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ENERGY BILLS

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

ON

S. 737	**H.R. 2729**
S. 1617	**H.R. 3165**
S. 2744	**H.R. 3246**
S. 2773	**H.R. 3585**
H.R. 957	

DECEMBER 8, 2009

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ENERGY BILLS

TUESDAY, DECEMBER 8, 2009

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

The subcommittee met, pursuant to notice, at 2:35 p.m. in room SD–366, Dirksen Senate Office Building, Hon. Maria Cantwell presiding.

OPENING STATEMENT OF HON. MARIA CANTWELL, U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. The U.S. Senate Committee on Energy and Natural Resources, Subcommittee on Energy, will come to order. I want to thank my colleagues for being here today to hear testimony on a list of legislative bills.

H.R. 957, the Green Energy Education Act of 2009.

H.R. 2729, to authorize the designation of national environmental research parks.

H.R. 3165, the Wind Energy Research and Development Act of 2009.

H.R. 3585, the Solar Technology Road Map Act.

S. 737, a bill to amend the Energy Independence and Security Act of 2007, to authorize the Secretary to conduct research and development demonstration to make more biofuels compatible with small non-road engine and for other purposes.

S. 1617, to require the Secretary of Commerce to establish a program for awards of grants to states to establish revolving loan funds for small and medium sized manufacturers to improve energy efficiency.

S. 2744, a bill to amend the Energy Policy Act of 2005 to expand authority for awarding technology prizes by the Secretary of Energy.

S. 2773, a bill to require the Secretary of Energy to carry out programs to support the research and demonstration and development of commercial applications for offshore wind energy and other purposes.

We're very pleased to have the Under Secretary of Energy here, the Honorable Kristina Johnson. So thank you very much for joining us today to speak on all of these legislative proposals from both the House and the Senate.

The agenda for this is a hearing today so that we can hope to move these bills. Obviously it's important that the committee consider these bills on a regular order but at first receive some expert

testimony on them. Under Secretary Johnson, we are eager to hear from you about the Department's views. Ultimately if funds are appropriated for them, you will have to administer these programs. It's important that we hear the Department's views first and foremost.

I want to note as we consider energy related research and development programs and I'm sitting here with my colleague, Senator Stabenow from Michigan.I'm going to call on her in a minute along with the Ranking Member Risch, as soon as he shows up. I'd also like to highlight an item that is not on the agenda that Senator Stabenow and I worked hard on which was the establishment of a new 30 percent investment tax credit for manufacturing.

We were able to get 80 votes in the Stimulus Package for this 48C tax credit for construction equipping renewable energy and for smart grid technology and manufacturing facilities. Senator Stabenow and I worked very hard on that. As we hear from the President in the next couple of days on his jobs agenda and as our colleagues move off of health care and on to jobs agenda, we are going to be working hard to resubmit that legislation in hopes that it will be a key component of our job activities moving forward.

We think not only will it help create jobs here at home, but whole new industries that will support entire communities and manufacturing and clean equipment that we need to transform our Nation. The solar industry is a good case example of this.

First, solar is a leading American photovoltaic model maker. They built their first pilot plant in 2005 in Ohio. But when they needed to scale up production generous manufacturing incentives and market demand in Germany and Malaysia led them away from the United States. If this clean energy manufacturing stint has become part of a stimulus bill it would launch a wave of new clean energy manufacturing facilities around the country. Just the stimulative effect for the solar industry alone would create 315,000 jobs.

Let me also note for the record that Senator Stabenow introduced S. 2843, which is a companion bill to the House Bill that is on the schedule today, H.R. 3246 which we are considering today. The bill is co-sponsored by Senators Wyden, Brown and Nelson, of Florida.

I would also like to take note that Senator Collins has provided testimony and cannot be here today on S. 2773 and S. 737 that we will also include her comments in the record on that. That is a bill to authorize the Secretary to do research and demonstration projects on biofuels.

[The prepared statements of Senator Collins follow:]

PREPARED STATEMENTS OF HON. SUSAN M. COLLINS, U.S. SENATOR FROM MAINE

S. 2773

Chairman Cantwell, Ranking Member Risch, and members of the subcommittee, thank you for holding this hearing today on the Offshore Wind Energy Research, Development, Demonstration and Commercial Application Act, which I introduced on November 16th.

This legislation requires the Secretary of Energy to carry out a program of research, development, demonstration and commercial application to advance offshore wind turbine technology. This bill would advance the goal of the Department of Energy to produce 20 percent of our nation's electricity from wind resources by 2030.

Currently 61 percent of U.S. wind resources is in deepwater, greater than 60 meters (197 feet) depth. Winds at these locations are stronger and more consistent

than closer to shore or on land. It will, however, take technological advances to harness this energy efficiently and cost-effectively.

This bill would focus national efforts to develop offshore wind technologies. This should be a national priority because this source can produce clean, renewable energy for major U.S. population centers. The 28 coastal U.S. states use 78 percent of the electricity in the U.S. For example, Maine's offshore wind resource is close to the 55 million people who live in New England, New York, New Jersey and Pennsylvania. This is 18 percent of the total U.S. population.

Developing cost-competitive offshore wind technology will require improvements in the efficiency, reliability, and capacity of offshore wind turbines and reductions in the cost of manufacturing, construction, deployment, generation, and maintenance of offshore wind energy systems. That is why my bill directs the Secretary of Energy to support existing university centers and establish new centers to support research, development, demonstration and commercial application. The bill authorizes $50 million annually over ten years for:

- the design, demonstration, and deployment of advanced wind turbine foundations and support structures, blades, turbine systems, components, and supporting land-and water-based infrastructure for application in shallow water, transitional depth, and deep water offshore;
- full-scale testing and establishment of regional demonstrations of offshore wind components and systems to validate technology and performance;
- assessments of U.S. offshore wind resources, environmental impacts and benefits, siting and permitting issues, exclusion zones, and transmission needs for inclusion in a publically accessible database;.
- design, demonstration, and deployment of integrated sensors, actuators and advanced materials, such as composite materials;
- advanced blade manufacturing activity, such as automation, materials, and assembly of large-scale components, to stimulate the development of a U.S.-blade manufacturing capacity;
- methods to assess and mitigate the effects of wind energy systems on marine ecosystems and marine industries; and
- other research areas as determined by the Secretary.

Again, I extend my appreciation to Chairman Cantwell and Ranking Member Risch. This bill would support critical renewable energy research that would help reduce our use of fossil fuels and improve our energy security.

S. 737

Chairman Cantwell, Ranking Member Risch, and members of the subcommittee, thank you for holding this hearing today on the Biofuels Compatibility Act of 2009, which I introduced on March 30th with Senator Mark Udall. This legislation would amend the Energy Independence and Security Act of 2007 to expand on a research, development, and demonstration program, authorized in that bill, to include efforts to make biofuels more compatible with small non-road engines.

The Energy Independence and Security Act of 2007, directed the Secretary of the Department of Energy (DOE), in coordination with the Secretary of the Department of Transportation (DOT) and in consultation with the Administrator of the Environmental Protection Agency (EPA), to carry out a program of research and development regarding the impact that biofuels, like ethanol, may have on existing fuel storage and delivery infrastructure used for petroleum-based fuels. It is critical that these biofuels also are safe to use in operating small non-road engines. My bill requires these agencies to expand their research program to include small engines such as those in snowmobiles, boats, lawnmowers, and chainsaws. In my state, the only fuel generally available is an ethanol-gasoline fuel blend with 10 percent by volume of ethanol. Many communities across the country have similar restrictions of fuel availability, which makes this legislation especially timely and important.

Previous testing done through DOE shows that increased ethanol content in smaller engines creates a leaner burning mixture, which may increase idle speed on some small engines, creating unanticipated clutch engagement on equipment such as chainsaws and handheld trimmers. Also, fuel ethanol is more corrosive and less efficient than traditional gasoline blends. During these difficult economic times, equipment damage due to ethanol-gasoline fuel blends only adds to the many challenges facing Maine's farmers, fishermen, independent woodsmen, and recreational industry.

As we pursue strategies to lessen our dependence on foreign oil, we must also take action to ensure that ethanol fuel blends are safe and efficient for small engines. I urge my colleagues to support this important legislation.

Again, I extend my appreciation to Chairman Cantwell and Ranking Member Risch. It is important that people throughout the country, who depend daily on the nation's fuel supply to power their tools and recreational vehicles and boats, can depend on the fuels approved for sale in general commerce. I look forward to working with them to advance this legislation.

Senator CANTWELL. So again, Under Secretary Johnson, we're glad that you are here today to testify on all of these bills.

I will certainly call on the ranking member when he shows up.

But now I'd like to, if I could, call on my colleague, Senator Stabenow, to address the legislation she's here to discuss.

Then we'll get to you, Under Secretary Johnson. Thank you.

STATEMENT OF HON. DEBBIE STABENOW, U.S. SENATOR FROM MICHIGAN

Senator STABENOW. Thank you, Madam Chair.

I first want to thank you for partnering with me on so many items that effect manufacturing and both in clean energy and in a number of other areas. We have been able to partner on the Finance Committee as well as here. I appreciate the fact that you understand, as I do, that we need to make things in this country. That that's really what this is all about is the ability to make things in America and create jobs and strong businesses and put people back to work.

Madame Under Secretary, it's great to see you again.

I did want to comment on the legislation that I've introduced, S. 2843. Also commend my colleague in the House, Congressman Gary Peters, who's done a terrific job of passing this legislation in the House of Representatives. I do think it's important that we also acknowledge the fact that in the Recovery Act that we passed at the beginning of the year. We have been able to move the ball forward with, as the Chair indicated, the 30 percent manufacturing tax credit for clean energy technology.

It's wonderful to have an Administration that gets it, quite frankly, when we put forward the fact that we needed to focus on manufacturing technology development and deployment. Equipment going to plants, retooling plants and so on. There was not a moment of hesitation from the Administration.

So I appreciate that very much, the fact that there's an understanding that yes, we need R and D, but we need to be able to go farther. As I said, put boots on the ground and actually be able to retool and help offset the costs of equipment and be able to get us all the way there in terms of creating manufacturing jobs. So I thank you very much for that.

I also want to mention the fact that Senator Brown has legislation. I'm a co-sponsor of the Impact Bill which would also help small and medium sized manufacturers. I think that's an important piece that we need to be focused on as well.

According to the Michigan Manufacturer's Association we have more than 700 auto suppliers in Michigan. We are proud of that. That totals more than 50 percent of the North American auto supply base.

This is not about rust belt technology. It's about advanced manufacturing. I also want to say I saw someone slipping in the back, a friend of mine, who does work, major work, on advanced manu-

facturing. Madame Chair, Chip McClure, from ArvinMeritor, I saw in the back.

Chip, it's nice to see you. ArvinMeritor is at the front end of leading technologies and batteries, yes, for trucks as well as for cars. So we're really glad that you're here today as well.

The Advanced Vehicle Technology Act, Madame Chair, provides funding for advanced vehicle technology research and development in the Department of Energy. We know that this was spur innovation. Ensure that America leads the world in inventing, developing and manufacturing technologies that will power vehicles for the future.

Around the world other nations are making tremendous investments. In fact I think it's important to note that we have, I believe, it's $280 million a day that China is now investing in clean energy technology. Shame on us if in this new energy revolution we're not the ones creating the jobs here in America. Shame on us if we let that technology and those jobs go overseas.

So, Madame Chair this is about building engines and batteries and other components. We also have considered an additional natural gas vehicle bill, in my legislation, that passed in the House of Representatives. These bills, combined together, put forward a bipartisan effort to help us retool for new markets, move forward on advanced manufacturing.

It certainly is critical that we do this now. I wish we had done more sooner. We've worked on efforts to do more sooner. But right now this is an opportunity to move as quickly as possible.

So I thank you for the time. I would very much appreciate my colleague's support.

Senator CANTWELL. Thank you, Senator Stabenow.

Senator Barrasso, did you want to make a statement?

Senator BARRASSO. Thank you very much, Madame Chairman. I'm delighted to hear from Dr. Johnson first. Then perhaps, make a statement and some additional questions.

Thank you, Madame Chairman.

Senator CANTWELL. Thank you for that. I think when Senator Risch comes we'll allow him to make an opening statement. But since he's not here, Under Secretary Johnson, we'll let you proceed.

Again, thank you for your visits to the Pacific Northwest both on visiting the Hanford side as well as the other activities to focus on job creation. So, thank you for being here today.

STATEMENT OF KRISTINA M. JOHNSON, UNDER SECRETARY OF ENERGY, DEPARTMENT OF ENERGY

Ms. JOHNSON. Thank you, Madame Chair, Ranking Member Risch and members of the subcommittee for the opportunity to be here today to give the Department of Energy's assessment of several energy bills currently under consideration. We appreciate your interest in the views of the Department of Energy on these bills. Over many years and many Administrations, the Department has enjoyed an open and productive relationship with this committee. Those of us serving under President Obama certainly plan to continue and strengthen that relationship.

We are encouraged by the committee's commitment to continue to improve on the substantial and positive investment made in

clean energy through legislation enacted in recent years. In particular, we wish to thank you for all the hard work this committee has put into the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, the Clean Energy portions of the American Recovery and Reinvestment Act of 2009 and this year's reporting of the American Clean Energy Leadership Act. Additionally, I want to thank the sponsors of the bills we are discussing today, from both sides of the aisle and both sides of the Capitol, for their hard work on clean energy legislation.

Given the brief amount of time I have today I will summarize the Department's views and recommendations regarding several of these bills. A detailed analysis of each is contained in my prepared statement which I have submitted for the record.

First I will address H.R. 957, the Green Energy Education Act. Adequately preparing our work force is a subject that grew near and dear to my heart during my 25 years as an educator. A general work force deficiency is growing across the energy sector.

The rapid deployment of new energy technologies coupled with the fact that 40 to 60 percent of energy utilities' skilled workers and engineers are eligible to retire by 2012 reinforces the need for a broad approach to address the green jobs development and training challenge. To this end, the Department already has been working closely with the National Science Foundation to strengthen the scientific, technology and engineering and math education programs at the technical, undergraduate and graduate levels.

While H.R. 957 would advance the Department's energy technology development mission in the specific arena of building technologies, we think that the scale of the challenge demands a more comprehensive approach. We believe that this bill could be improved to authorize activities beyond what the Department is already undertaking. To more fully address the larger issue of energy education, green jobs creation and work force training that extends beyond buildings.

Turning next to H.R. 3246, the Advanced Vehicle Technology Act of 2009, we believe this act would enable the Department to build on its continuing efforts to improve existing vehicle technologies and emphasize other modes of transportation to significantly reduce passenger and commercial vehicle miles traveled. We also believe the bill generally covers an appropriate technology portfolio. It includes well placed interest in heavy duty vehicles and is well aligned with prior year program budgets.

We do, however, have some concerns regarding the hydrogen and fuel cell activities authorized in the bill which are detailed in my written testimony.

H.R. 3585, the Solar Technology Road Map Act, includes several features that would support the Department's continuing vision for the solar energy technologies program. We are enthusiastic about the funding levels proposed. The road map concept is consistent with the Department's prior efforts to establish ambitious, yet achievable targets for clean energy technologies.

In fact, the existing solar program is already working with industry representatives and others to develop a solar vision study which will look at opportunities to achieve 10 to 20 percent of the Nation's electricity generation from solar technologies by 2030. While

we welcome additional industry input and funding for demonstration projects the Department is concerned that the bill would place the Department's solar program under the watch and direction of a semi-autonomous committee. This is problematic for a couple reasons.

First, it would bind a Federal agency's research and development efforts to the recommendations of a non-governmental entity.

Second, constraining the flexibility of the Department to such an entity would hinder the Department's ability to respond to an ever changing research and development landscape as often diverse sources of information and changing situations arising from yet unknown, but expected outcomes of the Department's research and development efforts.

Again the support Congress has shown for solar technologies in recent years has been encouraging and exciting. We would encourage Congress to stipulate that the committee would provide the kinds of non-binding advice and recommendations traditionally provided by publicly chartered, Federal advisory committees rather than a binding approach.

Finally I'll offer a few comments on S. 1617, investments for Manufacturing Process and Clean Technology Act of 2009 and S. 2744, Carbon Dioxide Capture Technology Act of 2009. In the case of the former, the Department appreciates the committee's support for improving energy efficiency across the manufacturing sector, a goal the Department shares. I am pleased to note the Department is already working to carry out many of the bills goals through work of its own or by collaborating with other Federal and State agencies, including the Department of Commerce.

We stand ready to work with this committee and the Commerce Department to consider how the bill can be improved to draw upon our deep, domain knowledge and build off our existing programs.

S. 2744 would authorize the creation of a "C Prize," similar to other authorized energy technology competitions to foster novel technologies that separate carbon dioxide from dilute sources. The Department supports the creation of such a prize as we consider carbon capture to be an essential tool in the mitigation of greenhouse gas emissions. As currently proposed, however, the bill's recommendations may be overly prescriptive, particularly in the area of intellectual property protection. We recommend that the Department be granted greater latitude in calling upon diverse sources of information in formulating such a prize.

In the interest of time, I'd refer you to my prepared statement where you will find the balance of the Department's detailed recommendations on these and the other proposed bills. I'd like to thank you again for the opportunity to testify. We look forward to working with you on these and other energy proposals.

Thank you.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF KRISTINA M. JOHNSON, UNDER SECRETARY OF ENERGY, DEPARTMENT OF ENERGY

Madam Chairman, Ranking Member Risch, and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss several draft energy bills. We deeply appreciate your interest in the views of the Department of Energy (The Department) on these bills. Over many years and many Administra-

tions, the Department has enjoyed an open and productive relationship with this Committee, and those of us serving under President Obama certainly want to continue and strengthen that partnership.

In recent years, Congress has made a very substantial and positive investment in clean energy through the enactment of the Energy Policy Act of 2005 (P.L. 109-58), the Energy Independence and Security Act of 2007 (EISA)(P.L. 110-140), and the clean energy portions of the American Recovery and Reinvestment Act (P.L. 111-5).

This year, the Committee has proposed further investment and we thank you for all your hard work in reporting the American Clean Energy Leadership Act (S. 1462). As President Obama said while dedicating a new solar plant in Central Florida, "At this moment, there is something big happening in America when it comes to creating a clean energy economy. . . . And I have often said that the creation of such an economy is going to require nothing less than the sustained effort of an entire nation—an all-hands-on-deck approach similar to the mobilization that preceded World War II or the Apollo Project."[1]

The American Recovery and Reinvestment Act 2009 (The Recovery Act) alone provided the Department with $36.7B in appropriations—$32.7 billion in grant and contract authority, $4 billion in credit subsidy for loan guarantees, plus $6.5 billion in borrowing authority for the Power Marketing Administrations. These funds will support some $100 billion in clean energy and environmental clean up projects when leverage and cost share are included, creating hundreds of thousands of jobs and providing a meaningful down payment on the nation's energy and environmental future.[2]

For this hearing, I would like to offer the Department's views on nine proposed bills, as the Subcommittee has asked. These bills are: H.R. 957, H.R. 2729, H.R. 3165, H.R. 3236, H.R. 3585, S. 737, S. 1617, S. 2773, and S. 2744. I will address each bill in order of introduction starting with the House bills, except the two wind bills, which I will address together.

H.R. 957—GREEN ENERGY EDUCATION ACT

Background

A cornerstone of The Department's mission is to create an energyliterate generation of skilled workers, scientists, and innovators who can accelerate the transition to a clean energy economy and ensure U.S. global competitiveness. The Administration is deeply committed to promoting the creation of green jobs.

While the Department appreciates H.R. 957's focus on building technologies, we would like to impress upon the Committee that a general workforce deficiency is growing across the energy sector. The rapid deployment of new energy technologies, coupled with the fact that 40 to 60 percent of energy utilities' skilled workers and engineers are eligible to retire by 2012[3] reinforces the need for a broad approach to address the green job development and training challenge.

To this end, the Department works closely with the National Science Foundation (NSF) in a number of areas to strengthen scientific educational programs at the technical, undergraduate, and graduate levels. These projects are aimed at creating a pipeline beginning at the K-12 level and extending through the post-graduate level to ensure the ongoing development of a workforce with the skills and capabilities to create and scaleup innovative energy technologies and improve processes over the long-term. Further, the Department is already closely coordinating with NSF on education, green jobs training, and workforce development. The Department recognizes the importance of leveraging NSF resources, and is already taking proactive steps to solidify a stronger working relationship with our colleagues.

H.R. 957 would facilitate stronger collaboration between the Department and the National Science Foundation. As written, the legislation would authorize The Department to fund NSF's flagship interdisciplinary training program (IGERT) to educate architects and engineers to collaborate on high performance building technologies and practices.

H.R. 957 assigns priority funding for applications encouraging partnerships between architectural and engineering schools. These fields are inextricably inter-

[1] From "Remarks by the President on Recovery Act Funding for Smart Grid Technology." Press release. October 27, 2009. http://www.whitehouse.gov/the-press-office/remarks-president-recovery-act-fundingsmart-grid-technology.

[2] The Department has been funded at $36.7 billion in Recovery Act dollars, after $2 billion of the original $38.7 billion was redirected to the Cash for Clunkers program.

[3] Center for Energy Workforce Demand 2007 Report: Gaps in Energy Workforce Pipeline.

twined, and can advance energy efficiency in the design and construction of high performance buildings.

By supporting multidisciplinary graduate education and curriculum development activities, H.R. 957 will advance the Department's broad energy technology development mission. The bill recognizes the need to produce the next generation of engineers and architects who can work together from design concept to building operation to integrate energy efficiency and renewable energy more fully into the clean, competitive economy of the future.

We would note here that the Department is already undertaking efforts in creating or funding green job training programs through existing authorities.

Through the Recovery Act, the Department is funding approximately $140 million in training and technical assistance to develop standardized training curricula for residential energy workers, expand the number of weatherization training centers, and to create a national weatherization worker certification framework

To serve the commercial building sector, the Department's Building Technologies Program has issued a Funding Opportunity Announcement (FOA) to support the development of training programs for building technicians, operators, energy auditors, and others responsible for building and operating high performance commercial buildings. These programs offer an opportunity to demonstrate how partnerships with the Department of Labor's public workforce system, labor management partnerships, education institutions such as community colleges, and community organizations can meet the workforce needs of the commercial building sector. The Department of Energy estimates that approximately $7.5 million will be available for multiple awards under this FOA.

Utilities, colleges, universities, labor organizations, and trade associations, will be able to apply for over $100 million in grants issued through a FOA to improve smart grid technology education and implementation, as well as funding programs and curricula to train or retrain workers in the electric power sector.

Recommendations

The Department is committed to achieving effective legislation to train and educate the new energy economy work force. The Department backs a coordinated, interagency approach and a balanced investment in education and training opportunities from kindergarten to adult job training, beyond just buildings. Although a good start, H.R. 957 could be improved to more fully address the larger issue of energy education, green jobs creation, and workforce training. I look forward to working with the Committee to strengthen this legislation.

H.R. 2729—NATIONAL ENVIRONMENTAL RESEARCH PARKS

Background

The Department's predecessor, the Atomic Energy Commission, established the first environmental research park in 1972 at the Savannah River Site in South Carolina in response to recommendations from the scientific community, other Federal agencies, and Congress. Between 1972 and 1992 six additional research parks were designated on The Department sites.

The research parks, located on Department-owned land, represent six major ecoregions across the U.S. and provide research opportunities on natural ecosystems as well as on the environmental transport, cycling, and fate of radionuclides and other contaminants resulting from nuclear weapon development and testing. While the Department-sponsored researchers utilize the research parks to conduct high-priority mission relevant research, research park use is dominated by researchers sponsored by other Federal agencies including the National Science Foundation, the Department of Agriculture, Geological Survey, and the Department of Defense. This is due in large part to the attractiveness of these areas for general ecological-type research beyond the scope of the Department. Currently, stewardship of each research park is the responsibility of its respective laboratory management and operating contractor, with oversight by the managing Department program office.

H.R. 2729 formally institutionalizes existing research parks by directing the Secretary to designate six National Environmental Research Parks as protected outdoor research reserves for the purposes of conducting long-term environmental research on the impacts of human activities on the natural environment.

The bill authorizes $30 million annually—$5 million for each of the National Environmental Research Parks—for the Department's Office of Science to carry out eco-research and education activities.

As a threshold matter, much of the research contemplated by this bill is already being performed. This legislation may also have a few unintended consequences.

- Any official designation of park lands as "protected sites" could impede the parks' future use for mission priority activities and could restrict the Department's current authority at the proposed sites.
- While the research parks are well-suited for conducting the research proposed by the bill, much of this research is outside the scope of the Department's mission and core competencies. An example would be H.R. 2729's proposed research regarding the general ecology of the site and region in addition to population biology and ecology. Such research should continue to be supported by other, more appropriate Federal agencies.

Recommendations

The Department recognizes that the current environmental research parks will continue to be a valuable resource for the overall scientific community, and we believe the current support arrangement is working well. As such, current Departmental activities and authorizations are sufficient.

Wind

The Department's Wind Program leads the Nation's efforts to address the barriers to the acceleration of large-scale deployment of land-based and offshore wind energy.

The Department's 2008 report, *20% Wind Energy by 2030*, outlines an aggressive scenario in which the U.S. could generate 20% of its electricity by 2030, and it also identifies the technical and non-technical barriers that must be overcome in order to achieve this. The Department's Wind and Hydropower Technologies Program is currently funding research to address the challenges identified by the report, which include reducing wind turbine capital costs by improving reliability, integrating wind energy into the power grid, addressing environmental and siting concerns, and building the domestic wind manufacturing industry.

The Department is working to improve reliability of wind technology, by, among other things, reducing blade and gearbox failures. These failures present one of the greatest challenges to wind technology, as they require costly repairs and reduce investor confidence. To reduce the risk facing new turbine technologies, the Department is funding the creation of facilities that will help industry develop the next generation of large wind turbine designs. For example, a new $45 million large wind turbine drivetrain testing facility, and a new $25 million large blade test facility capable of testing 90 meter blades have been recently awarded under Recovery Act funding.

To overcome wind energy integration challenges, the Department is developing tools and strategies, such as wind forecasting techniques, which will improve the integration of wind energy with the electrical grid. The Department is funding two state-of-the-art high penetration wind integration studies, the Eastern Wind Integration and Transmission Study and the Western Wind and Solar Integration Study that evaluates the impact of integrating up to 30% wind energy into the U.S bulk power system.

To address the environmental and siting challenges, the Department funds projects that seek to understand and mitigate the impacts of wind energy development on wildlife. For example, the Department funds work at Texas Tech University and Kansas State University to assess the environmental impacts of wind energy on species of grassland birds. Habitat impacts on grassland species are a particular concern because extensive wind energy development could take place in grassy regions of the country. Three other projects funded by the Department will focus on developing tools to assess habitat risks when siting wind energy projects. Jones & Stokes Associates, Inc., The Nature Conservancy, and Pandion Systems, Inc. will each work to develop scalable, spatiallyexplicit tools to calculate potential environmental impacts from wind deployment. The Department also provides local and state governments with resources to help them make informed decisions about wind power in their communities.

To build the domestic wind manufacturing industry, the Department works with companies to develop innovative manufacturing processes and to develop a qualified wind workforce. For example, the Department is funding PPG Industries in Shelby, NC to improve wind turbine blade manufacturing processes in partnership with MAGIndustrial Automated Systems in Hebron, KY. Current blade fabrication technology is labor-intensive and prone to variability, resulting in incidences of manufacturing defects[4]. The PPG research will develop an automated fabrication methodology to deliver precise control of fiberglass preimpregnated material placement. This effort will reduce blade-to-blade variability, lower incidences of premature fail-

[4] Wetzel, Kyle K. "Defect-Tolerant Structural Design of Wind Turbine Blades," American Institute of Aeronautics and Astronautics, Inc., 2009-2409.

ure, reduce cost of wind energy, and potentially increase blade manufacturing capability by as much as 100% when fully implemented by a manufacturer. To ensure an adequate wind workforce, the Department is funding a project with Southwest Applied Technology College in Cedar City, Utah, to provide students with practical and applied wind energy training. The school will target skilled unemployed workers and minority populations, especially Hispanic and Native Americans.

The Department's National Wind Technology Center (NWTC) in Boulder, Colorado is recognized internationally as a leading wind energy research and development facility. The NWTC has advanced wind turbine testing capabilities and provides an ideal site for testing turbines under extreme conditions; the NWTC experiences strong wind directionality and gusts up to 85 miles per hour at wind turbine hub height. This year, the NWTC installed a 1.5 MW wind turbine, the first utility-scale turbine to be owned by the Department, as well as a 2.3 MW turbine operated in partnership with industry. These turbines are fully instrumented to act as test platforms for future R&D to further improve the reliability and performance of wind turbine components and to reduce the cost of wind energy. For example, load data from the foundations of these two research turbines will be used to help codify a national standard for permitting requirements of utility scale wind turbines. A uniform permitting standard would provide a significant improvement to the current patchwork regulatory schemes imposed on wind developers.

H.R. 3165—WIND ENERGY RESEARCH AND DEVELOPMENT ACT OF 2009

Background

This legislation authorizes $200 million annually through 2014 for a cumulative investment of $1 billion dollars. H.R. 3165 authorizes the Department to carry out a wind R&D program to improve the energy efficiency, reliability, and capacity of wind turbines through new materials and technologies, optimize the design and adaptability of wind energy systems, and reduce the cost of construction, generation, and maintenance of wind energy systems. Finally, the bill requires the Department to fund merit-reviewed, cost-shared demonstration projects conducted in collaboration with industry.

The Department currently has $80 million in appropriated funding for FY 2010 to pursue RD&D of wind energy technologies. The activities authorized in H.R. 3165 are largely consistent with much of the work currently underway at the Department, and with the Department's *20% Wind Energy by 2030* report, which identified the barriers and pathways for supplying 20 percent of the Nation's electricity from wind energy by 2030. Using ARPA-E funding, the Department has been able to finance breakthrough wind technologies, High Efficiency Shrouded Wind Turbine, FloDesign (Wilbraham, MA)[5] and Adaptive Turbine Blades: Blown Wing Technology for Low-Cost Wind Power, PAX Streamline Inc. (San Rafael, CA)[6], which are consistent with the wind program's goals.

H.R. 3165 recognizes the need to resolve the impacts of wind turbines on federal radar assets. These radars are used to ensure aviation safety, support homeland security, protect military assets, and enable timely weather warnings for public safety. The Administration realizes this is a critical unresolved issue.

Recommendations

The Department would like to work with Congress to tighten Section 3's proposed demonstration program to reflect the development status and needs of the wind industry. We urge the Committee to consider placing special emphasis on the demonstration of innovative offshore wind technologies, including integrated systems, components, structures, materials and infrastructure. Domestic, pre-commercial, leading edge technologies remain the most appropriate investment for a robust demonstration program. The U.S. has yet to install a single offshore wind turbine while Europe has over 1500 MW installed and a target of 40,000 MW by 2020. Investment

[5] FloDesign Wind Turbine Corporation (Wilbraham, MA) will develop a new shrouded, axial-flow wind turbine known as the Mixer Ejector Wind Turbine (MEWT), which is capable of delivering significantly more energy per unit swept area with greatly reduced rotor loading as compared to existing horizontal axis wind turbines (HAWT). Prototypes will be built and tested, demonstrating the advantages of lightweight materials and a protective shroud that will reduce noise and safety concerns and accelerate distributed wind applications.

[6] PAX Streamline, Inc (San Rafael, CA), along with Georgia Tech Research Institute, will lead a project to adapt Blown Wing technology for wind turbines, culminating in a 100 kW prototype. Circulation control technology or "Blown Wing" technology creates a virtual airfoil by jetting compressed air out of orifices along a wing and has the potential to radically simplify the manufacture and operation of wind turbines. Unlike a fixed airfoil, a Blown Wing can be dynamically adjusted to maximize power under a wide range of wind conditions, and can be generated from a slotted extruded pipe that can be domestically manufactured at a fraction of the cost.

by the U.S. government is critical for development of a domestic industry. There are numerous offshore wind projects proposed in the Great Lakes, such as the Cuyahoga County Project in Lake Erie, and numerous projects in the Northeast that should be supplied by U.S. manufacturers.

The Department asks that the legislation include a specific authorization for environmental research. One set of persistent issues facing the wind industry are the environmental impacts associated with wind power facilities. Project developers must not only finance, construct, and maintain wind farms, but must also consider the effects of wind energy systems on the surrounding environment. As written, researching the impact of turbines on wildlife and natural habitats could be funded under the Section 12(b)(12) "catch-all" provision of this bill that enables the Secretary to determine if the Department should perform research in addition to the prescribed areas. However, given the significance of environmental issues associated with wind energy systems deployment, the Department would like to see a greater emphasis on addressing this important area of research in collaboration with other responsible federal agencies.

The Department is currently funding efforts to evaluate the possible benefits of certain energy storage technologies to assist with wind integration. Areas of study include how the suite of power system flexibility options (including energy storage) can best be utilized to address wind variability issues; evaluation of the use of hydropower to assist with wind integration; and the study of how storage technologies can be integrated into wind power components to extend equipment operating life.[7]

S. 2773—OFFSHORE WIND ENERGY RESEARCH, DEVELOPMENT, DEMONSTRATION, AND COMMERCIAL APPLICATION ACT OF 2009

Background

Only very recently has the U.S. government invested significantly in offshore wind technology research and development, and consequently, no domestic offshore wind systems or manufacturing base exist for the sector. In FY 2009 and FY 2010 the Federal Government began investing in offshore wind technologies, including an $8 million Recovery Act funded consortia led by the University of Maine that will deploy two floating offshore turbine prototypes and conduct research to optimize the design of floating platforms, while also providing wind energy career educational opportunities for university students.

S. 2773 authorizes $50 million annually from FY 2011 through FY 2021, for a cumulative investment of $500 million. S. 2773 requires the Department to carry out a comprehensive program of research, demonstration, and development of commercial applications for offshore wind energy to improve the efficiency, reliability, and capacity of offshore wind energy systems, at all water depths, while reducing costs throughout the supply chain.

Further, the legislation supports offshore wind resource assessment work, while considering the technologies' environmental impacts, benefits, and mitigation techniques for marine ecosystems and industry. This research would also address the unique challenges to generating energy offshore, including siting and permitting issues, exclusion zones, and transmission needs.

S. 2773 also authorizes the Department to award grants to institutions of higher education to establish one or more national offshore wind centers that meet specified requirements to focus on deepwater offshore floating wind energy technologies.

S. 2773's authorization levels and timeframe appear consistent with prior Departmental and industry assessments necessary to deploy a national offshore R&D program focused on lowering deployment costs, ensuring high technical reliability, facilitating economic revitalization of U.S. port facilities, and mitigating environmental impacts.

Recommendations

The Department estimates that only one-third of the cost of an installed offshore wind energy facility is represented by the wind turbine itself. Therefore, lowering the cost of offshore wind requires additional focus on electrical grids, project operation and maintenance, and installation and staging costs. The bill's authorization language should include research aimed at optimizing installation methodology, electrical transmission design, operations and maintenance practices, installation

[7] DOE is currently funding energy storage research through the Office of Electricity Delivery and Energy Reliability (OE), and pumped-storage hydropower research and development through the Office of Energy Efficiency and Renewable Energy's Wind and Hydropower Technologies Program. The Wind Program works with these parties to coordinate and collaborate, but feels that continuing to fund these activities under the offices that are already working on storage makes more sense than creating separate storage activities in the Wind R&D bill.

vessel design, and manufacturing and assembly. With no offshore wind turbines currently deployed in U.S. waters, this type of government support will be integral to accelerating early-stage offshore wind development.

While the Department supports the establishment of a comprehensive national R&D program for offshore wind, Section 4 of the bill authorizing a national offshore wind energy center[8] [emphasis added] is overly prescriptive and duplicative of the Department's recently announced deepwater offshore wind R&D award to a consortium led by the University of Maine. Three examples of S. 2773's language can illustrate why such a prescriptive approach may overlook opportunities for offshore wind. First, Section 4(b)(4) requires each "center" to have access to the Atlantic Ocean, the Gulf of Mexico, or the Pacific Ocean. This language precludes the Department from funding a center on the Great Lakes, which have significant offshore wind energy potential and have begun to attract investment from developers, such as the Cuyahoga County Project in Lake Erie. Second, although R&D on offshore wind in shallow and transitional depths is authorized by the bill, the national center created by the bill is restricted to only deepwater offshore wind systems. This legislative treatment favors one offshore technology over the R&D needs of shallow and transitional depth waters, with little policy or technical justification. Finally, Section 4's language requiring that universities be designated as lead institutions may prove to be an unnecessary constraint on otherwise qualified consortia applying to establish offshore wind centers.

The Department supports establishing a comprehensive National Offshore Wind Energy R&D Program as contemplated by S. 2773 in which multiple research, development, and demonstration projects play a critical role. Such projects should be established through grants awarded on a competitive basis.

H.R. 3246—ADVANCED VEHICLES TECHNOLOGY ACT OF 2009

Background

Department-funded research has contributed heavily to the advancement of vehicle technologies. The advanced vehicle technologies in the Department's research portfolio can significantly reduce petroleum consumption, thereby strengthening our national energy security through both fuel substitution and energy efficiency. For example, plug-in hybrid electric vehicles with a 40-mile electric range using cellulosic E85 have the potential to reduce petroleum consumption by as much as 85% compared to conventional gasoline-powered internal combustion engine vehicles.[9] The Department is not only developing the technologies to make vehicles more energy efficient, but is also considering the full life cycle impact of cars on the environment. For example, the Department research produced a 40 percent weight savings on a per-part basis for a mid-sized automobile with the development of quick plastic forming aluminum. We have also developed technology to reduce commercial vehicles' engine cradle (structural element that supports the engine) weight by 65-70 percent using magnesium. Currently, the Department is involved in the commercialization of a process that can salvage nearly all of the plastic in a vehicle (approximately 10% of the average vehicle's weight), not only preventing landfill waste but also displacing oil and natural gas and reducing the cost of plastics through recycling.

Other examples of technologies developed by the Department and being used by Industry include:

> Every U.S. hybrid vehicle sold has intellectual property from the Department's Nickel Metal Hydride battery research, and Chrysler plans to begin production on a Cummins engine incorporating the Department's technologies which make its internal combustion engine operate cleaner and more efficiently. Lastly, collaborating with New Flyer, the Department co-developed the technology for hybrid transit buses, technology which has migrated to other applications such as light trucks and crossover vehicles.

The Department supports H.R. 3246, as the current Vehicle Technologies Program funding authorization expires at the end of FY 2010. We believe the bill generally

[8] In short, the Wind Program supports the R&D section of the bill, but does not feel that it is appropriate to designate a national center at this time because the technology is new and committing to fund one or a small number of centers may "lock in" the technology development to the specific attributes of that location e.g. local technology expertise, physical attributes such as water depth of the nearest site for offshore development, turbine designs optimized for the wind speeds at that particular location, etc.

[9] Argonne National Laboratory Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model. Emissions associated with direct and indirect land-use change are not considered in this analysis.

covers an appropriate technology portfolio, includes well-placed interest in heavy-duty vehicles, and is well aligned with prior year Program budgets.

Recommendations

The Department agrees with the suite of technologies authorized in H.R. 3246. However, the inclusion of hydrogen and fuel cell activities in H.R. 3246 would result in duplicative authorizations and potential budgetary issues. Currently, Title VIII of the Energy Policy Act of 2005 (EPAct 2005) serves as the authorizing language for the Department's hydrogen and fuel cell activities, and does not sunset until FY 2020. It is likely that hydrogen and fuel cell activities were included in H.R. 3246's activity list only because several hydrogen activities were included in the Vehicle Technologies FY 2009 appropriation. However, these activities were moved back to the Fuel Cell Program for FY 2010, and are no longer part of Vehicle Technologies.

Therefore, the Department respectfully requests to continue to rely on EPAct 2005's authorizations for the Department's Fuel Cell Program activities. The EPAct 2005 authorizing language provides sufficient authorization for current DOE activities, and removing H.R. 3246's hydrogen and fuel cell reference would avoid any unintended complications that can result from duplicative authorizations.

H.R. 3246 would enable the Department to build on the Department's continuing efforts to improve existing vehicle technologies, as well as emphasizing other modes of transportation to significantly reduce passenger and commercial vehicle miles traveled. We look forward to working with the Committee and the Congress on this important legislation.

H.R. 3585—SOLAR TECHNOLOGY ROADMAP ACT

BACKGROUND

The goal of the Department's present Solar Energy Technologies Program is to make solar energy technologies cost-competitive with conventional grid electricity by 2015 and to enable a high penetration of solar generation energy within the U.S. This goal drives a number of projects and initiatives relating to photovoltaic (PV) and concentrating solar power (CSP) technologies and requires examination of critical issues relating to grid integration and the transformation of markets for solar technologies.

We appreciate the strong Congressional support shown for solar technology development. The Recovery Act provides $118 million for solar initiatives, In October, the Advanced Research Projects Administration-Energy (ARPA-E) announced approximately $17.7 million[10] in solar grants, and Congress recently appropriated $225 million in FY 2010 for the Department's Solar Program. This funding enables the Department to make prudent investments in applied research to further reduce the costs of solar technologies. I'd like to highlight a few of the R&D efforts currently underway at the Department:

> Innovations arising from Department -funded R&D in the areas of thin-film solar cells, high-efficiency single-crystal solar cells, and very high efficiency gallium arsenide solar cells have since been commercialized by companies such as First Solar in Ohio, Sunpower in California, and Boeing/Spectrolab, also in California. In August 2009, the Department announced over $37 million[11] of awards for early-stage company investments—including those made through the Small Business Innovative Research program—and $14 million in investment through the national laboratories. This includes $5 million invested in CSP technologies. We are currently working on the next generation of solar technologies including kerfless wafering and atmospheric thin film processing, which can lead to broader market impact, lower manufacturing cost, and increased conversion efficiency.
>
> The Department is also investing in balance-of-systems (BOS) technologies, the most significant cost barrier for PV. BOS technologies are necessary to support full solar electricity generation systems, but are separate from, for example, the actual PV panel. BOS costs include items like inverters that allow connection with the electric grid; they can account for as much as half the total installed cost of a solar electricity generation system, and so create substantial barriers to lowering the cost of solar energy. As an example of the Department's commitment in this area, the Department recently announced awards for up to $11.8 million to five companies to develop new inverter technologies under our Solar Energy Grid Integration Systems program. Overall, we invested approxi-

[10] http://arpa-e.energy.gov/news.html
[11] http://www.energy.gov/news2009/7824.htm

mately $122 million in this area in 2009, including $16 million in CSP technologies. Some of these funds are going toward development of inverters with advanced nano-material transformers that provide lighter weight, longer life, and lower cost as well as advanced residential control systems that can effectively managed PV panels along with other household renewable and conventional power systems to maximize time-of-day energy use.

The Department is increasing its investment in large-scale demonstrations of integrated photovoltaics and CSP systems. As part of funding received through the Recovery Act, the Department recently announced $37.5 million in high-penetration solar deployment projects. Carried out by universities, and utilities, with national laboratory partners to assess the technologies, these projects seek to assess the impacts of high levels of solarenergy penetration on the electric grid. Investigations will include both voltage and frequency behavior of the distribution and transmission feeder portions of the grid in the presence of clear and intermittent solar conditions. This information is important to defining a path for 10% or greater penetration levels of solar in the grid and also in defining the requirements for grid energy storage use.

H.R. 3585, the Solar Technology Roadmap Act, as currently drafted, significantly alters the form and function of the Department's solar energy RD&D. We would like to draw the Committee's attention to concerns we have with the consequences of this alteration. First, the bill in effect changes the governance of the Department's Solar Program. Second, it changes the emphasis of the Program from cost effectiveness of technology to instead following a prescribed mix of solar demonstration projects.

H.R. 3585 provides the Department an authorization level of $350 million in FY 2011, rising in $50 million increments to $550 million in FY 2015. The aggregate authorization would total $2.25 billion over four years, far exceeding any previous authorization levels.

We note, however, that H.R. 3585 would supplant previous authorities except for two provisions of the Energy Independence and Security Act of 2007 (EISA). It would become the de facto authorizing language for the Department's solar activities.

Our first and greatest concern is that Sections 103 and 108 of the bill require the Department to form a semi-autonomous Committee that will largely govern the solarenergy activities at the Department. The proposed committee would be charged with producing a comprehensive analysis of recommendations for investing Federal RD&D dollars over near-, mid-, and long-term horizons based on current issues and barriers facing the industry. As written, the proposed legislation binds the Department's R&D efforts to the recommendations of the Roadmap Committee, requiring the Department to follow the Committee's recommendations for 75 percent of all appropriations by 2015. We urge the Congress instead to stipulate that the Committee would provide the kinds of non-binding advice and recommendations traditionally provided by publicly-chartered Federal advisory committees.

Our second concern is that Section 105 specifies a solar-technology demonstration plan that may not embody the most appropriate scale of projects encompassing the most effective mix of technologies, as might be determined by the Secretary.

As written, the proposed legislation prescribes a particular schedule of future solar demonstration projects, specified both with regard to project scale and with regard to technology mix. These particular project sizes and technology mixes may not provide the largest benefit to the Nation under future conditions which we are not likely to be able to foresee with any clarity.

While the Department welcomes the support that the proposed legislation would provide to solar research and development, the Department is concerned that the legislation as written may not maximize public benefits.

The existing Solar Program actively solicits and receives input from stakeholders in industry, the national laboratories, and academia, through its use of peer-review as well as from other formal and informal discussions over many years. For example, as part of an effort to develop a PV Manufacturing Initiative, the Solar Program worked this fall with the National Academies of Science to hold two day-long workshops with industry and other participants to discuss the needs of the industry and the role of the Federal Government to promote the domestic industry and industry standards.

The Solar Program is also now working with industry representatives and others to develop a Solar Vision Study which will look at opportunities to achieve 10-20 percent of the Nation's electricity generation from solar technologies by 2030. We intend to strengthen our external review process in the near future with an advisory board—which can be viewed as somewhat analogous to the Roadmap Committee en-

visioned in the draft bill—that will meet several times a year to review the entire solar program.

While we welcome additional industry input and funding for demonstration projects the Department is particularly concerned about this bill's practical effects, which are to constrain the flexibility the Department has to respond to diverse sources of information and exploit new breakthroughs in technology development, such as those made through investment in ARPA-E grants and the HUBs.

Recommendations

The Department strongly urges the Committee to consider the above concerns when reviewing the proposed legislation. Providing the most effective solar technology research and development programs requires the Secretary and The Department to make a series of constantly evolving judgments. It is important that we be allowed to call on multiple sources of information when we formulate our solar technology R&D priorities, and that we be responsive to provided information, even information that will only become available as R&D programs and national markets progress.

S. 737—BIOFUELS RD&D FOR NONROAD ENGINES

Background

Through RD&D efforts geared toward the development of integrated biorefineries, the Biomass Program is helping transform the Nation's renewable and abundant biomass resources into cost competitive, high performance biofuels, bioproducts, and biopower. To that end, the Biomass Program's R&D efforts support the goal of the EISA's Renewable Fuel Standard that requires 36 billion gallons of renewable fuel by 2022.

DOE is currently evaluating the impact of engine durability and emissions for use of higher ethanol blends in vehicles and small nonroad engines. The Department has completed emissions' lifetime testing of hand-held lawn and garden equipment, including line trimmers, leaf blowers, and generators. These results are reported in *Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Nonroad Engines, Report 1—Updated*[12], which is available online.

Over the past two years and pursuant to this small nonroad engine effort, the Department has coordinated with the engine industry to identify key issues, testing needs, and additional participants. Spearheaded by the small non-road industry's Engine Manufacturers Association and the automotive and oil industries' Coordinating Research Council, this effort will result shortly in a compilation of industry input and opinions.

S. 737 clarifies to the "Biofuels Distribution and Advanced Biofuels Infrastructure" Program authorization in EISA Section 248. The proposed legislation amends both the scope of the program in Section 248(a) to include the impact of biofuels on small engines, as well as requiring that impact on small engines be a focus area in Section 248(b). As enacted, the current program's authorization language does not preclude the Department from undertaking these activities, and the legislation's section 248(b)(9) provides an additional "catch-all" provision that the Secretary could use to implement such a program.

By supporting the investigation of problems associated with the use of biofuels in small nonroad efforts, S. 737 is in line with research needs already identified by the Department concerning use of higher renewable fuel blends necessary to meet Renewable Fuel Standard requirements. The Department is already working on research in this area, under its existing authorizations in both its Biomass and Vehicle Technologies Programs. In particular, the Department is funding testing of chainsaws, motorcycles, snowmobiles, and marine engines. Thus, S.737 may be useful only to the extent that it underscores Congress' explicit support for this effort.

It is also worth noting that EISA's original Section 248, which S. 737 amends, did not prescribe any authorization levels for the program, and specific authorizations to carry out this section have not been provided.

Recommendations

The Department understands the need to investigate potential issues with the utilization of higher-biofuel blends in small nonroad engines and already funds a number of research projects on nonroad engines. As a result, the Department does not see a need for this amendment.

[12] The report is available online at http://www.nrel.gov/docs/fy09osti/43543.pdf)

S. 1617—INVESTMENTS FOR MANUFACTURING PROCESS AND CLEAN TECHNOLOGY ACT OF 2009

Background

The Department appreciates the committee's support to improve energy efficiency across the manufacturing sector. I am pleased to note that the Department is already working to carry out many of the bill's goals.

Through a variety of programs, the Department provides assistance to energy infrastructure investment to businesses of all sizes. The Loan Guarantee Program (LGPO), Energy Efficiency and Conservation Block Grants (EECBG), and Small Business Innovation Research (SBIR) Program all act as funding mechanisms to address the Nation's energy infrastructure and generation needs.

Structurally, the Office of Energy Efficiency's (EE) Block Grant program most closely resembles S. 1617's proposal to create revolving loan funds to the states. A portion of the EE block grant structure is specifically targeted towards the creation of revolving loan funds and may be reinforced by recent House legislation.[13] Through the Recovery Act, $37 million[14] was announced to support SBIR with an emphasis on near-term commercialization and job creation. And although current Loan Guarantee solicitations do not have special provisions to promote the award of loans to small businesses, LGPO is in the process of developing a Manufacturing Solicitation that would be open to Small and Medium Enterprises (SMEs) under our Financial Institutional Partnership Program (FIPP). Through the current solicitation, LGPO will continue to finance construction of manufacturing plants, as it did with its first loan guarantee award to Solyndra, Inc. of Fremont, CA, a SME.

Concerning Sec 137 (bb)(2), the Department, in consultation with the Department of Commerce, should make the determination of what is and is not an energy efficient product. Such a structure would be consistent with the longstanding positive working relationship between the two agencies on programs such as the EnergyStar rating system. We recommend changing the authority from the Secretary of Commerce to the Secretary of Energy, in consultation with the Secretary of Commerce.

Recommendations

The Department has a track record of collaboration with other federal and State programs, including a Memorandum of Understanding between DOE's EERE and the Department of Commerce's Manufacturing Extension Partnership Program. The Department stands ready to work with this Committee and DOC to consider how the bill can be improved to draw upon the Department's deep domain knowledge and build off of the Department's existing programs.

S. 2744—CARBON DIOXIDE CAPTURE TECHNOLOGY ACT OF 2009

Background

EPAct 2005 authorized the Department to implement several prize competitions for breakthroughs in RD&D and commercial applications of energy technologies. Specifically, EPAct 2005 authorized the Freedom Prize to reduce the country's dependence on foreign oil by rewarding innovative deployment of existing technologies in industry, the military, schools, governmental entities, and communities. EISA amended EPAct 2005 to include additional prize competitions, including the Hydrogen Prize (H-Prize) and the Bright Tomorrow Lighting Prize (L-Prize). The HPrize sought to provide incentives and reward advances in technologies, components, or systems related to hydrogen production, storage, distribution, and utilization, while the LPrize seeks to spur the development of ultra-efficient solid-state lighting products. The proposed legislation would authorize another DOE competition in another area of research—carbon capture.

S. 2744 would authorize the Department to create a new carbon dioxide capture technology prize, a "C-Prize," to foster novel technologies that separate carbon dioxide from dilute sources.

The Department and the Administration consider carbon capture to be an essential tool in the mitigation of GHG emissions. A cost-effective technology that could significantly contribute to the mitigation of atmospheric carbon emissions would be consistent with the goals and objectives of the Administration.

While the bill provides authorization to establish a C-Prize, it sets no parameters for award amounts, which would of course be subject to appropriations.

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[13] H.R. 2936: Bill to Underwrite Increased Lending to Domestic (BUILD) Manufacturing Act http://www.govtrack.us/congress/billtext.xpd?bill=h111-2936.

[14] http://www.energy.gov/news2009/7824.htm.

The Board authorized in the bill may qualify as a Federal Advisory Committee, which would be subject to Federal Advisory Committee Act (FACA) requirements.

Under Section 7, the bill states that the "applicant will agree to vest the intellectual property of the application derived from the technology in 1 or more entities that are incorporated in the U.S.". The S. 2744's Intellectual Property language is a significant departure from previous prize legislation. The Department is concerned that the language will deter qualified applicants from entering the competition. The bill additionally requires C-Prize recipient(s) to vest patents in an entity or entities incorporated in the U.S., and it prohibits the transfer of title to other than U.S. incorporated entities until expiration of the first patent issued. However, the bill does little to protect U.S. technology investment because (1) any foreign company can incorporate a subsidiary in the U.S. for a nominal fee; and (2) the language does not prevent the U.S. corporation from licensing its patents to foreign companies or prevent the U.S. corporation from manufacturing outside the U.S. Furthermore, the vesting language, without clarification, may discourage existing U.S. companies from competing, for fear that their investment may be diluted by forced licensing and transfer or assignment of patent rights.

Recommendations

The Department urges the Committee to consider these concerns when reviewing the proposed legislation. The recommendations of the Committee established in the legislation should not be prescriptive, but rather should serve as one of several sources of information the Department can call upon when formulating its carbon capture technology R&D prize.

Madam Chairman, this concludes my testimony. Again, I thank you for the opportunity to testify before this Committee, and I would be pleased to respond to your questions.

Senator CANTWELL. Thank you very much for your testimony.

Senator Barrasso, did you want to make a statement now?

Senator BARRASSO. I would, but I was going to then enter into questioning as well. So I'd be happy to——

Senator CANTWELL. We'll start with the questions then.

Under Secretary, on this curriculum development on 9957, how is it, you know, your energize program which is about developing curriculum. How do you explain the differences between this bill and that program? I know that we've also had some Department of Labor money that's gone out for like the wired grants and things of that nature for curriculum development.

Ms. JOHNSON. Right. This particular bill calls for the Department of Energy to provide funding to the National Science Foundation for an IDGERT Grant, Inter Disciplinary Graduate Education Research and Training Grant. I actually, when I was a professor at the University of Colorado, had one of these grants.

They're quite good. They're cross disciplinary in a particular subject. But they can be a broad subject across the entire science and technology field.

RE-ENERGYSE which is REgaining our ENERGY Science and Engineering Edge program was inspired by President Obama's State address to the National Academies in April. It really is focused on energy technologies K through 20 plus. So it's looking at outreach for K through 12 to use energy to stimulate our young people to go into science, engineering, technology and math subjects.

It provides scholarship programs for students to attend higher education in both community college as well as 4 year research universities. Internship programs for students. It provides opportunity then for students to go on to graduate work, post docs, on to become re-trained in energy, so that we ultimately are trying to at-

tract our best and brightest to go into the energy fields and help us continue the momentum in building clean energy technology.

So I would say the difference is in the one case we're looking at RE-ENERGYSE to look at all the energy portfolio. This particular bill focuses on just connecting building engineers and architects together to work together on one, I would say, more narrow field. So we support a broad education bill that would help us to really impact the entire energy portfolio.

Senator CANTWELL. Who do think should be responsible for the more near term issues of curriculum and development?

Ms. JOHNSON. Who in terms of?

[Laughter.]

Senator CANTWELL. I'm sorry. Agencies.

Ms. JOHNSON. Agencies?

Senator CANTWELL. Department of Energy? Because this is the new partnering with National Science Foundation.

Ms. JOHNSON. Right.

Senator CANTWELL. I don't know if you've ever done something like that before.

Ms. JOHNSON. Yes. Right.

Senator CANTWELL. Usually joint partnerships don't always, from an oversight perspective, kind of, can get lost in the focus. But I'm just—if you're looking at this from a broad perspective, we see a lot of activity now where we have emerging technologies and emerging industries. So——

Ms. JOHNSON. Right.

Senator CANTWELL. If we want to help accelerate that, then you can provide a lot of help for the curriculum development that needs to take place today. Most of these companies are so new and so young. They don't have time to do the curriculum development.

They're just doing the hiring. But they can't find the work force because we haven't done the curriculum training.

Ms. JOHNSON. Right.

Senator CANTWELL. So I was just curious as to how you saw that activity fitting into, if that's a DOE portfolio issue or do you think that belongs at Department of Labor? Somewhere else?

Ms. JOHNSON. Thank you for your patience, Senator, and amplifying upon that question. So there are several areas where Department of Energy is already working with the National Science Foundation. We have what's called the SULI Program which is Summer Undergraduate Laboratory Internships which is also an area in reenergize.

RE-ENERGYSE is a joint program with the National Science Foundation and the Department of Energy. So we use the laboratories, the 17 laboratories in Department of Energy, as a place where students the National Science Foundation has reached out to and helped identify can go for a summer internship program.

We also have the FAST Program, which are Faculty and Student Teams, that is joint with the National Science Foundation.

Then the National Science Foundation and our Office of Electricity Delivery and Transmission work together on an I/UCRC Program which is an industry university center in power systems engineering.

We have a history of programs that have worked well. I do see that there's a natural way to partner between NSF which developed a beautiful program, a beautiful set of programs in the education realm and funds curriculum with the deep domain knowledge that Department of Energy brings to the table. So I think that this is a natural area for us to collaborate across the entire energy spectrum.

I think that in terms of curriculum development, I think that that's something, that as you pointed out quite rightly, companies don't have time to do. But universities working in isolation probably won't develop the kind of programs that industry needs. So again, it needs to be a partnership.

I think that this is where industry and these two government agencies can come together to create some very powerful programs. So we're supportive of the legislation just we'd like to see it broadened a bit.

Senator CANTWELL. Thank you. On S. 2729, on the energy parks, I don't see the environmental research park at Hanford listed in there. If this were to become law would the Department support including one at Hanford?

Ms. JOHNSON. If this were to become law we would see that in the future that it would be possible to examine Hanford in becoming part of it. I think right now we still have a bit of clean up to do to get it ready to be transitioned into this kind of facility which traditionally has supported ecology work and environmental work with USGS and Department of Ag and Department of Defense as well as the Department of Energy. So I think further down the road when it's ready and fully cleaned up to transition I would——

Senator CANTWELL. You don't think there's enough land there that it's able to transitioned now?

[Laughter.]

Ms. JOHNSON. There certainly is a lot of land as I noticed on my visit. I'm just not sure how much of that land would be ready and fully cleaned up and be able to be qualified to be——

Senator CANTWELL. I think the things that we're talking about now are, you know, very far from the cleanup sites and quite massive. So anyway, we'll get back to you on that issue.

Ms. JOHNSON. Ok, thank you.

Senator CANTWELL. Senator Stabenow, did you have?

Senator STABENOW. Yes, I did. Thank you very much.

Senator CANTWELL. We're going in order of attendance.

Senator STABENOW. Thank you. I do have to leave in a moment to go to the floor. So I appreciate this very much.

Specifically, according to the National Academy of Sciences and DOE, the amount of fuel consumed annually by heavy duty trucks and buses has more than doubled over the past 35 years.

Ms. JOHNSON. Right.

Senator STABENOW. It now counts for 21 percent of the total surface transportation fuel that's used in the United States. However, it's very questionable that we have had a proportional level investment in advancing medium and heavy duty technologies. That's really the reason that I've introduced this bill and my colleague in the House of Representatives.

It's a comprehensive vehicle R and D bill considering the full spectrum of transportation needs. You've made heroic efforts through the DOE on section 136 which I was pleased to author in the Energy Act a few years ago and battery grants. But we have a long way to go as it relates to focusing on new technologies for medium and heavy duty sectors.

So my question is this. To what extent is the DOE working to transfer new innovations in passenger vehicle R and D that contribute to the reduction in oil use such as plug in hybrid, electric vehicle technology into the medium and heavy duty sector?

Second given the fact that given the decline in heavy truck funding from 86.6 million in the 2002 Federal budget to the requested amount of 25.2 million for this year, 2009, within what framework does the Department expect advancements in the medium/heavy duty sector to come on par with passenger vehicles? Wondering if your efforts have been constrained by fluctuations in appropriations? I'm assuming that's a yes.

[Laughter.]

Senator STABENOW. Would you see the advanced vehicle technology bill helping you be able to bring that more on par?

Ms. JOHNSON. Right. First of all let me say we really appreciate the support that Congress has shown and continue to show for the advanced vehicles. This work has greatly contributed to both the light duty as well as the heavy duty fleet.

One of the exciting things that I've been able to participate in is reviewing the heavy duty and being—not reviewing, but at least being able to observe the American Recovery and Reinvestment Act funding of about $230 million and $80 million has been for Super Truck. I think they'll be some exciting things that will be coming out of that particular program.

I think that although our funding hasn't been at the same level in the heavy truck as the light duty truck area, there are things that we investigate in both areas that are helpful and overlap, light weighting, fuel efficiency. We look forward to working with you on your bill in order to see more of the research go further in demonstration and deployment opportunities in this area.

Senator STABENOW. I look forward to working with you as well. I do think given how much we're talking about in terms of the volume of transportation fuel and where it's used in the economy that we really need to make this a priority going forward. So I look forward to working with you.

Thank you.

Ms. JOHNSON. Thank you, Senator.

Senator CANTWELL. Thank you.

Senator Barrasso.

Senator BARRASSO. Thank you very much, Madame Chairman. Welcome, Dr. Johnson. It's great to see you again.

I also want to thank the chairman of the full committee, Senator Bingaman, who has been partnering with me on the introduction on the piece of legislation that you'd referred to, the Carbon Dioxide Capture Technology Act of 2009.

Ms. JOHNSON. Right.

Senator BARRASSO. This is a bill that he and I have jointly introduced in the last month. I had introduced a similar bill in the last

session of Congress. But working with Senator Bingaman in his leadership and knowledge, I think we have a much improved bill. I'm very grateful to have him as a co-sponsor of this.

You know, some in this body and when you and I talked before your confirmation, some in this body have discussed various proposals to regulate the output of carbon dioxide through a cap and trade approach. Others have advocated a carbon tax. Those are two ends of the same problem in addressing greenhouse gas emissions.

But overlooked is the excess carbon dioxide already in the atmosphere. This is the carbon dioxide that we're concerned about and that the bill specifically addressed. The best science tells us that excess carbon dioxide in the atmosphere is a contributing factor in the issue of global climate change and to what extent there is considerable debate.

It would seem to me a worthy approach to find a way to remove excess existing carbon dioxide from the atmosphere and then permanently sequester it. That's the other end of the problem. Some people refer to it as air capture.

I've a letter from Klaus Leisinger, who is the Ewing-Worzel professor of Geophysics at Columbia University, the Chair of the Department of Earth and Environmental Engineering, calls it dilute capture of carbon dioxide. Professor Leisinger believes this is a particular long term importance in terms of this global issue. So to accomplish this we're certainly going to need to invest the money to develop the technology. How do we best do that?

So the approach that Senator Bingaman and I have in this piece of legislation takes this through a series of financial prizes where we, through your Department, set technological goals and outcomes. Then the first to meet these, the criteria, would receive Federal funds and also international acclaim. I think that prizes are a unique tool in creating technological development.

The government already offers prizes. Department of Energy's prize, the L Prize, there's also NASA's Centennial Challenge Program. The economist recently reported on NASA's competition to create a new lunar lander for future moon exploration. The article says that NASA's system of prizes and then I'll quote, "spurs technological development using the twin lures," it says, "of hard cash and the kudos of being officially recognized as cleverer than your peers."

[Laughter.]

Senator BARRASSO. Scientists love to be recognized that way. I think that's kind of more than the money, is the recognition. So I think that the prizes are/can be a unique tool for fostering technological advances.

So Madame Chairman, what I'd like to do, if I could is submit as a part of the record this letter* from the Professor from Columbia University talking about dilute capture of carbon, who goes on to say that this can be done anywhere at any time. It's particularly well suited to start small in niche markets and would be very good for prize forum.

Senator CANTWELL. Without objection.

Senator BARRASSO. Thank you very much, Madame Chairman.

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* See Appendix II.

So what I heard, Dr. Johnson, from you is that you support this effort but had some legitimate concerns. We are looking, Senator Bingaman and I, are looking at improving this bill because we want to see this succeed.

Ms. JOHNSON. Right.

Senator BARRASSO. We want this technology developed. I think you said you had some concerns about intellectual property issues?

Ms. JOHNSON. Right.

Senator BARRASSO. In your written testimony some issues about the latitude that the Department might need. I just wonder if you had some thoughts on that. If you'd be willing, you and your Department, to work with Senator Bingaman and with me in finding ways to improve the bill and then getting this passed and getting those scientists motivated.

Ms. JOHNSON. Right. Certainly we would love to work with you and Senator Bingaman too, on this bill. We think that greenhouse gas emissions are a big problem facing the planet. All the tools that we can employ in order to move forward on this problem are welcome.

The only, I would say, issue with regard to intellectual property is that the individuals that would be eligible for the prize from my reading of the bill would be companies that were incorporated in the U.S. or would vest those patents in the U.S. The only concern we have is perhaps that would deter some applicants from applying and helping solve the problem. That was all the concerns.

So sure we absolutely look forward to working with you, Senator, on this bill.

Senator BARRASSO. Good. As you know we really didn't even set dollar figures on the prize because we felt that——

Ms. JOHNSON. Right.

Senator BARRASSO [continuing]. Would be best done by a committee that came together through the Department under the leadership there to say what kind of motivating factors do we need?

Ms. JOHNSON. That would be great. Look forward to it.

Senator BARRASSO. Thank you. Thank you, Dr. Johnson.

Ms. JOHNSON. Thank you.

Senator BARRASSO. Thank you very much, Madame Chairman.

Senator CANTWELL. Thank you, Senator Barrasso.

Under Secretary Johnson, I'd like to go back to a couple of these bills just to get your input on further discussion.

Ms. JOHNSON. Sure.

Senator CANTWELL. One is S. 2773, the Offshore Wind Energy Research Development and Demonstration. Obviously a lot of the things on the docket today are in the research realm.

Ms. JOHNSON. Right.

Senator CANTWELL. Continuing on renewables. It's my understanding that there is an agreement between FERC and the Mineral Management Service on who administers the citing of offshore facilities. So is the Department working with those agencies as you look at demonstration projects for offshore?

Ms. JOHNSON. Right. First of all, again, we look forward to working with the committee in this very important area. It turns out that the potential of our offshore wind are thousands of gigawatts

which is very significant compared to the overall electrical usage in this country.

So it's a tremendous resource. We look forward to working with the committee on both these bills. They both look at robust R and D in the area.

S. 2773 is a bill that addresses the deep offshore wind opportunity. We feel it would be duplicative with work that we're already funding through the American Recovery and Reinvestment Act, $8 million for a deep offshore wind center. So we look forward to working with the committee to incorporate more inclusive language that wouldn't restrict it just to certain areas, but able to attack our entire wind resource, which as I said before, is extensive and would include the Great Lakes, for example.

Also to include shallow and transitional waters and focus on not only the cost of the turbine, which is about a third of the cost of these wind farms, but also focus on the reliability. How do we get the energy from, you know, deep offshore or shallow shore, onshore, project maintenance and installation and staging?

So we are quite interested to work with the committee on these bills.

Senator CANTWELL. What about the engineering center in general? Do you support that concept?

Ms. JOHNSON. We are supporting, as you know, the engineering centers through our hubs, our energy innovation hubs. We are supportive of centers, definitely, as a way to bring together industry, university partners and researchers in the labs in order to solve these very difficult problems. So we are supportive of engineering centers.

Senator CANTWELL. On S. 737 on the biofuels for small engines.

Ms. JOHNSON. Right.

Senator CANTWELL. What are you—do you think that adding these additional items will help us? I know the Department is doing a lot of research on various engine types which we support.

Ms. JOHNSON. Right.

Senator CANTWELL. We're very proud that we've had a lot of both Maritime applications in the Pacific Northwest.

Ms. JOHNSON. Yes.

Senator CANTWELL. Research done on biofuels used in our very fleet that has more people traveling on it annually than Amtrak. We've had demonstration projects on Boeing planes as well in biofuels. So we want to keep seeing the research and development take place.

Do you think that this adding small, non-road engines will help or?

Ms. JOHNSON. Right. First of all I would like to say thank you very much to the committee and to Congress for supporting $800 million in biomass for biofuels applications, for example in the American Recovery and Reinvestment Act. We announced last Friday the integrated bio-refineries, part of that which was nearly $500 million. So thank you so much for that opportunity to work in this arena.

Currently we are funding research that covers non-road engines including snowmobiles, motorcycles, chain saws. We know that there has to be more work done on hand held devices, 2 stroke en-

gines that right now are not very comfortable with ethanol. So we have more work to do.

We have no concerns with the bill. It would be certainly within the portfolio of R and D that we're currently carrying out.

Senator CANTWELL. I know my colleagues, Senators Collins and Udall, that is a very big concern of theirs, particularly the seizing that can occur and the injury to individuals with these chain saws. So we certainly hope that we can look at those applications and get support for that kind of analysis and help.

On the Solar Technology Roadmap, you mentioned you were more interested in some non-binding targets on that.

Ms. JOHNSON. Right.

Senator CANTWELL. Could you?

Ms. JOHNSON. Right.

Senator CANTWELL. Could you discuss how you think that?

Ms. JOHNSON. Sure.

Senator CANTWELL. Obviously we could proceed in achieving some of the goals. If you didn't have the targeted—if you didn't have the targets be binding?

Ms. JOHNSON. Yes, absolutely. The bill as written covers a lot of the areas that we feel are quite important to the whole solar technologies program. We're quite excited about the level of funding and the opportunity to work on trying to realize bringing 10 percent or more of our generation from solar by 2030.

It is just the part where 75 percent of the funding would be under the guidance and direction of a semiautonomous, non-government group that would have binding authority. We believe that the Secretary and his staff are in a great position and should have the authority to manage the solar energy portfolio. So we'd definitely like to work with the committee on the language on this particular bill.

We're excited about what it covers. It's just that particular binding requirement. If it was non-binding and more of an advisory in guidance that we do quite a lot with our FACA committees, that would be our preference.

Senator CANTWELL. What about the model that is used for semiconductor industry? Is that appropriate as outlined in the bill?

Ms. JOHNSON. It calls for a solar energy road map. We're currently working on one called the Solar Powered Visions. It is involving industry as well as our DOE laboratories.

So we believe it is a good idea to have a road map. Know where you're going and what needs to come next. We look forward to continuing our work with your support in this endeavor.

Senator CANTWELL. Ok. I see my colleague from Oregon is here. Senator Wyden, did you have questions for the Under Secretary?

Senator WYDEN. I do, Madame Chair. Thank you for all the good work you're doing. You are our champ on this whole cause. It is great to have a chance to do some work with you on it.

Madame Secretary, let me give you my sense about where we are on this. I believe that America is missing the boat on the energy storage issue. I mean, if you look around the country, this Nation is building gas plants, for example, because we aren't fully capturing the potential for storing renewable energy sources.

Ms. JOHNSON. Right.

Senator WYDEN. That makes no sense even by the bizarre ways of the beltway. It's got to be changed. Do you disagree with that point I've just made?

[Laughter.]

Ms. JOHNSON. I agree that storage is crucial if we're going to bring on the amount of clean energy renewables, particularly wind and solar. So the Department of Energy has a study that we've produced which is 20 percent wind by 2030. We've also looking at our solar energy road map we're just trying to get to 10 to 20 percent by 2030.

So we know that level of intermittency which could be 40 percent of our electrical generation cannot be brought onto the grid in its current function. That's why we're very pleased and grateful for the funding through the American Recovery and Reinvestment Act which allows us to do the smart grid investment grants to try and look at storage and to carry out demonstrations where we can provide storage as well as a more upgraded grid.

Senator WYDEN. But on the basic point, I want to make sure because we're going to have a couple of hearings in here.

Ms. JOHNSON. Right.

Senator WYDEN. This is a question of kind of delivering a wakeup call.

Ms. JOHNSON. Right.

Senator WYDEN. Isn't it fair to say that this country is missing the boat on energy storage. Literally I'm looking at press releases from California where they're talking about, you know, various kinds of,you know, gas generating projects.

Ms. JOHNSON. Right. Yes.

Senator WYDEN. That they're having to put in place because there has not been the capacity to store it. Isn't that correct?

Ms. JOHNSON. Yes. Senator Wyden, you're correct in that. In order for us to bring on the intermittent renewable energy we need base load energy. Right now that's mainly gas.

Now we can look at battery storage. We can look at pumped water storage. We can look at compressed air storage.

But in order to bring on this level of intermittency we will have to have a way to manage that load. Storage is one of the ways that we are investigating through our various programs.

Senator WYDEN. Let's look at the two areas that come to mind. This afternoon Senator Stabenow has a very fine bill that I'm a cosponsor of, obviously dealing with advanced, you know, vehicle batteries. There's been very significant potential in terms of hybrid vehicle technology.

Ms. JOHNSON. Right.

Senator WYDEN. A company in Oregon, for example, is even producing a plug in motorcycle.

[Laughter.]

Senator WYDEN. That can go over 40 miles on a battery charge without using any gasoline. Now I have sent a letter recently to Secretary Chu urging that he expand the Department's program to include vehicles like these motorcycle efforts. We've got a company in Oregon, Brammo, that has been involved in this.

What role do you see for energy storage for vehicles, especially for vehicles other than automobiles?

Ms. JOHNSON. One of the programs that we're funding through the American Recovery and Reinvestment Act in the smart grid investment grants is looking at small fleets that are electric vehicles and plug in hybrid electric vehicles where you store them, charge them up at night and then run them during the day as a fleet from a corporate entity, then come back and recharge them. From this investigation, probably the most important thing that we'll get out of this is the data about how we control and utilize the demand of—the interaction I should say, an integrated system of the storage in batteries of a fleet of say, up to 1,000 vehicles, then how that would play with the less demand at night from the generation and storage.

I think that what we will learn is how do we actually manage these kinds of integrated systems. We'll learn more than about what kind of storage we need in order to scale that in the different interconnection regions in the country.

Senator WYDEN. Now as far as I can tell, the staff says much of the rest of the world gets around on small two and three wheel vehicles. I'm trying to get a sense from you. Is the DOE working at all on plug in systems for vehicles like motorcycles?

Ms. JOHNSON. I'm not sure. But I'd be glad to get back to you for the record.

[The information follows:]

The Department is working on the development of advanced battery technology, primarily for automotive application in hybrid and electric drive vehicles. However, the same technology is very applicable to other types of electric drive vehicles, including electric motorcycles, motorbikes, and scooters. More specifically, the Department participates in an international collaboration on battery-powered electric two-wheelers, under the auspices of the International Energy Agency (IEA Hybrid and Electric Vehicle Implementing Agreement, Annex XI, Electric Cycles). Research is directed at battery application requirements for various market segments and public charging infrastructure needs for battery powered two-wheelers.

Senator WYDEN. Because that's what I'm talking about when I say and you're going to hear me say this a lot.

Ms. JOHNSON. Right.

Senator WYDEN. As it relates to these upcoming hearings. I think we are lagging significantly in this energy storage area.

Ms. JOHNSON. Right.

Senator WYDEN. I think when you're looking at what's going on around the world both in terms of, you know, products and research we just got to get serious about this and quickly. Let me ask you then about the other storage question that I care a great deal about and that's grid connected storage to support renewables. Here utility storage systems can help generate the same kind of fossil energy savings by storing the renewables intermittently.

I've got a bipartisan piece of legislation which has now been introduced on both sides. It's technology neutral. It creates investment tax credits to use energy storage technologies that are directly connected to the grid and also incentives for businesses and homeowners can install their own energy storage units.

Now, the committee is also going to be holding a hearing on grid connected systems on Thursday. But you won't be able to, you know, be here for that. So my question to you on this is I wrote the Department last summer suggesting that the agency look more

at how storage systems could complement the deployment of renewable technologies.

We didn't get a response to that letter either. My question here is what role do you see for energy storage systems to support renewable energy development and what can you tell us you're going to initiate in this area?

Ms. JOHNSON. If I could go back to your question before just for a minute in terms of the motorcycles and, you know, hybrid plug ins and 2 wheel. I would say that nothing that we're supporting would preclude obviously using those particular vehicles. I think that one of the things that we've realized from some of our studies is that well, first of all we know that of the 19.5 million barrels of oil that we consume a day that 70 percent of that is going into transportation.

We know that 57 percent of that is imported. So we appreciate this is a crucial problem, not only for greenhouse gas emissions, but also for our energy security. So one of the things that we're quite excited about and working in the Department on, is improving the efficiency of our internal combustion engine. The same time building their capability and compatibility with biofuels. At the same time providing this in a plug in hybrid electric vehicle whether that's a two wheel or three wheel or four wheel.

So that involves bringing an integrated system together that understands storage, understands biofuels and makes our internal combustion engine run as efficiently as possible. So our studies have shown that a plug in hybrid electric vehicle of any kind that would have a 40 mile electric range working with an E85 cellulosic ethanol, for example, would reduce our consumption by 85 percent. So some of the things that we're currently doing that are speaking to that and getting out into commercialization is that we're looking at light weighting.

So for about every 10 percent you save in light weighting a vehicle, which of course a two wheeler is pretty light weight to begin with, you can save up to six to 8 percent in terms of fuel efficiency. That takes you to about 30 percent of the light weighting. So we're heavily involved in light weighting.

We've also been heavily involved in some of our battery technology, in particular the U.S. hybrid vehicles in this country, their nickel metal hydride battery was developed in technology from DOE. So we've been heavily involved in hybrid battery development and storage, been heavily involved in light weighting, heavily involved in biofuels. So our approach has really been a systems integration approach.

Now the next step is to integrate it onto the grid. Then to look at how the storage interplays with the grid and how you dispatch and flow the electrons to where they are needed and at times during the day where the load is lighter. So I can say that, if anything to take away, would be we're looking at it as an integrated approach. We're definitely looking at storage and this is actually a very interesting question that you raise because distributed energy and distributed energy storage verses very centralized energy production and storage.

So where does it make sense to have pumped hydro as a dam somewhere that has the capability of storing quite a lot of power?

Then where does it make sense to have a more distributed system which you might have with the fleet of 1,000 vehicles that have a smaller battery? This is actually a problem that we're investigating right now. It's not clear where or how you parse that distribution.

So appreciate your insight on that. We'll look forward to coming back and chatting with you about this as we learn more from these experiments that have been funding through the Recovery Act.

Senator WYDEN. The reason that I'm asking these questions is when you, as somebody who is very knowledgeable and I'm glad you have the position you do. You tell me that there's nothing that precludes using these two and three wheel vehicles. I'm saying to myself, as a United States Senator, we've got these companies, you know, making them.

I'm looking around the world and seeing these two and three wheeled vehicles out there. I'm saying I want a different answer than my government saying we won't preclude it. I want to hear my government say, this is what we're doing to go gangbusters into a very exciting kind of field. Let's go to the question of the grid connected systems. So I just have you on the record on that.

So we've got a piece of legislation, 1091, bipartisan, both House and Senate, to create these incentive tax credits for energy storage. That it's directly connected to the grid. It's also incentives for business and homeowners to install their own storage units.

I'm asking you, of course, because we're not going to be able to have you on Thursday. This, of course, is the Energy Committee. I'll be working with Senator Cantwell because we also serve on the Finance Committee.

What's your general assessment of the value of that kind of legislation?

Ms. JOHNSON. I'm not familiar with that particular bill right now. So I'd be glad to provide, for the record, an answer to that.

[The information follows:]

Enhancing our national energy storage capability is an important tool to improve electric grid reliability and resiliency. Storage technologies can reduce power fluctuations, enhance system flexibility, and enable greater integration of variable generation renewable energy resources such as wind and solar power. The core function of energy storage is to bridge the gap that exists between the characteristics of the generation andoad technologies within our electrical system. While this includes integration of variable generation renewable energy technologies such as wind and solar, there exist today gaps and mismatches throughout the grid that stress our infrastructure and would benefit from the system flexibility that could be introduced via the deployment of energy storage technologies.

While there are technological and other barriers to widespread deployment of energy storage systems, one important barrier is economics. Current costs are high and can discourage investment. S. 1091 will provide a 20 percent tax rebate for a wide variety of grid-related energy storage applications as well as community and on-site storage.

The Department believes the incentives provided by the bill will have a significant impact on the deployment of storage on the grid. The bill covers a wide-range of energy storage technologies and applications. It will provide incentives for utilities and developers to employ energy storage to better accommodate ample night time wind energy, mitigate ramping, and reduce daytime peaks. The Department notes that technical comments it provided on previous versions of this bill have been addressed in the current version.

The Department offers the following technical comments for clarification: clarify the types of vehicle:

- SEC. 4. ENERGY INVESTMENT CREDIT FOR ONSITE ENERGY STORAGE. (b)(6)(A)

(6) QUALIFIED ONSITE ENERGY STORAGE PROPERTY—

A) IN GENERAL—The term 'qualified onsite energy storage property' means property which——

i) provides supplemental energy to reduce peak energy requirements primarily on the same site where the storage is located, or

ii) is designed and used primarily to receive and store intermittent renewable energy generated onsite and to deliver such energy primarily for onsite consumption.

Such term may include property used to charge:

i) plug-in electric and plug-in hybrid electric vehicles using internal combustion or fuel cell systems,

ii) material handling equipment such as forklifts using electricity if such vehicles are equipped with smart grid services which control time-of-day charging and discharging of such vehicles. Such term shall not include any property for which any other credit is allowed under this chapter.

The intent of this language is to clarify that a qualifying property supports vehicles that plug in to the electric grid, whether they are purely electric or hybrid, and regardless of the type of hybrid technology. This would include plug-in hybrids based on fuel cell or hydrogen technologies as well. The changes would also enable properties that support equipment such as forklifts that use electricity to qualify for investment credit.

Ms. JOHNSON. But can I come back to the question you asked about the 2 and 3 wheeler?

Senator WYDEN. Yes, sure. Of course.

Ms. JOHNSON. Just because there are a number of mechanisms that have worked very well that the Department of Energy has, including the 48C tax credit, which I'm a big proponent of, manufacturing for the opportunity to deploy these systems and devices overseas to the market as well. So the 2 wheeler and three wheeler electric vehicles that you were talking about, I mean, those companies should apply for some of these manufacturing tax credits in order to scale up. Be able to not only serve the markets that are in this country, but overseas.

So we actually are quite enthusiastic about working with companies like the ones that you have described. We have many mechanisms from the 1703 to 1705 to 1603 loan guarantee programs and tax credits in the 48C. So I think that we, depending on the size of the company, we also launched this fall a new part of the SBIR solicitations.

We put 50 percent of the emphasis on commercialization job generation in the clean energy areas. We just announced last week or the week before the $18 million in the first, phase ones of those. So we, not only would it not preclude, but those are exactly the companies that we're hoping are going to come forward and take advantage of these particular instruments that we have to help manufacturing in this country.

Senator WYDEN. Let's do this. I hope that we'll get a favorable response to the letter I sent Secretary Chu with respect to the vehicles, the Brammo motorcycle that we hadn't gotten a response to that.

Ms. JOHNSON. Right.

Senator WYDEN. On the second piece of legislation you have Senator Shaheen, Senator Dorgan, Senator Menendez, Senator Collins, Senator Kerry. You have a number of Senators, both the Energy Committee and the Finance, you know, committee, 2 committees that are working in the storage area. How long would it take for

you to get a written response to my questions about that legislation?

Could we have that within 2 weeks?

Ms. JOHNSON. Oh, yes. Absolutely.

Senator WYDEN. Great. Look forward to working with you. Thank you, Madame Chair.

Senator CANTWELL. Thank you. Thank you, Senator Wyden. I think your point about these 2 and 3 wheel vehicles and the opportunity.

You know, we see so many cargo ships coming into Puget Sound carrying vehicles from China and other goods and services. It would great to know that the 1.32 billion people there in China, who are always saying that we're ahead on the technology, R and D end of the equation, if we were solving some of these problems and helping with that market. I don't think that China is looking at 1.32 billion people driving cars.

Ms. JOHNSON. Right.

Senator CANTWELL. I think they're looking at the opportunity for transportation on these two and three wheel vehicles as a real opportunity in their country. So I hope we can make progress on this. So we appreciate your interest.

I have one last question, if I could Under Secretary Johnson, about the Impact Act of 2009, S. 1617. You know that we've passed a loan program for manufacturers out of this committee before.

Ms. JOHNSON. Right.

Senator CANTWELL. Focused on energy projects. This particular bill deals with this, I mean it's directed at the Secretary of Commerce to establish revolving loan funds. So how would the Department of Energy and Commerce work together on this? Who do you think is best suited to administer such a revolving loan fund?

Ms. JOHNSON. Thank you, first, for introducing this bill on clean energy manufacturing or revolving loan program. Let me just take a minute to note the Department is already working to carry out the goals of the bill. Through our loan guarantee program which administers our 1703 and 1705 and ATVM loans, as I mentioned earlier to in response to Senator Wyden, we also have the 48C and 1603 tax grant subsidies for manufacturing components and production of renewable energy.

We've worked together with the Department of Commerce well in the past. We continue to do that in the future. We would relish the opportunity to do that through this particular bill.

I think that in our area we've been working hard in the areas to define energy efficiency products. We would hope that the Department would take the lead in that particular area and to using our deep domain knowledge and background and leverage off of these successful programs to continue to work with our colleagues at Department of Commerce in such a legislation that might come forward.

Senator CANTWELL. So do think ideally there's 2 separate programs or do you think there's one program with consultation?

Ms. JOHNSON. I think one program with consultation would work very well.

Senator CANTWELL. Ok. Then the targets on some of these areas? Are they going to be streamlined? I mean, obviously part of the

challenge is in the SBA models are better models because they get capital out to the market faster.

Ms. JOHNSON. We have been working very hard in the last 6 to 9 months to get capital out. We've made 4 loans for a billion dollars with Solyndra and Red River and Nordic and others for clean energy, you know, production companies. So we see that we have a big investment in our loan guarantee office.

It's working well. We look forward to the opportunity to continue those opportunities and deals that we've been doing.

Senator CANTWELL. Great. Again, thank you very much. We will keep the record open for another 2 weeks on these bills.

Ms. JOHNSON. Ok.

Senator CANTWELL. So people, committee members, have questions to submit to you, we appreciate you getting back to us in answers.

Senator CANTWELL. Again, thank you for your dedication to this particular area and your great background steeped in this.

So we look forward to moving forward on many pieces of this legislation. So the hearing is adjourned. Thank you.

[Whereupon, at 3:31 p.m. the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

RESPONSES OF KRISTINA M. JOHNSON TO QUESTIONS FROM SENATOR MURKOWSKI

H.R. 957—GREEN ENERGY EDUCATION ACT

Question 1. S. 1462, the American Clean Energy Leadership Act, which this Committee sent to the full Senate in June, contains a broad energy workforce development section which, along with programs to address future energy workforce shortages, specifically includes training for energy efficient construction, retrofitting, and design. In your view, would H.R. 957 complement this legislation or be duplicative?

Answer. Both S. 1462, the American Clean Energy Leadership Act (ACELA), and H.R. 957, the Green Energy Education Act, contain provisions that would help our workforce develop the skills needed to address future opportunities in energy efficient construction and design. H.R. 957 appears to support the creation of energy efficient construction through curricular development and post graduate fellowships that would require partnerships between engineering and architecture schools. ACELA Subtitle D, Section 450 most closely resembles the program proposed in H.R. 957. This Section proposes programs that would be developed by the Secretary of Energy in coordination with the Secretary of Labor to award grants to community colleges to provide training and education in industries and practices in energy efficient construction, retrofitting and design.

Work force development programs at many levels can help build a skilled energy and energy efficient building workforce. Community colleges can help train workers to deploy new technologies quickly and post graduate institutions can contribute research to building technology, science, and engineering. The two bills appear to address these needs in different ways. They target different sectors of the educational market (community colleges and post graduates) and different time scales (immediate delivery of training, longer-term development of graduate-level curriculum and post doctoral research).

While the Department appreciates H.R. 957's and ACELA's focus on building technologies, we would like to emphasize growing opportunities for skilled workers across the clean energy sector. The rapid deployment of new energy technologies, coupled with the fact that 40 to 60 percent of energy utilities' skilled workers and engineers are eligible to retire by 2012[1] suggests the benefits of a broad approach to address the green job development and training challenge.

To this end, the Department works closely with the National Science Foundation (NSF) on currently funded and proposed activities to strengthen scientific educational programs at the technical, undergraduate, and graduate levels. These projects are aimed at creating a pipeline beginning at the K-12 level and extending through the post-graduate level to ensure the ongoing development of a workforce with the skills and capabilities to create and scale-up innovative energy technologies and improve processes over the long-term.

H.R. 2729—NATIONAL ENVIRONMENTAL RESEARCH PARKS

Question 1. The legislation directs each Research Park to support a wide degree of research and monitoring work. How does the research and monitoring provided for in the bill match up with Department of Energy priorities?

[1] Center for Energy Workforce Demand 2007 Report: Gaps in Energy Workforce Pipeline.

Answer. Generally, H.R. 2729 authorizes the Department of Energy (DOE) to support research in eight areas at the research parks:

a. Ecology of the site and the region;
b. Population biology and ecology;
c. Radioecology;
d. Effects of climate variability and change on ecosystems;
e. Ecosystem science;
f. Pollution fate and transport research;
g. Surface and groundwater modeling; and
h. Environmental impacts of development and use of energy generation technology, including renewable energy technologies.

Several of these research areas are consistent with DOE research priorities and are areas of research that the Department supports. In general, research activities are conducted at locations that are optimal for the proposed studies and are not limited to, or selected for, use of research park lands. Research in effects of climate variability and change on ecosystems and ecosystem science is supported by the Office of Science's Office of Biological and Environmental Research (BER). Specifically, research is targeted at understanding the role of terrestrial ecosystems in the global carbon cycle, understanding the effects of changing concentrations of greenhouse gases on terrestrial ecosystems, and understanding the role of terrestrial ecosystems in terrestrial carbon sequestration. BER also supports research consistent with pollution fate and transport research on the transport and fate of contaminants, specifically radionuclides and heavy metals in the subsurface. This research on the behavior and interactions of contaminants, in subsurface environments provides knowledge needed by DOE's Offices of Environmental Management (EM) and Legacy Management (LM) to develop new strategies for the remediation and stewardship of weapons-related contaminants at DOE sites. Research in surface and groundwater modeling is also supported by BER, EM, and the National Nuclear Security Administration (NNSA) as it relates to the fate and transport of subsurface contaminants (including geological carbon sequestration) and long-term environmental stewardship of DOE sites. It should be emphasized again, however, that the above research is conducted at locations that are consistent with the specific hypotheses being tested and not at "research parks," per se.

The DOE Office of Energy Efficiency and Renewable Energy supports research in environmental impacts of development and use of energy generation technology, including renewable energy technologies as it relates to the development and deployment of new energy technologies. EM and the Office of Science have supported research in radioecology in the past, particularly at the Savannah River Ecology Laboratory in recent years, however, the Department's priority has shifted to subsurface contaminant fate and transport to more directly address the Department's legacy waste and clean-up responsibilities.

The bill's proposed research areas in ecology of the site and the region and population biology and ecology are not well aligned with the Department's mission priorities and are better supported by other Federal agencies.

Question 2. How does the authorization of $5 million/year for each Research Park impact the Office of Science's overall budget?

Answer. The authorization of $5 million/year for each of six National Environmental Research Parks (NERPs) would total $30 million/year, if appropriated. The Office of Biological and Environmental Research would be the likely group to manage this NERP program as it currently supports research in atmospheric and terrestrial systems, as well as climate modeling. But finding would have to be appropriated, not only the $30 million specifically authorized for the six NERPS, but also additional funds to support the solicitation, review and management of six large, new research activities which would be a major new effort within the relatively small Office of Biological and Environmental Research. Moreover, in addition to its potential budget impact, the proposed new program would be counter to the Office of Science's best practices for management of research programs and optimal use of scientific resources by the broader scientific community. The Office of Science currently supports high priority research as identified by expert advisory panels and selected through external peer review. Under this legislation, the site rather than the quality or overall importance of the research would command the funding.

Question 3. How would making the Research Parks permanent impact the Department's ability to utilize federal land in the most appropriate manner to meet its mission? What are the potential impacts on future land transfer to the local communities?

Answer. The Section 3 savings clause of H.R. 2729 does specify that the bill shall not be "construed to limit the activities that the Federal Government may carry out

or authorize on a site on which a National Environmental Research Park is located." The Department is concerned, however, that once research park lands were officially designated as "protected outdoor research reserves," public opposition to any development within the parks, even for DOE mission related purposes, would increase significantly. Additionally, the savings clause does not address the issue of future land transfers to local communities. The Department is concerned that any official designation of a "research park" could prohibit the transfer of any parcels within that boundary to local communities for productive economic use.

H.R. 3165—THE WIND RESEARCH AND DEVELOPMENT ACT OF 2009

Question 1. To date, how much has the federal government spent on wind research and development?

Answer. From 1978 to 2008, the Department of Energy has been appropriated over $1.6 billion (in 2008 dollars) to invest in wind energy research and development (R&D), as compared with nearly $24 billion for Nuclear Energy R&D and Infrastructure, $41 billion for Fossil Energy R&D, and over $15 billion for Fusion Energy over that time period. In Fiscal Year 2009, $55 million was appropriated for wind R&D. In Fiscal Year 2010, $80 million is appropriated for wind R&D, with an additional $118 million allocated through the American Recovery and Reinvestment Act of 2009.

Question 2. Please provide an overview of the Departments current wind research and development efforts. Is the research called for in H.R. 3165 duplicative of ongoing wind research efforts at the Department?

Answer. The activities proposed in H.R. 3165 appear largely consistent with much of the work currently underway at the Department of Energy (DOE), and with DOE's *20% Wind Energy by 2030* report. The Department already engages in research and development (R&D) activities described in Section (2)(b) of the bill. However, H.R. 3165 does not propose specific authorization for wind energy environmental research, such as the effects of wind turbines on wildlife and habitat, which is of major concern to the wind industry and communities considering wind power development.

The Department's wind energy research is currently focused on improving the performance and lowering the costs of wind technology; improving the integration of wind energy into the electrical grid; addressing barriers to the responsible deployment of wind power systems; and supporting the development of a domestic supply chain and workforce for wind energy. The Department carries out these activities through its National Laboratories, and through public-private partnerships with industry and academia.

Question 3. Since there is already over 25,000 megawatts of land based wind power installed in the United States, is there really a need to conduct a wind energy demonstration program?

Answer. The Department supports placing special emphasis on demonstrating highly innovative land-based wind designs and offshore wind technologies, including integrated systems, components, structures, materials and infrastructure.

There is an identified need for demonstration of advanced wind plant performance characterization methodologies and applications (including forecasting, wake effects, and aeroelastic interactions), as well as advanced manufacturing techniques to help increase the domestic content and cost competitiveness of wind turbine components.

Technologies that need a robust demonstration program include new advanced turbine components, materials, and, most importantly, nascent offshore wind technologies. The U.S. currently does not have any offshore wind energy systems installed. Much of this can be attributed to complexity in the regulatory framework and related permitting requirements, low technology maturity, lack of minimum infrastructure such as adequately outfitted ports and vessels, an untrained labor force, and the perception of risk among potential investors. Therefore, offshore wind may need the support of a demonstration program in order to establish its viability in the U.S. The National Renewable Energy Laboratory estimates that the U.S. offshore wind resources, including the Great Lakes, exceed 2500 Gigawatts.[1]

DOE's *20% Wind Energy by 2030* study concludes that with dedicated policy support, at least 54 Gigawatts of this potential could realistically be developed by 2030.[2]

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[1] "Large-Scale Offshore Wind Power in the United States: Assessment of Opportunities and. Barriers", NREL Report (unpublished DOE-funded study, 2007).

[2] "20% Wind Energy by 2030, Increasing Wind Energy's Contribution to the U.S. Electricity Supply" DOE/GO-102008-2567, July 2008.

Question 4. How much wind energy research and development is performed by the wind industry?

Answer. Over the last two decades, the wind industry has worked with the Department of Energy (DOE) to advance wind technology and develop state-of-the-art wind turbines. These projects require substantial cost-share from industry. For example, one industry member contributed over $4.5 million in cost-share to a project with DOE to develop a 1.5 MW wind turbine. DOE understands that the American Wind Energy Association's research and development (R&D) action plan calls for annual non-federal wind energy R&D spending of at least $224 million in order to supply 20 percent of the Nation's energy from wind resources by 2030. European Commission estimates suggest that the wind industry provides roughly three-quarters of all European wind R&D funding, with the remaining quarter coming from national governments within the European Union. For example, one foreign wind turbine manufacturer spent $175 million on R&D in 2008, while a U.S. manufacturer of utility-scale wind turbines spent $21.1 million. The wind industry continues to invest in R&D to develop new multi-megawatt onshore and offshore wind turbine designs, to optimize wind turbine component designs and materials, and to improve the reliability and cost-competitiveness of wind turbine technology.

H.R. 3246—ADVANCED VEHICLE TECHNOLOGY ACT OF 2009

Question 1. I'm concerned that if the federal government dramatically increases its spending on vehicle technology R&D, companies within the industry will be incentivized to reduce their own spending. Do you believe a cost-share between the federal government and private industry should be required for any activities carried out under this bill? If so, what do you believe would be an appropriate level for that cost-share?

Answer. Government uses a broad portfolio-based approach to supporting research, development, and demonstration projects in the energy area and attempts to scale funding to the need. Federal support is targeted to areas where there is evidence that the private sector on its own is not supplying sufficient funding. The closer a technology is to commercialization, the more the Federal government requires of the private sector to minimize crowding out. For instance, cost-sharing is an important mechanism for leveraging government funds and insuring that the Government's partners focus on topics relevant to the market. The cost-share requirements set forth in Section 988 of the Energy Policy Act of 2005 (minimum of 20 percent cost share for R&D projects and minimum of 50 percent cost share for demonstration and commercialization projects) have proved effective in meeting these objectives.

Question 2. I'm also concerned by the overlap that could result from the passage of this bill. H.R. 3246 includes a section requiring the Secretary to "ensure, to the maximum extent practicable" that activities carried out under the bill do not duplicate existing efforts. Aside from much higher spending, can you please elaborate on how the program set up by this bill differs from the activities already being carried out by EERE's Vehicle Technologies program, NETL's Advanced Vehicles and Fuels Research program, the Advanced Technology Vehicle Manufacturing Incentive program, and other similar federal programs?

Answer. Many of the activities proposed by H.R. 3246 represent ongoing work currently underway in the Department's Vehicle Technologies Program. H.R. 3246 updates existing authorities from the Energy Policy Act of 2005 (EPAct 05) from a technology standpoint, as well as ensures that many current EPAct 05 authorizations set to expire in the next several years do not expire. The Department does not anticipate duplication of existing efforts.

Question 3. Has the Department looked at any other ways to spur innovation within the private sector? For example, instead of providing nearly $3 billion more for R&D, could the establishment of a prime rate loan program result in similar gains in fuel economy and lower emissions at lower cost to taxpayers?

Answer. The Department has initiated new programs to spur private sector innovation in both research and development (R&D) and manufacturing. Examples of R&D investment include the Advanced Research Projects Agency-Energy (ARPA-E) and the support the Department provides for deployment through credit programs such as the Advanced Technology Vehicles Manufacturing Loan Program (ATVM). The Department's support of long-standing programs, such as Small Business Innovation Research (SBIR), has achieved notable success for vehicle technology development, as exemplified by Al23 Systems. With initial SBIR funding in 2001, Al23 Systems was able to further its lithium ion battery technology development, receive additional competitively-awarded Departmental R&D fluids, and raise additional capital from private sector partners. Al23 Systems recently received, through competi-

tive award, Recovery Act funds to scale up and build automotive battery manufacturing facilities in the United States that are expected to support the widespread use of plug-in hybrid and other electric vehicles.

Question 4. Earlier this year, the Energy Committee passed a bill that would require the National Academy of Sciences to complete a comprehensive "transportation roadmap" to evaluate the potential of many of the technologies listed in this bill. Would it make more sense to complete that study before funding all of these technologies, rather than funding all of these technologies without a good understanding of where our limited federal dollars are likely to be most effective?

Answer. The Department is currently working with the National Academy of Sciences (NAS) to support a $2.2 million study focused on light-duty vehicle fuel economy, as directed by the Energy and Water Development and Related Agencies Appropriations Act, 2010. The study is scheduled to begin this year; over the course of the two-year effort, the NAS will rely on data from the Department's Vehicle Technologies Program and others to perform an analysis. Based on preliminary information from the ongoing NAS review as well as previous NAS reviews of the FreedomCAR and Fuel Partnership, the Department's technology portfolio—which emphasizes vehicle electrification—is appropriate. The International Energy Agency's Electric and Plug-In Hybrid Roadmap mirrors DOE emphasis on drivetrain electrification. Two authorization bills currently under Congressional consideration, H.R. 3246 and S. 2843, would authorize a research, development and demonstration program that is very well aligned with the current DOE program focus.

H.R. 3585—SOLAR TECHNOLOGY ROADMAP ACT

Question 1. This legislation establishes a Solar Technology Roadmap Committee, with at least one-third of the Committee members to come from the solar industry, in order to create a Solar Technology Roadmap to direct DOE's solar research. Does the Department believe such a Roadmap Committee is necessary? What is the Administration's position on potentially allowing non-federal employees to direct Federal activities?

Answer. The Department's Solar Energy Technologies Program actively solicits and receives input from stakeholders in industry, the National Laboratories, and academia through peer-reviews, as well as from other formal and informal discussions over many years. The Department is actively strengthening its external review process to receive input and comments from outside stakeholders. As written, the proposed legislation binds the Department's research and development efforts to the recommendations of the Roadmap Committee, requiring the Department to follow the Committee's recommendations for 75 percent of all funding appropriated for the Solar Energy Technologies Program by 2015. While the Department welcomes additional industry input and support for demonstration projects, DOE is particularly concerned about this bill's practical effects, which will constrain the flexibility the Depailnent has to respond to diverse sources of information and explore new breakthroughs in technology development. The Department is also greatly concerned about having non-federal employees direct Federal activities.

Question 2. H.R. 3585 requires the Department of Energy to spend an increasing, minimum amount of the solar program budget—30% starting in 2012 and increasing to 75% in 2015—as directed by the Roadmap Committee's research and development recommendations. What if the Energy Secretary does not agree with the Roadmap Committee's R&D recommendations? Do you believe that this legislation unnecessarily ties the Department's hands?

Answer. As written, the proposed legislation unnecessarily binds the Department's research and development (R&D) efforts to the recommendations of the Roadmap Committee, requiring the Department to follow the Committee's recommendations for 75 percent of all funds appropriated for the Solar Energy Technologies Program by 2015. The Department urges the Congress instead to stipulate that the Committee provide non-binding advice and recommendations traditionally provided by publicly-chartered Federal advisory committees. Providing the most effective solar technology R&D programs requires the Secretary and the Department to make a series of constantly evolving judgments. This legislation will constrain the flexibility the Department has to respond to diverse sources of information and explore new breakthroughs in technology development.

Question 3. Please provide an overview of the Department's current solar research and development efforts for Concentrating Solar Power technology, Photovoltaics, and solar thermal water heating technology. To date, how much as the federal government spent on solar research and development?

Answer. The Department of Energy (DOE) has significantly increased its support for solar energy technologies over the last five years—growing from $83 million in

Fiscal Year (FY) 2006 to $247 million in FY 2010—to enable the U.S. to compete in the global marketplace with cost-competitive solar energy by 2015. The total 30 years' investment in solar research and development (R&D) since the Department's inception in 1979 is approximately $6.1 billion (in 2008 dollars). This funding has helped the U.S. become the world leader in innovative solar technology, and may be compared with investments of nearly $24 billion for Nuclear Energy R&D and Infrastructure, $41 billion for Fossil Energy R&D, and over $15 billion for Fusion Energy R&D over that time period.

The DOE Solar Energy Technologies Program focuses on reducing photovoltaic (PV) manufacturing costs, proving that concentrating solar power (CSP) systems can provide dispatchable power through the use of low-cost thermal storage, and providing the thermal energy needs of a Zero Energy Building.

The CSP subprogram is focusing its efforts in four major areas: (1) R&D of low cost systems that include thermal storage to achieve cost competitiveness in the intermediate and baseload power markets; (2) establishment of a demonstration program of new CSP technologies that could lead to gigawatt-scale deployment of CSP projects; (3) working with the Bureau of Land Management (BLM) in identifying BLM-managed land environmentally suitable for utility-scale solar projects and (4) addressing market acceptance issues related to water consumption and transmission.

The PV subprogram priorities are to: (1) conduct R&D on existing and current PV technologies that have the potential to achieve cost parity with conventional electricity generation sources by 2015; (2) increase the lifetime of PV components and systems, and prove the market viability of new PV technologies; (3) in coordination with the Office of Electricity, conduct R&D to allow for wide scale integration of PV systems within the existing grid system; (4) conduct outreach to key state and national stakeholders that can help remove market impediments for the adoption of PV technologies.

The Solar Heating and Cooling activity within the Building Technologies Program supports R&D on (1) exemplary low-cost solar water heating systems for net-zero energy homes (ZEH) in cold climates and the development of prototype systems; (2) combined solar heating, cooling, and water heating systems that utilize seasonal storage to achieve high solar fractions; (3) dehumidification applications for combined photovoltaic/thermal systems for ZEH; and (4) support of a solar rating and certification system.

Question 4. How much solar energy research and development is performed by the solar industry?

Answer. As most U.S. solar companies are private and have no obligation to publicly disclose their spending, direct figures on non-governmental research and development (R&D) spending by the solar industry are not available. The best proxy measurement for non-governmental R&D spending is early stage (venture capital and private equity) investments in solar companies. While some of this funding is used for manufacturing scale-up, a large proportion of early stage investments is for R&D. In addition, there is R&D spending that is funded by later stage investments, such as debt and public equity. In 2008, U.S. solar companies received approximately $2.6 billion of venture capital and private equity investments (source: Bloomberg New Energy Finance, http://www.newenergymatters.com/).

Question 5. H.R. 3585 specifically exempts the Solar Technology Roadmap Committee from the Federal Advisory Committee Act. What is the Department's position on this exemption?

Answer. Creating the most effective solar technology research and development (R&D) programs requires the Department of Energy (DOE) to make a series of constantly evolving judgments. It is important that the Department be allowed to call on multiple sources of information when formulating solar technology R&D priorities. Legislation should not constrain the Department's flexibility to respond to diverse sources of information, as would be the case currently proposed by Sections 102 and 103 of H.R. 3585. However, the Department may support the establishment of an advisory committee from which DOE may receive collective input to better inform its decisions related to these matters. If the committee is only advisory to the Secretary, the Department does not see any reason to exempt the committee from the Federal Advisory Committee Act.

S. 737—BIOFUELS FOR SMALL NON-ROAD ENGINES

Question 1. What is the current status of the program required by Section 248 of the 2007 energy bill? Has it been created by the Department, and if so, what progress has been made in each of its nine focus areas?

Answer. Research and testing on most of the nine focus areas identified in Section 248 of EISA 2007 are underway. Some results are in review for publication. Summary of progress in the nine focus areas:

(1) Corrosion of metal, plastic, rubber, cork, fiberglass, glues, or any other material used in pipes and storage tanks—In coordination with the Environmental Protection Agency, the Department is conducting materials testing on components of underground storage tanks and on metals, elastomers, and plastics commonly used in dispensing equipment. Performance testing on dispensers and distribution components (hoses, nozzles, swivels, breakaways and one submersible turbine pump) is also ongoing.

(2) Dissolving of storage tank sediments—Not currently funded.

(3) Clogging offilters—Ongoing research is being conducted on dispenser filters as a component of the full dispensing system.

(4) Contamination from water or other adulterants or pollutants—Not currently funded.

(5) Poor flow properties related to low temperatures—Completed for biodiesel use in vehicles and not considered significantly different for small engines; not considered relevant for other commercially available biofuels. Publications can be found at http://www.nrel.gov/vehiclesandfuels/npbf/pdfs/cftr_72805.pdf

(6) Oxidative and thermal instability in long-term storage and uses—Complete for biodiesel; ongoing for other biofuels. Multiple biodiesel publications can be found at http://www.nrel.gov/vehiclesandfuels/npbf/pubs_biodiesel.html#quality.

(7) Microbial contamination—Not currently funded. The issue is considered well-understood by industry and does not require additional Departmental research.

(8) Problems associated with electrical conductivity—Not directly under study, but research currently underway on materials compatibility for E15 and E20 includes corrosion, which is affected by electrical conductivity.

(9) Such other areas as the Secretary considers appropriate—Areas not currently being addressed are not impeding the near-term deployment of biofuels.

Question 2. The Fiscal Year 2010 Energy and Water Appropriations bill included $7.5 million for the Vehicle Technologies program at DOE to "expand and accelerate" the testing of intermediate fuel blends. Does your Department intend to include small, non-road engines—such as those used in outdoor equipment and boats—in its tests as part of the required expansion?

Answer. Yes, small, non-road engines will be included in Fiscal Year 2010 tasks, including studies that are currently underway or are being planned to examine the effects of intermediate ethanol blends on chainsaws and marine engines. Additional studies on motorcycles and snowmobiles are planned and may be conducted pending evaluation of incoming data on the marine and chainsaw testing.

Question 3. Could you take just a minute and summarize what preliminary testing, such as the testing completed by the Oak Ridge National Laboratory, has suggested about the use of ethanol in small, non-road engines?

Answer. Oak Ridge National Laboratory, the National Renewable Energy Laboratory, and the Transportation Research Center (a commercial testing laboratory in Ohio) have completed tests on a variety of small, non-road engines. Emissions and exhaust temperature testing using blends of EO, El 0, E15, and E20 was conducted on power washers, generators, leaf blowers, and line trimmers in their new and full-life conditions. On each engine type, low-cost general use and higher-price fuel types were tested.

Testing showed that as ethanol levels increased, small, non-road engines operated less fuel-rich, leading to higher temperatures of both the exhaust and engine components and to changes in the exhaust emissions. In general, hydrocarbon (HC) and carbon monoxide (CO) emissions tended to decrease with higher ethanol content, while oxides of nitrogen (NOx) emissions tended to increase. Combined HC+NOx emissions (which are regulated as such) decreased in most cases. As ethanol content in the fuel increased, some engines experienced higher idle speeds and unintentional clutch engagement due to less-rich operating conditions. No obvious material compatibility issues were observed during these tests.

S. 1617—INVESTMENTS FOR MANUFACTURING PROGRESS AND CLEAN TECHNOLOGY ACT

Question 1. Please describe the role, if any, that the Industrial Technologies Program at the Department of Energy will play within the loan program, as envisioned in S. 1617.

Answer. The Loan Guarantee Program Office (LGPO) supports innovative energy technology projects that reduce or sequester greenhouse gases, including many of the technologies that would be supported by S. 1617. To achieve the Program's goals, the LGPO works in close coordination with the relevant DOE program offices including Fossil Energy, Nuclear Energy and Energy Efficiency Renewable Energy. In the context of Title XVII this coordination and role is ongoing; the LGPO will continue to access technical expertise provided by the program offices, including the Industrial Technologies Program, in matters such as developing solicitations and reviewing loan guarantee applications.

Question 2. What skills will be needed to reflect the range of activities the program needs for long-term success?

Answer. U.S. manufacturers need employees with ever-increasing skills to compete in the global marketplace, particularly in growing industries such as clean technologies. Increasing worker education and training will be central to achieving long-term manufacturing success. The knowledge and skills of manufacturing employees at all levels—from technicians to engineers to plant managers—on energy technology management, as well as the manufacture of clean energy technologies, needs to be significantly strengthened.

The Department's Industrial Technologies Program (ITP) has a history of developing industrial energy efficiency resources, including tools, training and energy assessments that assist manufacturing staff in saving energy. Studies conducted by trade organizations and government organizations, including the United Nations Environment Programme, have indicated a wide set of skills will be required not only for the manufacture of clean technology and energy efficient products, but also for their implementation. These skills and associated professions include planning and design; project management and procurement; technical-engineering skills related to energy management; trade skills including electrical and mechanical skills; and computer operation or software specialization. In addition, entrepreneurial skills can often be as important as technical knowledge for emerging industries. Availability of workers with these skill sets will be beneficial to the retooling, expansion, and improvement of U.S. manufacturing facilities. The Department's ITP will coordinate with other agencies to assist in identifying the needed skills in manufacturing to support the implementation and manufacturing of clean energy technologies.

Question 3. Please describe the role that the industrial assessment centers will play in assisting the small and medium sized firms in improving their energy efficiency.

Answer. The Department's 26 Industrial Assessment Centers (TACO provide engineering services and technical assistance to small and medium sized firms by conducting no-cost energy audits at manufacturing plants. An engineering professor experienced in energy auditing and several students lead each energy audit. The audit analyzes a wide range of energy uses at the plant, including heating, cooling, lighting, steam, and motor applications and provides a report with recommendations that typically identifies about 10 percent reductions in energy use. About 300 energy audits are conducted every year throughout the U.S. IAC personnel also familiarize plant personnel with the Department's software decision tools, training possibilities, technical information, energy management methods and other materials which can enable plant workers to make continuing improvements to their energy systems. At any time, the IAC program employs approximately 200 engineering students who are acquiring energy-engineering skills for application in professional careers. The IAC program serves as a model approach for strengthening the U.S. clean energy manufacturing supply chain.

Question 4. Please describe how the loan program our Committee passed earlier this year (ACELA, Title II, Subtitle A, SEC 201) will be coordinated with this new loan program in addressing energy efficiency improvements within the industrial sector?

Answer. The Administration has not taken a position on either ACELA or S. 1617. As such, the Department has no view on how the two pieces of legislation might be coordinated if passed.

S. 2773—OFFSHORE WIND ENERGY RESEARCH, DEVELOPMENT, DEMONSTRATION AND COMMERCIAL APPLICATION ACT OF 2009

Question 1. Is the Department currently undertaking any research and development work for offshore wind resources?

Answer. The Department seeks to address barriers to responsible offshore wind energy development, including the technical challenges posed by the harsh marine environment, as well as the permitting and environmental challenges associated

with siting offshore projects. The Department is providing approximately $25 million in projects in Fiscal Years 2009 and 2010 appropriations and Congressionally Directed Projects, to support offshore wind energy through feasibility assessments, environmental studies, and technology research and development. These projects include a recently launched research consortia headed by the University of Maine to develop composite floating platforms for offshore wind turbines. In addition, the Department of Energy is investing up to $70 million in Recovery Act funds to create facilities capable of testing next-generation land-based and offshore wind turbine drivetrains and blades. These facilities, located in Boston, Massachusetts, and Charleston, South Carolina, will improve U.S. competitiveness in offshore wind energy technology by supporting the testing of next-generation designs.

Question 2. According to the American Wind Energy Association, offshore winds are stronger and more consistent than wind resources located across land. To date, however, there are no offshore wind projects in this country, even though the Cape Wind project has been under development since 2001. Why is the United States so far behind Europe, which already has over 600 megawatts of installed offshore wind capacity?

Answer. The fact that no offshore wind projects have been installed in the U.S. to date can largely be attributed to the complex regulatory framework and related federal and state permitting requirements faced by project developers. While U.S. policies for offshore oil and gas extraction are well established, policies, regulations and processes for offshore wind energy development are still in development, although tremendous strides toward clarification have been made in 2009 through Federal/State collaboration.

Significant financial investments are being made in Europe to support installation of offshore wind turbines and support infrastructure. Investment in the development of commercially operated offshore projects in Europe is approximately €3 billion (approximately $4.1 billion) per year and is expected to increase to €8 billion (approximately $11 billion) per year by 2020. Government policies and regulations set the stage for the research, investment, and development needed to create a sustainable offshore wind industry and send signals to the financial community regarding the viability of the sector. While the U.S. government has supported wind technology deployment through tax incentives such as the Production Tax Credit, Investment Tax Credit, and American Recovery and Reinvestment Act Section 1603 grants, these incentives do not distinguish between land-based and offshore wind energy projects, and do not lend themselves as well to offshore wind. In order to qualify for these tax credits or grants, project construction must commence before the end of 2012. This deadline is currently unrealistic for offshore wind projects, which face a significantly longer development and permitting process than land-based wind projects.

A significant step forward in clarifying the regulatory context for U.S. offshore wind development occurred in April 2009, when the Department of Interior's Minerals Management Service (MMS) issued final regulations governing all renewable energy projects on the Outer Continental Shelf (OCS). The Energy Policy Act of 2005 gave MMS lead agency authority over offshore alternative energy and alternate use activities on the OCS. Prior to this explicit authorization, the regulatory approval pathway for offshore wind development in Federal waters was undefined.

To date, several project developers such as Cape Wind have successfully completed a number of the steps required for offshore wind permitting and siting approval, including environmental reviews. However, they still remain several years from being able to actually install systems, given the remaining requirements that must be met.

Recent strong support for offshore development by East Coast and Great Lakes states, coupled with collaborative efforts by MMS, such as the formation of state task forces and Interior Secretary Salazar's announcement of the opening of an Atlantic Off-Shore Wind Permitting Office on December 14, 2009, promise to greatly streamline the permitting process for developers. These steps send a strong signal to potential investors that the hurdles that have delayed offshore development in the U.S are being addressed.

Question 3. Based on Europe's experience, does the Department believe offshore wind facilities will interfere with shipping or fishing interests? What about the effects on marine life? Finally, how do offshore wind facilities handle severe weather?

Answer. Offshore wind energy presents a different set of potential risks to the environment and coastal communities than land-based wind. The Department works with other agencies, such as the Department of Interior's Minerals Management Service (MMS), to identify priority research areas relating to environmental and human impacts of offshore wind turbines. Several studies from Europe indicate that while no significant negative effects on birds, mammals, or other biological factors

from existing offshore wind projects have been observed to date, uncertainties and risks remain. Research funded by DOE to determine the effects of offshore technologies on marine habitats and ecosystems is currently underway. Robust research, thoughtful stakeholder engagement and careful siting will allow for the development of clean, affordable, domestic offshore wind energy while protecting the environment and stakeholder interests.

The severe weather associated with the marine environment requires offshore wind turbines to be more rugged and durable than those installed on land. National safety certification standards can help ensure that offshore wind technology and facilities are designed to withstand the effects of severe offshore waves and wind. DOE works with MMS to review existing national safety certification standards and how to apply the standards to the design and operation of U.S. offshore wind turbines and structures, taking into account regional considerations such as hurricane winds and storm driven waves of the mid-and north Atlantic. Application of these standards will ensure the safe installation and operation of wind turbines in U.S. waters.

Question 4. S. 2773 directs the Secretary to competitively award grants to establish one or more National Offshore Wind Centers at institutions of higher education. Does the Department believe such National Offshore Wind Centers can assist its research and development efforts?

Answer. A coordinated national offshore wind energy program supporting focused research and development (R&D) would help facilitate the long term clean energy and economic benefits of a mature offshore wind energy industry. Establishing an integrated network of national-scale research and development centers supporting this effort could be important to the success of such a program. Such institutions, whether universities, National Laboratories, or other independent or industry-supported research centers, could be awarded DOE funding focused on specific regional or technical research efforts. Examples of focused research include turbine systems optimized for Great Lakes or Gulf of Mexico conditions, floating foundations optimized for deep water applications in the Atlantic and Pacific Oceans, test facilities to validate and understand the resiliency of wind turbines to hurricanes, ice floes, and other site conditions unique to U.S. waters, and the development of baseline environmental studies and regional databases to be used to streamline project review and permitting processes.

Examples of planned national-scale facilities and R&D efforts that have recently been selected for DOE funding, and could support a coordinated national offshore wind energy effort include:

- Up to $45 million from the Recovery Act to Clemson University for a Large Wind Turbine Drivetrain Testing facility featuring power analysis equipment capable of performing highly accelerated endurance testing of drive systems for land-based and offshore wind turbines rated at 5-15 megawatts;
- Up to $25 million in Recovery Act funding to the Massachusetts large wind blade test facility, which will be the only U.S. test center capable of testing wind turbine blades up to 90 meters long for both land-based and offshore wind energy systems, and;
- Up to $8 million in Recovery Act funding plus $5 million through Congressionally directed, funding to a consortium led by the University of Maine to develop and test floating foundation systems capable of supporting large wind turbines in deep water.

RESPONSES OF KRISTINA M. JOHNSON TO QUESTIONS FROM SENATOR STABENOW

Question 1. Undersecretary Johnson—you mentioned in your testimony that by including hydrogen and fuel cell activities as an eligible technology in the Advanced Vehicle Technologies Act this would duplicate existing authorities such as the Energy Policy Act of 2005 that also includes authority for hydrogen technologies.

Answer. The Department is concerned that H.R. 3246 would be considered the sole authorization for all vehicle R&D activities, including those currently sponsored by the Vehicle Technologies and Hydrogen and Fuel Cell Technologies Programs. The current level of funding appropriated for these programs plus the expanded medium and heavy-duty vehicle authorization outlined in the Act currently exceeds the total authorization level cited by the Act for Fiscal Year 2010. Hydrogen and fuel cell activities detailed in Title VIII of the Energy Policy Act of 2005 are currently authorized through 2020,. All of these activities are listed as only one of 26 technology areas in H.R. 3246, Section 101. Most of the other vehicle technologies areas in H.R, 3246 have authorizations that expire before the hydrogen and fuel cell authorization, and many expire by 2015. The Department has no issue if H.R. 3246 is intended as a supplemental authorization to previous authorizations.

Question 2. Why is hydrogen the only example of a technology that DOE already has other authorities to perform R&D functions on? Certainly you could say the same for electric batteries and components, as an example, which has various authorities under EPACT 05 and EISA 07.

Answer. The Department is concerned that H.R. 3246 would be considered the sole authorization for all vehicle R&D activities, including those currently sponsored by the Vehicle Technologies and Hydrogen and Fuel Cell Technologies Programs. The current level of funding appropriated for these programs plus the expanded medium and heavy-duty vehicle authorization outlined in the Act would currently exceed the total authorization level cited by the Act for Fiscal Year 2010. Hydrogen and fuel cell activities detailed in Title VIII of the Energy Policy Act of 2005 are currently authorized through 2020. All of these activities are listed as only one of 26 technology areas in H.R. 3246, Section 101. Most of the other vehicle technologies areas in H.R. 3246 have authorizations that expire before the hydrogen and fuel cell authorization, and many expire by 2015. The Department has no issue if H.R. 3246 is intended as a supplemental authorization to previous authorizations.

Question 3. Congressman Peters and I envision this bill to be a comprehensive and integrated R&D authority for as many priority vehicle technologies as possible, fully recognizing that it may supplement or compliment ongoing activities at DOE. We did not want the legislation to miss any important R&D activities and or minimize future technologies that may advance vehicle energy efficiency. We created an umbrella authority where a certain level of duplication is appropriate.

Answer. The Department appreciates the Senator's statement and now better understands the intent of the legislation.

Question 4. Finally, I want to emphasize the importance of hydrogen technologies. The recent Energy and Water Appropriations bill appropriated $175 million for hydrogen related activities. This was after the DOE recommended reduced the funding from $180 million to $60 million. Clearly, Congress views hydrogen as an important technology to continue to pursue for the long term, especially as other foreign companies have made it clear that hydrogen is still a potentially game changing technology for vehicles in the next 10 years or so.

Answer. The Department recognizes that hydrogen could play an important role in the Nation's energy future. The Department plans to spend approximately $52 million in Fiscal Year 2010 for basic research relating to hydrogen and fuel cells in the Office of Science in addition to the $174 million appropriated for the Hydrogen and Fuel Cell Technologies Program in the Department's Office of Energy Efficiency and Renewable Energy, The Department also has an active leadership role in the international hydrogen and fuel cell community, coordinating with more than 15 countries and the European Commission through high-level international partnerships and through collaborative work on R&D projects. This level of international engagement allows the Department to stay abreast of global progress, to leverage that progress to the benefit of domestic technology development efforts, and to ensure U.S. competitiveness in these critical, emerging technologies.

Question 5. Can you explain more about DOE's views on the future of hydrogen fuel cell R&D as it relates to vehicles?

Answer. The Department is pursuing a diverse and inclusive portfolio of both near-and longer-term technologies to reduce greenhouse gas emissions and petroleum use in the transportation sector. Hydrogen and fuel cells, advanced biofuels, and batteries are all essential elements of this portfolio. The Department believes that having a diverse array of technology options will help the United States meet its long-term energy goals. Accelerating the deployment of hydrogen and fuel cell technologies in near-term markets—such as stationary power and specialty vehicles—is critical to the longer-term viability of hydrogen and fuel cell technologies. The success of hydrogen and fuel cells in these markets will help drive down costs by building a domestic supply base and achieving economies of scale in manufacturing. Early market success could also spur investment and innovation in the technologies, hastening progress for longer-term applications, including fuel cell electric vehicles.

RESPONSE OF KRISTINA M. JOHNSON TO QUESTION FROM SENATOR BARRASSO

Question 1. In your testimony, you raised concerns regarding intellectual property language included in S. 2744. Will you provide specific legislative changes that would address the Department's concerns?

Answer. The intellectual property (IP) language in Section (7) of S. 2744 provides that as a condition to receiving an award, the applicant must vest IP relating to carbon dioxide capture technology in one or more entities incorporated in the U.S. For prize legislations, the H-Prize Act (P.L. 110-140, Sec. 654) being one example,

we have concluded that the value of the resulting IP for significant technological breakthroughs generally is worth more than the proceeds from the prize itself. As a result, any IP provisions that seek to divest title or otherwise encumber IP are viewed as a deterrent to participating in such prize competitions. We would recommend the following IP provision from the H-Prize Act, Sec. 654 (f)(4):

> Intellectual property.—The Federal Government shall not, by virtue of offering or awarding a prize under this subsection, be entitled to any intellectual property rights derived as a consequence of, or direct relation to, the participation by a registered participant in a competition authorized by this subsection. This paragraph shall not be construed to prevent the Federal Government from negotiating a license for the use of intellectual property developed for a prize competition under this subsection.

RESPONSES OF KRISTINA M. JOHNSON TO QUESTIONS FROM SENATOR CORKER

Question 1a. Under H. R. 2729 as currently drafted, how can the interests and needs of the local governments that are hosts to the proposed Environmental Research Parks be protected when their interests are in conflict with those of the Environmental Research Parks?

Answer. Currently, the Department of Energy as owner of the DOE laboratories and the sites which they occupy, is responsible for addressing and accommodating, to the extent possible, the interests and needs of the surrounding local governments and citizenry. Regardless of the outcome of H.R. 2729, the Department will continue to work with local communities and governments in furtherance of the general welfare.

Question 1b. Would you support modifying the legislation so that these local governments can have meaningful input into interim and permanent land use decision making processes? If so, how would you suggest doing that?

Answer. H.R. 2729 provides ample provisions for local community involvement, through public education and outreach activities and through requirements that the Department enter into cooperative agreements with local institutions of higher learning. Accordingly, modification of the legislation is not necessary.

Question 2a. How can land parcels that are currently under consideration for transfer to the nearby local government best be protected from land use alternatives that are envisioned by the legislation?

Answer. The Department is in the process of transferring several parcels at sites that would be designated as "National Environmental Research Parks" under H.R. 2729. The draft deeds will be revised to contain a restrictive use covenant that specifies that the property is not subject to the requirements set forth in H.R. 2729.

Question 2b. When the Department of Energy has agreed to transfer land to a local government, how can those agreements, memoranda of understanding, or land use options be privileged and protected should new land use priorities established by the legislation change the context of the aforementioned agreements?

Answer. Any proposed land transfers would be accomplished by a transfer of deed, which would be legally binding; nonbinding documents like memoranda of understanding would not be used. Once the deed has been executed by the Department, the deed would contain a restrictive use covenant, that specifies that the property is not subject to the requirements set forth in H.R. 2729. Any executed deeds would be accessible to the public, as public records, and would not be privileged or protected.

APPENDIX II

Additional Material Submitted for the Record

STATEMENT OF HON. GABRIELLE GIFFORDS, U.S. REPRESENTATIVE FROM ARIZONA, ON H.R. 3585

INTRODUCTION

Chairwoman Cantwell, Ranking Member Risch, Members of the Subcommittee, thank you for the opportunity to offer my views on H.R. 3585, *the Solar Technology Roadmap Act of 2009*. As the lead sponsor of this legislation in the House of Representatives, I believe it is well designed to achieve critical research and development (R&D) goals in solar energy technologies with the potential for significant public benefit. I appreciate the opportunity to clarify the thinking behind some of the provisions of this legislation and respond to critiques of the bill.

THE SOLAR OPPORTUNITY

Investing in solar power offers a tremendous opportunity for us to stimulate our economy, increase our national competitiveness, strengthen our national security, and reduce the environmental and public health impacts associated with electric power production.

History makes a powerful case for investing in solar R&D. Photovoltaic (PV) technologies have consistently declined in price every year since they were introduced onto the market, driven by improved research and development as well as steady increases in sales volume. In 1954, approximately one watt of PV devices was manufactured; in 2009, approximately one billion watts will be manufactured worldwide. Non-PV solar technologies, including solar thermal technologies, are also improving rapidly. Current estimates are that commercially available solar products will achieve grid parity with fossil fuel-based power within the next five years.

According to testimony provided by Ken Zweibel (Director of the George Washington University Solar Institute and a former long-time solar researcher at the National Renewable Energy Laboratory) at a hearing held by the Energy & Environment Subcommittee of the House Committee on Science & Technology, a relatively small Department of Energy program of $5-15M per year called the Thin Film PV Partnership "nurtured several second generation PV technologies from bench-top to multibillion dollar annual sales. Two key U.S. companies [today], UniSolar and First Solar, were substantial participants. Both are now world leaders in PV technology, and in fact, First Solar was the second largest manufacturer of PV modules in the world last year."

AUTHORIZATION LEVELS

I would like to respond to concerns that have been expressed by some about the authorization levels in this bill. I believe the best justification for the proposed authorization levels comes from taking a historical look at Federal investment in energy R&D. Between 1978 and 2007, the U.S. government spent $30 billion on R&D for nuclear energy alone, and another $24 billion on fossil fuel research.[1] During the same period we spent less than $6.5 billion on solar energy, and more than half of that research was performed prior to 1985.[2]

Some might think these disparities are justified based on the respective electricity-generating potential of these different technologies, but that is not the case. Indeed, the opposite is true. Our nation's solar resources are truly vast in scale, and

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[1] U.S. Energy Information Administration, *Federal Financial Interventions and Subsidies in Energy Markets 2007*, Report #:SR/CNEAF/2008-01.

[2] DOE Budget Authority History Table by Appropriation; DOE Congressional Budget Requests.

they are capable of making a significant contribution to our energy needs. Using technology available today, solar power could meet the electricity demands of the entire United States on a square piece of land approximately 100 miles by 100 miles, or about 10,000 square miles.[3] For comparison, at least that much land area is currently covered by artificial lakes behind hydroelectric dams, which provide less than 10% of our nation's electricity. Solar analysts at DOE are currently preparing a study that outlines how, with the right incentives, solar power could meet as much as 20% of America's electricity needs by the year 2030. That is the same proportion of our power currently provided by nuclear energy.

Despite the enormous scale of the solar resource, its tremendous electricity-generating potential, and its relatively low social costs, we have spent just one-tenth as many resources developing solar technologies as we have developing nuclear power. In the last thirty years, we have spent four times more money developing coal technology as solar, even though burning coal for power is a profitable business that has been around for over 100 years, while solar is still an emerging technology. At the end of the term covered by my bill, it would authorize $550 million for solar R&D. Yet at the peak of the energy crisis in the 1970s, we spent $2.9 billion a year on nuclear power development alone, and $1.8 billion on fossil fuels.[4]

I fully support having strong research programs in nuclear, coal, and other important energy options. The fact I wish to highlight is simply that we have consistently underinvested in renewable energy R&D, including solar R&D, relative to its potential to benefit our nation. The funding levels authorized in H.R. 3585 are amply justified by the vast potential of the solar resource and global market opportunity for new solar technologies. It is time for the scale of our solar investments to match the scale of the solar opportunity.

RESPONDING TO DOE TESTIMONY

The most innovative feature of H.R. 3585 is a provision that calls for the establishment of a committee to create a Solar Technology Roadmap. The committee would consist of a minimum of eleven members, all selected by the Secretary of Energy (Secretary) and appointed to three-year terms. Members would be solar experts drawn from diverse backgrounds, including industry, academia, national laboratories, and other entities or organizations as appropriate. At least one third, but no more than one half of the members would come from industry. The committee's task would be to develop a research plan—or roadmap—to identify R&D needs in order to advance solar technologies in the near- (up to 2 years), medium- (5-7 years), and long-terms (up to 15 years). The bill calls for the roadmap to be updated every year and completely overhauled every three years to keep up with the evolution of solar technologies. Importantly, the bill also calls for a portion of funds appropriated for the solar R&D program to be allocated according to the recommendations in the roadmap, starting with 30% in FY 2011 and rising gradually to 75% in FY 2015.

The written testimony on H.R. 3585 submitted by Dr. Kristina Johnson, Undersecretary of Energy, identifies the Department of Energy's (DOE's) "greatest concern" as the fact that the bill would "require the Department to form a semi-autonomous Committee that will largely govern the solar-energy activities at the Department." Dr. Johnson correctly points out that the bill, as written, would bind, at least partially, the Department's R&D efforts to the recommendations of the Roadmap Committee, requiring the Department to follow the Committee's recommendations for the allocation of a steadily increasing percentage of the total amount appropriated for solar R&D, ultimately topping out at 75% in 2015. However, H.R. 3585 would not empower the Roadmap Committee to "largely govern" the Department's solar energy activities. The Committee could only provide recommendations in the form of a roadmap. The Department is not legally bound to carry out all of these recommendations, nor even necessarily follow the top priorities identified. In addition, the Roadmap Committee has no power to award grants, and is explicitly barred from recommending specific recipients of funds.

Dr. Johnson concludes by urging Congress instead to stipulate that the Roadmap Committee would provide non-binding advice and recommendations. Although Dr. Johnson identifies the partial binding of funding decisions to the roadmap as the Department's greatest concern, she does not provide a convincing explanation of why it is a concern (e.g. how the proposal would fail to promote the public interest) or how the Department's preferred course would mitigate the concern.

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[3] Estimate assuming 5 acres/megawatt from NREL FAQ (http://www.nrel.gov/csp/troughnet/faqs.html#land); EIA, *Electric Power Industry 2007: Year in Review*.

[4] U.S. Energy Information Administration, Federal Financial Interventions and Subsidies in Energy Markets 2007, Report #:SR/CNEAF/2008-01. Figures are in 2007 dollars.

Later in her testimony, Dr. Johnson does attempt to justify the Department's position by explaining that, "providing the most effective solar technology research and development programs requires the Secretary and the Department to make a series of constantly evolving judgments. It is important that we be allowed to call on multiple sources of information when we formulate our solar technology R&D priorities, and that we be responsive to provided information. . ."

I could not agree more, and that is precisely why the H.R. 3585 requires that the solar roadmap be updated annually and that solar R&D funding be tied to the recommendations of the Roadmap Committee; it is to ensure that resource allocation decisions are consistent with the up-to-date recommendations that emerge from a multi-stakeholder process involving experts from across the solar R&D community. Far from obstructing consultation with, and responsiveness to, "multiple sources of information," H.R. 3585 would require it. While I applaud recent Department initiatives to consult with solar stakeholders in industry, the national laboratories, and academia, there is no current requirement that DOE officials consult with these stakeholders or anyone else in making their R&D decisions. H.R. 3585 would ensure that these diverse stakeholders are not only consulted, but that their recommendations are heeded as the Department allocates Federal solar R&D dollars.

I realize that 75% is a significant portion of the total funding for solar R&D. However, when we are talking about ensuring that taxpayer money is allocated in accordance with a long-term research plan created through a multi-stakeholder process, it is hard to understand why people might think this is a bad idea, especially considering that the roadmap would be published for all to see. In terms of transparency, long-term thinking, and integration of diverse views, the roadmap process would far exceed anything required of DOE today. What's more, the roadmap idea is not new or untested; it is based on the highly successful Technology Roadmap for Semiconductors, a semiconductor industry-led initiative that has been widely hailed as contributing to steady and rapid technological advancement in that industry since the early 1990s.

In contrast with the proposed roadmap process, right now solar R&D funding decisions are made according to whatever rationale DOE may deem appropriate. There is no assurance of transparency, no long-term planning requirement, and there is no obligation to consult with industry or other stakeholders. For members of Congress concerned with responsible stewardship of taxpayer dollars, the roadmap process should come as a welcome proposal.

Finally, even if 75% of R&D funding were allocated in accordance with the roadmap, fully 25% of the R&D budget would remain free to be allocated to projects outside the purview of the roadmap. If the full authorized amount were to be appropriated in 2015, that 25% alone would be more than the entire appropriation for solar R&D in the American Recovery and Reinvestment Act of 2009.

CONCLUSION

I am gratified that in her testimony Dr. Johnson acknowledges the value of a roadmap-like process in discussing DOE's own plans to establish an external advisory board to review the entire solar program several times a year. There appears to be widespread agreement, both inside and outside DOE, that such a process would add value. H.R. 3585 simply takes the next logical steps, first by giving the external reviewers explicit instructions to examine technical hurdles over different time horizons, and then by ensuring that, once solicited, their expert advice is used as a template to guide Federal solar R&D programs.

On October 22, 2009, the House of Representatives provided a ringing endorsement for increased Federal investment in solar R&D and the roadmap concept by passing H.R. 3585 by a strong bipartisan vote of 310 to 106. I encourage the Senate to take up this legislation and pass it without significant modification so that our nation may strengthen its leadership in solar technology development in the years to come.

STATEMENT OF ILAN KROO, LELAND T. EDWARDS PROFESSOR OF ENGINEERING, DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS, STANFORD UNIVERSITY, STANDFORD, CA, ON H.R. 3165

I am writing to support the inclusion of innovative new approaches to wind energy in the Department of Energy's (DOE) Wind Energy Research and Development Act of 2009. In addition to the program topics currently proposed, I believe it is critical to invest in innovative new approaches to wind power. As an example, concepts for airborne wind energy generation have been proposed by several companies, and

funding for these unconventional, but high-potential projects, could be very important at this time.

Most of the current research in wind energy systems has focused on incremental improvements to individual system components and improved methods for modeling conventional wind turbines. This research, if successful, will lead to important, but small, advances in current systems. Unconventional concepts for wind energy generation have, by contrast, received little serious research and development support. Although many of these concepts are not feasible for utility-scale power generation, those that do appear feasible should be an important part of the nation's research program. I therefore encourage the inclusion of innovative approaches to wind energy, including airborne and high-altitude wind power as a research topic in DOE's wind energy research. Amending HR3165 will give the pioneers of these new technologies the opportunity to compete for available funding within the DOE. Your support for this amendment will help meet federal energy goals, create new jobs, and ensure that the United States leads in the development of this innovative technology.

STATEMENT OF THE SOLAR ENERGY INDUSTRIES ASSOCIATION, SEIA, ON H.R. 3585

Established in 1974, the Solar Energy Industries Association (SEIA) is the national trade association of solar energy industry. As the voice of the industry, SEIA works with its 1,000 member companies to make solar a mainstream and significant energy source by expanding markets, removing market barriers, strengthening the industry and educating the public on the benefits of solar energy.

SEIA would like to commend the leadership of Representative Gabrielle Giffords on HR 3585. Representative Giffords is an outspoken and articulate supporter of the solar industry who understands that in order for the solar energy industry to accelerate its pace of growth and contribute to job creation, economic development, energy self-reliance and improved environmental quality in the United States, we will need to build on our long-standing and highly successful partnership with the Department of Energy (DOE) on research, development and deployment (RD&D) of all solar technologies: PV (Photovoltaics), CPV (Concentrating Photovoltaics), CSP (Concentrating Solar Power), Solar Heating and Cooling. The continued support of Congress for solar RD&D and initiatives like HR 3585 are essential for continued progress.

Historically, DOE has prepared solar roadmaps in collaboration with all key stakeholders including industry, academia, utilities, and a wide-ranging mix of local and national energy constituencies. The PV Manufacturing Roadmap is a recent example of this success, which has led to measurable and substantial improvements in cost reduction and performance improvement. The cost of solar panel production has declined from $33/W in 1979 to as low as $1/W today. As a result of this progress, we have seen increasing deployment of solar technologies on homes and commercial roof-tops as well as large, central station systems.

DOE and the national labs have produced significant results in the CSP side of the industry as well. DOE funding at the national labs helped develop a trough that was used in the largest CSP trough facility to be built in nearly 2 decades. Acciona Energy's Nevada Solar One, a 64-MW plant near Boulder City, Nevada, came online in June 2007. DOE and Sandia National Lab have supported development of dish-Stirling technology, culminating in the first commercial dish-Stirling plant, coming online near Phoenix Arizona in December 2009.

SEIA proposes to build on the success of these efforts leads and supports an inclusive planning process with DOE for all solar energy technologies.

Many of the SEIA member manufacturing companies were born out of the integrated circuit (IC) industry or with the support of technical leaders from that sector. We know that industry roadmaps, like the International Technology Roadmap for Semiconductors (ITRS), accelerated innovation and cost reduction in the integrated circuit equipment and manufacturing arenas. However, we believe a roadmap process modeled on the ITRS that was helpful in the IC industry would be inappropriate for the solar industry, now and for the future.

Consider the evolution of the IC industry. In the early stages of growth, the core material—silicon—was configured in several different device architectures. Once the CMOS (complementary metal—oxide—semiconductor) structure in silicon emerged as the most scalable single solution, the ITRS roadmap was implemented and linewidth nodes from 65nm to 45nm to 22nm to 15 nm became the framework for defining tools. In contrast, a solar cell has only one device architecture, a diode, but there are literally thousands of material possibilities, including monosilicon, multisilicon, thin film silicon, cadmium telluride, and copper indium diselenide.

An important reason for the success of the IC roadmap was that, unlike the solar industry, the IC industry had a natural split of intellectual property between processing and chip design and there was a shared interest between those two groups of companies in mechanical aspects of wafer size and linewidth geometry. With the competitive landscape of material and device narrowed to one each, then a prescriptive roadmap was relevant to the next wave of predictable progress.

The PV segment of the solar industry also differs from the IC industry in the make-up of the final product. Given that half or more of the cost of a solar power system can be driven by the balance-of-system cost (e.g. sales, marketing, permitting, financing, delivery, installation, monitoring, operations and maintenance of the system), we recognize that any solar roadmap should incorporate learning from mass production manufacturing sectors like the automotive industry, the construction industry, and large household appliances. We already see examples of the onward march of manufacturing expertise entering the solar industry from auto businesses like Bosch in Europe and BYD in China.

Further, we see the emergence of vertically integrated stakeholders which span the value chain elements of manufacturing silicon, growing ingots, building solar panels and installing their own power plants.

The solar industry must have the flexibility to address a wide spectrum of end-user applications ranging over three orders of magnitude from 500MW power plants in the desert to 5kW residential rooftops, and over a range of environmental conditions, building and land characteristics, and end-customer preferences. The solar industry also has a strong innovation culture with private funding for, and success in, a wide range of materials, processes and device designs developed in highly competitive individual small businesses. Fortunately, the scale of the solar industry even at this early stage of development is large enough that a single U.S. photovoltaics manufacturer, such as SunPower Corp., First Solar, United Solar, BP Solar, Sharp Solar or SolarWorld, can drive tool vendors to develop machines for the millions of solar panels produced annually by any innovative, but company-unique technologies. Furthermore, tool vendors, such as Applied Materials, are at a scale to establish a market for flexible tool-platforms for both unique technology platforms and continuously variable configurations, specific for customers' unique roadmaps. This diversity enables faster growth because the competition of ideas is always at work. By accelerating cost reduction for the benefit of all the different approaches have different supply chain constraints and the diversity of products satisfies a greater range of end-user requirements.

We thus support an inclusive planning process with DOE to develop a roadmap that supports and rewards a rich diversity of PV, CPV, CSP and solar heating and cooling that are responding to market demands without prematurely "picking a winner" through prescriptive funding assigned by a select few. One of the key features of a successful roadmap will be to integrate flexibility at the same time as scaling is enabling further cost reduction in solar electric power.

Some of our colleagues in the solar industry are just launching their production manufacturing. Consider CIGS technology, or PVGU (PV Glazed Units). Should those kinds of technologies find good success in manufacturing reliable solar panels at a low cost, we would not be wise to establish a rigid roadmap that directs DOE away from facilitating the rapid expansion of such promising technologies. We want all current successful technologies to be encouraged to ramp up as quickly as possible without putting up hurdles to new, promising technologies born from our current public and private solar investments.

Finally, we applaud the spirit and intent of HR 3585 to increase funding and enhance RD&D for solar at DOE. However, we would like to ensure that the actual funding for R&D continues to grow while enhancing the scale of the deployment efforts by DOE. The OMB estimated outlay of $193 million from HR 3585 in 2011 is below 2009 total solar RD&D DOE funding, and section 105 prescribes significant expenditures for large-scale deployment support for certain specific project sizes. Over the last three years, department support of research, development and deployment in support of commercializing innovative technology and driving total system cost reduction has been very effective; we believe that a decrease in this type of funding would have negative consequences, especially in light of the extreme risk-aversion to technology exhibited by the financial community after the past year's credit crunch. With the combination of section 105 project deployment funding and the potential diversion of up to 75 percent of DOE solar RD&D funding to select roadmap purposes, we are concerned that the substantial success of recent DOE solar funding could be at risk.

We all support continued growth of funding for the full spectrum of solar technologies, (PV, CPV, CSP & Solar Thermal) across the value chain in addition to the specific project and roadmap funding contemplated in this bill.

Thank you for the opportunity to comment and support the increased funding contemplated by HR 3585 and Representative Giffords.

STATEMENT OF LEN SHEPARD, CEO, SKY WINDPOWER, ON H.R. 3165

I urge you to consider including language specific to high altitude wind power in any wind, climate or energy legislation, including HR3165 and related bils. Everyone who flies across the United States has experienced the tremendous power in high altitude winds. As you know, that is why it typically takes 4-5 hours to cross our continent going west to east and 5-6 hours east to west. Because the wind at altitude is not limited to ridge lines or other surface geography, we have the flexibility to tap this tremendous power source using existing transmission lines. High altitude wind energy conversion systems can transform the energy landscape, generating enough power to meet the USA's most aggressive renewable energy goals. We need your support to achieve that.

This November's High Altitude Wind Power Conference revealed diverse methods from nearly a dozen companies to convert high altitude winds into clean energy. About 50 million private sector dollars have been invested in a half dozen of these companies that are developing airborne technologies to tap this very high (50-80%) capacity factor wind power.

A new industry of American leadership and jobs can be gained with your support. Government funding for this new industry will significantly decrease the time to bring this power source on line and increase the speed at which new clean tech jobs are created. America is the right place to develop these systems because the aerospace technology and know-how is here.

We and others believe that high altitude wind power conversion systems can take us cleanly through the 21st century and beyond. Time Magazine included Sky WindPower's Flying Electric Generators as one of the 50 Best Inventions of 2008. The July 30, 2009 issue of Nature displayed the efforts of Makani Power, Joby Energy, Magenn Power, and Sky WindPower. Recently, Sky WindPower was featured under utilities in the London Times. The December 2009 issue of Scientific American included Flying Electric Generators in their "20 World Changing Ideas."

You can help us achieve energy independence, exceed carbon emission reduction targets, and create American jobs by supporting the development and testing of high altitude wind power conversion systems. Thank you in advance for your consideration.

STATEMENT OF GABRIEL HUGH ELKAIM, ASSOCIATE PROFESSOR, AUTONOMOUS SYSTEMS LAB, COMPUTER ENGINEERING, UNIVERSITY OF CALIFORNIA, SANTA CRUZ, CA, ON H.R. 3165

Through my work as a researcher of applied control systems at the University of California at Santa Cruz, I've become acquainted with the efforts of Joby Energy, Inc. and others working to develop airborne wind turbine technology. This small group of innovative entrepreneurs is leading the exploration of new technology that has the potential to revolutionize the wind turbine industry.

As you are undoubtedly aware, wind energy as conventionally implemented has very serious problems with capacity and intermittency; the fact that the energy is diffuse and low-density and requires backup generation capacity (hot idling peakers) or a currently unavailable smart electric grid to move the energy across geographically diverse regions such that scattered wind effects "average" out. Technological advances will help the efficiencies at the margins, but this is essentially a problem of physics. Germany's experience in large scale wind energy portfolio and required gas turbine backups makes this abundantly clear.

By "lifting" the turbine to high altitude and the jet stream, many of these problems can be addressed. The science is clear: high altitude wind holds a vast amount of energy and recent technology advances and innovative engineering now make it possible to harness that energy and put it to work. While the engineering challenges are great, the physics are very much in favor of the high altitude solution.

Amending H.R. 3165 to include research foci on high altitude wind and airborne wind turbine technology will enhance current research and development efforts to potentially deliver options for timely and responsive solutions to our energy crisis.

Thank you for your consideration.

STATEMENT OF JOEBEN BEVIRT, FOUNDER, JOBY ENERGY, INC., SANTA CRUZ, CA, ON H.R. 3165

I am writing to request the inclusion of amendments to support exploration of high-altitude wind energy as a research topic for the Wind Energy Research and Development Act of 2009 (HR 3165).

Specifically, we request that the words "and altitudes" be inserted on page 3, line 20 after "variety of wind conditions"; and, on page 4, line 4 insert (9) "airborne wind turbine technology" (version dated September 10, 2009).

These amendments will allow developers of this transformational technology to compete for research and development funding at the federal level.

Currently, federally supported efforts to advance conventional wind energy technologies yield only incremental efficiency gains. However, energy generation is truly limited by the low capacity and intermittency of surface winds.

Research conducted by Dr. Ken Caldeira of Stanford University and Dr. Cristina Archer of California State University shows that high-altitude winds are significantly stronger and more consistent than surface winds. Focus on the research and development of airborne wind turbines can help harness high-altitude wind, a vast and dependable source of energy.

Several innovative companies, in collaboration with academia, are developing airborne wind turbines that can generate renewable energy at a cost and capacity comparable with coal power plants.

Additionally, the deployment of reliable and low-cost renewable energy technology will help achieve energy independence, create numerous jobs, and mitigate environmental damage.

Therefore, I am requesting the Committee act to spur the exploration of high-altitude wind energy and development of airborne wind turbines by amending HR 3165. Harnessing this resource presents a true cost-effective alternative to fossil-fuel based power generation.

Thank you for your consideration.

STATEMENT OF CORWIN HARDAM, FOUNDER AND CEO, MAKANI POWER, INC., ALAMEDA, CA, ON H.R. 3165

At altitudes just above conventional wind turbines, there is a wind energy source that is too large to ignore. Recent studies by Dr. Caldeira (Stanford) and Dr. Archer (Cal State) have shown the available energy in the winds at altitude above the continental US to be many times greater than the current global level of consumption. At this time, American companies are the technology leaders in the exploration of this untapped resource. For the success of these companies, it is critical that you include language specific to airborne wind energy in any wind, climate or energy legislation, particularly HR3165 and related bills.

This new resource has been vetted by the private sector. Google Inc. is a strong supporter in airborne wind energy and has invested $15M in our company. However, private equity alone cannot establish this technology at the utility scale and must be coupled with Federal support to establish airborne wind energy as a viable area of exploration. This cannot happen unless high-altitude wind energy is listed as a research topic for the Wind Energy Research and Development Act of 2009 (HR 3165).

STATEMENT OF GRANT CALVERLEY, PRESIDENT, SKYMILL ENERGY, INC, FRIDAY HARBOR, WA, ON H.R. 3165

SkyMill Energy, Inc., supported by The Boeing Company, is developing an innovative technology that could generate an almost unlimited supply of renewable energy for our nation from high altitude winds. We would greatly appreciate your help with fixing the unintentional omission of high altitude wind power research in bill HR3165, the Wind Energy Research and Development Act of 2009 .

High-altitude wind represents an enormous and untapped form of highly concentrated renewable energy. The US appears to seriously lag several countries in research and funding to find a commercially practical technology to tap this abundant potential resource. The DOE currently has no apparent activity in this area.

SkyMill Energy, other US based high altitude wind power researchers, propose to demonstrate such transformational technologies. SkyMill's innovative system is performing successfully in subscale prototypes and high-fidelity engineering simulations. The results to date suggest that a full-scale commercial system could outperform current-technology land based wind turbines by over a factor of five.

Due to the current complete lack of DOE interest in airborne wind power technologies, SkyMill Energy is investigating a mix of Chinese venture capital, Chinese government funding and Chinese airspace to commercialize our system. This is not our preferred development path, but one we may be forced to follow with out a change in policy.

HR3165 properly supports a variety of programs to advance terrestrial wind turbine technology, however, the current bills wording precludes funding for any high altitude wind power technologies. Following are two suggested changes.

> Sec. 2 (b) (6) advanced control systems and blade sensors to improve performance and reliability under a wide variety of wind conditions and altitudes;
>
> Sec. 2 (b) (new line item after item (8) Airborne wind power technologies.

Thanks for your assistance.

STATEMENT OF CRISTINA L. ARCHER, DEPARTMENT OF GEOLOGICAL AND ENVIRONMENTAL SCIENCES, CALIFORNIA STATE UNIVERSITY CHICO, CHICO, CA ON H.R. 3165

I am writing to encourage your support of amending HR 3165 to include language that would promote exploration of high altitude wind energy and research and development of airborne wind turbines for capturing this immense resource. Inclusion of this language in the Wind Energy Research and Development Act of 2009 would help innovators in the emerging high-altitude wind power sector to bring this new technology to fruition.

It is known that winds typically get stronger with increasing altitude. Through research at Stanford University and California State University we have extensively characterized this phenomenon and estimated the power potential of global tropospheric winds. The power contained in high-altitude winds is not just higher but also more consistent, in general, than winds near the Earth's surface.

In November 2009, we hosted the first annual High-Altitude Wind Power conference in northern California, drawing participation from several technology developers and researchers in this field. The results of their work show tremendous promise for the deployment of low-cost, reliable and clean energy.

I believe the research and development of technologies to harness the power of high-altitude winds can dramatically increase our renewable energy generation while establishing our technical leadership and enabling energy independence.

Again, I encourage you to support these amendments that are crucial to help solve our energy crisis.

STATEMENT OF MICHAEL G. WHEELER, COUNTY COUNCIL CHAIR, LOS ALAMOS COUNTY, LOS ALAMOS, NM, ON H.R. 2729

On behalf of the Incorporated County of Los Alamos, New Mexico ("County"), I am writing to express the County's support for the National Environmental Research Park Legislation (H.R. 2729, To authorize the designation of National Environmental Research Parks by the Secretary of Energy, and for other purposes) ("NERP Legislation") provided certain amendments are made to the NERP Legislation that are described in this letter and set forth in Attachment A.*

The NERP Legislation will provide funding for ongoing environmental research at U.S. Department of Energy ("DOE") sites around the country. The important mission of each environmental research park is to conduct research, train people in ecological and environmental sciences and to educate the public.

The County has learned that NERP activities at those DOE sites where they are sufficiently funded have been valuable to the adjacent communities. The current programs have ensured that the communities adjacent to DOE sites are educated on the positive environmental activities at the DOE sites. Further, the NERP Legislation will provide researchers at Los Alamos National Laboratory with sufficient funds to continue their important environmental research and expand the program to include community education. The County supports such activities and wants similar education, outreach, and research programs to occur throughout Northern New Mexico.

Upon reviewing the NERP Legislation, the County has two primary concerns: 1) the need for community input into the creation of formal environmental research

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* Document has been retained in subcommittee files.

parks, and 2) the potential unintended consequence that environmental research parks may impact ongoing activities at DOE sites—including land transfer which is critical for the County's future self-sufficiency and economic diversification. To address these two concerns, the County recommends the following amendments to the NERP Legislation (which are inserted into the legislation as Attachment A for your reference):

- Section 2(b) is amended by inserting: "(b) Local Government Involvement-Prior to designating each National Environmental Research Park, the Secretary of Energy shall seek input from the effective units of local government surrounding each site regarding each local National Environmental Research Park."
- Renumber previous Sections 2(b) through 2(f) accordingly.
- Section 2(f) (as renumbered) is amended by inserting: "(4) update local communities on National Environmental Research Park activities."
- Section 3 is amended by inserting as the last sentence: "Nothing in this Act shall be construed to constrain the transfer of lands otherwise surplus and excess to programmatic needs of the Federal Government to surrounding local communities."

Each of the suggested changes should not change the actual operation of these proposed environmental research parks and should only clarify what the County has been told by the parties advocating this NERP Legislation—that the NERP legislation will not impact ongoing activities at the sites. The County also believes the suggested amendments will enhance involvement and participation by the local governments at the other DOE sites identified in the NERP Legislation which will only enhance the educational outreach activities and ensure that a broader community is aware of these scientific endeavors.

STATEMENT OF KLAUS S. LACKNER, MAURICE EWING AND J. LAMAR WORZEL PROFESSOR OF GEOPHYSICS, CHAIR, DEPARTMENT OF EARTH AND ENVIRONMENTAL ENGINEERING, COLUMBIA UNIVERSITY, DIRECTOR, LENFEST CENTER FOR SUSTAINABLE ENERGY AT THE EARTH INSTITUTE, COLUMBIA UNIVERSITY, NEW YORK, NY

I saw the hearing notice for the Air Capture Prize and am pleased to submit a testimony for the record. While it is understood that capturing carbon dioxide emissions from power plants is necessary to reduce greenhouse gases in the atmosphere, dilute capture of carbon dioxide is of particular long-term importance. Unlike more widely known carbon capture and storage (CCS) technologies, dilute capture development would especially benefit from a prize such as the one being considered by this bill.

We need new technologies like air capture to complement existing CCS strategies. Since capture from dilute sources can be done anywhere at any time, it is particularly well-suited to start small in niche markets where there is demand for commercial carbon dioxide. Offering a prize for the development of dilute carbon dioxide capture technology is a positive move to encourage technology research and development. The prize creates visibility and will foster entrepreneurial approaches and a healthy spirit of competition. With successful implementation, it will stimulate efforts in the right direction which will ideally have future government involvement to ensure long-term success.

I am encouraged by this Air Capture Prize bill and believe it will result in valuable advances in the development of new technologies in the dilute capture of carbon dioxide.

Thank you for your time and attention.

ATTACHMENT

November 30, 2009.

I am Klaus S. Lackner, Ewing-Worzel Professor of Geophysics at Columbia University. My research focuses on the management of carbon and carbon dioxide to avoid climate change. I am investigating technologies that can provide plentiful, clean energy from fossil fuels without contributing to the build-up of carbon dioxide in the atmosphere. While I certainly build on a foundation of earlier work, I am generally considered to have started the concept of air capture of carbon dioxide for managing the atmosphere's carbon loading. By now there are a number of different research groups pursuing this goal. and I have helped found a company that aims to develop commercially viable air capture. I am also working at Columbia Univer-

sity to understand the underlying basic mechanism of dilute capture of carbon dioxide.

While one might debate the highest acceptable level of carbon dioxide in the atmosphere, there is little argument that there is a threshold that should not be exceeded. Unfortunately, holding the carbon dioxide level of the atmosphere constant at any reasonable level will require drastic reductions in emissions before the world breaches this threshold. It is not sufficient to hold emissions constant. Persistent global emissions, even if they were three times smaller than today's emissions, would drive the carbon dioxide concentration over any such threshold. The natural return to an earlier level, even after stopping all emissions. could take many centuries or even millennia. Holding the line at a third of current global emissions would permit a world average per capita emission that is but a few percent of the current per capita emissions in the United States. The concerns over climate change challenge the viability of fossil fuels, which unavoidably produce carbon dioxide when they are consumed.

At the same time, all countries that strive for improvements in their living standards and desire to maintain economic growth will need ready access to affordable energy. Policies must provide access to increasing energy supplies while stopping the accumulation of carbon dioxide concentrations in the atmosphere. This is the conundrum of climate change. Simply abandoning fossil fuels over the next few decades in favor of other alternatives is impractical. The enormous price strains in the oil sector over the last decade were driven by far smaller mismatches in supply and demand than would occur if more than 80% of the world's energy infrastructure would need to be phased out. Fortunately, it is not necessary to stop the use of fossil fuels if the carbon dioxide produced can be kept out of the atmosphere. It is the emissions of carbon dioxide not the use fossil fuels that need to be eliminated.

Although carbon capture and storage (CCS) technologies by themselves may be insufficient for stabilizing the climate in a timely fashion, without CCS, stabilization is a nearly impossible task. This is especially true if the commonly cited threshold of 450 parts per million (ppm) of CO_2 in the air proves to be the critical limit. While one must consider all options from improved energy efficiency, to non-fossil energy alternatives, one must include carbon dioxide storage, because abandoning fossil fuels would be extremely disruptive to the global economy.

Much of the focus in CCS has been on capture from large concentrated sources of carbon dioxide, like power plants, steel plants and cement plants. However, a large fraction of all emissions comes from small, dilute and distributed emission sources. CCS could make a far larger contribution to climate stabilization if it could also address the capture of carbon dioxide from dilute sources, among them the atmosphere itself If CCS is to contribute significantly to an emissions reduction of 80% in the United States by 2050, then it is necessary to address the transportation sector, the home sector, and all those emissions that would otherwise be too difficult to control. Capture from dilute streams, particularly from the air. offers the opportunity to reduce emissions across the board. Capture from dilute streams is quite different from other methods of capturing carbon dioxide. Its feasibility seems counterintuitive to some. Why should it be possible to collect carbon dioxide from streams that are several hundred times more dilute than those encountered in power plants? Yet the thermodynamic analysis is quite clear. The additional energy required for air capture when compared to flue gas scrubbing is indeed small. While some detractors still point to engineering rules of thumb, these generic rules do not address the specifics of real implementations that have been demonstrated, and these rules seem similar to those used to "demonstrate-that heavier-than-air flight is not possible. These types of objections ignore that birds can fly and trees can collect carbon dioxide from the air.

Analysis reveals that a windmill that would reduce emissions by displacing fossil-fuelproduced electricity would be far larger than a carbon dioxide collector that would recapture an equivalent amount of carbon dioxide. Moreover, I and others have shown that the minimum binding strength of the carbon dioxide absorber need not be much larger than the binding strength required to capture carbon dioxide from the flue stack of a conventional coal fired power plant. The analogy to windmills suggests that contacting the air is not limiting the process; the analogy to power plants suggests that the dominant costs are similar to those encountered in flue gas scrubbing.

Unlike carbon dioxide capture from large concentrated sources, capture from the air can be done anywhere and anytime. This means it is possible to start small. Rather than trying to solve the carbon management problem at once, one can begin by filling the small market niche of industrial and commercial carbon dioxide demand. A big power plant would immediately overwhelm any local market for carbon dioxide. Unlike power plant capture and storage, capture from dilute streams can

become a standalone business that can operate on any scale. One can start with individual entrepreneurs and small companies that sell physical carbon dioxide or create carbon dioxide credits. The market for carbon reductions is potentially very large, but today's prices are low. The market for physical carbon dioxide that is used for industrial, agricultural and commercial applications is much smaller, and prices vary geographically, but in some locations where carbon dioxide is trucked in over large distances these prices are currently very high. Carbon dioxide capture from dilute sources, specifically from the air, provides an enormous arbitrage opportunity that—even in its early stages when a ton of carbon dioxide is still expensive—can satisfy commercial demands. Thus, dilute capture will create a business opportunity that allows bootstrapping the technology in ways that are not possible in the utility sector. Such a business will see climate change demands as an opportunity, in contrast to an existing utility, which at best will see carbon management as an unavoidable cost of doing business.

Offering a prize, such as the one proposed by this bill, for the development of dilute carbon dioxide capture technology is a positive move to encourage technology development. The prize creates visibility, and it provides a clear sign of the realization that we need more than business as usual to lead us to carbon dioxide stabilization. By focusing on dilute streams, the prize is offered to the one sector in the carbon management arena that is open to entrepreneurial approaches. The prize. if implemented as intended, would offer a challenge and will stimulate efforts in the right direction. Just like the DARPA challenge for autonomous cars, it will bring forward numerous small entrepreneurs and academic institutions that will focus on the theoretical underpinnings. Supporting such development is a good idea. It will create more competition in a field that is new and accelerate it from a few players to a bigger development in a short time.

Since, as I argue below, the technology is not only feasible but also transformative, a prize alone will not be sufficient to assure development of this field. The prize will focus entrepreneurial energy, engender debate and deliver a proof of principle. However, ultimately, a technology of such importance deserves ongoing governmental support. Capturing carbon dioxide from the air will be an important development. A recent article in Nature by Sarewitz and Nelson, pointed out that air capture if it can be done, has all the important features necessary to solve the climate change problem. Air capture, combined with CCS, addresses the root of the problem, which is the accumulation of the carbon dioxide in the atmosphere. It does so without forcing established technologies out of business, and it assures that any emission of carbon dioxide, no matter how difficult to control at the source, can be canceled out or compensated for. Institutional barriers are easier to overcome if entrenched interests are not forced out. Once air capture is implemented, it provides a baseline against which all other capture options could be measured.

Capture of carbon dioxide from ambient air clearly could play a major role in the transportation sector. It would make it possible to retain gasoline, diesel and jet fuel for cars, trucks and air planes. Liquid carbon based fuels provide an exceptionally convenient and energy-dense option for storing energy on board of vehicles. The use of air capture makes it possible to retain these fuels.

It is my assessment that the cost of air capture can be driven down to the point where it would add no more than ten percent to the price of gasoline. While I can give reasons why this is plausible, the only way to prove such a bold statement is to deliver on this goal. The prize will spur such development.

It is quite possible that Jim Hansen is correct and that we have already exceed the safe limit of carbon dioxide in the air, or that even with the best of intentions, we cannot reduce emissions fast enough to stop climate change. Even if all emissions were stopped today, global warming could continue for decades. In that case it may be necessary to reduce the carbon dioxide concentration in the atmosphere. Air capture is one of the few technologies that could accomplish this in a reasonable amount of time. Yet one should not rely on air capture to achieve a last minute rescue. It is worth noting that an even a short excursion above the safe threshold poses a severe risk of irreversible damage. For example, it is not possible to refreeze glacier fast enough to prevent irreversible damage.

Finally, air capture is not something that would be implemented at the expense of other alternative energy forms. Indeed, air capture provides an opportunity to give these alternatives a much wider range of applications. It can provide carbon dioxide for growing algae for biofuels, which need carbon dioxide supplements to maintain rapid growth. Air capture could also provide carbon dioxide for the production of synthetic fuels from carbon dioxide, water and renewable energy. A world with ample renewable energy could produce synthetic fuels to solve the complex problem of storing energy on board of vehicles and planes.

It is refreshing to see a bipartisan approach to finding a practical solution to the climate change/energy conundrum. The Barasso-Bingaman bill makes a strong statement that technology is important for solving the climate change problem. I believe that carbon capture from dilute sources is of particular long-term importance. Unlike most CCS technologies, dilute capture development would benefit from a prize. After development has begun, I would hope for deeper government involvement for this new and vital technology.

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