garman said we're hard to a hands-on, hard to talk to, we're a large number of people, but we are very focused, and becoming more focused on hydrogen. We are a vast well of knowledge that has yet to be tapped. This is not an oversight, it's just a mistake at times as we extend the timeline to achieve the hydrogen economy.

Attracting private equity is also key to quickly moving the hydrogen economy forward. It is a huge undertaking that cannot be funded by industry alone, the Federal Government alone, or any other group alone. However, there are billions of dollars of capital from private equity that could be channeled into creating the hydrogen economy. Think. This is hydrogen—private equity capital is demanding capital, it is high-expectation capital, but it's the same type of capital that was used to fund the dot-com economy that the industry used once the Government supported the establishment of the basic protocols and framework and goals of the Internet.

In 2004, there was approximately $100 billion of underemployed, private-equity funds in the United States, and 39 billion euros in Europe, according to Alex Partners, a private equity form with substantial investments in the auto industry.

The hydrogen title directed the Secretary of Energy to draft a coordinated plan for the programs that are directly related to fuel cells or hydrogen. This plan could attract substantial interest from private equity as it lays out a solid platform, a strong roadmap and timeline, and provides the underlying stability needed from the Federal Government. We need an energy policy.

Third, if we don't move quickly, we stand to lose not just our jobs and clout in the auto industry, but also our standing as a superpower. Today, there is much talk about oil reaching $100 a barrel. This would have a devastating impact on this economy. A recent study by the Office of Study of the Automotive Transportation, the University of Michigan Transportation Research Institute, and the National Resources Defense Council, called "In The Tank,"* says that at $80 to $100 a barrel, the equivalent of $2.86 to $3.37 at the pump, Detroit's big-three automakers would see their sales fall 9 to 14 percent. In addition, 16 facilities, mostly in the Midwest, would close, and at least 300,000 jobs would be on the line, 37 percent which are in Michigan, Indiana, and Ohio.

Washington has committed $1.2 billion to its Hydrogen Fuel Initiative, with the goal of producing commercially viable fuel cell vehicles by 2020 and a major dent in oil usage by 2040. It's a start, but it's not good enough. I firmly believe that increasing our collaborative efforts to include suppliers, all automakers, and private equity in the process, we can move this timetable ahead substantially.

I thank you.

[The prepared statement of Mr. Leuliette follows:]

PREPARED STATEMENT OF TIMOTHY D. LEULIETTE, CHAIRMAN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, METALDYNE CORPORATION, PLYMOUTH, MI

Mr. Chairman and members of the committee, thank you for this opportunity to testify before you today on the need for our nation to move quickly to a hydrogen economy. I am Tim Leuliette, chairman, president and chief executive officer of Metaldyne Corporation. Metaldyne is a leading global designer and supplier of metal-based components, assemblies and modules for transportation related powertrain and chassis applications including engine, transmission/transfer case, wheel-end and suspension, axle and driveline, and noise and vibration control products to the motor vehicle industry. It has annual revenues of $2 billion and over 6,500 employees at 45 facilities in 38 countries around the world.

To put it in a different perspective we are the 69th largest automotive supplier in the world, according to Automotive News.

I have had the privilege of working in the auto industry for more than 30 years, most of which I spent in the supplier community. I have served as president and chief operating officer of Penske Corporation, a closely-held diversified transportation services company managing businesses with annual revenues exceeding $10 billion and more than 33,000 employees at over 200 facilities worldwide. I also was president and chief executive officer of ITT Automotive Inc., and president and chief executive officer of Siemens Automotive L.P. In that position I became a member of the Siemens Automotive Managing Board and a corporate vice president of Siemens AG. I was the first non-German to hold this level of authority in the 143-year history of the electrical and electronics company.

I also held executive positions at Bendix and various engineering and planning positions at Ford Motor Company and American Motors Corporation.

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*The study has been retained in committee files.

In addition, I have experience in private equity as a former partner in Heartland Industrial Partners, a private equity firm established to acquire and expand industrial companies in sectors ripe for consolidation and growth. Heartland builds value by investing in well-positioned industrial companies, whose talent, technology, assets and market position afford them the opportunity to be a platform for industry consolidation and value-creation.

I also have had the privilege of serving on several boards including Collins & Aikman, TriMas Corporation, Vattikuti Urology Institute of Henry Ford Health Systems, and Karmanos Cancer Institute. I am the past chairman of the board of The Detroit Branch of The Federal Reserve Bank of Chicago and have strong affiliations with Detroit Renaissance and Junior Achievement.

In these roles I have been witness to, and part of, many restructuring strategies, new business models and makeovers in the automotive industry. These were minor compared to what our industry is working through today. Globalization has thrown the auto industry into a transformation on a scale greater than we have ever witnessed. This globalization in no way resembles what we saw in the 1980s and 1990s when the mature automakers and their suppliers began to build more plants in emerging countries . . . and in the southern U.S. This globalization is the 21st century kind that will redraw boundaries geographically, politically, economically and socially. It will change our business, our technologies and our relationships.

In the end new regions . . . and companies . . . will be super-empowered to become superpowers of industry. Our challenge as a nation and as an industry is to play a key role in creating and influencing that structure.

To accomplish that, we must quickly create a National Energy Policy that mandates collaboration with every part of the U.S. auto industry to develop new technologies such as hydrogen. That means including suppliers and all automakers, both domestic and foreign-based with a strong U.S. presence, in the national debate on hydrogen. As a nation and an industry we cannot afford to allow politics and competitive concerns freeze out companies, people or regions to stand in the way.

The National Energy Policy must transcend elections, political parties and corporate boundaries to meet the needs of the consumer, the environment and national security. I commend this Committee on the collaborative business model it set as it worked in a bipartisan manner to promote energy policy.

As GM's head of research Larry Burns has said "the biggest risk of all is to sit on the sidelines and not try to create this future." There's plenty of precedent, he noted, for a society-wide effort. The Panama Canal, the Manhattan Project and the moon missions of the 1960s all involved public funds and private partners. And all produced dramatic results.

The same can be accomplished with the Hydrogen Title. We must begin building a national consensus for its necessity then fund aggressive research programs aimed at moving the relevant technologies toward commercial viability, and keep them in the U.S.

ROLE OF AUTOMOTIVE SUPPLIERS AND THE NEED TO INCLUDE THEM IN THE NATIONAL DEBATE

The stated purpose of the Hydrogen Title is to:

- enable and promote comprehensive development, demonstration, and commercialization of hydrogen and fuel cell technology in partnership with industry
- build a mature hydrogen economy that creates fuel diversity in the massive transportation sector of the United States
- sharply decrease the dependency of the United States on imported oil, eliminate most emissions from the transportation sector, and greatly enhance the nation's energy security.

Accomplishing these goals requires a comprehensive "partnership with industry." Unfortunately, no such partnership exists between the federal government and the automotive industry because current programs fail to include two-thirds of the auto industry . . . the supplier community.

According to the most recent statistics released by Motor & Equipment Manufacturers Association (MEMA) in June 2006:

- U.S. automotive suppliers (parts manufacturers) are a $384 billion industry ($199.2 billion of the market consists of Original Equipment and $184.7 billion consists of the Aftermarket), which are the components used to repair and service vehicles once they are already out on the road.
- Overall, the U.S. automotive supplier industry employs more than 1.2 million people at over 11,500 domestic plant locations across the country.

- There are 2.9 jobs in the auto supply chain for every 1 assembly (automaker) job and supplier products account for more than two-thirds of the content on each new vehicle.

This is a large, nationally and globally influential group that must play a leading role in this initiative: Yet, despite their weight in terms of employment, facilities and capital investment, suppliers have no formal or direct ability to participate in the federal government's hydrogen program (FreedomCAR). They can only bid for grants and projects under the EERE Vehicle Technologies Program, which focuses more on hybrid components and short term gains in fuel efficiency. They also don't have a seat at the table in the Congressional and national debate on hydrogen policy.

This is not only an oversight; it is a huge mistake that will extend the timeline to achieving the Hydrogen Economy by decades. There is a misconception that suppliers simply build systems, components and parts to automaker specifications. In readily suppliers play a key role in automotive R&D and innovation. According to a recent NSF report, the auto industry spent $16.9 billion on R&D in the U.S. in 2003. Of that, supplier R&D accounted for $6.9 billion, or 40%.

Let's take a look behind the numbers and into the DNA of the supplier network. The R&D done by the automakers is often applied R&D. The pure R&D is done by suppliers, and it has been for years. Automakers didn't develop airbags, suspension systems, anti-lock brakes or windshield wipers that sense the rain and automatically turn on, just to name a few innovations created by suppliers and "applied" by the automakers.

Suppliers are used to being nimble, fast and flexible, to serving numerous customers and to delivering new products to the marketplace quickly. They have honed these skills through collaboration within the supplier community and innovative partnerships.

Many suppliers already have such programs in place for alternative energy. For example:

- Freudenberg-NOK General Partnership (FNGP) between Freudenberg & Co. of Germany and NOK Corporation of Japan has been involved in the research and development of advanced fuel cell sealing technology for more than 10 years. Headquartered in Plymouth, Michigan, FNGP handles the entire group's manufacturing R&D work, with a portion of the operation focused on automotive and stationary fuel cell development. Originally considered less critical than other parts of the fuel cell tack, sealing technologies have received renewed attention over the past few years.
- ECD Ovonics and its partners successfully completed a demonstration project to modify a commercial gasoline/electric hybrid vehicle to run on hydrogen utilizing a new low-pressure, metal hydride hydrogen storage system developed and manufactured by Texaco Ovonic Hydrogen Systems, LLC, a joint venture between a unit of ChevronTexaco Corp and ECD Ovonics.
- Delphi Corp., a partner in the U.S. Department of Energy's advanced fuel cell development program, has exceeded the power density level required to meet the government's $400 per kilowatt cost goal for fuel cells. Meeting the cost target is essential if fuel cells are to expand beyond their current niche markets into widespread commercial use. At $400 per kilowatt—nearly one-tenth the cost of power-generating fuel cells currently sold on the market—fuel cells would compete with traditional gas turbine and diesel electricity generators and become viable power suppliers for the transportation sector.
- Siemens is partnering with the University of South Carolina to build and test a prototype diesel engine that runs on hydrogen instead of petroleum.

As you can see the supplier community is ready, willing and more than able to play a leading role in the march to the hydrogen economy. It simply needs an avenue to march down and an invitation to the parade. The Hydrogen Technical and Fuel Cell Advisory Committee the Secretary of Energy is establishing to advise the government on hydrogen programs is just that avenue.

The committee is to consist of representatives from domestic industry, academia, professional societies, government agencies, federal laboratories, previous advisory panels, and financial, environmental, and other appropriate organizations. I urge this Committee to ensure that DOE makes this group an active participant in its efforts and the creation of future policies and national strategies.

I also strongly encourage this Committee to extend membership in the Hydrogen Technical and Fuel Cell Advisory Committee to the automotive supplier industry, to other groups such as SAE and to the entire "domestic" auto industry. We need

to include foreign-owned manufacturers with a significant presence in the U.S. (e.g. Toyota, Honda, Nissan, Bosch, Denso, etc.)

As I've outlined this hydrogen strategy, you're probably asking yourself, why is this guy who heads a nuts and bolts company pushing hydrogen? The answer is simple. The industry and the hydrogen movement need the engineers at Metaldyne and other suppliers to address the tactical issues of hydrogen vehicles. Suppliers are often the inventors of technology and hydrogen is no different. There is money to be made here and I intend to be sure Metaldyne is at the forefront. As suppliers of powertrain and chassis components and systems we must not only be prepared for new and developing technologies, we must take a leadership role in ensuring the most positive long-term solutions are adopted. That solution is hydrogen.

INVESTMENT IN HYDROGEN TECHNOLOGY IS A JOBS AND GLOBAL COMPETITIVENESS ISSUE

The countries and industries that develop the technologies that move to the hydrogen economy first will see significant job growth. However, none of this will happen overnight. Many of those jobs will be in the traditional automotive supplier community as well as in new entrepreneurial companies that will continue to grow up as a result of new technology. There will be new R&D and manufacturing jobs. There will be new jobs created to develop and build new alternative energy distribution networks.

To attract and maintain these jobs we must create a collaborative environment in the U.S. that will foster the growth of the hydrogen economy. Otherwise there is every reason to believe the jobs will go to other countries with strong R&D networks and aggressive collaborative government/industry programs.

We have the resources in this nation to makes the hydrogen economy a reality. For example, Michigan currently is home to GM, Ford, DaimlerChrysler, Toyota, Nissan, Hyundai R&D centers as well as dozens of supplier R&D centers. South Carolina formed the South Carolina Hydrogen and Fuel Cell Alliance, a state-wide initiative designed to promote the development and use of quality, cost effective and accessible hydrogen fuel cells, and related technologies. Indiana has supported the development of several efforts such as the ForeverGreen Enterprises Inc. construction of a high-technology hydrogen production facility in DeKalb County. The company will manufacture Green Hydrogen from materials that would otherwise be regarded as waste, therefore reducing manufacturing costs and the negative impact this waste would otherwise have on the environment. Our national labs have hydrogen programs going.

During a visit to the California Fuel Cell Partnership last year President Bush said "the idea of a hydrogen-powered automobile is not a foolish dream. It is a reality that is going to come to be . . . Hydrogen has vast potential to dramatically cut our dependence on foreign oil . . . Investing in new technologies, like hydrogen, will enable our economy to be strong."

I couldn't agree more that the world is hooked on oil. It's a life-threatening addiction that is driving countries, companies and individuals to try and kick the habit. This dependence not only threatens to further weaken profits and cost jobs among the U.S. automakers, it is a national security risk to the United States and is wreaking havoc on the global environment.

The U.S. is currently struggling with how it will maintain its superpower status and our status as the largest consumer of energy and oil is making it more and more difficult. The only way we are going to gain a competitive advantage is if we solve the energy issue before other countries do and that demands a National Energy Policy and a larger commitment to hydrogen.

Washington has committed $1.2 billion to its Hydrogen Fuel Initiative, with the goal of producing commercially viable fuel cell vehicles by 2020 and a major dent in domestic oil usage by 2040. As you know, that is simply too little. I commend this Committee for its strong stand to authorize substantial monies to the hydrogen initiative and encourage the current Administration to move that recommendation forward. The United States can't be a superpower if it's out of power. The current plan outlines a timetable 10 times longer than the Manhattan Project and four times longer than putting a man on the moon.

In short, there is no unified sense of urgency on a national level to develop a robust, realistic, well-funded energy policy that allows us to thumb our noses at gas stations in the near future.

Such a play is essential as the globalization march continues. As China, India and other developing countries embrace free markets and foreign investment, they're producing hundreds of millions of newly minted middle-class car buyers. In the U.S. we are producing a new person every 12 seconds, and each one of them will need

a car. Between now and 2020, the number of vehicles worldwide likely will rise from 750 million to more than a billion.

We can't keep up with the oil consumption needed to run those vehicles. The International Energy Agency says that in its base line year of 2002 the world consumed 78 million barrels of oil daily and had a production capacity of 80 million barrels a day. By 2015 the agency estimates that the world will be consuming 103 million barrels a day, and 119 million barrels a day by 2025.

The catch is the world cannot meet the demand.

Boone Pickens says worldwide production of oil is 84 million barrels a day and is never going any higher . . . that is unless we find the capital investment money needed to search under new sands and seas for untapped reserves.

So if we add the expected 300 million vehicles to the mix, and the result could be a "super spike," with the price of a barrel of crude, at least for a time, exceeding $100. That $100 a barrel price tag would have a devastating impact on the Midwest, and ultimately, the nation.

A recent study by the Office for the Study of Automotive Transportation, the University of Michigan Transportation Research Institute and the National Resources Defense Council called "In the Tank" says that at $80 to $100 a barrel . . . the equivalent of $2.86 to $3.37 at the pump . . . Detroit's Big Three automakers would see their sales fall 9-14 percent, a decline of 1.9 to 3 million vehicles. That would mean an industry-wide drop of $11.2 to $17.6 billion in pre-tax profits.

In addition, 16 factories, mostly in the Midwest, could close and at least 297,000 jobs would be on the line, 37 percent of which are in Michigan, Ohio and Indiana.

It should be noted that the week of July 4 the U.S. consumers paid an average of 3.9 cents more than the week before, or $2.97 a gallon, the second-highest level ever, the government said Monday. The national pump price for regular unleaded gasoline is up 65 cents from a year ago and not far from the record $3.07 reached last September after Hurricane Katrina disrupted petroleum supplies, according to the federal Energy Information Administration's weekly survey of 800 service stations.

Depending on fuel prices and consumer incentives, sales of hybrids and advanced diesels are likely to go from about 100,000 units this year to as many as 1.8 million by about 2010. Initially, most of these vehicles will be imported. Since advanced diesel engines under about 5 liters will displace many gasoline engines, and since full hybrids don't use conventional transmissions, Michigan and Ohio—and to a lesser extent Indiana—stand to be major losers unless production of these vehicles, or at least their powertrains, are produced in this area.

Specifically, if 1.8 million "HADs" . . . that is hybrids and advanced diesel vehicles . . . are sold by the end of the decade, these three states stand to lose more than 66,000 jobs, nearly one-third of the U.S. total of 207,000 potentially lost jobs, according to Fuel-Saving Technologies and Facility Conversion: Costs, Benefits, and Incentives.

These statistics drive home the need for a collaborative strategy that attracts not only hybrid technology but ensures future alternative energy powertrains and vehicles are developed and manufactured in this country. If the U.S. truly wants to be player in 2020 there must be a strong, doable national plan for hydrogen. Hydrogen is the most abundant, environmentally friendly fuel source in the universe and it is the way of the future.

We need to follow a four-step plan to reduce our dependency on oil. The first two we can do in the automotive industry. The second two require political action.

- First, establish a well-funded and powerful industry consortium made up of all the major stakeholders . . . automakers, suppliers and labor.
- Second, establish a hydrogen-powered vehicle design team to set industry practice and design rules.
- Third, set a national target that 80 percent of the vehicles sold in the United States and 100 percent of the imported vehicles are hydrogen-powered by 2025.
- Fourth, provide federal customer incentives, research dollars and funding for infrastructure issues by imposing a gas tax and/or by alternative means that include investment by public and private equity.

CAPTURING THE INTEREST OF THE AMERICAN PEOPLE—EDUCATING THE PUBLIC ON HYDROGEN

One of the hydrogen economy's greatest challenges is moving the public away from its fascination with hybrid and ethanol vehicles. That will require a collaborative effort among all stakeholders—government, automakers, suppliers, unions—to educate people on the benefits of hydrogen and the need to quickly move to that technology.

The timing is right. A CNN poll conducted in early May found that 60% of adults thought seriously about purchasing a fuel-efficient vehicle because of the skyrocketing price of gasoline.

The message is simple. Hybrids and ethanol, while good and necessary intermediary steps to hydrogen, are not long-term solutions to our dependency on oil. There are many studies out today that are either pro or con when it comes to these forms of alternative energy. The most important thing is that they are being discussed in many forums and are generating conversation and public awareness. That can only help create more conversation about the need to move more quickly to the hydrogen solution.

Hybrid vehicles might actually use more fuel than a normal car. They run on full gasoline at highway speeds because the ECU detects highway long journeys might drain the battery too fast. In addition, the gasoline in hybrids relatively small and therefore has to work harder and use more fuel compared to a conventional powered vehicle with a larger more potent engine.

There are other disadvantages. The metals in the nickel-metal hybrid battery currently used in hybrid vehicles are 25 times more expensive than lead. Nickel has been identified as a carcinogen. Hybrid vehicles have not been on the road long enough to allow the batteries to prove their projected cycle life. No significant recycling capability exists.

Ethanol also is not a long-term cure. According to scientists in New York and California, it takes more energy to make ethanol than you get back in fuel savings. More precisely, says David Pimentel of Cornell University, it takes the equivalent of 1.29 gallons of gasoline to produce enough ethanol to replace one gallon of gasoline at the pump. Instead of making the nation more energy self-sufficient, ethanol production actually increases our need for oil and gas imports, he says. Pimentel and Tad W. Patzek, professor of civil and environmental engineering at Berkley, conducted a detailed analysis of the energy input-yield ratios of producing ethanol from corn, switch grass and wood biomass as well as for producing biodiesel from soybean and sunflower plants.

"The United State desperately needs a liquid fuel replacement for oil in the near future," says Pimentel, "but producing ethanol or biodiesel from plant biomass is going down the wrong road, because you use more energy to produce these fuels than you get out from the combustion of these products."

In a recent paper in the journal *Natural Resources Research,* he calculates it takes the energy equivalent of 271 gallons of gasoline to grow a hectare (about 2.47 acres) of corn. Part of that energy is for tractor fuel, but the biggest use is for manufacturing nitrogen fertilizers, which are mandatory for high-yield corn-growing. These fertilizers are made by heating natural gas under controlled circumstances so that it reacts with nitrogen in the air. Not only does it take heat to do this, but it uses up natural gas that could have been burned as fuel. Pimentel estimates that in corn-growing, nitrogen fertilizers alone use the equivalent of 80 gallons of gasoline per hectare.

Another study done at the Universite Laval in Quebec, Quebec, in 2004 says E85 costs substantially more to operate annually. For example, the annual cost to use E85 in a Chrysler Sebring convertible was $1323 in 2004 U.S. dollars, compared with $900 for gasoline.

While this study and others are heavily questioned by pro-ethanol groups the positive side is that they are generating conversation and public awareness. That can only help create more conversation about need to move more quickly to the hydrogen solution.

A NATIONAL STRATEGY ON HYDROGEN—HOW PRIVATE EQUITY CAN HELP FUND THIS NEEDED TRANSITION TO A NEW ENERGY SOURCE

The Hydrogen Title directed the Secretary of Energy to draft a coordinated plan for the programs that are directly related to fuel cells or hydrogen. The plan was required to describe the national agenda for the next five years for the programs and the milestones that will be used to evaluate the programs for the next five years. This strategy could attract substantial interest from private equity if the Secretary's plan lays out a solid platform, a strong roadmap and timeline and provides the underlying stability needed from the federal government.

Attracting private equity is key to quickly moving the hydrogen economy forward. The federal government does not have the funds. Private equity does. In 2004 there was approximately $100 billion of undeployed private equity funds in U.S. and •39 billion in Europe, according to Jay Alix, president of Alix Partners, a private equity firm with substantial investments in the auto industry.

"Enormous new markets are developing through the commercialization of energy technologies," said M. Grier Eliasek, managing director of Prospect Street Ventures, a leading private equity and merchant banking firm focused on investing in energy companies. "We believe these markets offer excellent opportunities for private equity investment, and we are actively pursuing a number of such opportunities at this time. In an economy in which many sectors are struggling for growth, energy technology represents a robust, rapidly growing market."

Several firms have shown interest in several forms of alternative energy as concerns about peak oil supply, skyrocketing oil and natural gas prices and national security issues heat up. In fact, the energy component is the fastest growing clean technology and makes up more than 70% of investments in the clean technology industry, Tucker Twitmyer, managing partner with Philadelphia-based EnerTech, a venture capital firm focused on energy technologies, said in a recent Knowledge @ Wharton article.

The article also points out that the window of opportunity for investment in clean technology has never been more robust. According to the 2006 Cleantech Venture Capital Report on North American venture capital investing, up to 3% of all venture capital was used for clean technology during the dot.com bubble from 1999-2001. That rose to 5-6% from 2002-2005 and the study suggests that it will jump to 10% of all VC investment by 2009. That amounts to between $6.2 billion to $8.8 billion invested as venture capital firms go to the markets to raise capital in an estimated 1,000 rounds between 2006 and 2009, the article said.

Following are some example of venture capital investments in clean energy:

- Kleiner Perkins Caufield & Byer has backed a handful of clean tech companies, including Miasole, a San-Jose based solar technology firm. Former Secretary of State Colin Powell is one of KPCB's general partners.
- EnerTech, which invests in power and energy consumption, manages $290 million, 80% of which is in clean energy.
- New Energy Capital (NEC) in New Hampshire is financing renewable and efficient energy projects from wind power to geothermal to biofuels.
- Goldman Sachs owns wind farm projects through its acquisition of Horizon Wind Energy.
- Yellowstone Energy Ventures has made minority investments in public and private companies involved in alternative energy and renewable energy technologies. It has invested in several fuel cell companies including Protonex Technology Corporation, which is developing fuel cells with emphasis on military applications, and Cellex, which is a leader in fuel cell power solutions for industrial vehicles.
- Virent Energy Systems, a University of Wisconsin spin-off, just received $7.5 million in venture capital from Cargill Ventures. Virent is trying to develop a cost-effective way to generate hydrogen fuel from water and sugar in a one step process as part of a car's engine or an electrical generator.

CHALLENGES FACING THE AUTO INDUSTRY

The U.S. auto industry is going through a transformation unlike anything we have witnessed before. This transformation has been in the offing for more than 25 years, ever since the first oil crisis in the early 1970s. Since then the traditional domestic auto industry has been teetering on the edge of the cliff only to be drawn back by the deceitful business cycle of improved sales, better profits and the promise of diversification success we've come to expect over and over again. This time the consumer is driving the transformation and many companies are not prepared because they didn't learn from the past and adjust their strategies accordingly.

That said we need to remember in all this that the auto business is strong, vibrant and growing. We have had record or near record annual sales in the U.S. since the turn of the century. The difference is the competition is stronger . . . and there's more of it. The U.S. auto market now looks more like the European market with 8-10 major companies vying for business instead of three companies—General Motors, Ford and Chrysler—dominating the market.

This transformation is good and necessary . . . for the industry and the U.S. It is a form of creative destruction that is driving home a sense of urgency to develop the right product, be flexible, embrace change and learn from the past. As economist Joseph Schumpeter said creative destruction is the process of replacing good things with better things. This creative destruction has shaken the auto industry to the core and instills a sense of urgency to change . . . to find and embrace new, more innovative business models and technologies that require working together.

Industry, government and public and private investors need to have that same sense of urgency about the pace at which this nation moves toward a hydrogen econ-

omy. There is no time to waste. The product development decisions being made today are for vehicles that will be built 10 years from now. Companies are not only deciding what vehicles they will build . . . you can bet many will be alternatively fueled . . . but where they will build them and where their systems and components will be sourced. The only way to ensure those vehicles are built in the U.S. is to develop a robust, innovative and comprehensive national energy policy that requires collaboration among all domestic industry (automakers and suppliers), academia, professional societies, government agencies, federal laboratories, previous advisory panels, and financial, environmental, and other appropriate organizations.

CONCLUSION

The auto industry, which has long been the bedrock of the U.S. economy, is at a crossroads and must adopt a new business model that will weave its collective expertise into a single fabric. This new model requires collaboration at all levels—manufacturing, technology, and research and development. This new business model will be based on realistic relationships that will meld cultures, philosophies and technologies and prepare us for a new future that will be nothing like we've seen before.

Developing alternative energy sources that will decrease the U.S. dependence on petroleum imports is key to developing that new business model. To accomplish that we must collaborate and share information—without jeopardizing competitive advantages for companies. The technological challenges facing the industry and the nation today are more than any single company can achieve without extraordinarily large financial expenditures within a reasonable timeframe. The problem requires a national effort that pools the resources of the federal government, all sectors of the automotive industry and public and private investors to move the U.S. to a hydrogen economy faster and more efficiently.

There is simply no future in the status quo and there can be no status quo in our future.

Senator ALEXANDER. Thank you very much.

First let me recognize that Senator Dorgan has arrived, who's been a strong proponent of the hydrogen economy for some time.

We've all made brief statements. Would you like to make one, Senator Dorgan?

STATEMENT OF HON. BYRON L. DORGAN, U.S. SENATOR FROM NORTH DAKOTA

Senator DORGAN. Mr. Chairman, only that I regret I have been downstairs at another hearing, and I'm scheduled—we have a schedule on the floor to speak on stem cell research, and I'm scheduled to be there for my presentation in a short while. But thank you for holding this hearing. I know my other two colleagues here, as well, are spending a great deal of time on this issue. I think that the issue of hydrogen fuel cells is just critically important, and I've been happy to work with a bipartisan group of legislators on these issues in recent years.

Senator ALEXANDER. Thank you, Senator Dorgan.

Dr. Paul.

STATEMENT OF DR. DONALD L. PAUL, VICE PRESIDENT AND CHIEF TECHNOLOGY OFFICER, CHEVRON CORPORATION, SAN RAMON, CA

Dr. PAUL. Thank you, Mr. Chairman and members of the Senate Energy Committee. Chevron is pleased to have the opportunity to testify before the Senate Energy and Natural Resources Committee on the future of hydrogen as a transportation fuel, as well as DOE's hydrogen program and the impact of the Energy Policy Act in advancing hydrogen as a fuel.

As Chevron's chief technology officer, I oversee all facets of our company's new energy technology development and commercialization, including hydrogen generation and hydrogen infrastructure, can share our experience as well as our views regarding the critical next steps.

Chevron, first and foremost, is committed to diversifying the Nation's fuel supply. As you know, Chevron is the second-largest U.S. energy company. We've been involved in the fuelmaking business for 125 years.

Although there's no silver bullet, from our perspective, we are actively pursuing new energy fuel sources, including biofuels, gas-to-liquids, and hydrogen, to name a few.

Today, as we've heard from my distinguished colleagues, we're facing a new energy equation, in terms of the world's demand for energy. I believe that we are going to need every form of energy, we must develop new types of energy, and we must increase energy efficiency and conservation. We, at Chevron, are committed to providing American citizens with reliable and affordable supplies of energy.

In terms of hydrogen as a fuel, we believe that the fuel cell technology and related infrastructure technology will continue to evolve. As we heard before, in current use today are stationary fuel cells, which deliver high-quality, high-reliability power. Chevron, in fact, uses them for such critical applications ourself, and have done so for several years.

In addition to stationary power, we believe that hydrogen can provide, in the nearer term, viable transportation fuel, such as for transit systems, which I will describe some more later, while widespread use for passenger vehicles will be dependent upon resolving key technological, operational, and economic challenges. We're very encouraged to date, as we have heard, but there remain significant challenges to a distribution of a new fuel system at scale.

Although hydrogen has many positive attributes, there are still important challenges. These happen to come from the nature of infrastructure, and I'll discuss those a little bit more as time goes on.

We have been involved with the Department of Energy's controlled hydrogen fleet infrastructure demonstration and validation program for the last few years. We're the only major energy company leading such a project, and, as such, as you will hear in a few minutes, we have been able to focus on the challenges specifically associated with distributing—manufacturing and distributing, store and dispensing fuel.

We believe that demonstration programs have been critical to advancing hydrogen as a practical fuel. Oftentimes, the infrastructure part of the energy equation is ignored. Our current infrastructure took us almost a century to build. The challenge of building an entirely new one is unique, and we haven't faced that as a Nation for some time. It's absolutely critical that both the devices that use hydrogen as a fuel for the vehicles and the hydrogen infrastructure be developed simultaneously. This is part of the key challenge.

What I would like to do is to talk about a couple of the key issues associated with infrastructure.

Infrastructure amounts to advancing the technology, integrating all the technologies and systems together, operationalizing the

technology and practice to deliver a safe, reliable, and continuously operating infrastructure, and ultimately understanding how it will be used by customers. All of our programs through DOE demonstrate some of these elements.

I'd like to refer you to the picture there. This is the first hydrogen energy station that Chevron had put up with its partners, Hyundai and UTC. It's located in southern California. The key elements of this demonstration were to understand, Could you practically distribute, manufacture, store, and operate, on a continuous basis, a hydrogen infrastructure? This is a small demonstrate site at Hyundai's research center.

The next project, which opened, this last February, is a—oh, I'm sorry. Let me back up.

What you see here is actually a distributed hydrogen production plant. As many of you know, we make hydrogen at scale in refineries today. They're the biggest single user. The challenge in translating that system to a consumer fuel distributed out where it can be used in society is miniaturizing—in our view, miniaturizing those facilities. What you see here is actually a new technology hydrogen generation facility. It's located at Chino. What we have done is actually miniaturized the technology, but included in it full safety, control, and operational characteristics, which are the other key elements of including a new—building a new fuel infrastructure.

Our second project actually took all of this to the next scale. What you see here is a station located in Oakland. This is Alameda, a Contra Costa County transit-system station. This is a system that supports both buses—there are three fuel cell buses—and a small fleet of cars. Hydrogen is made onsite; stored, distributed onsite. I think what is significant about this demonstration is, every element that would be involved in a commercial-scale demonstration is included here: maintenance, continuous operation. These buses operate every single day. And one of the benefits that we've learned from this demonstration is that tens—literally tens of thousands of individuals are going to be part of the hydrogen economy because they ride these buses.

I think we underestimated the value of that. Even the largest single fleet demonstration is a dozen.

The CHAIRMAN. You said tens of thousands?

Dr. PAUL. Tens of thousands of riders.

The CHAIRMAN. Are going to be what?

Dr. PAUL. Riding these buses and being part of—in their view, part of the new energy—the new hydrogen economy.

The CHAIRMAN. Using that?

Dr. PAUL. These buses operate a regular bus schedule in Oakland/Alameda County in Los Angeles. These are not—there's three buses. They operate full operational schedules every day. Thousands of passengers over the course of a year will ride these buses, take them to work, take them shopping, take them home. These are not—this is not—this is a miniature transit system, but it is complete. We make the fuel, we store the fuel, you distribute the fuel, people ride these buses, the buses come home, they get fueled, they get serviced. This is a fully integrated miniaturized system, the only one of its kind actually operating in the world today.

But what we learned was, it matters to the community that they can actually get on this bus, and it works fine. In fact, not only does it work fine, it's the quietest bus they've ever been on. And that was the other thing we discovered, that——

The CHAIRMAN. It was what?

Dr. PAUL. The quietest bus. And the reason that demonstrations are important is, you don't learn these things until you demonstrate the technology in the real world. And the other thing we learned is, these buses are quiet. They make no—basically, no mechanical noise that ordinary buses make. That actually turns out to be a benefit in a dense urban area.

So, I think this is a very important demonstration. This is number two.

Our third demonstration, which is under development, will be in Michigan, Selfridge Air National Guard Base. This is a result of a combination of the DOE program and a joint venture that Chevron has with TARDEC, which is the Tank and Automotive RD&E Center. So, that's our next site. It will be coming up this next year.

I'd like to wrap up by just going to the final one and talk for a moment about R&D. This is a picture of Chevron's large R&D center, devoted to hydrogen. That's in Houston. The question is, What are we working on? As you read, from the testimony, we have chosen to use natural gas as the fuel for our current demonstrations, basically miniaturizing what we do in industrial applications. Clearly, the great benefit of hydrogen is, it can be made from many, many things. That's really its true strength and diversification. We're working on research that would diversify this to other opportunities, particularly other liquid fuels, that include biofuels, for example.

The second challenge—and I—my friend and colleague, Dr. McCormick, mentioned that the challenge we have in both the automotive business and the energy business, like Chevron—is the sheer scale of these endeavors. One of the challenges today is that most hydrogen production at site run what are called 100 kilograms. Let me convert. Kilograms——

Senator ALEXANDER. Dr. Paul, we'd like to go on to Dr. Balcom, then come back to all four of you for questions.

Dr. PAUL. OK. I would just finish.

Increasing the scale by at least a factor of ten is a critical requirement.

I will close with two—focus on just two specific recommendations. One is, continue to support the demonstrations, because they do things in practice that you can't do in the lab. Second, it's very important to continue to fund basic research, particularly with respect to the number-one priority of storage.

Thank you very much, and I look forward to your questions.

[The prepared statement of Dr. Paul follows:]

PREPARED STATEMENT OF DR. DONALD L. PAUL, VICE PRESIDENT AND CHIEF TECHNOLOGY OFFICER, CHEVRON CORPORATION, SAN RAMON, CA

Mr. Chairman and Members of the Senate Energy Committee, Chevron is pleased to have the opportunity to testify before the Senate Energy and Natural Resources Committee on the future of hydrogen as a transportation fuel as well as DOE's hydrogen program and the impact of the Energy Policy Act (EPACT) in advancing hydrogen as a fuel.

As Chevron's Chief Technology Officer, I oversee all facets of our company's new energy technology development and commercialization, including hydrogen generation and hydrogen infrastructure, and can share our experience as well as our views regarding the critical steps required in the development of this technology.

By way of background, Chevron is an integrated, global energy company that produces oil, natural gas, transportation fuels and other energy products. We operate in 180 countries and employ more than 53,000 people world-wide. Chevron is the second-largest U.S.-based energy company and the fifth largest in the world, based on market capitalization. We are also involved in a wide-range of advanced clean energy and fuel technologies.

Chevron is committed to diversifying our nation's fuel supply. Although there is no "silver bullet", we are actively pursuing new energy and fuel sources including biofuels, gas to liquids and hydrogen to name just a few. As Chevron's Chairman and CEO David J. O'Reilly, has discussed on numerous occasions, including at a speech over two years ago at the U.S. Chamber of Commerce here in Washington, D.C., we are facing a new energy equation as the world's demand for energy grows. I believe that we are going to need every form of energy, we must develop new types of energy, and we must increase energy efficiency and conservation. We at Chevron are committed to providing U.S. citizens reliable and affordable supplies of energy.

Before discussing Chevron's extensive and innovative work in the hydrogen infrastructure area over the past 5 years, I would like to briefly mention that just over a month ago Chevron announced the formation of a new biofuels business unit to specifically pursue opportunities for supply of biofuels, and development of cellulosic ethanol. We have biofuel projects underway, including investing in development of a large scale biodiesel plant in Galveston, Texas and an E-85 demonstration project in California.

In terms of hydrogen fuel, we believe that fuel-cell technology and related infrastructure technology will continue to evolve. In current use are stationary fuel cells which generate high reliability and quality power and are commercially available today. Chevron has installed two stationary fuel cells at our facilities in San Ramon, California, and Houston, Texas. These fuel cells convert hydrogen from natural gas into electricity, clean water and usable heat, and provide secure, digital-grade power to select data systems and laboratories. We undertook these projects to gain experience with designing and installing stationary fuel-cell systems, and to help us translate this experience into other types of fuel cell projects. Our subsidiary, Chevron Energy Solutions, has installed fuel cells in many facilities, including at U.S. Postal facilities.

In addition to stationary power, we believe that hydrogen may provide a viable transportation fuel under certain conditions in the nearer term, such as for transit systems, while future widespread use for passenger vehicles will be dependent on resolving technological and economic challenges. We believe that central vehicle fleets and transit systems are the most practical means of using hydrogen in the near future in addressing both infrastructure as well as vehicle challenges. Fleets, such as buses, use a centralized fueling point and hydrogen storage can be overcome by vehicle size. Although hydrogen has many positive attributes as a transportation fuel, as I will discuss, there are still some major challenges that must be overcome before hydrogen will be an integral component of the fuel mix. We are still very much in the learning and demonstration mode.

CHEVRON'S RESEARCH AND DEVELOPMENT INITIATIVES

Chevron has been a leader in researching and demonstrating the potential for using hydrogen as a transportation fuel, including using proprietary reforming technology developed at our labs to generate hydrogen on-site. We are the only major energy company leading projects under DOE's "Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Program" with our auto partner, Hyundai and fuel cell partner, UTC. This demonstration program is a unique five-year cost-share program in which autos and energy company partners develop demonstration sites, test vehicles and infrastructure, and share information in coordination with the DOE. Currently participating are all three major U.S. auto companies and Hyundai, three major energy companies and a number of fuel cell companies and other related businesses, many of whom are smaller, new technology suppliers.

We believe that this demonstration program is the centerpiece of DOE's hydrogen program, and is critical to advancing hydrogen as a practical transportation fuel. Often times, we see the infrastructure part of the energy equation being ignored or forgotten entirely. Our current infrastructure for fuels took over 100 years to fully develop—and given the complexities, it is absolutely critical that both the fuel cell vehicles and the hydrogen infrastructure be developed simultaneously. In Title VIII

of EPACT, there is also a demonstration program included, and we believe that it needs to be complementary to the one now well underway for the past three years, rather than competitive and creating potential duplication. The Hydrogen Fleet and Infrastructure Demonstration program must be completed, results evaluated, and shared among all parties to better define a roadmap for the future.

Under the DOE's Hydrogen Fleet and Infrastructure Demonstration program, we currently have two demonstration projects in full operation in California and are planning two additional sites, including a cold weather site in Michigan in coordination with the Department of Defense. The first demonstration site opened in Chino, California, in February, 2005, at the Hyundai Research Center. We provided our on site reforming technology and hydrogen pumps for the station, and are testing three passenger vehicles. The second demonstration site is at the AC Transit Bus headquarters in Oakland, California, and again we installed reforming technology and pumps for three fuel cell buses that travel in daily operation throughout the city. The site will be expanded in the future to incorporate the next generation of reforming technology and provide increased hydrogen production. The benefit of this demonstration project is that it allows citizens to actually experience riding the buses and directly benefit from the technology. Our infrastructure portions of these projects are unique—as I mentioned, we produce the hydrogen on-site, on-demand. We believe that decentralized production is a very important infrastructure pathway for a number of reasons—not only do you save transporting the hydrogen which is very difficult (unlike gasoline), but also it allows you to control how much is manufactured and stored for consumption when it is needed. In addition, having the hydrogen production on-site provides the potential for hydrogen to be supplied to power a stationary fuel cell.

We have learned many lessons from the demonstrations that we can share, and believe these could not have been learned had the DOE program only operated in laboratory and research settings. For example, our station systems are designed to run safely in an unattended remotely monitored production mode, (such as a fueling station would in the future), and therefore, the scope and sophistication of the technology we installed for the demonstrations is aligned with the path towards commercial reality. Another example is leak detection systems—these are particularly important for hydrogen production and storage systems and our demonstration facilities employ state-of-the-art, industrial-grade systems. We are now beginning to understand both the detailed and broad engineering factors which must be incorporated to meet commercialization standards. This knowledge is being used for future system improvements, and to gain the cost efficiencies essential for eventual commercial implementation. Because this is a new fuel infrastructure, the supplier community is new, often comprised of smaller companies, and needs to be developed to industrial-scale standards and size. The demonstration program has been an essential mechanism in developing this community. At this point, we have also learned that site location is very important, and permitting can be challenging due to various levels of understanding by local officials. We understand the value of public consultation and education as part of developing a demonstration site and the need for this as the technology develops. Also we are familiar with how to build confidence with important stakeholders, such as our site host, fire marshal and vehicle operators, in using the technology.

CHALLENGES TO COMMERCIALIZATION

Production and distribution of hydrogen

Hydrogen must be available when and where it is will be needed. Hydrogen is a fuel—not a natural resource. It must be manufactured from other sources, so how the supply system is developed is critical. The two primary sources of hydrogen are water and hydrocarbons. For the past 50 years, Chevron and the industry have been engaged in the large-scale conversion of hydrocarbons to hydrogen through refinery and gasification processes. As you may be aware, oil refineries are the largest current producers and users of hydrogen. Additional industrial uses are for chemicals, metals, and electronics manufacturing. Approximately 9 million tons of hydrogen is produced for industrial applications in the United States (world-wide production is about 40 million tons). The core technical and business challenge is to transform and adapt the hydrogen production and distribution system to support a much broader energy supply system for transportation and distributed power. The fundamental properties of hydrogen create both opportunities (it can be made from a variety of sources) and challenges (distribution and storage).

In Chevron's hydrogen program, we are adapting long-standing core competencies and proprietary technologies in fuels, catalysis, and process engineering to explore the development of a new distributed fuel-processing and delivery infrastructure.

The fundamental technology model relies on distributed, on-demand production of hydrogen, thereby materially reducing the costs and logistical barriers associated with large-scale transportation of hydrogen and significant onsite storage. Distribution and storage are the two primary cost components for hydrogen (as compared to production). It is important to note that this is essentially the opposite of gasoline, where production costs dominate distribution and storage. For the current generation of hydrogen infrastructure demonstrations, Chevron has concentrated on miniaturizing and distributing natural gas reforming and processing technology. This creates maximum use of the existing and extensive natural gas grid, resulting in dramatically reduced costs for the early stages of developing the infrastructure. Successful current R&D programs would allow for the extension of the small-scale reformer technology to utilize other light hydrocarbon feedstock as well.

Storage of hydrogen

Storing hydrogen in the car, at the refueling station and throughout the delivery infrastructure is a significant critical path challenge. The nature of the storage problems vary by application and each deserve the attention of R&D and demonstration by industry, national labs and the DOE. While much attention is given to storing hydrogen on board the vehicles, and rightly so, similar attention is needed in the other critical locations in the hydrogen infrastructure. In particular, cost effective dynamic storage in moderate volume is essential at the production and fueling sites. Today, all hydrogen storage is essentially in high-pressure vessels, typically at 5,000 pounds per square inch. Even at these pressures, the energy stored is far lower than with typical liquid hydrocarbon fuels. Where space is not a pressing limitation, such as with our production sites or on large vehicles, such as busses, the current technology is functional, but expensive. For the evolution to light duty vehicles, most believe that cost effective solid-state storage will be required. This is an important focus area for R&D programs. The bottom line is that the development of the infrastructure for hydrogen as a fuel will require advancements across a full system including production, distribution, and storage.

New codes and standards need to be developed that permit the development of the infrastructure

Existing building codes and hydrogen system design standards were not developed with consumer applications in mind. Today's codes provide large distance "setbacks" from other facilities that limit the locations where hydrogen can be manufactured, stored and dispensed. This was appropriate for hydrogen applications and applications of the 20th century, but they make retrofits of existing sites with limited area for expansion impractical for future hydrogen facilities.

Codes and standards will need to be updated to reflect the developments in safer hydrogen technologies arising from the new storage and control system technologies. In some cases, building codes will need to be strengthened to ensure safe maintenance facilities. Through research and demonstration of hydrogen generation and storage technology we will be able to gain the necessary safety knowledge which will lead to data driven codes and standards that do not currently exist.

PATHWAY TO COMMERCIALIZATION

We at Chevron anticipate that, realistically, the hydrogen supply of the future will have to be produced by a blend of energy sources—both hydrocarbons and renewable sources. This is the only scenario we can foresee that will enable hydrogen markets to emerge at scale, to adapt to diverse market structures, and allow hydrogen businesses to become profitable over the long term.

An avenue that leverages using the existing current infrastructure to produce hydrogen will be a critical step. We believe that using a distributed generation model will provide the most cost effective way to support the development of a fuel cell market. The technology to make this happen is small reformers and small electrolyzers. Providing consumers with this practical solution may help remove fuel availability as a near-term impediment to commercial adoption of fuel-cell vehicle systems.

Greenhouse gas emissions are being reduced using current reforming technology to produce hydrogen, and, in the future, those emissions may be further reduced by adding renewable energy sources, such as solar or wind, to produce hydrogen through electrolysis.

In sum, to develop a commercial-scale infrastructure, the cost of using hydrogen to consumers needs to be competitive in the market with other energy fuels. Large scale deployment requires that energy suppliers be convinced that hydrogen can compete with other fuels in the market. While there is reason for encouragement in special markets, broad commercial applicability has not been demonstrated.

Participation by auto companies, energy companies, and communities in the development of demonstration fleets of fuel-cell cars and buses will be important to get the infrastructure started and to prove the value and functionality. Specialty applications and niche markets that use much of the same technology but in different products are going to be important and will be a signpost along the pathway. One opportunity in this area may be for use of the hydrogen and fuel cell technology by the military. In addition, applications, such as airport ground equipment vehicles and fleets of industrial vehicles with centralized and stationary refueling, need to be successful before consumers are likely to be a significant user of this technology.

PUBLIC POLICY RECOMMENDATIONS

To pursue commercialization of hydrogen infrastructure and fuel cell technology, we believe that there are several critical areas for policy action. We recommend the following:

1. *Continue to Support DOES Hydrogen Fleet and Infrastructure Demonstration and Validation Program:* It is absolutely critical that DOE work on the infrastructure issues simultaneously with fuel cell vehicle development and storage technology which is being done with these demonstration projects. Energy companies have a key role to play in the development of the fuel cell market and Chevron is committed to helping the U.S. market move towards safe and cost competitive solutions. This should be a high priority in terms of DOE and other government R&D support.
2. *Fund Key Basic Research:* We believe that fundamental research must continue to be supported by Congress for this technology to move towards commercialization. Basic research performed by DOE national laboratories, the private sector, and academia will create the essential science and technology base needed for long-term, sustained advancement of hydrogen. We believe that the number one priority for this should be hydrogen storage. Without resolving the significant technology challenges, it will be very difficult to move forward on the large-scale implementation of hydrogen as a fuel.
3. *Engage Private Industry In Commercialization:* We believe that this will help make the technology commercial, and also focus government priorities on areas where there is the most need. Chevron has already significantly invested in R&D in the areas of hydrogen generation and storage. However, public-private sector partnerships are needed to provide the resources necessary to create conditions to allow commercialization of technologies that may not see economic returns for decades.
4. *Public Education:* When new technologies are on the horizon, there is a lot of fanfare and media attention surrounding the development of the technology. Unfortunately, this leads to unrealistic public expectations. As the hydrogen market evolves over the next few decades, technology breakthroughs will change the way hydrogen is made and supplied to the consumer. It is important that the public understand the market drivers, environmental benefits and cost benefits and challenges associated with each stage of the transition. The physical reality in the community provided by demonstration projects can uniquely educate the public.
5. *Monitor Market Signals:* Often we see that factors can change the need for a particular technology—either increasing or decreasing demand. Some of these factors may include competing technologies, availability of resources, and public opinion. We believe that this is addressed by EPACT in the roadmaps and studies required by the law. Periodic reviews will be necessary to assess progress, to steer or change policy as needed, and to implement appropriate mid-course corrections.

EPACT, for the first time, provides an authorized path forward for the hydrogen program which is very positive. It is appropriate that Congress oversee the DOE program and that public-private partnerships continue. We find that a partnership-based approach gives the most flexibility, delivers the best value for the dollars invested, and speeds the pace of technological innovation.

Thank you for the opportunity to testify and I would be happy to answer any questions.

Senator ALEXANDER. Thank you, Dr. Paul.

Mr. Balcom.

STATEMENT OF JAMES D. BALCOM, PRESIDENT AND CHIEF EXECUTIVE OFFICER, POLYFUEL, INC., MOUNTAIN VIEW, CA

Mr. BALCOM. Good afternoon, Mr. Chairman. My name is Jim Balcom, and I'm the president and CEO of PolyFuel, a world leader in engineered membranes for fuel cells.

Mr. Chairman, the Energy Policy Act of 2005 contains a variety of R&D initiatives designed to accelerate the commercialization of fuel cell technology, and I want to thank the committee for its leadership in drafting this legislation, and I would urge the committee to continue to advocate the full funding for the implementation of the act.

As the committee evaluates the administration's progress in implementing the act, I'd like to share two observations.

First, while the automotive application will allow society to realize the environmental benefits of fuel cells, the success of fuel cells in this critical market will be preceded by, and catalyzed by, their success in the portable power market.

And second, companies and governments that want to have a leadership role in automotive fuel cell technology must play an active role in the introduction of fuel cells into the portable market. And the reasons for this are several. First of all, the portable fuel cell application ranks higher in six critical areas, in terms of market readiness. The cost targets are much easier to hit. Second, the durability or lifetime targets are much easier to hit. Third, the fuel infrastructure, which we've just learned about, is much easier to put in place than in the automotive application.

Fourth, the regulatory changes are much easier to put in place and are already well on their way to being established.

And, fifth, the market kinetics—that is, the speed at which new technology is adopted—in the portable power marketplace is much more rapid than in the automotive application.

And, last, consumer demand for the longer run times that this portable fuel cell technology enables is very strong.

And these last two are the most critical. From history, we know that technological progress happens most rapidly in real markets with real demand pressures. And the examples of this are all around us, from rates of improvements in digital camera technology to hard-disk-drive technology and portable computing technology.

Unlike the automotive fuel cell market, where the best-case scenario has fuel cell technology meeting the DOE's commercial targets in mid-next-decade, we believe that strong consumer demand and these rapid market kinetics will result in the implementation of fuel cell technology within the next 2 to 3 years in the portable arena. After that, the subsequent mass commercialization of portable fuel cells will catalyze the automotive market, and that's because of the experience-curve effect. This occurs as new designs, materials, and processes are developed to meet market demand and solve real customer problems, and we predict that these innovations in portable fuel cells will have direct spinoff benefits for automotive fuel cells, which share many similar designs, materials, and processes as portable fuel cells.

And we feel that we're already seeing this at PolyFuel, both internally and externally. Internally, we have spent a significant

amount of money developing membranes for portable fuel cells, and that knowledge has led us to achieve critical advances in membrane technology for automotive fuel cells, as well. And externally, a number of leading fuel cell industry players have recently recognized the opportunity for market leadership—this is overall market leadership—and are moving convincingly into the portable fuel cell market space.

The 21st century will be dominated by energy concerns, and fuel cell technology will play a key role in U.S. efforts to achieve energy independence, improve the environment, and grow the economy. However, without a strong presence in portable fuel cells, the United States risks missing the boat in the broader fuel cell market applications. The U.S. auto industry has already experienced this to some extent with hybrid vehicle technology, where one U.S. auto executive complained recently that it could manufacture and sell more hybrid vehicles, but it could not obtain enough hybrid components from the foreign auto manufacturer that developed the technology.

The United States has the opportunity to solidify a strong leadership role in fuel cell technology, but it must act now to strengthen government and industry partnerships and refine the key enabling technologies to realize this opportunity.

I recommend that the Government reinstate funding for the competitively awarded, cost-shared portable fuel cell programs that were deferred, based on budget constraints, by the Department of Energy in early 2006. And, second, I also recommend that the Government look for ways to increase its support for research, development, demonstration, and commercialization of portable fuel cell technology. In this way, I strongly believe that the United States will best position itself to benefit from the synergies that will soon be available as portable fuel cell technology acts to catalyze the automotive fuel cell application. And in an era of rapid decline in domestic manufacturing jobs, the importance of securing a leadership position in this next-generation technology cannot be overstated.

I appreciate the opportunity to appear before the committee. I look forward to your questions.

Thank you.

[The prepared statement of Mr. Balcom follows:]

PREPARED STATEMENT JAMES D. BALCOM, PRESIDENT AND CHIEF EXECUTIVE OFFICER, POLYFUEL, INC., MOUNTAIN VIEW, CA

I. INTRODUCTION

Good afternoon, Mr. Chairman. My name is Jim Balcom, and I am the President and Chief Executive Officer of PolyFuel, a world leader in engineered membranes for fuel cells.

PolyFuel is headquartered in Mountain View, California, and our leading-edge hydrocarbon membranes enable a new generation of portable and automotive fuel cells that for the first time can satisfy the desire for long-running and cost-effective portable power, and can deliver on the long-awaited promise of clean, efficient automotive power based upon renewable energy sources. PolyFuel's unmatched capability to rapidly translate the system-level requirements of fuel cell designers and manufacturers into engineered polymer nano-architectures has led to its introduction of best-in-class hydrocarbon membranes for both portable direct methanol fuel cells and for automotive hydrogen fuel cells. Such capability—based on PolyFuel's more than 150 combined years of fuel cell experience, world-class polymer nano-architects, and a fundamental patent position covering more than 23 different inven-

tions—also makes PolyFuel an essential development partner and supplier to any company seeking to advance the state of the art in fuel cells. Polymer electrolyte fuel cells built with PolyFuel membranes can be smaller, lighter, longer-running, more efficient, less expensive and more robust than those made with conventional fluorocarbon membrane materials.

PolyFuel was spun out of SRI International (formerly Stanford Research Institute), in 1999, after 14 years of applied membrane research. The company is publicly listed on the AIM stock exchange in London.

II. PORTABLE POWER—CATALYZING THE FUEL CELL INDUSTRY

Mr. Chairman, as the Committee on Energy and Natural Resources conducts oversight and evaluates the Administration's progress in implementing the Energy Policy Act of 2005, I would like to share with the Committee two extremely important observations:

1. While the automotive and stationary markets will allow society to realize the environmental benefits of fuel cells, the success of fuel cells in these markets will be preceded and catalyzed by their success in the portable power market.
2. Companies and governments that want to have a leadership role in automotive and stationary fuel cells must play an active role in the introduction of fuel cells into the portable market.

Simply put, widespread adoption of fuel cells, and their long-term commercial viability, depends heavily on their rate of adoption in the power-hungry portable market. The U.S. government's focus on automotive and stationary markets is based on our need to increase energy independence, reduce emissions from power generation and transportation sources, economically revitalize the automotive sector domestically, and improve the reliability of our electric grid. Unfortunately, this strategy neglects the fact that portable fuel cells will achieve widespread adoption before automotive or stationary fuel cells are commercialized, and the positive impact that commercialization of fuel cells in the portable sector will have on the introduction of automotive and stationary fuel cells. This disconnect is not limited to government policy; companies who elect to focus their energies on the more technologically challenging but less immediate market segments, such as automotive or stationary, will "miss the boat", even in their own targeted markets. Unlike the automotive or stationary fuel cell markets, the commercialization of fuel cells into the portable market, supported by the development of high performance hydrocarbon membranes, is viable today.

Key distinctions between these three sectors are highlighted in the table below:

Market Drivers	Niche Opportnity	Oil Supply Global Warming	Urgency "Run-Time GAP"
Market Kinetics	Slow	Glacial	Rapid
Cost vs. Targets			
Low volumes	5–10 X	50–100 X	In Range
Commercial volumes	1.5 X	3.5 X	In Range
Durability vs. Targets	2/5th	2/5th	In Range
Regulatory Environment	Achievable	Complex	Coalesing
Fuel Infrastructure Requirements	Simple	Profound	Simple

Source: U.S. Department of Energy, Ballard, Honda, PolyFuel, and others.

Market Dynamics

The global effort to commercialize fuel cells in automotive and stationary applications is primarily driven by a desire to reduce the environmental impact of combustion engines and power plants fueled by hydrocarbon based fuels such as gasoline, diesel, natural gas, and coal. Additional drivers include a desire to reduce consumption of petroleum in the face of concerns about the stability and longevity of oil supplies, and a need to revitalize both the domestic auto industry and the aging power grid.

Unfortunately, and ironically, the dynamics of the automotive fuel cell markets resemble the pace of the environmental changes caused by global warming. The best case scenario in the automotive market has fuel cell technology meeting commercial targets outlined by the DOE in 2015, followed by commercial introduction around 2020. It is likely that significant environmental benefits from fuel cell vehicles will not be realized until the second half of the century. Similar dynamics exist in the stationary market.

The portable market, on the other hand, is characterized by rapid cycles of new product introduction and technological progression as illustrated by Moore's Law

and the emergence of more and more advanced devices such as cellular phones, laptop computers, personal digital assistants, and media players. In addition to more computing power, these latest devices are taking advantage of growing wireless connectivity to deliver to users more and more capability such as mobile TV, wireless music downloading, and GPS among others. Unfortunately, these advanced capabilities require more power and energy than current and future battery technology can deliver. This deficit manifests itself in decreased runtimes for the "power user" class of consumers. Content providers, wireless carriers, portable device makers, and battery manufacturers are all feeling the pain and are urgently seeking a solution to this problem.

PolyFuel refers to the gap between the capabilities of available battery technology and the demands of power hungry portable devices as the "runtime gap". Recently published studies indicate that portable device power demand is increasing three times faster than the rate of battery improvement. The Boston Consulting Group predicts that by 2010, the demand for energy is forecast to be four times that which is available using conventional technologies. Without a better power supply such as a portable fuel cell, users of contemporary personal electronic devices will experience runtimes measured in tens of minutes versus the hours that they will demand.

Technology Readiness

In addition to more challenging market dynamics, automotive and stationary applications have product requirements and environmental operating conditions that are much more demanding than those in the portable market. Two of these that are particularly challenging for fuel cells are cost and durability. As shown in the table above, the costs for today's automotive and stationary fuel cell technology, either at today's low volumes or when projected to commercial scale volumes, are well in excess of what is required for mass commercialization. A similar disparity exists for durability, where to date the industry has only been able to achieve lifetimes that are 40% of what is required for automotive and stationary applications.

Portable fuel cell durability is well within the required operating lifetime of 2,500-5,000 hours. PolyFuel has demonstrated lifetimes of 6,000 hours with the fuel cell membrane, the most critical and sensitive component in a portable fuel cell.

Commercial cost targets for portable power supplies, which range from $5,000 to $10,000/kW, are achievable today with Direct Methanol Fuel Cell (DMFC) technology. DMFC, the fuel cell technology of choice at most of the leading consumer electronics companies and all of the leading rechargeable battery companies, is widely considered to be ideal for the portable fuel cell application due to methanol's safety, energy density, low cost, ease of use, and ease of transport.

Regulatory & Infrastructure Requirements

Two other critical areas where the portable market compares favorably against the automotive and stationary markets are regulation and infrastructure. Before any significant adoption of fuel cells can take place in the automotive market, codes and standards in diverse areas such as hydrogen storage, hydrogen sensing, refueling, car parks, garages, fire, insurance, and building construction need to be adopted. Even more challenging will be the development of a multi-billion dollar "hydrogen infrastructure" which includes widespread compressed hydrogen gas distribution, filling stations and storage depots. While the infrastructure issues for the stationary application are relatively simple, regulatory issues are complicated by the fact that many of the relevant codes and standards for stationary devices are different from city to city and state to state.

In contrast, the regulatory and fuel infrastructure issues in the portable market are relatively simple, particularly after the recent decisions by the United Nations and the International Civil Aviation Organization that have set the stage for the carriage and use of methanol fuel cartridges onboard commercial aircraft. Such fuel cartridges, resembling disposable cigarette lighters, will, in the not-too-distant future, be available in every convenience store and market—which explains why companies such as BiC, Tokai, and Duracell are very active in the development of methanol fuel cartridges for fuel cells.

Portable as a Gateway to Automotive & Stationary

More than any other factor, the key variable that drives rapid technological and commercial progress is market demand. Significant market demand driven by the "runtime gap" is going to drive portable fuel cells to mass commercialization years before automotive fuel cells become economically viable, or stationary power fuel cells become widely deployed. Portable device manufacturers engaged in fuel cell systems development include Samsung, BYD, NEC, Sharp, LO, Sanyo, Fujitsu, Hitachi, Toshiba, and Sony; and all of these companies are well positioned to roll-

out fuel cell solutions that address the "runtime gap" for multiple products before the end of the decade.

The mass adoption of portable fuel cell technology will have a catalyzing impact on the commercialization timelines for fuel cells in the automotive and stationary markets. The three markets share many characteristics, including materials, suppliers, and manufacturing processes. Portable fuel cell technology shares many components with fuel cells for automotive & stationary applications. Wide and early adoption of portable technologies will provide experience to industry and consumers, develop a supply base, and drive economies of scale which will benefit commercialization of automotive and stationary fuel cells.

It is well understood that government support for research and development is critical to sustain the leadership position that the United States has achieved in the global race towards a fuel cell-based economy. Less well understood is the importance that government investment into the portable sector will have on both speeding commercialization of fuel cells in the automotive and stationary markets and on the potential for the United States to recover its leadership position in the $5 billion portable power industry that long ago moved overseas. In an era of a rapid decline in domestic manufacturing jobs, the importance of this potential cannot be understated.

Most of the U.S.-based companies in the portable power arena are working with foreign partners that will have prototypes available within the next 12 to 24 months. Without sufficient attention by the U.S. Government, it is possible that by the time the initial applications which integrate portable fuel cells take root here in the U.S., their design and manufacture will be firmly entrenched offshore. This scenario is not unlike that of Lithium ion batteries, whose technologies were predominantly developed in the U.S. but commercialized first in Japan, and are now produced exclusively by foreign companies in Asia.

It should be noted that in addition to the growing consumer demand for extended-run portable power in commercial products, U.S. military forces are also actively seeking alternatives to conventional battery technology to extend the run-time of critical sensor, soldier power, communications, and auxiliary power systems. As the Defense Department continues its efforts to transform the U.S. military into a more strategically responsive "network centric" force, I believe it is critical that the Departments of Energy and Defense work more closely to jointly leverage technology development and demonstration activities, and to ensure that the U.S. maintains both the technological capability and surety of supply necessary to promote our overlapping commercial and military interests.

The Energy Policy Act of 2005 contains a variety of initiatives designed to accelerate the commercialization of fuel cell technology. Most importantly, the legislation supports new funding for research and development; it also calls for increased technology validation and establishment of a modest market transition program. This comprehensive approach will complement existing programs, improve technology, and stimulate a reliable supply base. Importantly, I believe this strategy will help deliver the key technologies that must be developed to meet the deployment timelines set forth by the President and Congress. I would urge the Committee to continue advocating full funding for the implementation of the Energy Policy Act of 2005.

III. CONCLUSION

Mr. Chairman, as I have outlined in my testimony, the success of fuel cells in the automotive and stationary markets will be preceded and catalyzed by their success in the portable power market. Companies and governments that want to have a leadership role in automotive and stationary fuel cells must play an active role in the introduction of fuel cells into the portable market. Wherever possible, the U.S. Government should increase financial support for research, development, demonstration, and commercialization of portable direct methanol fuel cell technology within the Department of Energy's broader Hydrogen, Fuel Cells, and Infrastructure program. Additionally, funding should be reinstated for competitively-awarded, cost-shared portable fuel cell programs that were deferred by the Department of Energy in early 2006 based on budget constraints.

I appreciate this opportunity to appear before the Committee, and I look forward to your questions.

Thank you Mr. Chairman.

Senator ALEXANDER. Thank you, Mr. Balcom.

I'm going to ask Senator Domenici if he's like to ask the first questions in this round.

The CHAIRMAN. Well, I appreciate it. And I won't do justice to the panel. I'm thankful for you setting this up. This is the kind of panel that we would need a full 3 hours with five or six more Senators, because this is a truly exciting series of observations, and you have been cut short. And I'm not going to sit here and tell you that I'm going to help out much, because I'm supposed to be somewhere at 4 o'clock, and—just like everybody else. That's a true statement, and I'll have to do that.

But let me jump around.

Mr. Balcom, you noted, in passing, that there were many provisions in the Energy Act which we are very proud of—I hope you are—many provisions that do justice to the area we're speaking of: fuel cells. But then you quite properly said, as I understand the problem, we should push hard to fully fund the programs. Do I read you that that means that the programs are nicely worded and nice, cherished American goals, but, unless you put some money in them, they're not going anywhere, and that they're not funded very fully in—so far? Is that a fair assessment?

Mr. BALCOM. That's as we've experienced it. As a matter of fact, there were several competitively awarded cost-shared programs focused in the portable space. And I think this was a recognition by the Department of Energy that one needed to balance the early market opportunities with the mid- and the longer-term opportunities. And these competitively awarded programs, indeed, did do that. My understanding——

The CHAIRMAN. Well, I don't know what to do about it. I'm so frustrated. We went ahead and funded about $350 million over and above the executive branch this year in the Appropriations Subcommittee for energy activities found in the Energy Act. Now, I can't go back and think how many of them were in the area we're speaking of, but that's a pretty nice plateful when there was no money to back it up. We just had to take it out of something else, so we tried. But that's a tough, tough problem.

You noted in your testimony that the portable market is moving toward direct methanol fuel cells. Do you think that ultimately these same fuel cells could be used in vehicle applications?

Mr. BALCOM. Not exactly that same technology, Mr. Chairman, but a similar technology. The direct methanol fuel cell bears many similarities with the solid polymer PEM fuel cell technology, which is being used for automotive fuel cells.

The CHAIRMAN. Dr. Paul, in your testimony and—here before us, you talked about Chevron's—and you used some descriptive words regarding its research facility. What did you call it? Full center?

Dr. PAUL. Yes, it's a full research facility devoted to hydrogen.

The CHAIRMAN. Full center devoted to hydrogen. And how much do you—for purposes of letting the public know that you are investing in matters like this, how much is invested in that by you?

Dr. PAUL. Well, we have been spending at the rate of about $50 million a year.

The CHAIRMAN. About $50 million a year.

Dr. PAUL. Yes.

The CHAIRMAN. So, when they say you aren't interested in options for vehicles that aren't going to be run by gasoline, this is at least $50 million worth of interest, right?

Dr. PAUL. Yes, Senator. In fact, I would argue that we're basically in the broad energy business, and diversifying the range of molecules that we have to provide energy and fuel, I think, is the key to the future.

The CHAIRMAN. Well, that's what my guess would be.

Dr. McCormick, General Motors has made impressive progress—and you have stated that today—in fuel cell technology, much of that in recent years, although it's not yesterday. What are the greatest—or what are the remaining technical challenges, as you see them? Tell them to us.

Dr. MCCORMICK. Well, first of all, I think that the early generation technology can be done with derivatives of things we know today. So, first of all, I think the notion of a breakthrough for early generation is probably not critical. I think over a longer period of time the need for advanced hydrogen storage is absolutely critical, because we want to make it cheaper and more condensed on the vehicle. So, I'd say hydrogen storage is the leading thing that we want to focus on.

Most importantly—and it may be implied in your question—my mind today goes much more to commercialization and the challenges of getting it out of the laboratory and into the market, because of that "valley of death" problem, where we have very, very low volume, and trying to figure out how we actually bootstrap this technology up, like the Minuteman Program did for silicon chips, like ARPANET did for Internet, like the Transcontinental Railroad was done. I think we are going to have to have a very good partnership between government and industry, in terms of actually, as you said earlier, making the market. That's where my real thoughts are these days.

The CHAIRMAN. Well, Doctor, it seems to me that—as I reviewed for today, it came back to me that the big monkey on this future is, What do we do, ultimately, with the carbon dioxide? Because we can play around with it on a small scale, but, when we get to the big-time, and we hit the big leagues, we've got be talking about getting rid of it permanently. And that means we've got to make those technical breakthroughs that are much different than the one's we're making now. They've got to be the ultimate disposition of carbon dioxide.

Dr. MCCORMICK. Correct.

The CHAIRMAN. Right?

Dr. MCCORMICK. Right.

The CHAIRMAN. And that's not there yet. So, I mean, I would hope you would say when next—when you're asked what the big issues are—that's a big one, right?

Dr. MCCORMICK. I speak about it from a car company, and I think Don Paul can talk about it from the energy side, but certainly we've got to mobilize all the sources of energy. No doubt about it.

The CHAIRMAN. If you listen here, it's the same for automobiles, because if it's going to make a big dent in the transportation energy, which is the transportation crude oil usage, which is what we're talking about—to be a big player there, that's going to have to be a macroimpact, which is still going to get back to—you've got

to get rid of the CO_2, not just on an interim little bit—play a little game, but really getting rid of CO_2.

Dr. MCCORMICK. Right.

The CHAIRMAN. Now, Mr. Leuliette, I was very impressed with your great knowledge, and also sympathetic toward your position about where you and your suppliers are in this marketplace, and how you get so easily overlooked, not found, forgotten, which—depending upon which way you look at it. But tell me—part of that's because it's hard when there are so many small—so many thousands of components that are called what you are. But let me ask you, in your testimony you described several shortcomings of the hybrid vehicles and a reliance on ethanol. Am I correct?

Mr. LEULIETTE. As a long-term solution, that's correct, Mr. Chairman.

The CHAIRMAN. Aren't there also business opportunities for the supplier community related to hybrid vehicles and biofuel-based vehicles?

Mr. LEULIETTE. Yes, there are. And we're very active in that today. As a matter of fact, our company, Metaldyne, supplies key components for every vehicle using E85, and diesels, and everything else.

The CHAIRMAN. OK.

Mr. LEULIETTE. The issue here, I believe, is more, I think, the hearings here, for the longer term—the hydrogen issue—is a longer-term solution.

The CHAIRMAN.Well, I'm glad I asked because actually there is no disagreement. It is vital. It's just not—long term, it's not going to fit right? So, the automobile supply industry must be involved in developing a range of alternative technology vehicles, correct?

Mr. LEULIETTE. Correct. As Dr. McCormick mentioned, critical mass, volume, is key to success. There are two issues here with respect to putting hydrogen in place. One is the technology to create it, and the other is the process technology to produce it at low cost. It's the supplier community that is key to producing in high volumes at low cost and high quality. That's the role we've played today, and it's a role we'll play in the future.

The CHAIRMAN. Thank you very much.

Thank you, again, Mr. Chairman.

Senator ALEXANDER. Thank you, Senator Domenici.

Senator Thomas.

Senator THOMAS. Well, thank you, gentlemen. I guess my questions are a little more broader.

Mr. Balcom, you talked about portable fuel cells. How does that differ from what you're talking about with Chevron?

Mr. BALCOM. The principal difference is the fuel that's used. In a portable fuel cell, the fuel will be a methanol, a liquid methanol fuel, typically. Most of the industry has selected methanol as the fuel because it's easier to package, it's less expensive, it has a higher energy——

Senator THOMAS. So, you're not talking about hydrogen.

Mr. BALCOM. Yes, hydrogen would be used for the automotive application. That's where the difference lies. The similarities are similar membrane materials, similar plate materials, similar electrode

materials, similar catalyst materials. More of the materials are similar than they are different between the two technologies.

Senator THOMAS. What's the source of the supply for both of them?

Mr. BALCOM. The methanol—as a fuel, are you referring to? That comes from natural gas, principally. It's produced in the millions of tons per day—or per year, pardon me.

Senator THOMAS. OK.

I guess, Dr. Paul, when you were talking about your production, that the source is natural gas. Is that correct?

Dr. PAUL. Yes. The current fuel source is natural gas—basically what we use in industrial applications today, but miniaturized to take advantage of the infrastructure——

Senator THOMAS. In terms of the long-term supply of energy, is natural gas a long-term supply?

Dr. PAUL. I think natural gas is a long-term supply some places. I think the key to hydrogen, the key leverage we have by going to hydrogen, is going to be made by so many places—so many things. Some places, it's coal; some places, it's natural gas; some places it will be ethanol; some places, it will be conversion of electricity. I think—some places, nuclear—I think that's the great strength. But natural gas will be, I think a part of the production.

Senator THOMAS. So, there could be a number of other sources for what you're doing. I see. And that's great.

Dr. PAUL. Absolutely.

Senator THOMAS. Mr. Leuliette, you talked about the need for an energy policy. Don't we have an energy policy?

Mr. LEULIETTE. I think we have an energy bill, but I don't know if we have an energy policy. With respect—and I mean in the terms of energy policy, a goal, an established, real goal that's funded to achieve a certain outcome.

When we look at—and we've used many—and many people have used this goal, or this comparison of putting a man on the moon—if you want to attract private equity, the Government would need to say, "This is the target date, the real date, of achieving a 40-percent, 50-percent, 60-percent conversion of a vehicle fleet over to hydrogen," something for which there's a hard target for which people can start investing in. As I said, in the beginning, private equity did not flow to the dot-com and to the Internet world until it was established, until it was defined, until protocols were established, until the interface was defined. But it didn't take government money to grow Yahoo! or Google or anyone else. Once the infrastructure was in place and the economics were visible, capital came in to invest. And I believe that some role here in the hydrogen economy, that will occur, as well.

Senator THOMAS. There may be other things, but I guess I question a little bit how you think the role—the basic role is—of the Federal Government—the private industry is where the real opportunities exist.

Mr. LEULIETTE. The—you're asking the private—the Government played a role in the Internet in supporting the infrastructure and the protocol.

Senator THOMAS. And they're playing a role in energy policy, as well.

Mr. LEULIETTE. Yes.

Senator THOMAS. Incentives, reduction in loans, all kinds of financial incentives are there.

Mr. LEULIETTE. But the conversion to a hydrogen economy, Senator, is bigger than Chevron, bigger than General Motors, bigger than Toyota——

Senator THOMAS. Well, a hydrogen economy isn't the only alternative in the world, either, you know. There are other kinds of things that are going on.

Mr. LEULIETTE. Yes. And to the——

Senator THOMAS. It's a part of it. We've got nuclear, we've got solar, we've got wind, we've got all kinds of things that we're working on. It's not just hydrogen.

Mr. LEULIETTE. Agreed, Senator. But if we are here focusing on mobile transportation——

Senator THOMAS. No, I understand. And I'm all for that. I just——

Dr. McCormick, you're an automobile industry person with lots of automobile industry things going on around the world. Are they doing things like this? Are other countries doing some things of this kind?

Dr. MCCORMICK. Yes, absolutely. A couple of comments. All major auto companies have substantial programs in fuel cells and hydrogen. For my part, I have approximately 1,000 people working on it. For my part, a couple of years ago we acknowledged we had passed through, very rapidly, a billion dollars expended. And so, that's the kind of scale that work is going on around the world.

I must say that one of the things we do—and we're doing demonstrations around the world and stay actively engaged with governments around the world—because, to the discussion we've been talking about here, in terms of commercialization, some government somewhere in the world will find the right equation with the right amount of capitalism, the right rules and regulations, the right return, and all of us that are in the automotive industry will have to be there. And so, consequently, it is a worldwide activity. You have to look at the pronouncements of the Japanese prime minister and what MITI's doing, discussions that on-go continuously in China. Korea is actively engaged, and the European Union's actively engaged. So, it is very big.

Senator THOMAS. So, it is something others are involved, as well, and we have to share in learning that, and so on.

Dr. MCCORMICK. No doubt.

Senator THOMAS. One very quick question. How do you store enough hydrogen in a single tank? Isn't the single-tank issue a problem?

Dr. MCCORMICK. It is. What we really had to acknowledge was that hydrogen geometry looks different. We need a cylindrically—a cylindrical tube, and we had to acknowledge that we had to change the vehicle architecture a little bit and put the tube down the center of the vehicle, basically, rather than trying to stick it in the trunk. So, fundamentally, we started designing the vehicle around the hydrogen storage, rather than trying to make it look like gasoline.

Senator THOMAS. Oh, really? So, we need a longer car, huh?

Dr. MCCORMICK. No. No, actually not. The Sequel, which will be out later this year, is a full-sized vehicle that you would recognize. We could put it out in the parking lot and you'd recognize it.

Senator THOMAS. That's great.

Dr. MCCORMICK. Nothing unique about it——

Senator THOMAS. Well, we appreciate all of what all of you are doing. This is a real challenge for us, and an opportunity. So, thank you.

Dr. MCCORMICK. Thank you.

Senator ALEXANDER. Thank you, Senator Thomas.

Just a couple of other questions.

Mr. Leuliette, you have suggested that the supplier community is very important to the research and development and the transformation of the hydrogen economy, but it's not properly integrated into the Government's efforts. Do you—for example, were any suppliers included in the new advisory—technical advisory committee that was just announced by the Energy Department?

Mr. LEULIETTE. As I understand, there is no one involved in that. I need to check that, but there is no one involved. But, again, that wasn't because they were precluded. I don't think a supplier raised his hand and tried to be involved in that process.

Senator ALEXANDER. You don't think one did raise his——

Mr. LEULIETTE. No.

Senator ALEXANDER. It's the Hydrogen and Fuel Cell Technical Advisory Committee. Do you think it would be helpful if suppliers were represented on that committee?

Mr. LEULIETTE. I think it is. I'm not here today just to represent Metaldyne, but a collection of the CEOs of many of the suppliers, and we've discussed this, is that we need to provide a better way for you to talk to us. The supply community is a large group. It is thousands. But there's really only about 50 or 60 of us that are the large, multibillion-dollar, multinational companies that supply some of the key components. And so, the group could be a little bit more focused. And we need to provide a better avenue for you and Government to talk to us, and we are working on that.

Senator ALEXANDER. Well, I would like to encourage that. Mr. Garman is a reasonable person, but I didn't think his explanation of why you weren't involved was really a very strong one, that there were so many of you that they'd just not pick any of you. That didn't make much sense to me. You're here today, out of four representatives. And I would think that maybe your association, or, as you just suggested, some of the larger suppliers or some of representative group of suppliers, might suggest to the Department of Energy, in a more formal way, or to us, on this committee, how we can make certain that as we consider this subject and other subjects, that we don't overlook the fact that suppliers are a very important part of our economy, our jobs, our capacity for R&D. I doubt if any of the automotive manufacturers would disagree with that at all. And so, it may just be a matter of the Department of Energy or us, in developing our formula and our legislation, haven't been as attentive to that as we should be. So, I would look forward to your suggestions, and my guess would be, Mr. Garman would look forward to any suggestion that you might make, about how to make it easier for him to select among suppliers so that

they are included. And I'll be glad to mention that to him myself, specifically.

I have one other general question, really for any of you, and it's a sort of a blunt question, but it's an appropriate one, I think, for this discussion. Is the hybrid-car phenomenon of the last couple of years simply a passing fancy or a fad that is occupying our attention while we wait for some transformative technology, such as hydrogen fuel cells? Or, to put it another way, why would we expect major automobile companies to invest a lot of money in a technology on which they cannot make money, which is—as I understand it, the hybrid car costs so much more for consumers to buy that the margin of profit for each unit is relatively small. Some people have suggested that what the automobile companies are doing—and I'm not just talking about General Motors here; I'm talking about Nissan or others, as well—they may just be making a certain number of them to satisfy the public attention that's been focused on them, while, in fact, they're investing the real dollars in fuel cell economies and other more transforming technologies. How do we put that into perspective? Or is that an unfair characterization?

Let me just start with you, Dr. McCormick, since you're in this area, where you work.

Dr. MCCORMICK. A couple of comments. First of all, given the magnitude of the challenges that we see, both environmentally and in terms of dependence on petroleum, hybrid vehicles won't get us there, a 10-, 20-, 30-percent kind of improvement—I think, many times Secretary Garman has testified about the Department of Energy projections, and if you put those kind of efficiencies on top of what we're seeing, in terms of growth population and things, you can't get there from here. So, clearly, under any circumstances, it's a stopgap.

So, what we have done is really taken a portfolio approach. In the near term, it's hybrids, it's advanced engine technology of more conventional sorts, it's the E85, recognizing—and I think Dr. Paul said it really correctly—as we look at the world and all the emerging economies, and the pressures that are going to be there, both environmentally and energywise, we're going to need every amount of energy we can get, and we've got to use it most efficiently. And that inevitably leads you back to the fuel cell solution. So, what we want to do is get away from incrementalism and get as quickly as we can to something like hydrogen, where we can look for a sustained period of using that technology. So, we've got a very strong investment in all these things. But, at the end of the day, we think the hydrogen fuel cells is where we've really got to go.

Senator ALEXANDER. Mr. Leuliette.

Mr. LEULIETTE. Let me echo that from our perspective as a supplier. We see the economics of hybrid and E85, et cetera, being such that they are intermediate solutions. Our biggest concern in the supplier community is that the industry, the Government, or other groups look at these, what we call, "feel-good solutions" as solutions, and stop the focus in the energy in the longer-term scenario, such as hydrogen. That's the biggest risk we face. Because if we spend a lot of money on E85 infrastructure, if we promise that hybrids will be the solution, we will all be sitting around this

table 3 or 4 years from now, facing an even greater challenge, and had not spent the money properly to solve the root cause and deal with the root cause of the problem.

Senator ALEXANDER. Thank you.

Dr. Paul.

Dr. PAUL. I guess what I would add, Mr. Chairman, is that—go back to where I started and what Byron just mentioned. We're going to need all of it. I think we've got to have a comprehensive program. We have it. I know General Motors has it. And I would strongly encourage, and do encourage, the efforts being made by DOE and the Federal Government to support across the band of opportunities. Hydrogen, in the long run, but certainly coal, bio, oil shales, all of these things are going to—I think you want in your research portfolio, because you're going to need many options as time goes on.

Senator ALEXANDER. Mr. Balcom, we'll let you have the last word.

Mr. BALCOM. I'd like to just reinforce that the work that the U.S. DOE has done in balancing the portfolio between the short-term, the medium-term, and the long-term applications, I think, is an appropriate one. Just as one wouldn't put all of its practice into the long pass or the Hail Mary pass in a football game, you practice your ground plays as well as your short passes and your long passes, I'd recommend that they continue to do the same thing here.

Senator ALEXANDER. Well, you might, if you—if there were only a minute to go, put more of your options——

[Laughter.]

Senator ALEXANDER. But we don't—hopefully, have more than a minute to go.

This has been very helpful. This has been a very helpful hearing.

Our purpose today has been to put the spotlight on what our committee and the Senate regards as a transforming technology that could very well help us dramatically reduce our dependence on oil in this country. The advantages of that are reduced cost to consumers, cleaner air for our families, and a transformation of our foreign policy, as we can see, in terms of what's going on in the Middle East today.

What we want to do on this committee is not create the hydrogen fuel cell automobile; what we would like to do is to create an environment in which you can do that, and—by encouraging it, by staying out of the way, where that's the more appropriate thing is to do.

We've heard some very helpful suggestions today about where to put the focus, such as on hydrogen storage. We've heard suggestions about how to include a broader number of ideas. Dr. McCormick reminded us, this is a worldwide enterprise. There are many people with ideas. They ought to be included in whatever the Department of Energy is doing. Mr. Leuliette has reminded us that suppliers are a major part of our R&D effort and our effort to go ahead. Dr. Paul has talked about the demonstration projects that Chevron already has in place. This is no pipedream we're talking about. Mr. Balcom has reminded us, this is a transforming technology. So, this is very helpful.

This is, by far, from the last time we'll be discussing this. As Senator Domenici said before we left, this is so important that we need to find one or two of us in the Senate who can spend the time simply on the idea of the hydrogen fuel cell economy and make sure that we keep our eye on what the Department of Energy is doing and what we ourselves are doing to make sure that we help create this environment in which you can succeed.

Thank you very much for your time.

The hearing is adjourned.

[Whereupon, at 4:15 p.m., the hearing was adjourned.]

[The following statement was received for the record:]

STATEMENT OF UTC POWER, A UNITED TECHNOLOGIES COMPANY

UTC Power, a United Technologies Corporation (UTC) company, is pleased to submit the following statement for the record relating to the July 17, 2006 hearing on "Implementation of the Energy Policy Act Provisions on Hydrogen and Fuel Cells." With more than 40 years of experience, UTC Power is the world leader and the only company in the world that develops and produces fuel cells for applications in each major market: on-site power, transportation and space flight applications. We are also the world leader in the development of innovative combined cooling, heating and power applications in the distributed energy market.

SUMMARY

Fuel cells provide an opportunity to address a variety of U.S. energy needs including:

- Reducing dependence on foreign oil;
- Delivering assured, high quality reliable power;
- Decreasing toxic air and greenhouse gas emissions; and
- Improving energy efficiency.

UTC Power does not see any "show stopper" technical barriers to the advancement of fuel cells, but continued U.S. commitment to research, development, demonstration and market transition initiatives are essential to reduce cost, improve durability and enhance performance. Hydrogen storage and infrastructure requirements represent challenging obstacles for transportation applications, but near term opportunities exist with fleet vehicle applications such as transit buses that minimize these concerns. Stationary fuel cells for assured power represent another opportunity for near term commercialization at higher cost targets than those required for personal vehicles.

Fuel cells are available today for the transit bus and stationary markets. Near term successes in these applications are required to create public awareness and acceptance, establish a viable supplier base and stimulate continued investment. Last year's Energy Policy Act provides the basic framework for a comprehensive strategic focus, but a sustained national commitment to robust funding will be critical to our success. Hurricane Katrina reconstruction efforts represent an opportunity to deploy fuel cells in schools to serve as emergency shelters, hospitals and other critical infrastructure facilities to demonstrate their ability to provide sustainable energy for assured power requirements.

As we enter the summer hurricane and electric grid blackout season, concerns regarding reliable assured power increase. UTC Power believes there is an opportunity to enhance the value of fuel cell vehicles by enabling them to deliver power to the grid or other critical infrastructure such as emergency shelters. We are currently working with the Department of Defense to validate this concept with our heavy duty vehicle PureMotion™ 120 fuel cell power plant system.

COMPANY EXPERIENCE AND LEADERSHIP

UTC Power has led the development and introduction of fuel cell technology for more than four decades. We hold the unique distinction of having:

- produced all the fuel cells that provide electrical power and drinking water for both the Apollo and Space Shuttle missions;

- sold more than 255 stationary 200 kW units that have produced more than 1.2 billion kilowatt-hours of electricity and have accumulated more than 7 million hours of operating time by customers in 19 countries;
- provided stationary fuel cells that have a stack life of 40,000 hours (an 80,000 hour life cell stack is in the final stages of development);
- developed fuel cells for a number of automotive customers including Hyundai, Nissan and BMW and working with almost all of the major automobile manufacturers on fuel cell powered vehicles; and
- provided 120 kW fuel cell power systems that are currently powering four zero emission transit buses in revenue service in California.

UTC Power has participated in public-private partnerships with the Departments of Defense, Energy and Transportation in the development of its technology solutions for the stationary and transportation markets. Our proprietary low pressure drop, internally humidified natural water management proton exchange membrane (PEM) fuel cell technology has led to significant advances in efficiency, power density and cold weather performance.

Our longstanding involvement in these varied markets and applications provides a unique vantage point to discuss how fuel cell technology can help address U.S. energy needs, the status of technology today and the barriers we face.

NEED FOR SHORT TERM SUCCESSES

Our dependence on imported oil is well documented and personal automobiles consume the lion's share. Deployment of fuel cell vehicles powered by renewable sources of hydrogen can break our dependence on imported oil and at the same time take transportation out of the environmental debate. The auto market also represents the highest volume market, which is another reason this sector has received so much attention. But fuel cell vehicles for private use in meaningful quantities are a decade away since they represent the most demanding application in terms of cost, packaging and infrastructure. Existing electrical infrastructure and state and federal regulations create hurdles for any form of base load distributed generation to overcome.

Nothing breeds success like success. We therefore need to increase our immediate focus on near term applications that are available today such as stationary and fleet vehicles, including transit buses, to stimulate early volume and build the industry's supplier base. Since fuel cells represent a disruptive technology, the supplier base is reluctant to make the necessary investment. Early successes in the transit bus and stationary applications will help to overcome these fears.

In addition, stationary and fuel cell fleet vehicles have less demanding requirements and can compete at costs higher than those required by autos. Concentrating on these applications would enhance our ability to establish a profitable industry today and create stepping stones to the most demanding longer term auto application. Few companies can survive the next ten years waiting for the high volumes offered by the car market. Instead, they must find applications where profits can be realized today that will support the development of a strong industrial base in preparation for the future auto market. Success in these early applications can build the necessary public awareness and public confidence.

TRANSIT BUSES AND FLEET VEHICLES

Fuel cell transit buses offer the best strategic, near term potential to address the energy concerns cited above. In 2002, transit buses consumed the equivalent of more than 43,000 barrels of crude oil per day. The fleet of zero emission hybrid fuel cell buses currently powered by our fuel cells in revenue service in California is demonstrating greater than twice the fuel economy of a conventional diesel bus. Transit buses and fleet vehicles present an opportunity to begin to reduce oil imports in the near term while also improving air quality and reducing greenhouse gas emissions.

Buses and heavy duty commercial vehicles travel a relatively low percentage of the nation's vehicle miles, but they produce significant levels of toxic air emissions in densely populated urban areas. The transit buses equipped with UTC Power's PureMotion™ 120 fuel cell power system significantly reduce overall emissions due to the zero-emissions technology inherent in hydrogen fuel cells.

As we enter the summer hurricane and electric grid blackout season, concerns regarding reliable assured power increase. In light of this vulnerability, we believe there is an opportunity to enhance the value of fuel cell vehicles by enabling them to deliver power to the grid rather than from the grid as some people have proposed with the plug in hybrid approach. The "exportable power" approach could improve reliability and provide assured power during times of emergency to shelters, hospitals and critical infrastructure.

UTC Power is currently working with the Department of Defense to validate the ability of our PureMotion™ 120 fuel cell power system for heavy duty vehicles to export power to the grid or to provide power to emergency shelters. This approach would enable a transit authority, military base or school system to use their fuel cell buses to transport people in zero emission, efficient, hydrogen powered, quiet buses under normal conditions and provide emergency power during natural disasters or terrorist incidents.

Bus durability requirements assume a life of more than 30,000 hours for a system that must operate up to 16 hours per day, but with frequent starts and stops. We offer a warranty of 4,000 hours for the four buses that are operating today in AC Transit and SunLine Transit revenue service in California and have a technology plan to increase the life of these power plants to 25,000 hours by 2010 and up to 40,000 hours by 2015.

Cost targets for buses are more forgiving than for autos and their infrastructure requirements are limited since they rely on centralized fueling and maintenance. The four buses produced last year cost over $3 million per bus, but we have been able to reduce this cost to under $2.5 million and with volume of 100 units per year we can see a path to $1 million per bus. We are actively engaged in pursuing a number of worldwide opportunities to aggregate bus orders and achieve volume sales that will result in potential near term commercialization of the technology in this strategically important application.

STATIONARY FUEL CELLS

We also view stationary fuel cells as another near term opportunity to address air quality, climate change, reliability and energy efficiency concerns. The stationary fuel cell mission involves 24/7 steady state operation and a life of at least ten years or 80,000 hours.

Early adopters have been attracted by the ability of these systems to operate as base load grid-connect or grid independent assets. We've deployed units at schools, hospitals, law enforcement, research, telecommunications and military facilities to address assured power and other customer concerns. In addition, one of our units is operating at a Connecticut high school that enables the school to be designated as an emergency shelter. This concept could be replicated in areas subject to natural disasters to provide additional community benefits.

We also believe there's a significant opportunity in the Katrina reconstruction effort to rebuild with sustainable energy objectives. For example, we could reduce the environmental footprint of power generation and increase reliability by installing onsite, assured power fuel cells to help meet future emergency needs at schools serving as mass care shelters, hospitals and health care facilities, prisons, and other critical infrastructure facilities.

Since fuel cells can be deployed at the point of use, in addition to not relying on the vulnerable transmission and distribution assets of the grid, customers can benefit from the ability to capture waste heat and put it to constructive use for space heating, domestic hot water heating and industrial processes. Our units operating in the combined heat and power mode can operate at 85-90% efficiency thus generating energy savings that can reduce the cost of electricity by four to five cents per kilowatt hour.

Our PureCell™ stationary fuel cell power plant uses phosphoric acid technology and has demonstrated best in class durability with 27 of our units surpassing 40,000 hours without significant maintenance or replacement of the original cell stack. Our current high time unit has 60,000 hours and we are testing a new generation of technology that we plan to introduce to the market in the next several years that we are confident will achieve 80,000 hours.

The cost of these units is currently around $4,500 per kilowatt, but at volumes of 500 units per year and with the aggressive cost reduction efforts we have underway, we expect our next generation technology to be competitive at less than $2,000 per kW.

AUTOMOBILES

Cars are only driven an average of two hours a day which means their life requirement is low compared to other applications, However, autos experience many starts and stops and changes in speed that create unique needs for a robust and durable system through many different duty cycles. The Department of Energy's (DOE) short term durability goal for cars is 2,000 hours by the end of the learning demonstration program in 2008 with 5,000 hours as the ultimate objective.

We are participating along with Hyundai in DOE's Hydrogen Fleet and Infrastructure Learning Demonstration program as part of the Chevron led team. Ten

cars using our power plant are currently operational with a total of 32 vehicles planned.

As part of this initiative, we have cars on the road today that have passed the 500 hour mark and are still accumulating hours. In the laboratory we have run stationary loads for 13,000 hours, auto stress-test cycles of 5,000 hours and one million acceleration cycles, which gives us confidence that we can meet the goal of 5,000 hours in production vehicles.

Fuel cell cars must be capable of both starting and operating in cold conditions if they are to gain broad market acceptance. The consensus performance criteria are the ability to survive at –40 degrees Celsius and start at –30 degrees Celsius. Great progress is also being made in this arena. For example, one of our cars has run 25 cycles from frozen conditions as low as –10 degrees Celsius and we have demonstrated 43 cycles at –35 degrees Celsius in the laboratory.

BARRIERS

In short, technology development barriers for transportation fuel cells are being addressed at a rapid pace. At a small scale, we can meet the identified requirements and we don't envision any formidable show stoppers. This doesn't mean, however, that we don't need to continue our public-private partnership research, development or demonstration efforts. We strongly endorse the continuation of these activities and increased financial commitment to accelerate the progress we have made in the last few years.

The basic concepts of fuel cell technology have been proven. Our task now is to enhance key performance characteristics (such as durability); reduce costs; validate the technology in real world operating conditions; identify hidden failure modes through extended operation; and then identify and incorporate cost effective solutions. In the case of transportation applications, infrastructure and hydrogen storage still represent key challenges.

Three strategies are necessary for cost reduction:

- Internal programs to reduce cost through material substitution, longer life parts, and fewer parts. Examples include less expensive membranes; better seals; reduced use of platinum; enhanced performance materials for bipolar plates; and reduced system complexity.
- Improved manufacturing processes to eliminate labor intensive processes and identify high volume manufacturing solutions; and
- Incentives to help increase volume thereby spreading costs over a larger product base.

RECOMMENDED ACTIONS

UTC Power has called for a comprehensive national strategy to achieve fuel cell commercialization. Last year's enactment of the Energy Policy Act (EPAct) establishes such a framework, but more work needs to be done.

Budget requests and appropriation figures for this year fall far short of levels authorized by Congress. We recognize there are tight budget constraints, but given the benefits of fuel cell technology and the price we pay today for imported oil, health costs associated with poor air quality and lost productivity due to lack of reliable power, substantial increases in fuel cell technology investment represent a fiscally sound strategy.

While we are pleased that EPAct provides a fuel cell investment tax credit, the term is only for two years. We support legislative efforts to extend the tax credit timetable for the maximum length possible.

In addition, we believe more attention needs to be paid to ensuring the successful commercialization of near term fuel cell applications such as transit buses, fleet vehicles and stationary units. There are opportunities today for government purchases of fuel cell technology as part of Katrina reconstruction and pilot programs for schools powered by fuel cells to double as emergency shelters as well as the concept of fuel cell vehicles exporting power to the grid or critical infrastructure that merit consideration.

APPENDIX

RESPONSES TO ADDITIONAL QUESTIONS

RESPONSES OF THE HON. DIRK KEMPTHORNE TO QUESTIONS FROM SENATOR DOMENICI

Question 1. I'm pleased that you are aggressively moving forward on implementing the provisions of the Energy Bill. I continue to hear reports that things are not moving fast enough.

How long before BLM has this program fully operational?

Answer. Implementation of the Pilot Office project pursuant to Section 365 is well underway, and is in the last stages of implementation.

By October 4, 2005, an Interagency Memorandum of Understanding (MOU) to implement the oil and gas Pilot Offices was signed by the Administrator, Environmental Protection Agency; Secretary, Department of Agriculture; Assistant Secretary of the Army for Civil Works, U.S. Army Corps of Engineers; and the Secretary of the Department of the Interior. This MOU was signed nearly a month ahead of the 90-day timeframe required by the Act. This Interagency MOU establishes the roles, responsibilities, and delegations of authority among the Federal agencies for streamlining the Application for Permit to Drill (APD) processing and inspection and enforcement (I&E) in the seven BLM Pilot Offices identified by the Act.

In October 2005, the BLM initiated the recruitment process for 105 approved positions to support the APD approval process and I&E. The BLM Vernal, Utah pilot office has since noticed a substantial increase in their APD workload and identified a need for 11 additional positions to meet their workload demand. This increases the total number of approved BLM positions for the Pilot Offices to 116 positions. Currently, 102 BLM Pilot Office positions have been filled. In addition, BLM has hired nine contract positions (Botanist, Natural Resources and Wildlife Specialist, Geologist, and Soil Scientist) to support operations in the Pilot Offices. The Farmington, Carlsbad, Vernal, Buffalo and Rawlins offices have completed the hiring of all initial BLM positions. The Glenwood Springs office has only two vacancies remaining, the Miles City office has only three vacancies remaining. The BLM has transferred funds to support 6 Forest Service positions, 10 U.S. Fish and Wildlife Service (FWS) positions, 3.5 Corps of Engineers positions, and 1 Bureau of Indian Affairs (BIA) position for these agencies to support the Pilot Offices under the MOU.

The BLM Director has personally visited each Pilot Office, the BLM staff, and other Federal agencies and staff to emphasize the significance of this project to both the BLM and the Nation.

The BLM has been aggressive in implementing this section; we appreciate the support you have given us and we look forward to seeing real results from this effort.

Question 2. How have you directed the field offices to use the NEPA categorical exclusions found in Section 390?

Answer. The BLM policy guidance (Instruction Memorandum (IM) 2005-247) was issued on September 30, 2005, to BLM Field Offices for implementation of the NEPA categorical exclusion provisions of Section 390 of the Energy Policy Act (EPAct). The IM also provides guidance for improved NEPA compliance for oil and gas activities. The BLM is using this authority wherever applicable. Since the issuance of IM 2005-247, we have processed 895 APDs in the pilot offices using some form of this authority.

Question 3. As you mentioned, the Energy Bill does not change the requirements for endangered species, historic preservation, clean water and clean air.

What is BLM doing to actually develop new and innovative ways to do business?

Answer. In addition to the Pilot Office project, the following are two examples of how the BLM is developing new and innovative ways to do business:

1. The BLM has conducted a joint study of oil and gas practices with the Forest Service (FS). Section 362 of the EPAct requires that the Secretary of the Interior (BLM) and the Secretary of Agriculture (FS) improve the process for timely action on oil and gas leases and APDs, and improve the inspection and enforcement of oil and gas activities. The agencies are also required to develop and implement best management practices to improve the administration of the onshore oil and gas program. The BLM has updated the Gold Book of "Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development" and posted the update on September 28, 2005, on the BLM Best Management Practices webpage at www.blm.gov/bmp. In June 2006, copies of the Gold Book were printed to provide copies to the operators as a reference guide.

The BLM issued IM No. 2005-069 on February 1, 2005, establishing offsite compensatory mitigation guidelines for oil and gas authorizations, thereby providing additional opportunities to address impacts of proposed projects.

The BLM issued IM No. 2006-071 on January 19, 2006, establishing oil and gas process improvement teams in BLM Field Offices.

2. The BLM is developing innovative ways to create a "one-stop-shopping" approach to the APD process. By co-locating staff from cooperative Federal and state agencies, the BLM is making headway on this innovation. For example, in Montana, the BLM, together with the Montana Department of Environmental Quality (DEQ), signed a Memorandum of Agreement (MOA) on June 1, 2006, to fill one hydrologist and one air quality specialist position in the Miles City Pilot Office and one permitting position in Montana's DEQ Helena Office in support of Pilot Office operations. The BLM in Montana and Montana Department of Fish, Wildlife and Parks are drafting a MOA to support a wildlife position in the Miles City Pilot Office. The BLM in Wyoming is working with the Wyoming DEQ to establish a position in the Buffalo Pilot Office. Under a new statewide cultural resources protocol agreement, they are working to staff a position with the State Historic Preservation Office (SHPO). The BLM in New Mexico is working with the New Mexico Oil and Gas Commission to fund two positions, which will work directly with BLM inspectors to increase state and Federal program coordination. These innovative approaches aim to complete cooperative task in a more timely manner.

3. Another innovative approach is a pilot project to survey and protect cultural resources. The New Mexico BLM's pilot project will entail completing cultural clearances (a Class III archaeological inventory) for APDs in one large block of approximately 6,000 acres in Pierce Canyon outside Carlsbad. This pilot project is in response to recommendations of the national task force assembled to review the National Historic Preservation Act Section 106 compliance process in connection with reviewing APDs. The purpose is to test the long-term cost effectiveness and overall efficiency of doing Section 106 compliance for APDs on large blocks of land, rather than piecemeal on a permit-specific basis. This innovative approach should help protect cultural resources and aid in the management of energy programs by providing reliable data on the most efficient and cost effective way to do Section 106 compliance. The BLM is planning a meeting in November of 2006 to discuss lessons learned and best business practices developed in the pilot offices. The BLM plans to use this information to improve business practices bureau-wide, where practicable.

Question 4. Is there a better way to protect wildlife values than a blanket of winter stipulations and wildlife restrictions?

Answer. We typically have used blanket stipulations; but we are also testing new methods, such as voluntary off site mitigation, year-round drilling with other forms of mitigation, such as minimizing surface disturbance through directional drilling, consolidation of production facilities, and reducing truck traffic. For example, in the winter for 2005-2006, the BLM authorized the Questar Company, a BLM lessee to do winter well completions (drilling) in the Pinedale Anticline. The BLM is also working on a supplemental Environmental Impact Statement in the Pinedale anticline that would include directional drilling and consolidation of drilling infrastructure for Questar, Shell Oil and Ultra, other BLM lessees. This proposal would allow development of the Pinedale anticline while reducing habitat fragmentation, impacts to wildlife, and air pollution. In addition, the proposal would allow year-round activity over approximately six percent of the anticline. This would enable a year-round workforce to address some of the local community concerns over the seasonal boom and bust cycle of oil and gas activity in Sublette County. It will provide a more stable economic engine and better environmental planning.

Question 5. Last year the Fish and Wildlife Service decided Sage Grouse are not endangered, but I understand BLM continues place conditions to protect Sage Grouse.

Can you explain why this is?

Answer. In 2005, the U.S. Fish and Wildlife Service (FWS) issued a finding that the listing of the Greater sage-grouse as threatened or endangered was not warranted. The FWS cited numerous reasons for their finding, but cautioned that there was reason for concern because of the long-term declines in the population across the range and because current distribution of the species was significantly less than historic distribution. The FWS Director emphasized the need for the Federal and State managers and local working groups to continue their efforts to conserve sage-grouse and sagebrush habitats over the long-term. Part of the reason for this finding was the BLM's commitment to implement a range-wide conservation strategy.

In keeping with the FWS Director's suggestion that sage-grouse and sagebrush habitat protection efforts continue, the BLM continues to work closely with the state wildlife agencies, local working groups, the FWS, and private land owners on a wide variety of conservation projects for sage-grouse and other sagebrush-dependent species. Prior to the issuance of a lease, the BLM routinely places stipulations on the lease to protect habitat while allowing other multiple-use activities to occur. We do this in accordance with State Game and Fish conservation strategies. The BLM has learned through years of experience that addressing species and habitat conservation prior to allowing development is the best approach for avoiding the need to list species under the Endangered Species Act.

Question 6. What can you tell me about the listing efforts for the Lesser Prairie Chicken in my State of New Mexico?

Answer. The BLM has a major effort underway in southeast New Mexico that we believe will result in healthier populations over time and may preclude the need to list the species under the Endangered Species Act.

Our strategy is to manage traditional public land uses (oil and gas, and ranching) in a manner that allows continued operations on public lands, but preserves key habitat for the Lesser Prairie Chicken. This is being done through a planning process that has involved industry, ranchers, the State of New Mexico, southeast New Mexico counties, and conservation groups.

Beginning in 2005, BLM partnered with the Natural Resources Conservation Service (NRCS), the New Mexico Association of Conservation Districts (NMACD), oil and gas companies, and ranchers to begin a major reclamation effort of land damaged by past practices with emphasis on Lesser Prairie Chicken and Sand Dune Lizard habitat. Our goal is to expand habitat conservation efforts and populations across a broad area of southeast New Mexico. We are improving habitat by removing remnant facilities from abandoned oil and gas fields, such as power lines and old tanks. We have also reclaimed old unused roads, pads, and caliche pits. We are cooperating with ranchers in the area to improve grazing management with additional fencing and water development.

RESPONSES OF THE HON. DIRK KEMPTHORNE TO QUESTIONS FROM SENATOR THOMAS

Question 1. A large part of the problem with considering applications for permit to drill is that the staffs in your field offices are buried with NEPA work in an effort to get projects to a point that people can even apply to drill. Many of the staff that have been hired as a result of these Pilot Offices will be good at getting Environmental Impact Statements done. Do you think they can transition as easily to the processing of APD's?

Answer. Most resource specialist in the BLM Field Offices already work on both NEPA documents and APD processing. Since NEPA compliance is an integral part of each APD or group of APDs being processed, we do not expect any problems with the staff transitioning to the processing of APDs.

Question 2. Many of the BLM field offices in Wyoming are currently revising their Resource Management Plans. Can you give us an update as to when you expect these revisions to be completed and how long its been since they were last changed?

Answer. Currently, the BLM in Wyoming is preparing four Resource Management Plan (RMP) revisions, and one planned to start in January 2007. The status of the five efforts is as follows:

Pinedale RMP Revision. The initial Pinedale RMP was completed in 1988. The Record of Decision for the RMP revision is currently scheduled to be completed in the spring of 2008.

Rawlins (formerly Great Divide) RMP Revision. The initial Rawlins RMP was completed in November 1990. The Record of Decision for the RMP revision is currently scheduled to be completed in March of 2007.

Kemmerer RMP Revision. The initial Kemmerer RMP was completed in 1986. The Record of Decision for the RMP revision is currently scheduled to be completed in spring of 2008.

Casper (Platte River) RMP Revision. The initial Casper RMP was completed in 1985. The Record of Decision for the RMP revision is currently scheduled to be completed in October of 2007.

Lander RMP Revision. The initial Lander RMP was completed in June 1987. The Notice of Intent to revise the RMP is scheduled for release in the first quarter of 2007.

In addition, there are three projects involving plan amendments. They are:

Jack Morrow Hills Coordinated Activity Plan. The Record of Decision was signed on July 17, 2006, and a Notice of Availability was published in the Federal Register on July 20, 2006.

Buffalo Oil and Gas Leasing EA. The Notice of Intent was issued on December 16, 2004. There is potential that the current plan may be amended.

Hiawatha Regional Energy Development Project. This project is located in both the BLM Rock Springs, Wyoming office and the Little Snake, Colorado Field Offices. The Little Snake RMP is currently being revised. Because the level of drilling may exceed the analysis scope of the Green River RMP, an amendment may be required.

Question 3. I hear an awful lot about the high turnover rate of staff in many of the state BLM offices. What are some of the ways in which BLM has looked at reducing the number of folks who leave from year to year? Is it a function of an aging workforce or is it simply that there are better jobs to be had in the private sector?

Answer. Staff turnover has been substantial in some of our offices. Turnover is due to a variety of factors, including retirements, competition with industry for skilled staff, and the fast pace and heavy workload in our oil and gas offices. Additional staff resources in our pilot offices are helping to meet workload commitments and, in some cases, BLM is investigating ways to provide incentives, such as retention bonuses.

Question 4. What percentage of domestic oil & gas production comes from BLM lands?

Answer. The percentages of domestic oil and gas produced from BLM lands are 18% of domestic gas and 5% of domestic oil.

Question 5. Section 365 of the Energy Policy Act, which established the Pilot Offices we're discussing today, also required a Memorandum of Understanding be signed by several agencies. You discussed the memorandum in your testimony. This Section also allowed for Governors from affected states to be included as signatories to this Memorandum. Did Governors sign this memorandum, and if not, why?

Answer. The Governors have not signed the MOU. Each state has unique needs and we are working closely with the states on individual agreements for pilot office involvement. The first state agreement was recently signed with the Montana Department of Environmental Quality (DEQ). This agreement places three state DEQ positions in support of the Miles City Pilot Office operations. Similar agreements are being developed with a variety of state agencies in the five pilot office states.

Question 6. I'm certain we'll hear from Mr. Reed about the fisheries issues associated with BLM lands. What types of expertise exists at BLM to address wildlife issues associated with oil & gas development?

Answer. All of the BLM Field Offices, including the Pilot Offices, have wildlife biologists on staff. Several of our Field Offices also have fisheries biologists. In addition, we work closely with State game and fish agencies and the FWS.

RESPONSES OF THE HON. DIRK KEMPTHORNE TO QUESTIONS FROM SENATOR BINGAMAN

Question 1a. Multiple Use—I am pleased that BLM has been making efforts to improve permit processing, but I want to be sure that the program is balanced with BLM's other responsibilities.

Is BLM taking resources away from other programs (grazing, mining, recreation) in order to handle the oil and gas activities? If so, please provide specifics as to the programs and the magnitude of the diversion of resources.

Answer. The EPAct was passed after the enactment of the Interior Appropriations for Fiscal Year 2006. Immediately after passage of the EPAct, BLM analyzed the requirements in the law and identified milestones that must be achieved in FY 2006. In order to meet those timeframes additional funding was required in FY 2006. The BLM submitted and received Congressional approval on two requests to reprogram funds from non-energy programs to implement the Act. Under the first reprogramming, the BLM requested and received Congressional approval to reprogram $1,366,000 on March 29, 2006, from Fiscal Year 2005 unobligated balances in non-energy programs. The second request for reprogramming was for $4,889,000 from Fiscal Year 2006 funding, and was approved by Congress on May 4, 2006. Both

of these reprogrammings were one-time changes that will not be carried forward into future years. The amounts are shown by program in the table below:

AMOUNTS APPROVED FOR REPROGRAMMING INTO OIL AND GAS MANAGEMENT PROGRAM

Subactivity	Fiscal year 2005	Fiscal year 2006
Soil, Water and Air Management	$29,000	$437,000
Range Management	$103,000	$410,000
Forestry Management	$21,000	$0
Riparian Management	$65,000	$150,000
Cultural Resources Management	$62,000	$227,000
Wild Horses & Burros Management	$19,000	$0
Wildlife Management	$90,000	$0
Fisheries Management	$125,000	$0
Threatened & Endangered Species	$103,000	$0
Wilderness Management	$126,000	$62,000
Recreation Resource Management	$41,000	$194,000
Other Mineral Resources Management	$56,000	$91,000
Alaska Conveyance	$90,000	$22,000
Cadastral Survey	$36,000	$137,000
Lands and Reality Management	$0	$72,000
Resource Management Planning	$117,000	$283,000
Resource Protection & Law Enforcement	$0	$411,000
Hazardous Materials Management	$33,000	$138,000
Deferred Maintenance	$0	$1,991,000
Information Systems Operation	$98,000	$47,000
Administrative Support	$143,000	$172,000
Land & Resource Information Systems	$9,000	$45,000
Total	$1,366,000	$4,889,000

In the President's FY 2007 budget, BLM is requesting additional funding in the Oil and Gas Management Program for energy. These funds, if approved, will assist the non-Pilot offices to meet the demand for energy permitting and continue to meet inspection and monitoring commitments.

Question 1b. What steps is BLM taking in implementing the pilot program to ensure that other BLM programs are not adversely affected by the emphasis on oil and gas activities?

Answer. The BLM continues to manage the Federal resources under its multiple-use mandate. As indicated in the response to the previous questions, the reprogramming request approved by Congress were a one-time funding shift made necessary by the EPAct deadlines the BLM has to meet during FY 2006. In the FY 2007 budget request, the Administration has asked for an additional $9.2 million for non-pilot offices' processing of APDs, inspection and enforcement and monitoring.

Question 2a. Inspection and Enforcement—I have long advocated the importance of BLM having a robust inspection and enforcement program.

What steps is BLM taking to ensure that its inspection and enforcement program is adequate?

Answer. The Inspection and Enforcement (I&E) program is identified as a high priority in the Department of the Interior's Strategic Plan, and the BLM has committed considerable resources in recent years to ensure that we have an effective I&E program. The BLM recognizes the importance of inspections in environmentally-responsible energy development. In fact, this critical need was the rationale for a significant portion of the energy reprogramming requested and approved this fiscal year (See answer 1 a). As note above, the BLM's FY2007 budget request includes an additional $2.9 million to perform an additional 1,930 inspections and $2.0 million to conduct monitoring related to oil and gas development.

Over the past four years, the BLM recognized the need to strengthen its I&E program as the number of approved APDs and drilling increased. The BLM has successfully documented through its budget justifications the need for additional inspectors and to obtain additional funding. The BLM is committed to ensuring that the highest priority inspections are completed.

Question 2b. How many additional inspectors do you expect to hire in New Mexico with the funding from the pilot program?

Answer. Since enactment of the Energy Policy Act, the BLM has hired a total of 12 oil and gas inspectors—including 4 Production Accountability Technicians and 8 Petroleum Engineering Technicians—in the pilot offices in New Mexico. No additional hires are currently anticipated, although this could change depending on new development in New Mexico.

Question 3. Split Estates—We continue to hear concerns expressed by some ranchers in situations where there is oil and gas development on split estate lands. What is the status of the report on split estates? What steps is BLM taking to address these issues?

Answer. Since the passage of EPAct, the BLM conducted an extensive public outreach effort to identify issues and solicit recommendations from the public regarding the management of Federal split estate. BLM is currently finalizing the Split-Estate Report to Congress. The Report is expected to contain a number of recommendations for administrative action necessary to facilitate reasonable access for Federal oil and gas activities while addressing surface owner concerns and minimizing impacts to private surface.

Question 4. NEPA—How has BLM implemented section 390 of EPAct pertaining to categorical exclusions? What is intended for instances where extraordinary circumstances exist that would make use of a categorical exclusion inappropriate? Has this new policy been put out for public comment? If not, why not?

Answer. The BLM issued policy guidance (IM 2005-247) on September 30, 2005, to BLM Field Offices for implementation of the NEPA categorical exclusion provisions of Section 390 of the EPAct. The IM also provides guidance for improved NEPA compliance for oil and gas activities.

Section 390 of the Act establishes a rebuttable presumption that the listed categorical exclusions apply to the listed activities. There is no requirement in the statue to document the absence of exceptional circumstances in order to apply these statutory categorical exclusions. The statue made the exclusions immediately effective, and there is no provision for rulemaking or other means of seeking public comment before implementation.

Question 5. Abandoned and Orphaned Wells—According to information provided by the Department, New Mexico has 4224 abandoned wells on public lands, the largest number of any state. What is the status of implementation of the program for remediation of abandoned and orphaned wells? Can you please provide information relating to the timing of implementation for the record?

Answer. BLM defines wells as "Abandoned", "Plugged and Abandoned", "Orphan", and "Idle" (and further classifies "Idle" wells as either "Temporarily Abandoned" or in "Shut-in" status). These terms are defined and discussed below. BLM would be happy to provide a briefing to further clarify these terms as well.

By Bureau definition, the term "Abandoned" well means a well where the well bore was properly plugged to the surface, but surface reclamation has note been completed and/or approved. When the surface reclamation is complete, and inspected for proper reclamation, the well is then classified as "Plugged and Abandoned." In general, both "Abandoned" and "Plugged and Abandoned" wells pose no future liability to the public.

The Bureau definition of an "Orphan" well is "A well that is not associated with a responsible or liable party nor has sufficient bond coverage for plugging and surface restoration costs." There are currently 14 known Orphan wells on BLM-managed land in New Mexico. (The Energy Policy Act includes Orphan well provisions that are discussed below.)

An "Idle" well is a well which has been inactive for at least 12 consecutive months. There are 1197 Idle wells on BLM-managed land in New Mexico—a significant reduction from 1999, when there were 4,219 Idle wells in New Mexico. Idle wells are classified as either Temporarily Abandoned (TA) or in Shut-in (SI) status. Temporarily Abandoned status is defined by the BLM as a well that is not physically and mechanically capable of producing oil or gas in paying quantities, but which may have future value or beneficial use. Shut-in status is defined by the BLM as a well that is physically or mechanically capable of producing, but is not producing for other reasons. As of June 28, 2006, New Mexico's current inventory of idle wells is 735 wells in Temporarily Abandoned (TA) status and 462 in a Shut-In (SI) status.

The reduction in the number of idle wells is he result of higher oil and gas prices and the implementation of an idle well review program, which resulted in the return of wells to production or service use or the permanent abandonment of wells having no future use.

Section 349 of the EPAct directed the BLM to establish a means of ranking for priority, those orphan wells located on lands administered by the BLM. This ranking format of remediation, reclamation, and closure has been designed and field

tested in select BLM field offices. In addition, an Instruction Memorandum is being drafted to implement Subsection (f), a reimbursement, via Federal royalty credits, for remediation, reclamation, and closure of orphaned wells. A draft report to Congress (required within one year of enactment of the Act), to comply with Section 349, is currently under review.

Question 6. Coalbed Methane Report—What is the status of the report on section 1811, relating to coalbed methane production and water resources?

a. Please provide a timeframe for entering into an arrangement with the National Academy of Sciences to conduct the study as required by the Energy Policy Act.

Answer. On September 27, 2005, the BLM provided the National Academy of Sciences copies of several studies and reports that were previously prepared on the effects of coal bed natural gas production on surface and ground water resources. In addition, the BLM attended a meeting with the Committee on Earth Resources of the National Academy of Sciences on November 16, 2005, and discussed the requirements of Section 1811 of the Act. The BLM provided a letter to the National Academy of Sciences on April 24, 2006, requesting a review of the previous studies and reports to determine if significant deficiencies exist or if other information may be critically needed to address the requirements of the EPAct. No response has been received from the Academy; however, the BLM is prepared to discuss any additional study which the Academy can demonstrate is needed. The BLM will keep the Committee informed about any response from the Academy.

Question 7. Land Under Lease but Not Producing—Why are there so many acres under lease but not producing?

Answer. Exploration and production companies have inventories of leased acreage where there is currently no oil or gas production. It is normal for companies to have leased acreage inventories. This is necessary for an efficient exploration and production program. The initiation of drilling activities is a business decision that ultimately rests with the lessee. In making this decision, lessees must factor in the availability of exploration and development resources, such as drilling rigs, pipelines, and a qualified workforce. In addition, leased parcels can remain undeveloped due to litigation or requirements to complete further NEPA analysis and documentation.

Question 8. Resources—Are you finding that you must divert resources from other BLM programs and activities in order to process oil and gas leases? If so, what other activities have been cut?

Answer. Please see answer to Senator Bingaman question 1a.

Question 9. Inspections—Statistics in the BLM budget justification for FY 2007 indicate that environmental inspections decreased from 2004 to 2006. Why?

Answer. The Federal Oil and Gas Royalty Management Act of 1982 established an annual inspection cycle for high priority inspections. BLM implemented a policy that high priority wells are inspected annually, while all other wells are inspected on a three-year cycle. It appears in the FY 2007 BLM budget justification that many of the environmental inspections decreased because they fall into the three-year inspection cycle. For FY 2006, the BLM plans to complete all high-priority inspections. High priority inspections are those performed for wells with prior year production of over 12,000 barrels per month of oil or over 120,000 thousand cubic feet per month of gas, or for a record of noncompliance, i.e., 2 major or 6 minor violations in the prior year. The BLM is focusing on the high priority inspections to ensure that I&E resources are allocated where they are most needed.

Question 9a. Can you provide us statistics on the percentage of oil and gas operations on federal lands subject to environmental inspections over the past 8 years?

Answer. The BLM's Automated Fluid Minerals Support System (AFMSS) is the system with which the BLM tracks these statistics. Ongoing litigation in *Cobell v. Norton* has resulted in the continuing shut-down of AFMSS, so those statistics cannot be provided at this time.

Question 10. Processing Costs—Approximately what is the average cost for processing an application for permit to drill?

Answer. The average cost for processing an APD over the last three years has been $3,729.

Question 11. Cost Recovery Proposal—I see that the President's budget request for FY2007 proposes that the mandatory funding for the pilot project offices be terminated and replaced with APD processing fees paid by the industry at the end of FY2007. The Administration has transmitted proposed legislation to the Congress to accomplish this. What is the thinking behind this proposal?

Answer. The Administration's proposal is to replace the mandatory Pilot Office funding provided by the EPAct with cost recovery from APD processing fees effective at the end of fiscal year 2007. The Administration will be requesting authority to conduct a rulemaking to phase-in full cost recovery for APDs, beginning with a fee

amount that will generate an estimated $21 million, replacing the amount authorized by the EPAct. Increased reliance on cost recoveries is consistent with the finding of previous Inspector General reports and the 2005 Program Assessment Rating Tool (PART) review of this program, that found the program does not adequately charge identifiable users for costs incurred on their behalf.

Question 12. Pilot Project on Permit Processing—How well is the new pilot project on permit processing working from the perspective of the Fish and Wildlife Service?

Answer. The U.S. Fish and Wildlife Service (Service) is actively working with the Bureau of Land Management (BLM) at all levels in implementing EPAct section 365. A memorandum of understanding between the BLM and the Service identifies six specific responsibilities that will, once fully implemented, allow the Service to streamline its efforts under the permit review process. The two agencies are customizing the duties of each position at each office to result in improved permitting and protection for natural resources. Adaptive, Programmatic measures will reduce our permit review time while enhancing stewardship of endangered species and other federal trust resources. By integrating Service personnel with BLM staff early in the land use planning process, we anticipate greater regulatory flexibility, fewer last-minute delays, and an overall reduction in related environmental effects.

At this time, the Service has filled positions in 5 of the 7 identified Pilot Offices and has assigned temporary staff to the remaining 2 offices until we complete the hiring process for those offices. These staff are supported by 3 full-time existing Service employees who will oversee the initial stages of implementation. Critical to our long-term success is identifying and applying new and improved procedures for addressing the high volume of applications for permits to drill (APD) workload anticipated by the BLM. Also key to success is increasing staff in the pilot offices, and elsewhere, as workload increases and additional pilot program funding becomes available.

Although the new pilot project on permit processing is still coming online, the Service has seen improvements and considers, the program a success to date.

Question 13. Resources—Are you finding that you must divert resources from other Fish and Wildlife Service programs and activities in order to process oil and gas leases? If so, what other program and activities have been cut? What is the extent of the cuts?

Answer. At present, the Service is receiving sufficient resources from BLM to effectively evaluate pilot office needs and to provide initial levels of support to those offices. In addition, the Service is using base funds to support additional staff outside of the pilot program's scope to provide technical assistance and other services on oil and gas development activities throughout the nation. The Service has filled positions in five of the seven Pilot Offices and has assigned temporary staff to the remaining two offices that will remain in place until the Service can complete the hiring process for those positions. These staff members are supported by three full-time existing Service employees who will oversee the initial stages of implementation of the pilot program. Critical to the Service's long-term success is the identification and application of new and improved procedures to address the high volume of APD workload anticipated by the BLM, and increasing staff in the pilot offices (and elsewhere) as workload increases and additional pilot program funding become available.

Question 14. Good Science—Several of the witnesses have discussed the importance of science. I believe that it is essential that decisions in the field be based on the best available science.

As the head of the Fish and Wildlife Service, what steps are you taking to ensure that the biologists and other scientists at the Service can do their jobs and apply their best scientific judgments to leasing and permitting decisions?

Answer. The Service places the highest priority on using sound science in our decision-making. We expect each of our employees to attend a minimum of 40 hours of training each year to help them stay current in their area of expertise. Within the Endangered Species program, which would include staff at the pilot offices, we have policies that describe information standards (59 FR 3427; July 1, 1994), encourage our biologists to coordinate closely with their colleagues in State agencies (59 FR 34274, July 1, 1994), obtain peer review (59 FR 34270, July 1, 1994), and a recent policy on use of genetic information to help ensure that our decisions are based on the best scientific data available. In cooperation with the National Marine Fisheries Service, we have also developed regulations and a consultation handbook to clarify the procedures that Service biologists must follow when conducting consultations. We also provide each of our Regional Offices with capability funding on an annual basis to provide for a consultation expertise to support their field offices.

RESPONSES OF THE HON. DIRK KEMPTHORNE TO QUESTIONS FROM SENATOR SALAZAR

Question 1. Sec. 1811 of the EPAct authorized a National Academy of Sciences study of the impacts of coalbed methane development on water. When will the BLM provide the Academy with the funds it needs to complete the study mandated by Sec. 1811?

Answer. On September 27, 2005, the BLM provided the National Academy of Sciences copies of several studies and reports that had previously been prepared on the effects of coal bed natural gas production on surface and ground water resources. In addition, the BLM attended a meeting with the Committee on Earth Resources on the National Academy of Sciences on November 16, 2005, and discussed the requirements of Section 1811 of the Act. The BLM provided a letter to the National Academy of Sciences on April 24, 2006, requesting a review of the previous studies and reports to determine if significant deficiencies exist or if other information may be critically needed to address the requirements of EPAct. No response has been received from the Academy; however, the BLM is prepared to discuss any additional studies which the Academy can demonstrate are needed. The BLM will keep the Committee informed about any response form the Academy.

Question 2. How well is the new APD streamlining pilot project working? Do you have any specific information about the pilot office in Glenwood Springs, Colorado?

Answer. The BLM has made considerable progress in implementing the Pilot Office Streamlining Project provisions of Section 365 of the Act. An Interagency MOU for the Pilot Offices was signed on October 24, 2005, by the Administrator, Environmental Protection Agency; Secretary, Department of Agriculture; Assistant Secretary of the Army for Civil Works, U.S. Army Corps of Engineers; and the Secretary of the Department of the Interior. The MOU established roles, responsibilities and delegations of authority for streamlining the processing of oil and gas permits in the seven Pilot Offices. We are close to full staffing of the Pilot Offices and will continue to track the progress in expediting the permit application process.

The BLM in Colorado has filled 10 BLM positions in the Glenwood Springs Pilot Office, hired a contract Botanist, and funded a FWS position to support oil and gas permit processing. In addition, a collateral duty Corps of Engineers position has been assigned to support the Glenwood Springs Pilot Office. The number of APDs processed in the Glenwood Springs/Grand Junction office has increased by almost 10% over the same period of time in FY 2006 as compared to FY 2005. The number of APDs approved has increased by almost 15% over the same period of time in FY 2006 as compared to FY 2005. The Glenwood Springs/Grand Junction office has approved over 250 APDs this fiscal year.

Question 3. When does the BLM expect to report back to Congress on the split-estate issue as directed by the EPAct, Sec. 1835? Can you tell me, from the BLM's perspective, how the split estate listening session in Grand Junction went?

Answer. The BLM is currently finalizing the Split-Estate Report to Congress. The Report is expected to contain a number of recommendations for administrative action necessary to facilitate reasonable access for Federal oil and gas activities while addressing surface owner concerns and minimizing impacts to private surface. The March 22 listening sessions were well received; 65 people attended one of the afternoon or evening sessions, and 19 individuals addressed the panels. Issues identified by the public and the energy industry varied widely. Some people identified serious concerns; however, conflicts between mineral development rights and private surface rights seemed to affect a small minority of the public. No overriding issues were identified that would substantially affect all or most surface owners who may be subject to development of the mineral estate where the Federal government manages the minerals.

Question 4. What is the BLM doing to support non pilot project offices such as the White River Field Office in Meeker, CO that has experienced a 300% growth in APD requests?

Answer. To help the non-pilot offices keep pace with the pilot offices the BLM asked the Congress to approve two reprogrammings of funding to address the needs of the non-pilot offices. These requests were approved by Congress and additional funding has been provided to the non-pilot offices. In the FY 2007 budget request the Administration has asked for an additional $9.2 million for non-pilot offices' processing of APDs, inspection and enforcement and monitoring.

Question 5. It was recently announced that the White River Field Office in Meeker, CO was proposing to amend its resource management plan (RMP) because the existing plan anticipated 1,000 new wells over the life of the plan but it now appears that 10,000 to 15,000 new wells are likely over the course of the plan. In other booming gas areas, such as Grand Junction, is there a need to do the same?

Answer. The number of oil and gas wells anticipated in the original white River Field Office Resource Management Plan will likely be exceeded at the current rate of development. As a result, the BLM's White River Field Office proposed an RMP Amendment to analyze reasonable foreseeable development and the impacts of various development scenarios.

In other areas, RMP revisions have been scheduled well in advance. For instance, the Little Snake RMP is currently in the revisions process and the Glenwood Springs and Kremmling RMPs are currently in the initial stages of the revision process. The Grand Junction RMP is currently scheduled for revision in 2010.

The level of development in Grand Junction is not the same as it is in Meeker and in Glenwood Springs. The current level of development in Grand Junction has not exceeded the level expected in the existing RMP, nor is it expected to do so.

Question 6. What is the BLM doing to bolster its inspection and enforcement component in light of the June, 2005 GAO report?

Answer. The Inspection and Enforcement (I&E) program is an integral and key component of the Bureau's management of onshore oil and gas operations. In addition, the I&E program is identified as a high priority in the Department of the Interior's Strategic Plan. The Bureau has committed considerable resources in recent years to ensure that we have an effective I&E program.

Over the past four years, the BLM recognized the need to strengthen its I&E program as the number of APDs approved and drilled increased. The BLM has successfully documented through its budget justifications the need for additional inspectors and additional funding. Additional funding was provided for the pilot project offices in the EPAct, which has helped the BLM increase the inspection force. In the pilot offices, the BLM has hired 47 new Natural Resource Specialists and Inspectors. Additional funding has been requested in the FY 2007 budget to further increase the BLM's I&E capability. This funding will be used by the non-pilot offices to increase the number of inspections including environmental and monitoring inspections.

ADVANCED RESOURCES INTERNATIONAL, INC.,
Arlington, VA, June 30, 2006.

Senator PETE V. DOMENICI,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR SENATOR DOMENICI: Thank you for the opportunity to testify before the Senate Committee on Energy and Natural Resources on June 27th, 2006 regarding the Energy Policy Act provisions. Below I present answers to questions raised as a result of the hearing.

If there are any other questions, or if I can amplify our analysis of timing limitation impacts, please let me know.

Sincerely,

JEFFREY EPPINK,
Senior Vice President.

Question 1. Please describe the method used for the analysis.

Answer. Briefly, for this analysis we used two primary analytical tools that have been developed for the Departments of Energy and Interior by Advanced Resources. These tools are the Model of Unconventional Resources and the Energy Policy and Conservation Act Inventory model. We made assumptions, based upon historic data and professional judgment, for parameters such as the number of wells that could be drilled, federal land access, rig availability and jobs. The method used is fully described in Attachment 1.

Question 2. Can you elaborate on the effect that the increased permit backlog could have on your results?

Answer. As described in my testimony, the backlog of permits has increased by nearly 50 percent since last fall. I attribute this increase to the natural gas price spike over the winter. Barring further supply disruptions such as that resulting from last year's hurricane season, I would expect permit demand to moderate. To answer this question specifically, we would need to re-run the analysis based upon assumptions about the APD spike and future demand, which we could do over the course of a couple of weeks if requested by the Interior Secretary's Office.

However, to answer the question based upon my knowledge at this point, I would expect the results that we presented to increase by 15 to 30 percent as a consequence of the increased backlog. I would not expect the results to increase by 50 percent commensurate with the permit demand increase because I believe the demand increase will not to be a sustainable in the long run.

Question 3. What do you think are the toughest challenges to accomplishing the results you have outlined?

Answer. *BLM staffing.* I believe that the most significant challenge is hiring and retaining BLM staff that are knowledgeable about drill permit processing and, further, inspections and enforcement activities. BLM is competing with industry, which is also short-handed, for the same labor pool. Individuals could be trained to perform these jobs, but that will take additional time. I do note that Director Clarke, in her testimony at the hearing, indicated that BLM has had success in filling a significant number of positions, which is a good turn of events.

Land Access. The next most significant challenge is the issue of land access. Drilling in the Western U.S. is often contentious and I would expect this situation to only deepen. I do believe that the federal government can streamline the leasing and APD process, especially with regard to stipulations and permit conditions of approval. It is more a question as to whether this can be accomplished in a manner that is both timely and promotes sound stewardship of the nation's public lands. It is a difficult challenge.

I do want to comment on a related issue raised by Senator Craig, where he questioned the need for timing limitation stipulations, devised in the 1980s, and whether this access issue needed to be addressed specifically. We examined this precise issue for the Department of Energy, where we determined which of the timing limitations have the greatest impacts and, assuming modest environmentally acceptable changes were made to the stipulations, what the benefits would be. As it turns out, big game ranges, sage grouse and raptor stipulations are the most significant. If a modest 10 to 20 percent change in the geographies, timing and exception rates were to be made for these stipulations, the benefits could be substantial—estimated undiscovered natural gas resources on the order of 8 to 15 trillion cubic feet (equivalent) could be significantly more accessible for exploration and subsequent development. Such a result could accommodate anticipated growth in Rocky Mountain region production. The critical issue is the performance of the requisite science to justify such changes. It is a tall order to accomplish this in the near term.

Rig Availability and Pipeline Constraints. Based upon discussions I have had with industry players, the perception is that these issues will be (and are) solved in the marketplace. While short-term dislocations can occur, the market quickly reacts and makes the proper adjustments. Rig availability is a case in point—given the higher prices last winter, the rig market was very tight. However, since then, I have heard that a few companies have actually laid down (terminated contracts for) rigs in the wake of the natural gas price spike of this past winter.

[Attachment 1]

DESCRIPTION OF THE METHOD USED FOR ANALYSIS OF ENERGY POLICY ACT PILOT PROJECT OFFICES, IMPACTS OF INCREMENTAL APPLICATION FOR PERMIT TO DRILL (APD) PROCESSING

Implications from Historical Drilling Trends. BLM indicates that about 84 percent of all APDs that are submitted become approved. Further, data from BLM's Automated Fluid Minerals Support System (AFMSS)[1] for the last five years indicate that 82 percent of the productive wells completed on Federal lands[2] are natural gas wells. Table 1 shows a summary of the AFMSS data.

Table 1.—AFMSS DATA ANALYSIS

Status	2000 to 2004	Portion of APDs issued
Expired	21	0.2%
Dry Hole	863	7.0%
Prod Gas	9,390	75.9%
Prod Oil	2,093	16.9%
APDs issued	12,367	100.0%

[1] The AFMSS data were available to the project from the EPCA Phase II Inventory. AFMSS had been queried in March 2005 for the EPCA Inventory.

[2] Includes split estate minerals. Excludes Indian minerals.

Although modest drilling for oil has occurred, such drilling does not appear to be growing significantly; except for the Vernal BLM Field Offices, incremental oil drilling has remained flat over the last five years.

Incremental drilled wells are most likely to be located in the Rocky Mountain region; BLM data show that 93 percent of current pending APDs are in Rocky Mountain states. Advanced Resources estimates that over 85 percent of the oil and gas resources in the Rocky Mountains are unconventional natural gas. Although complete resource-specific drilling statistics for all types of natural gas resources are not available, it is anticipated that additional Federal wells are highly likely to be unconventional natural gas wells.

Modeling Approach. The conclusion to be drawn from the discussion above is that incremental wells that could be drilled on Federal lands are likely to be natural gas wells in unconventional resources in the Rocky Mountain region. As such, it is appropriate in this analysis to model incremental impacts on a natural gas-equivalent basis by examining unconventional resources.

Model. Modeling necessitated the use of an engineering/geologic and econometric-hybrid approach of the type available with the Unconventional Gas Recovery Supply Sub-module (UGRSSM), a component of the Energy Information Administration's (EIA's) Oil and Gas Supply Model. EIA's UGRSSM was developed by Advanced Resources, which calls its version of the model "MUGS" (Module for Unconventional Gas Supply). MUGS uses modified resource data from U.S. Geological Survey's (USGS) 1995 assessments, and cost data from various sources, including American Petroleum Institute's *Joint Association Survey on Drilling Costs.*

In addition, MUGS incorporates results from the Energy Policy and Conservation Act (EPCA) Phase I Inventory [3] to integrate Federal land access factors. The EPCA Inventory currently provides estimates of undiscovered technically recoverable resources and proved reserves of oil and gas as well as an inventory of the extent and nature of limitations to their development (generically called "Federal lands access"). EPCA access data are available for the Rocky Mountain region and are incorporated in MUGS.

MUGS provides sound analytical modeling features appropriate for this analysis because the model:

- Accounts for 87 percent of natural gas resources in the lower-48 states relative to USGS (1995) assessments,
- Incorporates resource limitations relative to drilling,
- Employs specific, typical well performance curves by resource play,
- Performs project economics for drill/no drill decisions,
- Covers the Rocky Mountain region, and
- Underpins the Department of Energy (DOE) National Energy Modeling System (NEMS) model for natural gas.

Access. Assessing Federal lands access is a complex issue. Actually the term "access" is somewhat of a misnomer. In fact, a minority (albeit significant) of resource-bearing Federal lands are "inaccessible" in that they cannot be leased the more significant issue revolves around the restrictions associated with leasable lands, where the majority of the undiscovered resource exists. These restrictions are primarily a function of timing limitations associated with various wildlife species, foremost among which are big game, raptors and sage grouse.

To estimate potential production, the access issue must be addressed. In this analysis, acting as a guide for setting EPCA access parameters for the MUGS model, a recent analysis performed for the DOE [4] by Advanced Resources was used. The DOE work entailed the use of datasets and modeling capabilities developed to support the EPCA Inventory. The DOE analysis quantified the degree to which wildlife resources such as big game, raptor and sage grouse habitat afford opportunity for increasing efficiency and access to resources. Figure 1 illustrates for the Rocky Mountain region, the relative impacts from a 10 percent scenario for increasing access. Figure 1 * shows various species modeled independently and in an integrated run. The resource changes result from the contribution of previously unleasable lands becoming leasable, but primarily from leasable restricted lands becoming less

[3] See http://www.doi.gov/epca/ for the EPCA Phase I report.

[4] Memo to DOE: "Analyses to Support Oil and Natural Gas Environmental Program R&D Planning Based Upon the EPCA Datasets and Model" by Advanced Resources, June 2005. The DOE analysis was performed to support efforts for evaluating and planning R&D activities related to Federal lands access.

* Figures 1, 2a, and 2b have been retained in committee files.

restrictive. Without this increased access, the estimates reported below could be as much as 20 percent less.

Modeling Scenario and Parameters. Parameters and considerations incorporated into the modeling process were established during multiple planning meetings with BLM personnel.

The parameters identified as major tangible levers for modeling are:

- Number of wells that can be drilled, and
- Federal land access parameters from the EPCA Inventory.

The modeling is conducted by setting up the base case, which reflects the status quo. The scenario case is then constructed to reflect changes. The difference between the base case and the scenario reflects the impacts due to changes.

The scenario is modeled under the assumption that the effects from APD processing are "quicker to market" than land access changes because incremental APD processing results in drilling that can immediately increase production. Alternatively, land access changes produce results by increasing resource availability and can ultimately result in greater aggregate production. The scenario constructed for the analysis capture the historic trends observed on issued APDs as cited above, namely, 84 percent of wells that start the APD process are approved and that 93 percent of drilled wells are productive.

Base Case. A base case was set up using a combination of price tracks from EIA's Short Term Energy Outlook (STEO) and the Annual Energy Outlook (AEO),[5] projected over 25 years. BLM spent about $27 million in FY2005 to process about 7700 APDs, and its workload is increasing. Figure 2a shows BLM's recent historical APD demand, processing capacity and backlog. Advanced Resources has projected these into the future based upon assumptions of modest growth in APD demand of 5 percent per year and increases in BLM APD processing capacity of 3.5 percent per year.[6]

Scenario. The scenario incorporates base case conditions, but represents the incremental impact of additional spending by BLM for the pilot program of an average of $19MM per year over five years. The majority of funding is devoted to APD processing, which is estimated to cost $4000 per well based upon historical BLM data. The distribution of future drilling is guided by current "pending well" APD counts in the pilot BLM FOs.

Land access increases by approximately 10 percent (based upon prior analysis of the issue for DOE as described above). The costs for land access planning and implementation were assumed to be $2.5MM per year. The land access is introduced into the model by resource play by basin as determined by the EPCA Phase I Inventory. The land access changes are incorporated based upon the DOE study, where access was increased by an average of 10 percent during the five years of the scenario for Rocky Mountain basins.

Figure 2b shows the APD processing as a result of the scenario. The static backlog is worked off while the number of APDs submitted also increases following the second year of the pilot project.

All MUGS modeling runs were conducted on a natural gas BCF-equivalent (BCFe) basis. Other modeling considerations based on historic trends included the following:

- For every 1000 APDs processed, 780 productive wells will result (see above),
- Average lag time between APD approval and spud of 3.3 months based on AFMSS data,
- Implementation year: FY2006,
- First production effects year for APD processing: CY2007, and
- First production effects year for land access: CY2008.

Rigs and Jobs. Although not accounted for explicitly in the model, rig and crew availability were also examined briefly. Short term projections of rig availability were made based on available data[7] for recent-year trends, and current and expected 2005 rig counts for Rocky Mountain states. Drilling crew requirements were

[5] See EIA's STEO (http://www.eia.doe.gov/steo) and 2005 AEO (www.eia.doe.gov).

[6] For years 2007-10. Estimates for 2006 were provided by BLM.

[7] See World Oil Magazine Feb. 2005—http://www.worldoil.com/and Baker Hughes Rig Count datahttp://www.bakerhughes.com/investor/rig/rig__ na.htm.

determined based on information obtained from field operator and from national statistics.[8] Table 2 shows projections based these sources.[9]

Table 2.—DRILLING RIG AVAILABILITY AND CREW REQUIREMENT

Year	2005	2006	2007	2008	2009	2010
Rig availability	285	331	364	385	398	407
Crew Requirement	6,273	7,290	7,999	8,466	8,762	8,946

The projected 2005 national rig utilization is 88 percent, a rate that could increase to over 90 percent at which point additional rigs would likely be built or regionally exogenous rigs would be brought into the Rocky Mountain Region. It should be noted, however, that for coalbed methane rigs, which are not separated in the statistics, increasing the rig fleet would be less difficult due to the shallow nature of coalbed methane wells.

Work force parameters included an estimated 22 workers per active drilling rig and the historic average of 37 wells drilled per rig in the Rocky Mountains to compute direct jobs. Indirect jobs were estimated using Bureau of Economic Analysis (BLS) Employer Costs for Employee Compensation (ECEC), which is about $60,000 per job per year.[10] To compute the amount of indirect jobs, Advanced Resources examined the 2004 income statements for three public companies and determined that the ratio of ECEC expenditures to wellhead revenue is about 25 percent.[11] Advanced Resources has not computed the multiplier effect of these increased jobs.

RESPONSES OF TOM REED TO QUESTIONS FROM SENATOR DOMENICI

Question 1. The pilot project office provision comes with funding of $20 million and we are reporting an Interior Appropriations bill today that will add $28 million in additional funding for Fiscal Year 2007. Industry has been putting millions into funding wildlife studies and cultural surveys.

Do you think this represents a good start on addressing the needs you have raised?

Answer. The $20 million and $28 million that you mention is allocated to the oil and gas program and for expediting processing of APDs pursuant to the pilot projects. To address the needs we have raised, these funds should have been allocated to the BLM's fish and wildlife habitat account and riparian management account. We strongly urge you to ensure that there is adequate staff and resources in place to properly manage fish and wildlife habitats and to mitigate for impacts from expanded energy development. Unfortunately, neither the fish and wildlife habitat account, nor the riparian management account, received significant increases in the FY 07 budget request or the Senate appropriations bill.

In recent years and in response to the demand for energy permits and subsequent workload, the BLM has re-directed resources from other programs (either through funding shifts or re-directing work of resource specialists to work on energy permits), including fish and wildlife programs. This has left long-established fish and wildlife resource programs without support and has caused abandonment of those programs that were formerly actively managed. In fact the BLM's own proposed guidance for implementing the 2005 Energy Policy Act directs states and offices to divert funding and staff from non-energy offices and programs to implement the Act.

The BLM plans on processing over 10,000 permits in FY2007, a significant increase from previous years compounding the impact to resource staffs. We believe that in order to deal appropriately with the expanded development of energy resources, wildlife and fisheries resources need more attention, not less. We oppose shifting funding or staff, as proposed by BLM, intended to manage fish and wildlife resources to expedite energy permitting, and suggest that any funding increases for energy development and permitting should be accompanied by comparable increases dedicated to managing fish and wildlife resources. Additionally we believe that fish

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[8] See U.S. Department of Labor statistics—http://www.umsl.edulservices/govdocs/ooh20022003/cgs005.htm

[9] The Rocky Mountain region rig fleet grew by more than 25 percent in 2004, a rate that would be unsustainable in the future, when additional rigs will need to be built or imported.

[10] Based on rates from BLS at http:/A,vww.bls.gov/news.release/ecec.t10.htm

[11] This ratio was computed based upon examination of the income statements for Burlington Resources, EOG Resources and St. Mary Land and Exploration, which were chosen based upon their Rocky Mountain focus as dominantly domestic, publicly traded producers. ECEC expenses were computed net of royalties, taxes, interest, DD&A and other non-job-related expenses.

and wildlife managers need to actively manage the resources and habitat not just work on energy permitting.

With respect to your question about industry contributions, some companies have provided funds for wildlife studies and we are very appreciative of their contributions.

Finally, we hope that the Committee will continue to conduct oversight functions to ensure that BLM takes the appropriate corrective actions if fish and wildlife studies determine that new or modified mitigation measures are necessary. Too often studies are implemented without the benefit of follow-through, either through lack of foresight, funding, or personnel. For any of these funds to be spent on studies that will prove beneficial, consideration for monitoring with resolute actions has to be part of the plan.

Question 2. We can all agree that it's too early to determine whether this program can be successful.

What are the top 2 or 3 items you think are essential to making this successful?

- Engage local sportsmen stakeholders and land mangers in the pilot office permitting process. The pilot office is a top-down permitting process and it alienates local biologists, land mangers, and citizens who want to be involved in oil and gas decisions affecting the places they know best. No doubt, this will not expedite APD processing in the near term. However, engaging and heading the advice and expertise of local biologists, land managers, and stakeholders in decisions affecting oil and gas activities, the pilot offices will have a broader base of support and result in long-term working relationships that will expedite decisions regarding responsible oil and gas activities down the road.
- Think cumulatively. With the tremendous increase in development (including oil, gas, housing, infrastructure) it becomes more and more apparent that when the bigger "40,000 mile view" is not considered, the consequences can be severe. For example, protection of the Colorado River Cutthroat trout (CRCT) population is a multi-state initiative that requires cooperation among multiple state and federal agencies for its success. If not coordinated, with considerations and protection measurements from impacts of oil and gas development, the CRCT (already a sensitive species) can easily warrant a threatened and endangered status.
- Put money in effort in studying the impacts to coldwater fisheries NOW. There is a profound lack of research on the impacts of development to coldwater fisheries and an attitude of "develop now . . . monitor and mitigate later" is short sighted and irresponsible way to conduct business on our public lands.

Responses of Tom Reed to Questions From Senator Thomas

Question 1. As an example, EnCana has donated $24.5 million to create the Jonah Interagency Mitigation and Reclamation Office. This effort represents an innovative approach to minimizing the footprint of development by pursuing off-site mitigation. Do you see other opportunities for industry to pursue environmental improvements in these sorts of unconventional ways?

Answer. While offsite mitigation can be a good tool to help reduce landscape-wide impacts from oil and gas development, the net result should not be a loss in fish or wildlife habitat. If there are 100,000 acres of wildlife habitat, and 50,000 acres is turned into and industrialized zone for oil and gas while the other 50,000 acres is "improved" for fish and wildlife, the public and our fish and wildlife is still out 50,000 acres. In short, off site mitigation can be a useful tool, but it is not the cure-all to define responsible oil and gas development.

Industry can continue their innovative approaches by using their business management approach for long-term corporate planning and apply similar principles to the long-term comprehensive planning for the environment and the impacts their companies will contribute to the environment. This obviously means working on the ground with key state, federal and natural resource interests to devise such strategies. Industry leaders need to seriously consider hiring permanent and professionally qualified staff who will be part of the problem solving scenario. Similarly, state and federal agencies need to think about long-term impacts defined with specific desired results and incorporate those parameters into their long-term planning efforts.

While preliminary steps toward this type of action have been initiated (potentially through the JIO) this type of opportunity needs to be incorporated into a committed plan from all participants. Based on the industry and BLM extraction scenario (up to 50 years in some places), this type of thinking and planning has to now become part of everyday business.

When the bottom line of a state wildlife agency will be affected due to a decrease in hunter numbers due to a decrease in herd size due to loss of habitat, that agency needs to be able to plan . for their budget inadequacies. In Wyoming, up to 90% of the Wyoming Game and Fish Department's budget comes from hunter and angler license fees. The issue is broader than simply minimizing the footprint of development through off-site mitigation.

The BLM needs to proactively engage in more innovative thinking. For many years now, industry and environmental/conservation groups have been working together to try and develop off site mitigation strategies but were thwarted by the BLM's reluctance to accept such a concept.

Moreover, innovative thinking has to include the future prospect of extraction decline, when the resource plays itself out. Planning for the decline during this wealthy period we are experiencing should also become part of the long-range vision.

Water quality and quantity is a big issue in the west. In the current drought situation, not enough emphasis is placed on water conservation in the energy industry. Innovative approaches that use water conservation techniques to maintain streams and rivers, municipalities drinking standards and agricultural practices need more emphasis. Coal bed methane, or coalbed natural gas, produced waters are just now receiving levels of recognition within the industry and agricultural. More emphasis and consideration on wildlife and fisheries impacts are needed.

Finally, reducing the impacts whenever possible is another innovative approach to pursue. For example, using directional drilling even if it may reduce profits in certain scenarios, remote monitoring, busing in workers, reducing well densities, reducing the number of roads needed for a field and limiting the use on those roads, minimizing generator noise, and not flaring wells at night are all ways to pursue environmental improvements.

Question 2a. If I could be a stickler on some of the numbers we're hearing for a moment, I have a couple questions:

When you say that 25 percent of Wyoming will be impacted by oil & gas development, how exactly do you come up with that number?

Answer. This number was provided by John Emmerich, Deputy Director of the Wyoming Game and Fish Department in Cheyenne. This includes all associated impacts from energy development on private and public surface lands, including roads, power lines, compressor stations, and indirect surface development from human traffic.

Question 2b. You said in your testimony that 3 million acres of land had been leased for every fisheries biologist at the BLM. Wouldn't the miles of streams and rivers per biologist be a more accurate measurement of their workload? Do you have those numbers?

Answer. Stream miles do not accurately reflect the true workload that fisheries biologists face regarding impacts affecting watersheds. This is because poor land management practices quite literally flow downhill. Streams and rivers are directly affected by what happens on surface lands. Infrastructure of energy production includes road building and can include roads adjacent to streams/rivers, over streams/rivers, and within vicinities of streams or rivers and their drainages. Such construction is almost always permanent and has the characteristic of eroding soils and silt into streams and rivers, through various means (culverts, sudden event weather-related drainages, heavy traffic, winds, etc.).

Even if a development is occurring a mile from the actual stream, ground water contamination, aquifer draw-down, increased erosion, and a host of other considerations need to be taken into account when reviewing the impacts of oil and gas on a watershed. Rather than using miles, perhaps acreage of watershed would better serve as a descriptive measurement for a biologist's workload. However, it is safe to say that all three million acres of land described fall within a watershed, so the effect would be the same.

Question 3. I appreciate your emphasis on working with everyone involved, early on in the process, to make sure development is done right. Can you elaborate on the sorts of cooperative efforts that Trout Unlimited is engaged in?

Answer. In Wyoming, TU is working with various energy companies seeking to develop oil and gas on public lands:

- Currently underway is a collaborative partnership with the project company, Dudley and Associates, on the BLM Seminoe Road CBM project in south central Wyoming. This project involves coal bed methane production with discharges occurring into a popular reservoir and river system. TU and Dudley, along with state and federal permitting agencies, are working on establishing parameters that provide minimal impact to fisheries while maintaining development goals

for the company. Significant research on coldwater fisheries and cbm discharge is being conducted with cooperation from the company, the BLM, Wyoming Game & Fish, EPA, Dept. of Environmental Quality, and the Governor's office.
- Shell Oil established an Advisory Panel this past winter and invited TU, among other conservation groups, to sit on the panel and assist in developing guidelines for wildlife and energy impacts in the Pinedale Anticline area.
- Encana Oil and TU have had numerous conversations about working collaboratively on projects which will enhance fisheries and protect waters from current and future development in the Upper Green River Valley.
- Questar and TU have had several opportunities to discuss ways to mitigate impacts to wildlife and fisheries through adaptive project development.
- TU participated as a contributor to the Western Governors' Association (April 2006) "Coal Bed Methane Best Management Practices" handbook.
- In Utah, we hosted a workshop to address oil and gas planning issues on the Uinta National Forest that brought together the BLM, Forest Service, Utah Division of Wildlife Resources, Utah Division of Oil Gas and Mining, Utah Division of Water Quality, Sage Grouse Working Group, Strawberry Anglers, Audubon Society, Utah Environmental Council, Questar, Wild Utah Project, Blue Ribbon Fisheries Advisory Council, and local concerned sportsmen to bring all to the table and address concerns early on in the process.

RESPONSES OF DUANE ZAVADIL TO QUESTIONS FROM SENATOR DOMENICI

LEASING, PLANNING AND PERMITTING

Question 1. You indicated some of the proposals in recent revisions to BLM's Resource Management Plans have the capacity to actually limit energy production in Western States.

Will you elaborate by describing for the committee some examples?

Answer. Given the fact that the majority of lands in the Rocky Mountain Region are managed by federal land management agencies, new development of important natural gas resources can only occur if federal land management agencies recognize the importance of allowing reasonable access to reserves. Updates to Resource Management Plans (RMP) often do not realistically plan for needed development of the energy resources in the area and do not include Reasonably Foreseeable Development scenarios for oil and gas activities and the necessary land use allocations to meet our country's energy demands. For example, the Draft Environmental Impact Statement (EIS) for the Price RMP identifies restrictions to development without any apparent consideration or description of expected future uses. The number of allowable wells per year is a highly significant conclusion of the Draft RMP/EIS and represents a regulatory ceiling of 1,540 wells. However, at the time the draft was issued, 1,402 wells were already in place, allowing for the drilling of just 138 additional wells. The number is completely inadequate to develop the energy resources contained in the Price area.

Although there are many resources, BLM's mandate is to manage for multiple use as defined by the Federal Land Policy and Management Act, 43 USC §1702 (c) ("Section 103(c)"). That section defines multiple use as the "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people." Id. Again the Price Draft RMP/EIS takes the most restrictive means of allowing mineral development. BLM's Fluid Minerals planning manual H-1624-1 requires the use of the "least restrictive stipulations that effectively accomplishes the resource objectives." There are adequate laws in place to ensure resources are protected including the National Historic Preservation Act, the Clean Water Act, the Clean Air Act, the Safe Drinking Water Act, and the National Environmental Policy Act. The Price RMP protects resources to the exclusion of all other multiple uses while also requiring energy companies to prove they will not damage resources. This is contrary to BLM's fundamental mandate of managing lands for multiple uses. Conditions placed on development are extremely restrictive without due cause and would cause severe and unacceptable adverse impacts on the ability of oil and gas operators to develop the resources in the Uinta Basin, a major producing area.

While the above two examples relate to the Price Time Sensitive RMP, the same issues of inadequate Reasonably Foreseeable Development and unnecessary stipulations on development are observed in other RMPs designated as "Time Sensitive Plans" (TSP). Twenty-one TSPs were identified as high priority because they address energy resource development, respond to nationally significant lawsuits, or have legislatively mandated time frames. With 2006 upon us, six TSPs critical to

oil and gas development are not yet final, limiting BLM's ability to effectively manage the public's energy resources. Without these TSPs finalized, the expanded energy resource development they were meant to address cannot proceed.

The Rawlins, Wyoming RMP is also a TSP, which is scheduled to be released this autumn. Many wildlife stipulations are based upon inaccurate scientific data or assumptions. These wildlife stipulations commonly restrict year-round drilling to just the spring and fall, leading to further delays in developing energy resources.

The Roan Plateau TSP contains numerous legal inadequacies that fail to comport with the Federal Land Policy and Management Act (FLPMA) which expressly declares Congressional policy that BLM manage public lands "in a manner which recognizes the Nation's need for domestic sources of minerals, [and other commodities] from the public lands." In addition, the RMP/DEIS does not comply with the Congressional statute that transferred administration of the Roan to BLM for the stated purpose of oil and gas exploration and development. Section 3404 of Title 34 of the National Defense Authorization Act for 1998 directed the Secretary of the Interior to lease the former Naval Oil Shale Reserves (NOSR) on the Roan Plateau for oil and gas exploration and development. The purpose of the Roan Plateau RMP was to fulfill the Congressional mandate for oil and gas development, yet the process has led to alternatives which would be in direct opposition to the law.

Question 2. How has BLM responded to these concerns?

Answer. IPAMS submitted very detailed comments to the BLM for the above-mentioned RMPs and others involving oil and gas development. It is difficult to know how, if at all, IPAMS' concerns are being addressed in these documents until the next version of the document is released. It is IPAMS' hope that our recommendations are being incorporated into the final versions of these plans. However, we suspect for some that is not the case. In addition, the Price RMP is being further delayed by a supplement to the Draft EIS that is adding four new Areas of Critical Environmental Concern (ACEC) that were not included in the original Draft RMP/EIS. These ACECs would further restrict leasing and development of energy resources in the Price area.

Question 3. The Energy Bill provided 5 Categorical Exclusions from NEPA to reduce the burdensome permitting process, yet it sounds as if they may be taking as long as an APD in some cases.

What would you attribute this delay to?

Answer. Permitting remains the most immediate and perhaps manageable element controlling the amount of natural gas to reach consumers. Commodity prices tell us that more wells need to be drilled. Both industry and BLM have responded and drilling is up. The backlog of permits in BLM field offices, however, continues to grow. The number of permits approved by BLM has increased 20% over the last three years. At the same time, the number of permits received by the BLM has increased 27%. Field offices have fallen further behind. For companies juggling tight drill rig availability with seasonal stipulations that allow drilling only during a narrow time frame, permitting delays are very problematic. Approval times are unpredictable and often reaching six months or more.

Categorical exclusions could be used to help ease this backlog. Since it takes time to implement new statutes and regulations, we anticipate the usage of categorical exclusions will increase over the next few years. Even when an Application for Permit to Drill (APD) meets all the criteria for a categorical exclusions, many field offices are still requiring site inspections which take time, and other review processes, such as ESA and historic preservation, lead to continued long processing times.

There are some notable success stories and I should have highlighted these in my testimony before the Committee on June 27, 2006. The BLM's Farmington Field Office has issued 249 categorical exclusions at last count, and their processing times have decreased significantly. For comparison, the entire state of Wyoming has issued 339 categorical exclusions and Utah 62. The recent completion of the Farmington Resource Management Plan (RMP) is the key to this extensive use of categorical exclusions. The experience in Farmington underscores the importance of land use planning as giving the agencies tools that can be used in conjunction with the EPAct to ensure natural gas supplies are headed to consumers. As other RMPs are updated, such as the Price, Vernal, Roan Plateau, and Rawlins Time-Sensitive RMPs, we hope to see more BLM field offices as successful as Farmington. IPAMS is planning to work with the BLM and Forest Service over the next few months to increase the usage of this advantageous provision of the EPAct.

Question 4. You touched on the three challenges facing producers on public lands—leasing, planning and permitting.

Given what we've heard today, what changes would you propose beyond those measures implemented in the Energy Bill?

Answer. A comprehensive look at the current process to identify where bottlenecks occur will help this Committee determine potential legislative action and oversight opportunities. Without examining the permitting process and making changes to improve its efficiency, BLM will likely continue to fall behind in permit approvals even as the agency's role will grow more important in meeting the nation's energy needs.

Recently, IPAMS conducted an informal survey of our members regarding their experience with Section 390 of the Energy Policy Act. Nearly one-third of the respondents had suggested the use of the categorical exclusions to the BLM and 28% were accepted. This finding may indicate the need for close oversight by this Committee to ensure the agency is carrying out the Congressional intent of Section 390.

Another area that needs attention is the processing of Expressions of Interest (EOI) to lease lands competitively. Much attention has been placed on the processing of APDs, but in some instances this has resulted in a de-emphasis on lease processing. Expressions of Interest are critical to exploration of new reserves and fields. The discovery of new resources in the Rockies being developed today is the direct result of past exploration on public leases. The continued backlog of leasing severely limits future energy development. Therefore, measures must be taken to increase BLM field office personnel and resources devoted to processing EOI as well as APDs. EOIs must become a higher priority for BLM personnel.

RIG AVAILABILITY, PIPELINE CAPACITY AND MANPOWER

Question 1. We often hear that the backlog of permits is increasing, yet we also hear that there are not enough drilling rigs available to actually drill anyway.

Please comment on the issue of availability of drilling rigs in the Rockies.

Answer. The market for drilling rigs is responding to demand for natural gas. Between 2000 and today, the number of rigs in the Rocky Mountains has increased 200% as noted on the attachment to IPAMS written testimony which is part of the official record and incorporated herein by reference.

Federal land management agencies have the ability to positively impact rig availability by implementing efficiencies in the permitting process. An unpredictable permitting process leaves drilling contractors unable to sufficiently respond to market conditions by moving more rigs in to the region, and producers are threatened with increased costs by losing drilling rigs or paying for drill rigs they cannot keep busy. Multiply these pressures by the number of rigs that are working and the need to have multiple permits available to execute a coordinated, flexible drilling program and the need for a more timely permitting process becomes painfully apparent.

Timing limitations are an excellent example of a regulatory burden that inhibits a larger response of drilling rigs to the Intermountain West. The drilling window in many areas is limited by timing limitations imposed under resource management plans for various reasons (wildlife habitat, nesting, breeding, etc.). The timing limitations prevent rig companies from sending more rigs to the Intermountain West because they are unable to keep their drilling rigs active the entire year and must move them to other geographic areas. Moving rigs is expensive for operators, but disruptive to those working on the rigs because they must either move or seek other employment.

We are optimistic that the Federal Permit Streamlining Pilot Project will help relieve some of the problems with permit processing, and hence rig availability. The current work being conducted by the Booz Allen consulting company to analyze permit processing in the pilot offices and recommend workflow and process improvements will help achieve this goal. IPAMS has contacted the project manager to become involved and provide an industry perspective to the study.

Question 2. Are there enough rigs and crews to meet demand by the producers?

Answer. The free market will respond to the demand for drilling rigs and crews if the regulatory process permits. However, the regulatory process discourages a larger response by the drilling sector. Timing stipulations serve as a deterrent for some drilling companies to bring more rigs to the Intermountain West since these rigs will only be busy half the year.

New and refurbished rigs are on order, but take time to deliver. Whether building or refurbishing, it requires long-term commitments by the operator. As a result, permitting becomes critical for keeping committed rigs working to bring natural gas to consumers.

A more predictable regulatory process would enable companies to commit to long-term development, and drilling companies would respond by increasing the supply of rigs. Year-round drilling enables a stable workforce of crews with the right training and experience. A stable workforce has obvious benefits to the communities

where they live and work, and alleviates the problems associated with boom and bust cycles and seasonal work.

Question 3. Is there pipeline capacity to meet demands for the Rockies' gas?

Answer. The free market responds to the demand for pipeline capacity in the Intermountain West. As production has increased, pipeline constraints have yielded substantial projects that are increasing pipeline capacity. The Rockies Express pipeline, with a daily capacity of 1.8 billion cubic feet, is currently under development to connect the Rockies with key markets in the mid-West and East Coast.

Question 4. Would you please comment on labor markets and the availability of qualified personnel to work in the field?

Answer. Like many other industries, the market for experienced, skilled labor is becoming tight with the aging workforce across the nation. We are seeing many highly skilled professionals moving into the area from declining fields in Texas and Louisiana. The current opportunities in the Rockies are providing excellent opportunities to groom junior professionals. Petroleum Engineering programs are seeing a resurgence in attendance as the market has become lucrative. As mentioned in question 2, a stable regulatory environment will help to smooth the boom and bust cycles experienced in the past and lead to a stable workforce in every aspect of the industry.

RESPONSES OF DUANE ZAVADIL TO QUESTIONS FROM SENATOR SALAZAR

Question 1. Thank you for your testimony, I appreciate hearing the views of an industry that is so important to our country, and Colorado.

As natural gas exploration and development expands into lands neighboring local communities and into areas that are highly valued, what opportunities exist for industry to collaborate with local communities to reduce conflict? I am motivated to ask this question by the positive experience between Antero Resources and Garfield County residents.

Answer. IPAMS encourages community involvement in providing input on development. However, where federal resources are involved, operators and the federal government have an obligation to maximize the recovery of resource so as to prevent waste. While operators are able in many instances to make operational concessions, it is a two-way street where the local community needs to understand the needs of the nation and that mineral resource development is a principle or major use of BLM lands under FLPMA (along with livestock grazing, fish and wildlife development, rights of way, recreation and timber production). See 43 U.S.C. § 1702 (1). The balance is sometimes difficult to strike especially in the Intermountain west where the population continues to increase on the western Slope.

Question 2. What is industry's position on due diligence requirements for lease that are held?

Answer. The term "due diligence" encompasses a broad number of issues. Most issues of due diligence occur on the lease in terms of the duty to the royalty owner. Based on Question number 1 above, presumably the question deals with what the industry's position is on external due diligence prior to developing a lease. IPAMS believes the answer to Question 1 above adequately addresses this issue.

RESPONSES OF DAVE FREUDENTHAL TO QUESTIONS FROM SENATOR DOMENICI

Question 1. What has been the States involvement in Bureau of Land Management's (BLM) planning efforts?

Answer. The state has been involved in numerous BLM oil and gas development projects. State agencies often participate in scoping through the final environmental impact statement/record of decision. The real work is accomplished when the state is at the interdisciplinary team level as cooperating agencies as defined by the National Environmental Policy Act (NEPA). State cooperating agencies usually involve personnel from the Game and Fish Department, Department of Agriculture, Office of State Lands and Investments, Department of Environmental Quality, State Trails Program, State Historic Preservation Office, Oil and Gas Conservation Commission and the Geological Survey. Because of the number of individual energy projects the BLM is working on, the agencies tend to focus on the major planning efforts. A current list of projects is attached. The state has also been involved in the Governor's consistency review of the Jack Morrow Hills Plan.

Question 2. Has the State been satisfied with its opportunities to involvement in BLM's planning and monitoring?

Answer. The interaction between the state and BLM field offices concerning planning and monitoring has been evolving. We are clearly further along in the area of planning. However, there is currently discussion on how to create a synergism be-

tween federal, state and local entities to conduct appropriate monitoring. Overall, the relationship has been better than ever, however, there is still work to do on communication in certain areas, but overall we see progress being made. Coordination and communication must exist between state and local cooperators and the BLM at the field and at the state office level.

Question 3. We can all agree that it's too early to determine whether this program can be successful.

What are the top 2 or 3 items you think are essential to making this successful?

Answer. First of all, the BLM and state need people with strong problem-solving skills to be able to work through issues. Adequate funding and support from the top are also an absolute must for monitoring and inspection to be successful. Without inspection and monitoring receiving the same level of attention and funding as currently provided to permitting efforts the chance of legal action—over everything that has been, accelerated or streamlined—could be jeopardized.

RESPONSES OF DAVE FREUDENTHAL TO QUESTIONS FROM SENATOR THOMAS

Question 1. Can you expand upon the comments in your testimony related to the role that the states can and should play in the implementation of these Pilot Offices?

Answer. The state can clearly play a role in the pilot offices, but also in other offices such as the Jonah Interagency Field office. The state can assist in gathering specific resource information and data to assist in the permitting, however, the state agencies see their true expertise as being in the implementation and monitoring of oil and gas development.

Question 2. You spoke about the Pinedale office in your testimony and said that 92% of the land that office oversees has been leased and that only 8% of the remaining land is available for wildlife and recreation. I do not believe that is true—just because something has been leased does not mean that it has been drilled or otherwise disturbed. Wouldn't a more accurate measure be the percentage on which drilling has been approved? Do you have those numbers?

Answer. I would like to expand on and clarify the 92%/8% issue. I agree that undeveloped leased land is certainly available for other activities and wildlife to use the leased areas. As long as development may occur, there is never the assurance, however, that the habitat will remain undisturbed. The main point of my statement, 'As an example, the Pinedale Field Office had 92% of its area leased, and a high likelihood that would fully developed, 8% of the remaining land does not seem to protect other resources values such as sage grouse, mule deer or antelope or recreation opportunities that provide solitude,' was to emphasize that, once leased, the BLM has the responsibility to allow the lease to be developed and, if developed, will then impact habitat because of surface and human disturbance.

The BLM is not eager to invest habitat or mitigation monies in a leased section of BLM land due to the possibility of additional surface and human disturbance. One might argue that the lease stipulations are in place to offset impacts to wildlife and other resources. To this point, there are currently studies suggesting that existing stipulations may not adequately protect mule deer herds or antelope migration or sage grouse nesting areas from impacts in later-developed areas. Many biologists are requesting that the BLM at the very minimum defer leasing in those areas with crucial habitat and low potential for development while other areas are fully developed to provide areas of undisturbed habitat. Pinedale is reviewing this option for its RMP.

In order to truly mitigate disturbance, in order for it to be effective, the mitigation must persist undisturbed during the life of the project.

Question 3. You make a case for the Pinedale, Wyoming field office being added to the Pilot Office program in your testimony. Is it fair to say that you would characterize Section 365 of the Energy Policy Act as a success even in these early stages of its implementation?

Answer. It is fair to characterize the early stages of the Energy Policy Act as a vast improvement over the pre-existing situation. There still remain many items that need to be implemented for success to be fully declared.

RESPONSES OF DAVE FREUDENTHAL TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Inspection and Enforcement—Your testimony makes some excellent points regarding the importance of inspection and enforcement. What additional steps do you think the Federal Government should take in this area?

Answer. There should be a minimum number of drill/production lease sites that are inspected randomly each year by a diverse team including representatives of engineering, biology, conservation, transportation, grazing and others, based on con-

sistent parameters. The inspection team should also include all agencies that have regulatory and/or inspection authority. The results should be released to the public.

Question 2. Monitoring—You also discuss the importance of monitoring the impacts of oil and gas production. Please provide us with your thoughts on what BLM should be doing in this regard.

Answer. During production, a minimum number of sites and/or leases should be inspected randomly each year. This again should include a team with a variety of expertise. The team should include representation from agencies with regulatory authority or interest in the issues. These inspections should be publicly announced and the results released to the public.

Question 3. Water Resources—What are your views with respect to the potential impact of coalbed methane production on water resources? Are there steps the Federal Government should be taking that are not being taken?

Answer. Additional monitoring regarding underground aquifers is needed. The federal government could help in this regard. As for surface water, the EPA is involved with the disagreement over water quality issues between Montana and Wyoming. The Wyoming Legislature has created a coal bed methane taskforce that is looking at this issue as well. Federal funding may be needed to help create a viable solution to water management for the Powder River Basin.

RESPONSES OF DAVE FREUDENTHAL TO QUESTIONS FROM SENATOR SALAZAR

Question 1. I appreciate your testimony regarding the need to improve inspection and enforcement activity by the BLM. Does Wyoming have any additional suggestions for how to accomplish better inspection and enforcement in the field?

Answer. There should be a minimum number of drilling and/or production sites that are inspected randomly each year by a diverse team including representatives of engineering, biology, conservation, transportation, grazing conditions of approval and others, based on consistent parameters. The inspection team should include all agencies that have regulatory and/or inspection authority in order to facilitate information sharing. The results should be released to the public.

Question 2. I also appreciated your recommendation to avoid "hasty" action to remove winter stipulations when our wildlife is most susceptible to pressure from industrial activity. How often are these stipulations able to be worked through with communication and cooperation with the state?

Answer. Attached is a letter sent to Senators Domenici and Bingaman in December 2005 that outlines our concerns. Essentially, Wyoming has been successful in meeting companies' operational needs when they are willing to help reduce the impacts to wildlife.

Attachments: BLM Hotsheet and 2005 Winter stipulation letter have been retained in committee files.

TUESDAY, JULY 11, 2006

RESPONSES OF CHRIS STANDLEE TO QUESTIONS FROM SENATOR DOMENICI

Question 1. Your company is truly global in its pursuit of biofuel technologies. You are pursuing projects in Europe and here in the US. Do you see opportunities for technological cooperation internationally?

Answer. We believe that there are great opportunities for international cooperation on new ethanol technologies. Air quality and energy independence are not just U.S. issues, and our goals are complimentary to, rather than competitive to, the goals of other nations in the area of renewable fuels. Abengoa promotes the sharing of information and improvements between companies both within and outside our borders, and that cooperation is critical to the most efficient development of these new technologies. Our current cost share project with the DOE promoted partnerships with international companies to develop better enzymes to more efficiently break down starch and sugars and improve the yield of feedstock to ethanol. We believe this has helped to encourage the development of the best technologies available. Several other countries in Europe, Asia and South America are also promoting the development of new ethanol technologies. In addition to our cost share project with DOE, we have similar cost share agreements with the European Union that make Abengoa one of the EU's leading partners. While these projects are clearly separately funded and address separate technologies, the pursuit of multiple potential technologies is the most logical way to determine which are the best. We are confidant that the lessons we learn from the operation of our new biomass facility in Salamanca, Spain (which is designed to demonstrate enzymatic hydrolysis technology), will help us more efficiently complete our pilot plant in York, Nebraska (to demonstrate biomass fractionation and fermentation technology). The simultaneous evaluation of both technologies will allow us to make a better and more informed decision as to the design of a full commercial scale biomass production facility which we are currently proposing to DOE in response to their most recent solicitation.

Question 2. How competitive are American biofuel companies internationally?

Answer. American biofuel companies are among the most price competitive internationally. However, this does not mean that American ethanol is the least expensive to produce. Brazil has a more mature ethanol industry that has been based on over thirty years of government support, plants that are fully depreciated, substantially less expensive feedstock supplies, fewer environmental regulations, no natural gas expenses, and low manpower costs. On a pure cost per gallon basis, Brazil is the current international leader, but it will not be able to replace the world's oil supply by itself. Additionally, there is little benefit to be gained in exchanging a dependence on imported oil for a dependence on imported ethanol.

The U.S. ethanol industry is capitalizing quickly with the passage of the Renewable Fuels Standard. It is by far the most diverse, developed and efficient renewable industry in the world. In fact, we expect the U.S. industry to quickly surpass the Brazilian ethanol industry as the U.S. industry expands both traditional starch fermentation production, and funds the anticipated cellulosic demonstration plants. Our industry is certainly the most technologically advanced of any ethanol industry in the world. Continued governmental support of the U.S. industry, and especially the development of new technologies such as biomass, will make the U.S. industry even more competitive internationally in the long term.

Probably just as important to the survivability of this growing industry, is a discussion on how to maintain a market driven system without putting the significant R&D investment by both the federal government and private industry at risk when oil prices fluctuate. We hope this discussion would include how the lessons learned from the early development of the starch based ethanol industry could help provide stability for the development of the cellulosic industry. For example, the Brazilian government made a commitment to be free of imported oil and backed that pledge up with a consistent policy on which the industry could move forward. We ask that the U.S. provide the same type of commitment to the renewable industry that would allow the U.S. to become much less reliant on imported energy.

One significant first step in making that commitment would be to fund the renewable programs created in the Energy Bill. We encourage the Committee to have a frank discussion on providing a consistent message regarding a commitment to the future of the renewable industry. We encourage the Committee to consider policies that would allow the market to send price signals to the industry, while also providing consistent incentives to ensure ongoing private investment in the future of the industry and the goal of reducing substantial dependence on imported oil.

Question 3. Can you help me to understand what exactly is meant by the term "biorefinery"? I have heard this term used to talk about existing ethanol plants, new ethanol facilities and future production sites for cellulosic biomass ethanol. What is the correct use of this term and does it refer to a facility that will produce a slate of fuels (i.e. gasoline, jet fuel, naptha, diesel, asphalt and chemicals) as an oil refinery does today, or is there only one product supplied—ethanol or biodiesel?

Answer. In our view, the term "biorefinery" means any facility that produces fuel or other products (including human or animal food products, plastics, lignin or even other energy sources, such as electricity) from renewable resources. It is not limited to ethanol or biodiesel, although those are the most common Biofuels today. The term would not be limited to fuels, as other valuable products are already capable of being produced.. However, products derived from petroleum or other non-renewable resources would not be included.

RESPONSES OF PAUL THOMSEN TO QUESTIONS FROM SENATOR DOMENICI

Question 1. Of the numerous directives aimed at the geothermal industry within EPAct, which are considered the most important by the geothermal industry, and why?

Answer. EPAct included many different provisions related to geothermal energy, including tax credits, a revision of the Geothermal Steam Act governing leasing and royalties, research directives for the Department of Energy, and others. In addition, geothermal energy and projects could be part of the federal loan guarantee program and are affected by many provisions relating to energy markets, reliability, and so forth.

Most within the industry would identify the inclusion of geothermal energy in the Section 45 Production Tax Credit as the most important of these items for two main reasons. First, the tax credit puts geothermal on an even footing with wind energy, which is often a competitor with geothermal projects in states with renewable portfolio standards. Without parity, geothermal projects had a difficult time winning solicitations. Second, the PTC helps reduce the high upfront costs associated with geothermal projects, which is important because states and consumers are seeking renewable energy but don't want to pay a premium for it. Together, state renewable standards and other state initiatives, along with the PTC, will spur the development of many new geothermal power plants.

Beyond the tax provisions, the leasing, royalty provisions, and research directive have many important benefits that would be difficult to prioritize. A company must obtain a lease before development can occur on federal land, so leasing is important; the counties in which geothermal development occurs should receive royalty payments, so royalty provisions are important; and finally, there is a continuing need for advances in technology, particularly to help industry find and develop the subsurface resource better, so research is important.

Question 2. On what type of land does the majority of geothermal development take place? (federal land, private land, etc) In the future, do you expect this to change?

Answer. We understand that roughly half of the geothermal power produced today involves some federal land or leases. It is expected that in the future this percentage will increase because so much of the potential resources in the West are on federal land. If working on federal lands becomes more difficult, which has been the case over the past decade or more, this may change. Additional bureaucratic burdens, delays, restrictions and other impediments on federal land will give development on private or state land a higher premium—even though the better resources may be on the public lands. This is already occurring in California, where obtaining leases and permits from the federal agencies have ground to a near complete halt.

A trend towards growing reliance on the federal lands is indicated by the recent GEA survey of geothermal projects. Of the 44 geothermal projects in nine western states that GEA identifies as currently under development, we estimate that more than 60% involve federal leases. The GEA 2006 "Update on Geothermal Power Production and Development" is available on the organizations web site at: http://www.geo-energy.org/publications/reports.asp.

Question 3. Why should geothermal, a regional resource, be supported by a federal agency such as the DOE? Why not focus on the regional support provided by WGA and individual western states?

Answer. Geothermal energy—the heat from the earth—is not a regional resource, but is available everywhere in the United States. Geothermal heat pumps capture the heat from the ground at shallow depths in all 50 states. Direct uses of geo-

thermal energy, which use low and moderate temperature resources, are used to support commercial enterprises in some 26 states.

Today, only high temperature geothermal power production is geographically limited. High temperature power production currently exists in four states—California, Hawaii, Nevada and Utah—but that is expected to expand to six in just the next year (Idaho and Alaska), and could expand even further with continued federal and state support. Western Governors' Association identified eleven states that are capable of producing geothermal electricity in the near term from known hydrothermal resources, given continued federal and state support. This expansion to a dozen states could be more than doubled in the coming decade if the ability to find and characterize geothermal resources improves; if efforts to produce power from oil and gas fields, small off grid systems, and other applications not typically considered are successful; and, if there is a multi-year commitment to fund the DOE geothermal research program needed to support these and other objectives. Relying on state and regional support alone would limit potential expansion. Not only do state and regional programs lack the resources of the federal program, but there would be little incentive to develop important improvements in technology applicable in other states or across the entire nation.

Energy is unquestionably a national issue, as well as a state and regional one, and new energy development needs support and encouragement from both federal and state governments. Geothermal energy can make a significant contribution to our national energy needs. As the Geothermal Energy Association stated in its testimony to the Senate Energy and Water Appropriations Committee this past April, "GEA projects that with continued federal and state support geothermal power could expand beyond providing 5% of California's electric power to providing 6% of the entire nation's electric power by 2025. We estimate that over 30,000 MW of geothermal power could be developed in the next 20 years, representing an investment in new domestic energy supplies of over $70 billion. This level of production and new investment in geothermal energy would mean 130,000 new full time jobs and 500,000 person-years of construction and manufacturing employment. Yet, at this level of geothermal production, we would only be utilizing a small fraction of the ultimate geothermal potential."

RESPONSE OF PAUL THOMSEN TO QUESTION FROM SENATOR WYDEN

Question 1. As renewable energy proponents, do you think that the federal government should play a different or larger role in assessing the value and availability of solar, wind and geothermal energy resources on federal lands? We authorized several provisions under last year's Energy Bill that put DOE and USGS in the driver's seat here, and yet now we are hearing that if you're measuring wind availability on BLM land, there's one set of rules and if you're planning a geothermal project on Forest Service land there's another set of rules. What should the federal government be doing to provide better assessments of renewable energy resources?

Answer. The directive and authorization of EPAct for a new national geothermal resource assessment, combined with the directive for DOE to conduct research into improved technologies for detecting geothermal resources and reducing drilling and development costs, seek to address this important question. The high cost and risk of identifying and characterizing geothermal resources is a principal barrier to our expanded use of these resources. According to the last USGS resource assessment, more than 80% of the conventional geothermal resources were considered "hidden" because we lacked the technology to find them without expensive and risky blind-drilling. That situation remains fundamentally unchanged today.

What can or should be done? First, the federal government should carry the mandate of EPAct and not shortchange resource assessment for renewable resources, particularly geothermal energy, both in agency budgets and congressional appropriations. Further, DOE and DOI should build upon the directives in EPAct by developing collaborative plans with state governments and industry to target exploration and subsurface research in order to identify the most promising new sites, and support cost-shared efforts or loan guarantees for early development activities as well as DOE's efforts to develop and apply advanced resource engineering techniques. Finally, the tax incentives included in EPAct for oil and gas exploration should be expanded to include geothermal energy.

Further, the question raises the issue of inter-agency coordination, which has created problems in the past for geothermal development. Large areas of the West involve the jurisdiction of multiple federal agencies, and coordination between these agencies and state and federal agencies is critical. EPAct addressed this, in part, for geothermal by requiring a new Memorandum of Understanding between the BLM and U.S. Forest Service regarding geothermal leasing and development. That

MOU is a first step and now must be put into action as BLM resumes a federal leasing program. Congress can help see that the good intentions of the MOU translate into agency actions through effective oversight. Also, Congress should consider directing the federal agencies to enter into similar agreements with state agencies that have overlapping jurisdiction.

RESPONSES OF DR. WALTER SNYDER TO QUESTIONS FROM SENATOR DOMENICI

Question 1. The Consortium is presently comprised of six institutions in the Intermountain west.

Is participation limited to the current members and if not what do you see the membership in the Consortium becoming in the future?

Answer. As you know, the Intermountain West Geothermal Consortium (IWGC) was authorized by EPACT (section 1820) as a collaboration among academic institutions and federal research laboratories. We are certainly open to new members. Our focus is on developing a better fundamental understanding of the geology, geophysics, hydrology, and geochemistry of geothermal systems and to transfer this knowledge to industry, federal and state agencies, municipalities, and industry. Our immediate goal is to fully launch the IWGC, that is, to implement section 1830 of EPACT. However, because of the importance of geothermal to the West's energy portfolio, we are open to new members interested in geoscience research. Collaboration is the key issue here. Collaboration occurs through new membership, but also between the IWGC and other institutions and programs. The IWGC should not, cannot, and will not do all the needed geothermal research, in particular that which focuses on the engineering aspects which are best done my other, ongoing efforts, such as at Sandia Laboratories, New Mexico State University, National Renewable Energy Laboratory, and elsewhere. Others may prefer to remain independent, such as Nevada's Great Basin Center for Geothermal Energy. But we clearly understand the need for collaboration of all groups doing geothermal research, regardless of focus. We want to emphasize that the membership of the IWGC will always reflect the need for doing practical research that agencies and industry can use, and that our membership must reflect that commitment.

Question 2. In your testimony you mentioned the Consortium represents a new way of doing research.

Can you clarify what that approach is and how it will benefit development of renewable geothermal resources in the west and the Nation?

Answer. Much is said about "technology transfer," that is, about transferring basic research results to the stakeholders for their use. This is easy to say, but more difficult to do effectively, and even more difficult to document. Because many of the IWGC members have for years worked closely with agencies and industry, we recognized this problem and have devised a four-point approach that taken together constitutes a new paradigm for research: 1) publication of results, 2) open access to all relevant data through a digital information system, 3) open access to physical geologic samples and logs, and 4) directly working and communicating with stakeholders. Separately, these four approaches are not revolutionary, but taken together they represent a new approach to research and knowledge transfer that can better serve the geothermal stakeholders.

Item 1 is standard and a basic requirement for research, however, it is important to note that items 1 and 2 are significantly different. It is not access to published papers that hinders public policy decision making, agency management decisions and activities, and use of research results by state and local governmental bodies and industry, but the lack of complete access to relevant data and metadata. Item 2 is, therefore, a significant new step for knowledge transfer that does not exist for geothermal energy research—and for much of the rest of federally-funded research. The IWGC is constructing an open-access, digital information system to capture data as it is generated.

Item 3 highlights the fact that far too often physical samples that have great, long-term value, are not properly stored or made available to all interested parties—samples that were paid for by federal research dollars. IWGC will make those samples and associated data openly available.

Item 4 is a bridge to stakeholders that researchers, on their own, typically have difficulty crossing. The IWGC is committed to working with stakeholders not only through our website, but by hosting and participating in conferences, seminars, and workshops and engaging in other outreach efforts. We will work directly with stakeholders and community organizations on specific issues of importance to them.

Question 3. What research is needed to promote direct use?

Answer. Direct use research is a wonderful example of the need for technology transfer. The first part of the answer lies in continuing to improve, through engineering research, technologies to utilize low and moderate temperature resources in a cost-effective way and delivering those solutions to the parties who can use them.

The second part of the answer lies with the type science research that the IWGC conducts. It is important to note that engineering solutions must be based on sound science. The answer to the first question applies here: we need a better fundamental understanding of the geology, geophysics, hydrology, and geochemistry of low-temperature geothermal systems. A general suite of questions illustrates the scientific challenges for direct use systems; these include the following.

- Where are the available direct use resources?
- What is the size of the resources?
- Can we develop better geophysical methodologies to inexpensively and reliably image the subsurface expression of these geothermal systems?
- At what rate of production can each system be used but sustained?
- With use, will the geological conditions of the system change over time as the chemistry and thermal characteristics change, and how might this affect production and sustainability?

The Boise geothermal system is a prime example within the U.S. of a city that utilizes direct geothermal heat to reduce power consumption. If we can answer the questions above, and others, then we will have the opportunity to apply this knowledge to other locations, such as Salt Lake City, Reno, Klamath Falls, and other metropolitan areas that have not yet assessed the potential for direct geothermal use.

Finally, the IWGC can serve as a contact point for the small businesses and entrepreneurs seeking to utilize geothermal energy for aquiculture, heating, food dehydration, etc. In some cases, we can work directly with these people, in other cases we would connect them with other existing and more appropriate organizations that can provided them more effective help.

RESPONSES OF DR. WALTER SNYDER TO QUESTIONS FROM SENATOR WYDEN

Question 1. As renewable energy proponents, do you think that the federal government should play a different or larger role in assessing the value and availability of solar, wind and geothermal energy resources on federal lands? We authorized several provisions under last year's Energy Bill that put DOE and USGS in the driver's seat here, and yet now we are hearing that if you're measuring wind availability on BLM land, there's one set of rules and if you're planning a geothermal project on Forest Service land there's another set of rules. What should the federal government be doing to provide better assessments of renewable energy resources?

Answer. The BLM and Forest Service should quickly implement plans and licensing rules and procedures that are uniform, reflect reasonable and attainable requirements, a streamlined process, and that are incentives to the development and use of renewable resources.

The federal government, through the BLM, Forest Service, USGS and DOE should also do more to help assess the value and availability of renewable energy resources on federal lands.

Insufficient manpower is a major limit on the speed and effectiveness of our federal agencies re streamlining the permitting and licensing processes. Some of these duties can only be done by the agencies, e.g., the permitting and licensing processes. Others, in particular the background work necessary for proper planning and assessment, can be leveraged by increased collaboration with academic institutions, federal research laboratories, and industry. Such collaboration is fostered by EPACT through DOE funding of research at academic institutions and federal laboratories, for example, in section 1820 where the establishment and funding of the Intermountain West Geothermal Consortium (IWGC) are authorized.

For geothermal, the first step to assessing its value and availability is to recognize that our scientific understanding of this energy resource is immature. To emphasize what is in the written testimony, to be able to fully and economically assess, find, and utilize geothermal resources, we must better understand the geological, geophysical, geochemical, and hydrologic nature of these complex systems. Our existing geologic knowledge is insufficient for an accurate assessment of the West's geothermal resource potential, much less to fully utilize our known resources. Some of the resources are hidden, that is they have no obvious surface expression. Others require engineering technology improvements that are predicated on first understanding the geological details. In short, without additional joint federal-academic research we can't realize our nation's potential for renewable energy.

The Energy Policy Act calls on the USGS to update the 1978 Assessment of Geothermal Resources, and then update this assessment as the availability of data and developments in technology warrant. Thus, the collaboration between academic institutions and DOE must extend to the USGS. It is recommended that periodically a concise assessment be provided to Congress on the progress and effectiveness of the collaboration among the federal agencies, academic researchers, and federal research laboratories.

RESPONSES OF BERNIE KARL TO QUESTIONS FROM SENATOR DOMENICI

Question 1. The Technology you are planning to use at your Hot Springs specialized and designed to fit just your unique situation?

Answer. The unique thing about this particular geothermal power plant is that it was not designed specifically for our site. In fact, many similar components came directly off the Carrier Refrigeration chiller production line. This means the infrastructure for mass production of these unit is already largely in place. While the idea of reversing a refrigeration cycle to generate power is not new in principle, United Technologies (UTC) is the first large scale manufacturer to build a commercial product based on this concept. While some small sacrifices to system efficiency are inevitable, these are more than compensated for by the resulting reduction in the upfront cost of these types of power plants, and similarly reduced maintenance costs because most components can be serviced by a certified refrigeration mechanic.

Question 2. How economically feasible is it for the oil and gas industry to use this technology to produce electricity from the large volumes of produced water they often deal with?

Answer. The estimated payback period for the generation facilities is 3 to 4 years, with an expected plant lifetime of 20 years. Once the power plant is in place, the generated power is essentially 'free' as no drilling or engineering would be required to obtain the power other than the upfront costs of the turbines.[1] The biggest initial hurdle to this idea is not economic, but in obtaining the buy-in of an oil company to install the first unit and demonstrate the feasibility of the concept. This is the role the Department of Energy Geothermal Technologies Program can and should play in developing this concept.

Question 3. Are there other possible applications of this technology?

Answer. Yes, absolutely! While Chena Hot Springs happens to have geothermal water as a heat source, it is important to remember this technology will work off any type of low-grade or waste heat source. Landfill flares and stack heat rejected from reciprocating engines have already been used to generate power in this way; biomass fuel is a frontrunner in Alaska for remote power generation using the same technology.

RESPONSE OF BERNIE KARL TO QUESTION FROM SENATOR WYDEN

Question 1. As renewable energy proponents, do you think that the federal government should play a different or larger role in assessing the value and availability of solar, wind and geothermal energy resources on federal lands? We authorized several provisions under last years Energy Bill that put DOE and USGS in the driver's seat here, and yet now we are hearing that if you're measuring wind availability on BLM land, there's one set of rules and if you're planning a geothermal project on Forest Service land there's another set of rules. What should the federal government be doing to provide better assessments of renewable energy resources?

Answer. I do not have personal experience with the circumstance you present in this question, so I cannot speak to this directly. However, I would encourage the federal government to adopt measures to simplify permitting and encourage renewable energy development on federal lands.

RESPONSES OF JIM WELLS TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. According to GAO's report, 22 states and the District of Columbia have encouraged the production of electricity from renewable resources through renewable portfolio standards. Can you please describe more specifically the role of the state RPS's in advancing the use of renewable electricity generation? Would a federal RPS have the same effect of encouraging renewable electricity production?

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[1] Paraphrased from the September 5, 2005 issue of Oil and Gas Journal, *'Geothermal electric power supply possible from Gulf Coast, Midcontinent oil field waters'.*

Answer. A state RPS is a policy that requires the retail sellers of electricity within that state, such as utilities and other marketers, to meet a portion of their energy needs with eligible forms of renewable energy. Eligible forms of renewable energy include geothermal energy, wind, and solar energy. Industry and government officials told us that the RPS standards have resulted in additional renewable energy development in both California and Nevada, and some officials noted that without an RPS, it is questionable whether utilities would readily purchase additional geothermal energy. GAO has not done work nationally to determine whether a federal RPS would also encourage development of renewable energy. Each state's energy situation is unique, and so are the RPS policies for those states that have them. Although some officials told us that there would be interest in a national standard, they noted there is no consensus on how the standard would be defined, what fuels would be included, or how it would be implemented. They also expressed concerns that a national standard not override states with aggressive standards such as California and Nevada. In addition, there are significant challenges in the West to the development of renewable energy, including the availability of adequate and affordable transmission that could make enforcing an RPS a challenge.

Question 2. Do you believe that the percentage of gross proceeds royalty as prescribed by EPAct 2005 will achieve the same revenues as the percent of the value of production royalty under the Geothermal Steam Act prior to amendment? Do you have advice on how this can best be accomplished?

Answer. It is not possible to ensure that the amount of royalties collected under provisions of the Energy Policy Act will be exactly the same as what would have been collected prior to the Act. However, we stated in our report that Interior could collect from currently producing leases the same general level of geothermal royalties as before the Act if the percentage of gross sales revenue collected in the future is based on past royalty histories and if electricity prices remain relatively stable. Interior already has a track record in examining past royalty histories and negotiating future royalties based on these data. However, it is not possible with reasonable assurance for Interior to predict future electricity prices, and if electricity prices rise, geothermal royalties will actually fall. Although challenging, one could implement contingencies for changing electricity prices, such as prescribing adjustment clauses that would track prices as they rose or fell within the 10-year period during which the Act directs the Secretary to seek to collect the same level of geothermal royalties.

Question 3. Do you think that the law as drafted will help ensure that where there is competitive interest in a lease the lease will be issued competitively resulting in a fair return to the public? Do the EPAct 2005 provisions improve upon the previous law in this regard?

Answer. We believe that the competitive leasing process prescribed by the Act will enhance the exposure of future leases to greater market forces which in theory should result in a more fair return to the federal government. We consider this to be an improvement. Before the Act, BLM determined whether leases had a reasonable potential for geothermal development and only offered those leases with a reasonable potential through a competitive auction. Geothermal companies will now have the option to independently determine whether any lands available for leasing have geothermal potential and can pursue these lands through the competitive auction process.

Question 4. Your report indicates that some developers noted difficulty in consolidating various geothermal leases into economically viable projects, and goes on to state that speculators lease geothermal resources not for development but to resell the leases at a significant profit. How widespread do you think this problem is? How can it be addressed? Do you think the federal government can or should share in the benefits of any secondary market for geothermal leases?

Answer. We defined speculators as companies or individuals who acquire leases to promote and resell, rather than to develop the leases themselves. Speculation is not necessarily bad. Sometimes speculators can actually lead to the future development of leases by promoting a new geological idea that results in the drilling of a test well. We did not uncover evidence that speculation in geothermal leases was widespread, but BLM officials did call our attention to some situations in which speculators were requesting excessive compensation for their leases that made geothermal projects uneconomic and therefore unlikely to be developed. Unfortunately, we again do not know the extent of this practice in either oil or gas leases as well as geothermal. We believe that the provision within the Energy Policy Act that directs competitive geothermal leasing and the provision that allows BLM to consolidate smaller leases into a larger block may reduce speculation and make it more likely that leases will be acquired by the developers of geothermal power plants.

RESPONSES OF BOB LINDEN TO QUESTIONS FROM SENATOR DOMENICI

Question 1. The technology you are using is a "concentrating dish-engine system." Can you describe how these work? How much energy one dish will produce? How much actual surface disturbance is needed for each dish?

Answer.

Stirling Energy Systems Overview

Stirling Energy Systems, Inc. ("SES" or "the Company"), a developer of solar power generation equipment for utility-scale power plants, has developed an innovative and highly efficient solar energy technology that is ready for commercialization. The Company's unique technology, the SunCatcher™, combines a mirrored concentrator dish with a high-efficiency Stirling engine specially designed to convert sunlight to electricity.

Technology Overview

The SES SunCatcher is a 25-kilowatt ("kW") solar power system designed to automatically track the sun and collect and focus solar energy onto a power conversion unit ("PCU") that in turn converts the intense heat to grid-quality electricity. The concentrator consists of a 38-foot-diameter dish structure that supports 82 curved glass mirror facets, each three-feet by four-feet in area. These mirrors concentrate solar energy onto the heater head of a high-efficiency, 4-cylinder reciprocating Stirling cycle engine, generating up to 25 kW of grid-quality electricity per system. Exhibit 2 illustrates the basic operation of the system.

Technology Advantages

Unlike conventional power generation, the SunCatcher produces no pollution or greenhouse gas emissions such as carbon dioxide ("CO_2"). The energy source is free, renewable, abundant, and inexhaustible. Most importantly, through advances made over the last decade, the technology is poised for commercialization. Key advantages over competing renewable technologies include:

Efficiency

Solar technologies in the past have been challenged by the economics associated with low efficiencies. On an annualized basis, the SunCatcher converts approximately 26-28% of the available solar insolation to grid-quality electricity, nearly twice that of the nearest solar alternative. The SunCatcher also holds the world's record at 29.4% conversion efficiency.

Best Fit—Least Cost

Leading California utilities have reported using a "best fit-least cost" evaluation methodology as the basis for selecting SES for a majority of the renewable capacity contracted to date. SunCatcher energy production is predictably maximized at midday, coincident with peak demand for electricity, for which utilities are willing to pay a premium. Due to its efficiency advantage, the manufacture and construction of a SunCatcher requires roughly one-half the raw materials of competing solar technologies for equivalent annual power generation, creating a significant cost advantage.

Predictable Costs, Easier Siting

SunCatcher operating costs are predictable. While up-front investment costs are higher than conventional generation, the SunCatcher is cost efficient to operate over its useful life because it relies on the sun, a free source of energy. As a result, SunCatcher plants are not subject to the volatility of fossil fuel prices. In addition, SunCatchers are easier to site since they do not produce emissions (in contrast to oil, gas, and coal), obstruct views (e.g., wind), and are not considered hazardous (e.g., nuclear). As a result of these benefits, solar energy enjoys broad public support.

As an illustration of the SunCatcher's land-use efficiency, an SES solar dish farm covering approximately 13 square miles of desert land is capable of producing 3.5 million megawatt-hours ("MWh") of power per year—the same amount of power produced by the Hoover Dam in an average year, but with a footprint that is less than 5% of the 250 square miles required by Lake Mead.

Additional Advantages and Customer Benefits

Additional advantages and customer benefits of the SunCatcher technology include:

- low water use, requiring water only for monthly dish mirror cleaning, a significant constraint for other concentrating solar technologies in the U.S. Southwest;

- units can be serviced and repaired individually without impact to the rest of the project, resulting in high overall plant availability;
- power production can be brought on-line incrementally as individual units are connected to the electric grid; and
- sites can grow as power needs increase from tens to hundreds of megawatts.

Technology

The SES SunCatcher is a 25 kW solar system designed to automatically track the sun, collect and focus the solar energy onto a power conversion unit that in turn converts the intense heat to grid-quality electricity. Exhibit 3 below illustrates the sun tracking cycle during daily operation.

The SunCatcher produces electricity efficiently, without fuel costs or environmentally harmful emissions. The modular nature of the system allows individual 25 kW units to be assembled and ready for operation in less than one day after the dish pedestal has been installed. This modularity allows the SunCatcher to produce power during the construction phase of a power plant, as soon as the first units are operational and connected to the transmission grid. More importantly, modularity permits maintenance to be performed on individual systems without shutting down the entire power plant, contributing to high overall plant availability.

The modular SunCatcher system can be scaled for smaller power plants (tens of megawatts) or for larger, utility-scale plants (hundreds of megawatts). For a detailed comparison of the SES SunCatcher to other power-generating technologies, see the SES SunCatcher Competitive Advantages section.

Power Conversion Unit

The PCU consists of a solar receiver, Stirling engine, 480-volt inductiongenerator, radiator cooling system, and support frame. The heart of the PCU, the Stirling engine, is the most thermodynamically efficient cycle for converting heat into mechanical power.

The Stirling engine is designed to be a low maintenance, highly efficient engine with a long useful life. There are many versions of the Stirlingengine, each customized for different applications. The Stirling engine used in the SunCatcher system is called a "4-95" which refers to the engine's four cylinders each with a 95 cubic centimeter displacement. Its inclusion in the SunCatcher system is the critical element which makes the SunCatcher technology so efficient and revolutionary.

In general, all engines require heat. Stirling engines use an external heating source where heating occurs outside the engine instead of within it, as in a conventional internal-combustion automotive engine. This external heating feature makes the Stirling engine very flexible and highly efficient while also allowing it to achieve ultra-low emission and noise levels.

In comparison to internal combustion engines, Stirling engines have a longer life and require less maintenance. Internal combustion engines must inject hydrocarbon fuels directly into the interior engine components, depositing corrosive combustion by-products, greatly reducing overall engine life. By contrast, the Stirling engine's internal components are never exposed to corrosive hydrocarbon fuels, which keeps the engine clean and significantly extends its useful life.

Dish Concentrator

The concentrator dish consists of a 38-foot diameter steel dish structure that supports 82 curved glass mirror facets, each three-foot by four-foot in area. It also includes a boom that connects the mirror support structure to the PCU. The boom is supported by a tubular pedestal, equipped with an integral azimuth drive, which is then anchored to a concrete pad. The boom-pedestal connection is pivoted to allow vertical motion via an elevation drive. The. dish controller is located inside the pedestal and is accessible through a weatherproof hatch. The dish structure is designed for low-cost factory automated fabrication and rapid on-site assembly.

Installation and Operation

Each SunCatcher system requires about a 20-inch augered hole about 16 feet deep for the foundation and mounting of the pedestal. About 8 dishes can be installed on each acre of land, with adequate spacing to minimize the shadowing from neighboring dishes.

When installed in a solar-rich desert (such as the Mohave Desert in California), each SunCatcher will produce about as much electrical energy each year as will be used by 8 to 10 households.

Question 2. I like your idea of "solar or wind enterprise zones."

Would you explain this idea further? Might we expand on that idea for whatever energy is being developed with "National Energy Areas"?

Answer. The concept of a solar enterprise zone is not original—It was actually tried out in Nevada about 10-15 years ago. The state set up a study group that identified some 5 different areas in Nevada that had excellent solar resources, available public lands (mostly BLM), and were acceptable to the nearby populations (i.e., there was no serious NIMBY ("Not In My Backyard") issues.

The largest of these, the El Dorado Valley south of Las Vegas, has been selected as a site for a 64 MW solar trough plant that is currently under construction.

The general concept is to establish a program whereby all Federal lands would be evaluated for potential use for renewable energy production. Each land-holding Agency would designate some portion of the lands determined to have renewable energy potential in their land-use plans as "set-aside" areas for renewable energy development.

This concept could certainly be expanded to cover virtually all 50 states and result in the development of National (Renewable) Energy Areas. (For some states, the idea resource would be solar, for others wind, still others geothermal or biomass.) To be most effective as a tool for developing renewable energy production, the selected "set-aside" lands would be further evaluated, with at least preliminary environmental impact studies (so-called programmatic EISs) performed, transmission interconnect analyses performed and incorporated into a broader transmission grid upgrade study.

A couple of important cautionary observations: these energy enterprise zones or set-aside areas should remain Federally-owned land and not be deeded over or sold to third parties. In the El Dorado Valley (NV) example, shortly after the area was identified as an ideal area for solar energy production, the land was deeded over from the BLM to the city of Boulder City. The city initially set unreasonably high lease rates for the land, which discouraged and delayed the development of any solar projects. More recently (in the past few months), the citizens of the city voted to sell off the land for residential development, which the city believes will make each of its citizens very wealthy. Sadly, though, the largest, most ideal solar area of the state will no longer be available for solar energy production.

It is also important to establish low-lease-rate guidelines for these renewable energy enterprise zones. Renewable energy, in general, can be characterized as having large front-end capital costs, which are offset over the lifetime of the plants by low or no fuel costs. They usually also require large amounts of land (particularly wind, solar, and biomass). Putting a high price-tag on land, either in the form of lease rates or property taxes, will likely make the projects uneconomical or non-financable.

Response of Bob Linden to Question From Senator Wyden

Question 1. As renewable energy proponents, do you think that the federal government should play a different or larger role in assessing the value and availability of solar, wind and geothermal energy resources on federal lands? We authorized several provisions under last year's Energy Bill that put DOE and USGS in the driver's seat here, and yet now we are hearing that if you're measuring wind availability on BLM land, there's one set of rules and if you're planning a geothermal project on Forest Service land there's another set of rules. What should the federal government be doing to provide better assessments of renewable energy resources?

Answer. I'm not familiar with what the degree of support the federal government is providing the geothermal industry. DOE has developed maps that show the general availability of solar, wind, biomass, and geothermal resources. In the case of solar, NREL has published hourly solar availability data for some 239 locations in the U.S. and its territories. These data were collected over a 30-year period from 1961 through 1990. More recent satellite data is now being collected to augment this large database.

About two years ago, NREL announced that it had developed a relatively high-resolution map of wind resources based on satellite data that covers much if not all of the U.S. (Because of the very site-specific characteristics of wind, it is still necessary for a developer to operate one or more wind survey towers (generally 50 meter towers) at a planned site for a minimum of one year in order to ensure that the particular planned wind turbine site will provide sufficient wind to support the economics of the project.)

The BLM has undertaken a program to revise their land use plans for all their controlled lands. Plans have been completed by some field offices, and others are still under development.

With regard to your observation that there seem to be different standards or rules for wind or geothermal projects. I believe the genesis of this difference lies in the fact that wind is treated as a resource affecting above ground-surface use rights,

whereas geothermal affects below-ground resources use rights and is treated in the same general way as minerals management issues by the Department of the Interior.

Finally, with respect to your question of what else should the federal government be doing in the area of resource assessments, I think it is important for NREL and USGS to expand and update the extensive data available for solar and wind resource assessment by utilizing the latest state-of-the-art satellite survey capabilities.

RESPONSES OF V. JOHN WHITE TO QUESTIONS FROM SENATOR DOMENICI

Question 1. As an organization that represents both industry and the environmental community, you are probably best equipped to see both sides of the fence. What will be most significant challenges to developing renewable energy on public lands?

Answer. All energy infrastructure projects face numerous barriers, and for renewable technologies, some of the challenges are unique. The close connection between renewables and electric transmission can make the very earliest stages of project development very difficult. Renewables are faced with trying to line up transmission access, project siting and site control and a power purchase agreement all concurrently.

In known renewable resource areas, state and federal agencies should closely to coordinate siting of both renewable technology projects and needed expansion of electric transmission. The active participation of federal land management agencies in these coordination efforts can help renewable technology projects overcome these hurdles.

As discussed in my earlier filed testimony, without access to transmission, renewable developers cannot secure financing to build their projects; and without committed projects, regulators cannot approve the transmission to connect them. These are complicated issues that can only be addressed by a very high level of coordination between federal, state and local governments with a stake in the process, and the private entities such as developers and utilities that will make the projects a reality. By beginning early and working together, we can achieve the goal of sustained, orderly development of our nation's renewable resources.

The framework which the California Energy Commission and CEERT have initiated in California can serve as an excellent template for these kinds of coordination efforts. The Tehachapi Wind Resources area has an estimated 4500 megawatts of wind energy potential, and remains untapped because of a lack of transmission capacity. It is essential that these resources be developed in a timely and orderly fashion, if we are to achieve Governor Schwarzenegger's goal of 33% renewable energy by 2020.

Tehachapi's enormous potential will only reached, however, if we can find a way to achieve unprecedented cooperation between all the parties, especially the Federal Energy Regulatory Commission and federal land managers such as the Forest Service.

In the Tehachapi Collaborative Study Group (TCSG) process, CEERT facilitated planning among renewable energy developers, public agencies, public and investor owned utilities, land holders and public interest advocates. Each one of these entities will represent a critical piece in the course of Tehachapi's full development, FERC and the U.S. Forest Service have critical roles to play, and both have taken actions which, in the past, impeded California's efforts.

The goals of sustained, orderly development of renewable resources and coordinated long term planning have been especially difficult for renewable technologies to achieve. Because the fuel for a renewable project is essentially free, the vast majority of the cost of renewable energy comes from the up front financing required. Also, because the technologies and equipment are significantly more expensive than their fossil fuel counterparts, they are more difficult to finance and have a higher level of risk. However, once the initial capital has been paid back most renewable projects can sell power at or below the cost of most conventional fossil fueled generation. Similarly many of the benefits from renewable energy will not be reaped immediately. The benefits of the critical role renewable energy plays in the fight against climate change will not be realized for possibly generations. However, if renewables are to indeed play such a role the action must begin now.

Question 2. What is needed to address the planning and development of the additional transmission lines necessary for renewable resources?

Answer. With knowledge of the location of the West's prime renewable resources, major transmission projects must take into account these resources in their planning, and recognize the need for renewables to gain access to the grid. Electricity

infrastructure has an extremely long life time, and renewables will benefit greatly from farsighted and coordinated transmission planning which focuses on the sustained, orderly development of the West's best renewable resource regions.

We believe that the most significant untapped renewable resource areas throughout the Western U.S. should be evaluated and prioritized. Among the considerations should be: quality and size of the resource; market for renewable power; the existing transmission grid near the resource; and the alternative generation options that will impact the economics of the development. Much of this work has already been done for some regions, while others will need additional investigation.

Once the regions have been identified, transmission planning groups should be formed in the mold of the TCSG. The Western Governor's Association has the existing capacity to jumpstart these groups and could serve as the coordinating body.

An example of the need for this kind of early coordination and cooperation between public agencies and energy stakeholders is the opportunity in the Mohave Desert regarding for concentrated solar power (CSP) projects.

The Bureau of Land Management (BLM) has conducted its current planning process for land in the Mohave with very little consultation with renewable energy advocates. As a result, though the Mohave has some of the best solar resources in the world, almost none of the BLM land in that area has been designated for solar development. This plan, if not modified, could significantly reduce the viability of concentrating solar power, which we believe is the next major renewable technology on the horizon. The recent heat storm in California provided a powerful reminder of the importance of development and commercialization of utility-scale solar technologies.

CEERT is working with the California Energy Commission to establish a study group for Mohave, which will seek to develop a consensus among stakeholders, including BLM, regarding transmission, land use, and procurement policies needed to rapidly develop large scale solar projects. We envision the process being similar to the Tehachapi process, but including siting and land use issues unique to this region and CSP technologies. We would hope the Committee could encourage the BLM's full and active involvement in this process, and that the result will be the kind of intense, coordination and cooperation that we believe is essential between California and the federal government.

A recently released study contracted by National Renewable Energy Labs and preformed by Black and Veatch consultants analyzed scenarios for the deployment of 2100 MW and 4000 MW of concentrated solar power in California. The study found substantial economic viability and benefits from these scenarios, yet without cooperation from the federal government, the projects will not come to fruition.

RESPONSES OF V. JOHN WHITE TO QUESTIONS FROM SENATOR WYDEN

Question 1. As renewable energy proponents, do you think that the federal government should play a different or larger role in assessing the value and availability of solar, wind and geothermal energy resources on federal lands?

Answer. As mentioned in Question 2 of our responses to Senator Domenici, the government could play an important role in helping to identify key renewable resource areas around the Western US. It will also be important for federal agencies to engage meaningfully in the collaborative process of planning the transmission. This is a fine line to walk as we are not recommending that the federal government seek to gain more authority in the process but rather increase their engagement collaboratively with the various other stakeholders. Many people will play a role in the expansion of renewables and transmission infrastructure around the West. An inclusive collaborative process will ensure that this is done in the most effective fashion. Additionally agency work in conducting environmental impact studies has generally led to the construction of better energy projects. This level of involvement has fallen off and should be restored.

As mentioned in our initial written comments, the lack of funding and the requisite staffing to adequately perform environmental studies and reviews has been an ongoing problem for many federal agencies including the BLM and Forest Service. Increasing the government's role in assessing renewable resources, would depend on increased funding for the Federal land managers.

Question 2. We authorized several provisions under last year's Energy Bill that put DOE and USGS in the driver's seat here, and yet now we are hearing that if you're measuring wind availability on BLM land, there's one set of rules and if you're planning a geothermal project on Forest Service land there's another set of rules. What should the federal government be doing to provide better assessments of renewable energy resources?

Answer. Consistency and harmony are always difficult issues to resolve when it comes to multi-agency efforts. These agencies, DOE, USGS, BLM, and USFS, may have different goals and statutory obligations. This highlights yet again the need for early collaboration and cooperation. However there is a very tangible value in being able to agree on the assessment of renewable resource areas throughout the west. As mentioned earlier, a cooperative state and federal government effort, coordinated through the Western Governor's Association, to identify and prioritize key renewable energy resource regions would be a crucial first step in creating collaborative planning for transmission and siting of projects. It is imperative in the West that the federal government play a role in this process from the very beginning because the Federal Government owns so much of the land where renewable resources occur.

In order to achieve this, it will likely be necessary for agencies to come together and try and resolve the differences in consistency between their different assessment strategies and priorities. Your question highlights an important first step in the process. Public input in developing an assessment strategy will be crucial to ensure that all factors impacting development are considered early on, including impacts on wilderness and environmentally sensitive land. This will help all stakeholders avoid delays later on in the process when more time and money has been invested by all those involved.

MONDAY, JULY 17, 2006

GENERAL MOTORS CORPORATION
Warren, MI, August 14, 2006.

Hon. PETE V. DOMENICI,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR SENATOR DOMENICI: Please accept my apologies for my delayed response to the committee questions. On the evening of my testimony in Washington, my mother fell into a coma and subsequently passed away last week.

I hope my responses are still timely enough to be of use to the committee.

Sincerely yours,

BYRON MCCORMICK,
Executive Director, Fuel Cell Activities.

RESPONSES OF J. BYRON MCCORMICK TO QUESTIONS FROM SENATOR DOMENICI

Question 1. I'd like to poll the panel on the key questions we have to answer about building a hydrogen infrastructure. Do you believe we should rely on on-site production, or centralized production with pipeline distribution?

Answer. My belief is that we will use both centralized and distributed production depending on the energy source and location. GM's vision includes centralized production from coal, biomass, natural gas, and nuclear and geothermal energy as well as distributed production from natural gas, wind and solar power, and electrolysis from any outlet for electricity. We also envision some degree of home refueling for customer convenience and to augment the infrastructure during the early phases on deployment.

Question 2. What further work is needed on codes and standards for fuel cells for vehicle applications?

Answer. This is a particularly relevant question. With respect to vehicular codes and standards, the Society of Automotive Engineers (SAE), NHTSA, and the International Society for Standardization (ISO) are doing an excellent job. There are remaining open items, but these are being addressed in an orderly technical way. The more troubling and perhaps more difficult issue is siting of fueling stations. Codes are local and interpretations vary greatly. GM and the energy companies are finding it very difficult to open stations in a timely fashion. Some sort of national standards would be very useful in order to expedite a rapid rollout once, or if, the U.S. decides to move to a hydrogen-based transportation system.

Additionally, techniques and government-approved uniform codes and processes for ensuring the quality of the hydrogen delivered would be very helpful. This is not so important initially, when large energy companies are the likely source, but becomes critical as we diversity our sources of hydrogen and entrepreneurs, small businesses, and other enterprises enter the "fuels" business, creating jobs and diversifying our energy portfolio.

In regard to the above two issues, the U.S. is competitively handicapped versus other countries like Japan, where such matters are centralized and then "rolled out" for implementation.

Question 3. Are you satisfied with the progress to date on these codes and standards?

Answer. In general, we are satisfied with the progress on codes and standards, with the exception of those for fueling stations. This is one area where the modeling capabilities and scientific insights of DOE labs such as Sandia could be useful. The big issue of concern to neighborhoods near the stations is "setback," or distance from stored hydrogen, in the event of a major accident. To support the creation of codes that will be broadly accepted, we need the participation of knowledgeable technical organizations that are viewed as neutral and objective. Corporations are not viewed in this manner.

Question 4. Are there any areas where you feel additional focus would be warranted?

Answer. Senator, I believe the path you were beginning to explore relative to transitioning the market is becoming the most critical. While we have not yet accomplished all of our technical and cost objectives, the questions associated with focusing and mobilizing the necessary financial resources to underwrite such a massive transformation is becoming progressively more important. Basically, we are creating a new industry, or industries if you include the massive automotive supply base and new hydrogen-production industry. The question is, how as a country do

we get this done? How do we work our way through the phase during which both the vehicles and hydrogen are too expensive because we are not at high-volume deployment? This is a business question for GM. It is a tax and incentives question for governments around the world.

Our ability to simultaneously develop answers to this question from both a business and government perspective may well determine whether this technology can make it out of the lab and into the hands of consumers in a timely and efficient fashion, and whether the U.S. is placed in a competitively advantaged or disadvantaged position.

RESPONSES OF J. BYRON MCCORMICK TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. The Department's hydrogen program hopes to achieve milestones out in the 2015 timeframe that will determine whether it is feasible to produce commercial hydrogen vehicles. At that point, how many years past these initial milestones will it take to introduce significant quantities of hydrogen vehicles into the U.S. market? What kind of government policies are needed in this transition period?

Answer. The speed at which fuel cell vehicles penetrate the market depends heavily on a number of critical factors, largely beyond the control of any auto manufacturer. Among these is convincing the public that fuel cell and hydrogen storage technologies are safe and that refueling will be available. Another is convincing industry (auto, energy, suppliers) that this initiative—which is different from all other previous alternative fuel/vehicle programs—is a key U.S. priority and that the transition will be accompanied by long-term, sustained government incentives, since the transition to a significant/meaningful volume of vehicles in the marketplace will indeed take some time. (The normal insertion of any automotive technology into the entire light-duty vehicle fleet takes more than 20 years!) Due to the technologies involved and the new supply base required, we estimate that it will take from 500,000 to one million vehicle sales per year to reach efficient scale. This represents a very significant capitalization risk to automotive OEMs and a very long-term outlook. As a result, the longer it is expected to take to reach these volumes, the more difficult it becomes to justify the initial investment required. Government incentives will be crucial to closing this gap.

More specifically, relative to actions the government can take to enable the transition.

- Provide unprecedented support of alternative fuel program with a clearly articulated, bold national vision:
  —"Moonshot" advertising and public service campaigns.
  —Education program to increase public confidence on safety and benefits.
- Sustained, long-term, compelling incentives (total package):
  —Substantial early vehicle purchase incentives (could be on the order of $500 million per year) for government fleets, commercial fleets, and retail customers (critical for mass-market acceptance).
  —Consumer non-financial incentives (e.g., HOV lanes, parking privileges).
  —OEM incentives (lessen the burden/share the high risk of early capitalization).
  —Supply base financial incentives (support early supply base capitalization with loan guarantees, tax-free facilities, etc.).
  —Incentives to hydrogen infrastructure providers.
  —Incentives to hydrogen station owners/operators (credits, loan guarantees, tax incentives).
  —Incentives initially applied broadly to all hydrogen feedstocks (later, applied to encourage renewable sources).
  —Hydrogen fuel incentives to ensure compelling price relative to gasoline—e.g., no hydrogen fuel tax until some percentage market penetration is achieved (recommend 10 percent), plus additional incentives (since price of fuel is a significant motivator of sales).

Additionally, the federal government should financially support the long-term, strategic development of a high-tech U.S. fuel cell industry capable of producing the world-class components required in Proton Exchange Membrane (PEM) fuel cells and hydrogen storage systems.

Question 2. What do you see as the two or three long R&D poles in the tent and based upon your experience will they be ready in the 2015 timeframe for initial decisions to be made on the commercial viability of a hydrogen vehicle?

Answer. I want to make a distinction between where I think government should play in R&D versus R&D in general. In general, the basic technologies and materials sets for early fuel cell vehicles are established. GM and others like us currently

are working on design refinement, manufacturing process development, and durability and reliability improvements. Government-funded research at the National Laboratories and universities should focus on high-risk, high-payoff items. Specifically, hydrogen storage should lead the list. The more hydrogen we can put on board cost-effectively at lower weight and volume, the better the vehicle and the greater the likelihood of consumer acceptance. Following this, there is a whole list of "substitution" materials that would reduce cost and provide the opportunity for more cost-effective solutions, including: cheaper, non-noble metal, high-activity fuel cell catalysts; cheaper membranes; cheaper hydrogen-tolerant materials to replace stainless steel; and less costly high-strength composite fibers. DOE, NSF, and other research funds should be directed toward such high-risk, high-payoff endeavors.

In the nearer term, siting of fueling stations with uniform codes and the ability to expand the fueling infrastructure rapidly is a significant "long pole." Government research on the most effective ways to safely store hydrogen at local fueling stations, based on science, is a critical element, along with the requisite translation of that science to workable codes that can be implemented across the U.S. in a uniform way. Government facilities like the Sandia Combustion Research facility would be well positioned to deliver this important element in a timely manner.

Question 3. Since hydrogen is only a carrier of energy and not an energy source per se like gasoline, how do you expect to produce the volumes of hydrogen needed outside the realm of reforming natural gas, which is already in high demand for industry and residential purposes?

Answer. Senator, this is a very important question. Our reason for developing hydrogen fuel cell technologies is based on the potential for diverse energy sources to create hydrogen. With over six billion people in the world, mankind is clearly going to need to be able to use all possible sources of energy efficiently and cleanly. There is currently a large hydrogen-from-natural gas industry already in place, growing, and geographically well-aligned with U.S. population centers. This industry services the petroleum industry, as "clean," low-sulfur gasoline requires processing with additional hydrogen to "replace" contaminants in the petroleum. Also, we are using progressively "heavier" crude oils; these oils have more carbon and less hydrogen and so require the addition of hydrogen for use in modern automobiles.

As a result, it is natural that the initial vehicle introductions will build off this large, in-place infrastructure. However, we see coal, nuclear and geothermal energy, wind and solar power, and biomass all playing a role as the hydrogen industry develops. Which sources will lead and when will very much depend on local circumstances, i.e., the trade-off between local generation and transportation from more distant sources. The good news about hydrogen is that local conditions can and will favor different solutions, which in turn creates energy diversity and the creation of local jobs.

DEPARTMENT OF ENERGY,
CONGRESSIONAL AND INTERGOVERNMENTAL AFFAIRS,
Washington, DC, August 31, 2006.

Hon. PETE V. DOMENICI,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR MR. CHAIRMAN: On July 17, 2006, David Garman, Under Secretary, testified regarding the implementation of the Energy Policy Act provisions on hydrogen and fuel cell research and development.

Enclosed are the answers to eight questions that were submitted by Senators Smith, Bingaman, and Wyden for the hearing record.

If we can be of further assistance, please have your staff contact our Congressional Hearing Coordinator, Lillian Owen, at (202) 586-2031.

Sincerely,

JILL L. SIGAL,
Assistant Secretary.

[Enclosures.]

RESPONSE OF DAVID GARMAN TO QUESTION FROM SENATOR SMITH

Question 1. It has been over 3 years since President Bush announced our nation's Hydrogen Fuel Initiative, and I know the Department of Energy has been working diligently on this initiative ever since. Indeed, your testimony today reports on considerable progress on many technology fronts.

While using hydrogen as a fuel for transportation has many attractions, including source diversity and essentially zero tailpipe emissions, it also faces major hurdles, including shipping, on board storage, and infrastructure development. Some believe that there are a number of alternatives that also have very attractive features with perhaps fewer technical or economic challenges. These include electric vehicles, plug hybrids, and a variety of fuels such as ethanol, methanol, and even methane. Isn't it possible that in the near term one of these pathways will be more technologically and economically successful than hydrogen powered vehicles? And, if so, should we be putting just as much effort and funding into these alternatives?

Answer. Hybrid vehicles and ethanol vehicles can have more of an impact in the near term on reducing oil consumption than hydrogen fuel cell vehicles. The Advanced Energy Initiative, announced by the President in his 2006 State of the Union address, proposes a 22 percent increase in research that will accelerate breakthroughs in energy technologies such as ethanol and plug-in hybrids. The Department's FY 2007 budget request for the Biomass Program is $149.7 million—$59 million higher than current funding. The budget request for the Vehicle Technologies Program, which includes hybrid technologies, is $166 million. However, these technologies alone cannot fully substitute for light-duty vehicle petroleum use in the long term. The National Academy of Sciences concluded that hydrogen has the most potential for dramatically reducing oil consumption and carbon emissions. The technical challenges involved in developing viable hydrogen and fuel cell technologies require significant R&D to achieve these long-term benefits. The Department's FY 2007 budget request includes a balanced portfolio of near- and long-term approaches that will all play an important role in overcoming our Nation's dependence on foreign oil.

RESPONSES OF DAVID GARMAN TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Section 783 of the Energy Policy Act directs the purchase of stationary fuel cell systems and potable fuel cell systems by the federal government to meet the federal energy management savings—what is the status of this program with respect to stationary fuel cell systems such as those produced by Ion American and portable fuel cells such as those produced by Poly-Fuel?

Answer. The Department recognizes that stationary and portable fuel cell technologies offer early market opportunities and that the Federal Government is a potential early adopter. The Department is evaluating EPACT 2005 section 783 requirements to determine how it could be integrated with existing efforts. The Secretary will call upon the Interagency Hydrogen and Fuel Cell Technical Task Force and the Hydrogen Technical Advisory Committee for recommendations regarding the status of stationary and portable fuel cell technology to determine how to proceed. The Department also is conducting studies to determine: a) the most promising near-term end-use applications for stationary and portable fuel cells, b) the user requirements necessary for adoption of the most promising applications, c) an economic comparison of most promising technologies, and d) strategies for DOE to promote deployment of fuel cells in the most promising market segments—when ready technologically and economically.

Background:

The focus of the Department's current research efforts in these areas is on reducing cost and improving performance so that these technologies can compete in the marketplace. The Department's 2007 budget request includes $63.35 million for research and development of solid oxide fuel cells such as the Ion America technology and $7.42 million for development of polymer-based fuel cells for stationary and portable power, such as the Polyfuel technology. To compete with existing technologies, stationary systems need to achieve 40% efficiency and 40,000 hour durability; current status is 32% efficiency and about 20,000 hours durability. Portable power systems must cost less than $3/W and have a lifetime of 5,000 hours; current status is $40/W and about 500 hours.

Question 2. Section 782 (c) of the Energy Policy Acts sets a number of actions that the Department must take with respect to developing fleet purchase requirements for fuel cell vehicles by 2010, what is the status of the Department in developing such a program?

Answer. The Department agrees that section 782 of EPACT provides opportunities to accelerate Federal adoption of fuel cell vehicles for fleets. However, fuel cell vehicles are not currently available for federal fleet purchasing or leasing. Because the technology is in the research and development phase, fuel cell vehicles are too costly and do not meet the current performance requirements of Federal fleets. Some fuel cell vehicles are being used by Federal, State and local agencies as part

of our Hydrogen Program learning demonstration project. The agencies are not leasing or purchasing these vehicles but are operating them so that the automobile manufacturers and the Department can obtain data on the performance of the vehicles, and address any problem areas.

The Department will continue to assess the status of the technology, with input from the Interagency Task Force and the Hydrogen Technical Advisory Committee, and will recommend that Federal agencies purchase or lease fuel cell vehicles when the technology is available and competitive—on the basis of performance—with conventional vehicles.

Question 3. The National Academies identified hydrogen storage as the key technical challenge facing the successful outcome of a hydrogen car system and that traditional gaseous fuel tanks will not work—how close is the Department to overcoming this issue and do you think it will be met by 2015 when you are hoping to achieve a 300 mile driving range?

Answer. Through the Department's Centers of Excellence and independent projects, which include 40 universities, 15 companies and 10 federal laboratories, the Program has made significant progress. We have identified materials with over 50% improvement in hydrogen storage capacity. Achieving the 2010 target of 6 weight percent, or percent hydrogen by weight, will enable some vehicles to achieve a 300-mile range; however, the long-term target of 9 weight percent is required to achieve this range in all light-duty vehicle platforms. Given the Department's plans, including theory-guided experiments and high-throughput experimental techniques, and the support of Congress, the Program believes that it may be possible to achieve target projections in laboratory prototype systems by 2015. Scaling up of laboratory prototypes to commercial systems by industry and developing high volume manufacturing capabilities to reduce cost would be expected to follow, if industry carries through with their present intentions.

Question 4. The Department's goal is to produce distributed hydrogen fueling stations with consumer cost of $2 per gallon of gasoline equivalent. It is my understanding that for reformed natural gas you have decreased the price from $5 to $3 but using reformed natural gas is unrealistic given its demand by industry and home heating. How close is the Department to meeting this goal using other methods such renewables (bio-production) or electrolysis of water?

Answer. The price of natural gas should not be considered exclusively as a factor when assessing the competitiveness of hydrogen cost; the price of gasoline should also be considered. If, for example, natural gas was available at a price of $12.50 per million Btu, analysis indicates that the resulting hydrogen cost would be $4.50 per gallon gasoline equivalent (gge). When used in a fuel cell vehicle, hydrogen at $4.50/gge may be competitive on a cents-per-mile basis with gasoline at $1.90 per gallon (untaxed) because of the increased efficiency of the fuel cell. EIA analysis indicates that natural gas demand is projected to increase by less than 3% between 2020 and 2025, when fuel cell vehicles are expected to be introduced into the market. Although natural gas provides an available feedstock pathway for distributed hydrogen generation, it is clearly a near-term "bridge" strategy because long-term supply concerns and price volatility are an issue. The Department is also making progress in renewable production of hydrogen and in electrolysis:

- Using ethanol as a feedstock, the current projected cost of producing hydrogen is about $4.40 per gallon gasoline equivalent (gge), an improvement from $6.70 per gge status in 2003. This price may be projected to fall further, with the anticipated decline in ethanol pricing.
- The economics of electrolyzing water into hydrogen and oxygen is heavily dependent on the cost of the electricity. The current cost of water electrolysis in a distributed system is estimated at $4.80/gge based on an electricity cost of $0.039/kWh, the lowest industrial electricity price that 25% of the population paid from 2000-2005. To reduce cost further, capital equipment costs for electrolyzers must be reduced from the current cost of $665/kW to $125/kW.
- We are also pursuing longer-term renewable hydrogen production pathways such as water-splitting using solar-driven high-temperature thermochemical, photoelectrochemical, and photobiological technologies, and other renewable resources, such as geothermal and wind as they become feasible.

Responses of David Garman to Questions From Senator Wyden

Question 1. The New York Times last Sunday, reported on the advent of fuel cell power packs for recharging cellphones, Blackberrys, and Personal Digital Assistants. Apparently the Europeans and Asians are ahead of the U.S. in marketing these devices that are due to become available next year. Why does the Administration focus almost exclusively on the use of hydrogen fuel cells for transportation when there

are other technologies that could help us save energy, create jobs, clean up the environment and compete in today's global hydrogen markets?

Answer. The Administration is primarily focused on hydrogen fuel cells for automotive applications because transportation accounts for 2/3 of the 20 million barrels of oil our nation uses each day; fuel cells in transportation applications could significantly reduce our dependence on foreign sources of oil. Fuel cells for portable power applications, such as cell phone chargers, etc., can improve energy efficiency of consumer electronics and decrease electricity use, but these do not provide the significant energy savings that are possible in the transportation sector. The Department, however, recognizes that stationary and portable fuel cell technologies offer early market opportunities that will facilitate the development of fuel cells for later use in the automotive sector. The Administration's 2007 budget request includes $7.4 million for development of polymer-based fuel cells for stationary and portable power, and approximately $2 million for research on manufacturing of fuel cells. This will help the U.S. maintain a leading position in all fuel cell technologies, including portable power.

Question 2. Toyota has been showing off their new hydrogen fuel cell demo car. Built at nearly $1 million each, Toyota has been involved in a Cooperative Research and Development Act Agreement with the Department of Energy to test their experimental engine designs under extreme driving conditions. Toyota claims that we are still 5-6 years away from seeing hydrogen fuel cell powered cars and trucks for sale. Is this true? What is the national timetable now for reducing the costs of fuel cells and getting hydrogen fuel celled vehicles on the road? If Chevron can power up a fleet of buses in the Bay Area today why can't we start driving hydrogen-fueled cars and trucks tomorrow?

Answer. There are a number of technical challenges that need to be overcome before hydrogen fuel cell vehicles become viable. These include improvements in hydrogen storage capacity to enable 300-mile range, further reductions in fuel cell cost, and improvements in fuel cell durability. Under the President's Hydrogen Fuel Initiative, the Department's Hydrogen Program is implementing an R&D plan to overcome these challenges during the next 10 years.

Fuel cell buses, like the ones run by AC Transit in the Bay Area and the CUTE buses in Europe, are available today because the cost and performance requirements of buses are very different from those of light-duty vehicles and trucks. For example, a fuel cell bus can carry large tanks of hydrogen on its roof and travels fewer miles between refuelings, so storage is not a major barrier for this application. Also, because public transit vehicles have specified routes and parking locations, hydrogen fuel cell buses can have dedicated fueling facilities on fleet property and do not require the flexibility in fueling locations that the public demands for its vehicles.

Question 3. Mr. Leuliette testified at the hearing, that the United States lacks a fresh, new, comprehensive, national energy policy that sets specific targets and goals for reducing American's dependence on imported oil and gas while we transition to a hydrogen fuels and renewable energy economy. Don't you think these types of targets or goals would be useful? Does the Energy Department have any official or unofficial targets or goals for reducing oil dependence using hydrogen or renewable energy? If not, why not? What are the latest estimates of how much of our domestic and imported oil could be displaced by hydrogen cell fuels? By when?

Answer. The Advanced Energy Initiative (AEI) will accelerate investment in clean energy technologies in order to transform the way we power our homes, businesses, and the entire transportation sector. To achieve these goals, the President has requested $2.1 billion in FY 2007—a 22 percent budget increase—to develop new technologies and alternative sources of energy to help diversify and strengthen our Nation's energy mix. The AEI focuses on researching and developing technologies that we believe hold great promise for reducing America's dependence on foreign oil and for increasing our use of solar, wind, biofuels, hydrogen, nuclear, and clean coal technologies. In addition, we have the ambitious metric of making cellulosic ethanol cost competitive by 2012. Through the development of advanced technologies for cellulosic ethanol, plug-in hybrids, and hydrogen fuel cells, we can help achieve the President's goal of replacing more than 75 percent of the oil imported from the Middle Ease by 2025.

DOE's benefits modeling suggests that, assuming a light-duty fuel cell vehicle penetration of 37% by 2050, oil savings would be 5.3 million barrels of oil per day. In an aggressive penetration scenario, which assumes that the vehicle penetration is 80% in 2040, the petroleum savings would be 11 million barrels of oil per day (our current import level).

RESPONSE OF TIM LEULIETTE TO QUESTION FROM SENATOR DOMENICI

Question 1. Do you believe we should rely on on-site production or centralized production with pipeline distribution?

Answer. This is not an area where Metaldyne has a great deal of technical information or expertise.

However, I believe it is too early to tell which distribution system should be used. Long term we need to look to the technology experts to lay out our options. When we decided to put a man on the moon we didn't specify a lunar module attached to a three-man capsule. In the end technology dictates the solution.

RESPONSES OF DAVID GARMAN TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Do you know how well integrated the Japanese parts suppliers are with the Japanese hydrogen car program?

Answer. While it is not public information, the Japanese parts suppliers are exceptionally well integrated in the Japanese car program. Traditionally they work very closely with the automakers at the earliest development stages of any vehicle project and the hydrogen car program is no different.

There is a Japan Hydrogen & Fuel Cell Demonstration Project, subsidized by the Ministry of Economy, Trade and Industry (MITI), that shows promise.

Question 2. Your testimony states that the DOE should include in its Hydrogen Technical and Fuel Cell Advisory Committee foreign-owned manufacturers with a significant presence in the U.S. can you explain this statement in a little more detail?

Answer. The auto industry is a global business. Where a company is headquartered is not indicative of the economic impact it has on that country or region. For example, Honda sells more vehicles in the U.S. than it does in Japan.

In Metaldyne's case we are headquartered in Plymouth, Michigan, but we see substantial growth and human resources and technical talent coming from other countries and regions. Integrating those skills and abilities into our corporate structure has allowed Metaldyne to more quickly develop innovative products and processes that have made us a leading global supplier. The same strategy holds true for developing a hydrogen economy.

As a nation and an industry, we cannot, and should not, ignore the talent base and technological expertise foreign-based automakers can offer to the U.S. hydrogen program. These automakers and suppliers employ thousands of people across our country, who everyday share their expertise with their global colleagues.

In addition, I would note that an exception was made and rules were constructed in order to allow DaimlerChrysler to be part of the current program given that their headquarters is in Germany. These same rules could be applied to the other foreign owned automakers.

The bottom line is, we need the best and the brightest to help move us as quickly as possible to the hydrogen economy.

RESPONSE OF JIM BALCOM TO QUESTION FROM SENATOR DOMENICI

Question 1. I'd like to poll the panel on the key question we have to answer about building a hydrogen infrastructure. Do you believe we should rely on on-site production, or centralized production with pipeline distribution?

Answer. In my humble opinion, I expect that the solution will be a combination of the two approaches of on-site production and centralized production, however, I understand that transporting hydrogen by pipeline is challenging and cost-prohibitive, other than for industrial-scale production and consumption situations.

Instead, I expect that the onsite supply of hydrogen for transportation purposes will be either through the reformation of natural gas, or through the electrolysis of water using electricity. Hydrogen produced at central locations (via larger scale natural gas reformation or water electrolysis) will be distributed in cryogenic liquid form in tankers or in high pressure gas form in tube trailers. Hydrogen is relatively easy to produce and distribute in each of these processes.

Some persons have proposed that the U.S. can use its abundant supply of coal to reduce its dependence on foreign oil; the conversion of coal to hydrogen along with CO_2 sequestration would provide an environmentally acceptable method of centralized hydrogen generation. This would require that the hydrogen be transported. An efficiency study would need to be conducted comparing the cost of transporting hydrogen versus producing the electricity first, and transporting the electrical power to an electrolyzer for the production of hydrogen closer to the point of use.

Nuclear power, and renewable sources of electricity such as wind, wave or solar can be used to produce electricity for the electrolysis of water into hydrogen. It may be more economical over the coming decades however to deliver the energy generated from these sources to the grid to offset any oil currently consumed to generate electricity. In this way, available oil supplies can be allocated to the transportation sector, where fuel mobility is most important and most challenging.

RESPONSES OF JIM BALCOM TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. I sense the same dynamics with your industry much like that with the chip industry when we formed SEMATECH in the 1980's—that the U.S. has developed the cutting edge critical technologies but that foreign competitors, particularly those in Asia, are about to win by bringing them first into market and setting the standards for use. Do we need to develop a similar industry—government partnership for critical R&D like SEMATECH or are there some other mechanisms that the government can employ such as federal purchasing to ensure we do not loose this market?

Answer. My understanding is that SEMATECH was established to counter a national threat to semiconductor technology in the U.S. The stakes are indeed high today in the case of energy, with the need to reduce U.S. dependence on foreign oil, and to reduce the threat of global climate change.

However, in this case the DOE already has a solid plan in place whereby industry-government partnerships would work together to conduct the long term R&D that will be required to change the massive transportation sector from one that relies on fossil fuels to one based on hydrogen. It includes several competitively bid, cost-shared projects with industry across a broad range of technologies.

The DOE has recognized and acknowledged that the portable fuel cell market will precede and has the potential to catalyze the automotive fuel cell market. Since so many of the designs, materials and processes are the same or similar between the portable and automotive fuel cell applications.

Unfortunately, due to a lack of funding, the DOE has suspended the portable fuel cell programs, along with several other programs for FY06. Until recently, the National Institute of Standards and Technology (NIST) also had competitively awarded, cost shared programs with industry focused on portable fuel cell technology through the Advanced Technology Program (ATP). Funding for this program has also recently been suspended and the projects cancelled.

PolyFuel doesn't feel that a specific SEMATECH initiative is required, but rather that funding for the existing government programs be maintained and the industry-government projects be executed.

Question 2. The Department is projecting initial milestones for developing commercially viable fuel cell vehicles by 2015, where will your market be by that time frame and who do you expect to be the major players?

Answer. Most of PolyFuel's customers are major consumer electronics manufacturers. They project that the market for portable fuel cells could reach 10% of the portable consumer electronic device customer base. One of the largest laptop manufacturers projects that the adoption rate could reach 30% of their customer base. Overall market projections vary, but one of the larger market forecasting firms, Allied Business Intelligence (ABI) has projected that the market for portable fuel cells could reach 50 million units by 2011. This would represent a 2% to 3% adoption in that timeframe. Several of the leading consumer electronic manufacturers have indicated that they intend to launch portable fuel cell powered devices in the 2007 or 2008 timeframe. One has indicated that they expect to have 1 million units in the field in late 2008 or early 2009.

Several U.S. based companies have leading technology in the portable fuel cell space. These include companies such as DuPont, PolyFuel and MTI Inc. However, many more Asian, European and Canadian firms are further ahead in terms of technology and market development. The risk is that foreign fuel cell manufacturers will achieve a substantial lead in the larger, but later, automotive fuel cell market by virtue of having been more active in the earlier portable fuel cell market.

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