

**STATEMENT OF**

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**BEFORE THE**

**SUBCOMMITTEE ON ENERGY**

**COMMITTEE ON ENERGY AND NATURAL RESOURCES**

**UNITED STATES SENATE**

**DECEMBER 8, 2009**

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 Administrations, 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.”<sup>1</sup>

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.<sup>2</sup>

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 energy-literate generation of skilled workers, scientists, and innovators who can accelerate the

<sup>1</sup> 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-funding-smart-grid-technology>

<sup>2</sup> 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.

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<sup>3</sup> 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 scale-up 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 intertwined, 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

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<sup>3</sup> Center for Energy Workforce Demand 2007 Report: Gaps in Energy Workforce Pipeline

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 eco-regions 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, spatially-explicit 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 MAG-Industrial Automated Systems in Hebron, KY. Current blade fabrication technology is labor-intensive and prone to variability, resulting in incidences of manufacturing defects<sup>4</sup>. 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 failure, 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

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<sup>4</sup> Wetzel, Kyle K. "Defect-Tolerant Structural Design of Wind Turbine Blades," *American Institute of Aeronautics and Astronautics, Inc.*, 2009-2409

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)<sup>5</sup> and Adaptive Turbine Blades: Blown Wing Technology for Low-Cost Wind Power, PAX Streamline Inc. (San Rafael, CA)<sup>6</sup>, 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.

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<sup>5</sup> 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.

<sup>6</sup> 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.

**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 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.<sup>7</sup>

<b>S. 2773   Offshore Wind Energy Research, Development, Demonstration, and Commercial Application Act of 2009</b>
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**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

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<sup>7</sup> 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.

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 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*<sup>8</sup> [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

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<sup>8</sup> 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.

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.<sup>9</sup> 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

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<sup>9</sup> 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.

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 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.

<b>H.R. 3585   Solar Technology Roadmap Act</b>
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**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<sup>10</sup> 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<sup>11</sup> 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 approximately \$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 solar-energy 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.

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<sup>10</sup> <http://arpa-e.energy.gov/news.html>

<sup>11</sup> <http://www.energy.gov/news2009/7824.htm>

**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 solar-energy 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 envisioned 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*<sup>12</sup>, 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

<sup>12</sup> The report is available online at <http://www.nrel.gov/docs/fy09osti/43543.pdf>

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.

## **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.<sup>13</sup> Through the Recovery Act, \$37 million<sup>14</sup> 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** | EAct 2005 authorized the Department to implement several prize competitions for breakthroughs in RD&D and commercial applications of energy technologies. Specifically, EAct 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 EAct 2005 to include additional prize competitions, including the Hydrogen Prize (H-Prize) and the Bright Tomorrow Lighting Prize (L-Prize). The H-Prize sought to provide incentives and reward advances in technologies, components, or systems related to hydrogen production, storage, distribution, and utilization, while the L-Prize 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.

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

<sup>14</sup> <http://www.energy.gov/news2009/7824.htm>

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.

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.