**STATEMENT OF**

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**BEFORE THE**

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**UNITED STATES SENATE**

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Chairman Bingaman, Ranking Member Murkowski, Members of the Committee, thank you for the opportunity to discuss the three pieces of legislation before us today: S. 629, the Hydropower Improvement Act of 2011; S. 630, the Marine and Hydrokinetic Renewable Energy Promotion Act of 2011; and Title I, subtitle D of the American Clean Energy Leadership Act of 2009 (ACELA, S. 1462 from the 111th Congress).

In his State of the Union address in January, President Obama referred to America's need to transition to a clean energy economy as "our generation's Sputnik moment," a goal so important that we need to "reach a level of research and development we haven't seen since the height of the Space Race."[1] S. 629 and S. 630 would dramatically increase the federal government's investment in both conventional hydropower and marine and hydrokinetic (MHK) renewable energy technologies.

The provisions being considered from ACELA address the interdependence of our energy and water consumption. Water is an integral component of many traditional and alternative energy technologies used for transportation, fuels production and electricity generation. Energy-related water demands are beginning to compete with other demands from population growth, agriculture and sanitation. This competition could become fiercer if climate change increases the risk of drought, making our water supply more vulnerable. The Department of Energy (DOE) has initiated many activities over the last few years to address this energy-water nexus.[2]

Since fiscal year 2008, when DOE restarted its Water Power Program, it has made significant strides in advancing next-generation water power technologies, assessing existing resources, promoting deployment opportunities, and cooperating with other government agencies to accelerate water power development. About 45 percent of all hydropower in the United States is generated at Federally-owned facilities, providing clean, renewable power to the grid.[3] DOE's estimates indicate that there could be an additional 300 gigawatts of hydropower through efficiency and capacity upgrades at existing facilities, powering non-powered dams, new small hydro development and pumped storage hydropower.[4]

DOE works on both conventional hydropower and on marine and hydrokinetic (MHK) technologies. The combined FY 2012 Budget Request for conventional hydropower and MHK technologies is $38.5 million. Conventional hydropower – energy derived from water using dams, diversionary structures, or impoundments for electric power – generates more electricity than any other renewable energy source in the U.S. Conventional hydropower represented 65 percent of U.S. renewable electricity generation in 2010, and seven percent of total U.S.

[1] http://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address
[2] See, for example, the activities undertaken by the National Energy Technology Laboratory, http://www.netl.doe.gov/technologies/coalpower/ewr/water/index.html.
[3] http://eia.doe.gov/cneaf/electricity/page/eia906_920.html
[4] FY09 DOE Interim Conventional Hydro Resource Assessment, Oak Ridge National Lab

electricity generation that year.[5] Conventional hydropower principally serves as a baseload electricity supply, but can also function as a dispatchable resource to balance variable renewable energy technologies such as wind and solar.

MHK technologies include energy devices that can extract energy from moving water, including waves and currents in oceans, rivers, and tidal areas, and from ocean thermal and salinity gradients. These resources if also developed in an environmentally responsible manner hold potential for helping our nation meet its clean energy goals.

In a March 2007 report, the Electric Power Research Institute indicated that its conservative estimate was that MHK power (from wave and tidal sources alone) could provide an additional 13,000 megawatts (MW) of capacity by 2025.[6] MHK power and ocean thermal energy are resources that typically can have higher capacity factors than some other renewable energy sources. In addition, they may not present the same level of integration challenges that large-scale development of variable renewable energy sources such as wind and solar may create for electricity grid planners and operators.

Through its Power Marketing Administrations (PMAs), DOE promotes and creates opportunities for new conventional hydropower technologies and development. PMAs encourage the most widespread use of hydropower possible at the lowest rates consistent with sound business principles. Some PMAs have established an active hydropower modernization program, adding hundreds of megawatts of capacity at existing facilities by updating equipment, while others have faced challenges in arranging financing. Because some of the challenges are statutory in nature, the PMAs and their customers may consult with the Committee on measures that would actively encourage expansion of hydropower capacity through updates to existing facilities.

Last year, DOE, the Bureau of Reclamation, and the Army Corps of Engineers signed a memorandum of understanding (MOU) on hydropower that aims to build long-term working relationships between agencies by prioritizing similar goals and aligning ongoing and future renewable energy development efforts.[7] The objectives of the MOU include deploying new, environmentally sustainable hydropower capacity, including upgrading existing facilities; powering non-powered dams; and research, development and deployment (RD&D) into new hydropower technologies, among other objectives. The pursuit and ultimate achievement of these goals will serve to strengthen our economy, enhance our national security, and protect our environment.

Water is an integral aspect of energy consumption and generation for many energy technologies other than hydropower as well. Many types of energy production make use of water, particularly for cooling, and increasingly, water-efficient technologies are being developed to reduce these

[5] http://www.eia.doe.gov/cneaf/electricity/epa/epa.pdf
[6] http://www.aaas.org/spp/cstc/docs/07_06_1ERPI_report.pdf
[7] http://www.energy.gov/news/8793.htm

impacts and help America use less water to meet its energy demands and use less energy to meet its water demands. Still, power generation from thermal energy sources (which include coal, natural gas and nuclear energy) accounted for approximately 41% of U.S. freshwater withdrawals in 2005.[8] Although most of the water withdrawn for cooling thermal power plants is subsequently returned to the source, this still can have disruptive effects on water flows and temperatures, which in turn negatively affect aquatic organisms, namely fish populations such as salmon. DOE estimates that there are significant opportunities to reduce water consumption for both electricity and fuels production. For example, in the electricity sector, development of hybrid wet-dry cooling systems may reduce water consumption by 70-80 percent compared to recirculating cooling systems. Moving, pumping and treating water and wastewater is in itself quite energy-intensive, representing roughly four percent of U.S. electricity consumption.[9]

The Department, through its National Laboratories and collaboration with universities and the private sector, is pursuing three major objectives to address the energy-water challenge. First, to address the increasing limited supplies of freshwater, DOE is considering strategies to increase use of nontraditional water resources in the power sector. Second, DOE is working to reduce the consumption of fresh water when generating electricity, while considering the full life-cycle of various energy technologies to determine how much water they demand and what kind of water quality they need. Finally, DOE is researching water-efficient technologies for the production of alternative or unconventional fuels for transportation.

I am pleased to offer the Department's perspective on these pieces of legislation. I will discuss these bills in the order they appeared in my invitation to testify before this Committee.

## S. 629: Hydropower Improvement Act of 2011

The Hydropower Improvement Act of 2011, S. 629, seeks to substantially increase hydroelectric capacity and generation and improve its environmental performance.

A recent report from the Federal Energy Regulatory Commission (FERC) demonstrates that little additional hydropower is in the pipelines.[10] Concerns include environmental issues and non-technical barriers to reduce the expense and uncertainty of the regulatory process is needed.

The most significant provision of S. 629 is a proposed authorization to DOE of $50 million per year for competitive grants and $50 million per year for RD&D to increase hydropower generation. This authorization level is significantly higher than the FY 2012 Budget Request for EERE's conventional hydropower program of $20 million, and would also represent a substantial increase to the FY 2010 Budget for conventional hydropower of $13 million. These

[8] http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf
[9] http://www.circleofblue.org/waternews/wp-content/uploads/2010/08/EPRI-Volume-4.pdf
[10] http://www.ferc.gov/legal/staff-reports/03-17-11-energy-infrastructure.pdf

additional resources, if appropriated would enable increases in renewable hydropower generation, and provide for the accelerated demonstration of innovative technologies that can improve environmental performance.

In FY 2010, DOE funded the Hydropower Advancement Project (HAP) for $3 million. The HAP is focused on the most cost-effective, least-controversial types of new hydropower development, and seeks to stimulate further hydropower development and generation without new dams. The project has already identified multiple opportunities for adding generation and/or improving environmental performance without sacrificing energy efficiency. Current funding allows for fifty initial facility assessments and three to five detailed engineering design studies. Additional resources would be used to support facility improvements that could result in increased hydropower generation at the most cost-effective sites.

DOE has invested in a three year program of research and development (R&D) to address issues related to the environmental performance and siting of hydropower technologies. These efforts focus on increasing fish passage, investigating adequate environmental flows and improving water quality and will help ensure that increases in conventional hydropower generation are coupled with concurrent improvements in the environmental sustainability of the industry, issues that DOE has been working on since the mid 1990s. If realized, the additional funding authorized by S. 629 would help scale-up the advanced turbines and optimize operational scenarios.

A quicker, two-year FERC licensing process, as proposed by S. 629 would help accelerate development of conventional hydropower resources. A streamlined licensing approach already has been implemented by FERC for small hydropower projects; expanding this quicker process would be welcomed by DOE and the hydropower industry. At the same time, we must be sure that this quicker licensing process does not sacrifice rigorous maintenance of environmental standards and ensures adequate opportunity to allow for public input. Providing a quicker regulatory process when all environmental and public concerns have been addressed is a valuable goal.

S. 629 would require FERC and the Bureau of Reclamation to conduct workshops on small hydropower projects and conduit hydropower.[11] These workshops would provide opportunities for the federal government, including natural resource agencies, industry, environmental organizations and other stakeholders to reach consensus on strategies to overcome barriers to greater hydropower deployment, including conflicting definitions of eligible projects and complicated, poorly understood permitting and licensing processes.

[11] Conduits are defined as tunnels, canals, pipelines, aqueducts, flumes, ditches, or similar manmade water conveyance systems that distribute water for agricultural, municipal, or industrial consumption and not primarily for the generation of electricity.

S. 629 would define a "small hydroelectric power project" according to the definition found in Section 4.30 of title 18 in the Code of Federal Regulations. DOE finds this definition problematic in this context, since this definition specifies that a small hydroelectric power project cannot be "owned or operated by the United States or by an instrumentality of the Federal Government." A majority of the non-powered dams that are proposed to be powered through this legislation are federally-owned by the U.S. Army Corps of Engineers and the Bureau of Reclamation. In fact, initial analysis by DOE for a forthcoming report indicates that the ten largest non-powered dams in the US with potential to produce more than one megawatt are all operated by the Army Corps of Engineers.[12] DOE accordingly recommends that the definition of small hydroelectric power project that appears in this legislation delete the requirement that the dam not be federally-owned or operated.

The Department appreciates that S. 629 recognizes the non-application of this legislation to the PMAs. In addition, the PMAs believe that they should have the approval right for efficiency power or capacity additions, improvements or replacements at Federal projects, made in association with this legislation, where the Army Corps of Engineers and the Bureau of Reclamation seek appropriations.

All other provisions of S. 629 would either build on or support current DOE activities and areas of interest.

**S. 630: Marine and Hydrokinetic Renewable Energy Promotion Act of 2011**

S. 630, the Marine and Hydrokinetic Renewable Energy Promotion Act of 2011, seeks to accelerate the growth of the MHK industry through additional federal aid, and expansion of the scope and scale of DOE's MHK activities. The additional funding authorized by this bill would represent a significant increase in DOE's program for MHK technologies and is significantly higher than either the FY 2012 Budget Request of $18 million or the FY 2010 Budget of $37 million.

DOE already has several MHK systems engineering efforts underway, but the additional systems engineering required by S. 630 would be used to accelerate these programs.

S. 630 would also require DOE to devote more R&D funding to develop open interface standards. This would ensure consistent design and development and allow unbiased comparison between competing technologies to achieve optimal energy generation in resulting systems. As the U.S. market develops, it will be crucial to avoid the pitfalls seen in the development of MHK technologies in Europe, where, despite tremendous strides that have been

[12] The National Hydropower Asset Assessment Project, to be released in April 2011.

made in device development and deployment, the interface standards with devices and data are still being developed.

The creation of a competitive grant program for MHK RD&D test facilities would mimic similar innovative activities already sponsored by DOE for other renewable energy technologies. DOE is currently investing in three MHK test facilities that focus on the demonstration of multiple MHK technologies. Investment in these National Marine Renewable Energy Centers (NMRECs) is critically important in order to help MHK technologies realize their full potential and to support their rapid commercialization if done in an environmentally responsible way. Each Center is currently developing plans for the development of open-water test facilities. Further investment in NMRECs, as called for by this legislation, would enable the open-water test berths to be established. Third-party testing and evaluation of device performance and reliability would enable private sector investment in these emerging technologies.

All three of DOE's existing NMRECs are unrestricted in terms of the device types they develop and support. Although none are geographically located for in-stream testing, tidal device research and development can substitute. It is unnecessary to distinguish between "marine" and "hydrokinetic" centers as the existing NMRECs could conduct research on any type of device.

On June 29, 2010, the Department of Energy and the Department of the Interior (DOI) signed an MOU for the coordinated deployment of renewable energy technologies on the OCS. The MOU's Action Plan includes a number of MHK-related activities, including coordination of studies and other activities to support future BOEMRE-issued MHK research leases, the development of environmental monitoring and mitigation protocols and collaboration on environmental study efforts, and development of a plan for MHK resource management and prediction. Additionally, on August 3, 2010, DOE announced the designation of Florida Atlantic University (FAU) as a national center for ocean energy research and development. With this designation, DOE awarded the new Southeast National Marine Renewable Energy Center $250,000 to undertake research and development of technologies capable of generating power from ocean currents and ocean thermal energy. FAU has applied for a five-year limited lease under BOEMRE's Interim Policy. If issued, this lease would allow for limited testing of ocean current devices on the OCS offshore Florida. DOE has also provided funding to the Northwest National Marine Renewable Energy Center to aid in the development of facilities to serve as an integrated, standardized test center for developers of wave and tidal energy, and the Hawaii National Marine Renewable Energy Center for the development of a site for the testing of wave energy conversion devices and ocean thermal energy conversion systems. DOE may seek to obtain research leases from DOI.

If funding is realized under S. 630, development of MHK technologies would be accelerated, speeding their transformation from promising but fledgling technologies to commercially viable, clean, renewable energy sources.

**Title I, Subtitle D of the American Clean Energy Leadership Act of 2009**

Title I, Subtitle D of ACELA contains provisions that would create an energy-water clean technology grant program in DOE and would require several studies on the energy-water nexus.

The grant program created under ACELA could serve as a useful way to spur industry to devote time and resources to develop strategies to minimize water consumption in energy processes. These provisions would also require DOE and other agencies to collaborate on several studies on this subject. The study that would be run by the Natural Academy of Sciences regarding the effects of energy development and production on U.S. water resources would be a useful, in-depth analysis. However, in this legislation, the analysis appears limited to a current assessment. While this in itself would be useful, DOE recommends that any such study also consider the expected increase in water demand from projected growth in energy production, and the water implications of moving to a clean energy economy. This will be especially important since certain clean energy technologies (carbon capture and storage, bioenergy, concentrated solar power, etc.) may result in increased water demands. The effects of climate change on water availability should also be analyzed in order to better understand the potential vulnerability of the energy sector to water constraints.

One of the other studies included in ACELA would require the Department of the Interior (DOI) to evaluate the amount of energy used in water storage and delivery operations. This study would be useful, but DOE suggests that the proposed study would benefit from consultation with other agencies with expertise in the energy-water area, including DOE.

In general, interagency consultation must be an integral component of our national strategy to address the energy-water nexus. Along with energy production, agriculture uses more water than any other sector in the U.S., so engagement with the U.S. Department of Agriculture will be essential. The U.S. Army Corps of Engineers must also play a vital role in developing more efficient water usage strategies. DOE welcomes efforts to build on existing collaborations with these and other agencies, such as the MOU referenced above.

These provisions would also require DOE to develop an Energy-Water R&D Roadmap to define future RD&D and commercialization efforts necessary to address emerging water-related challenges to future clean energy generation and production. DOE has already produced a report examining these issues, which it transmitted to Congress in January of 2007, and has developed a follow-up report, "Energy-Water Challenges and Research and Development Issues," that we expect will be finalized and transmitted to Congress shortly.

## Conclusion

In conclusion, I would like to again thank this Committee for its leadership in supporting both conventional hydropower and MHK energy technologies and in confronting the challenges associated with the interrelation of our energy and water consumption.

As Secretary Chu stated last year, "While hydropower is the largest source of renewable electricity in the nation, hydropower capacity has not increased significantly in decades. As the single largest owner of hydropower generation in the United States, it is important for the federal government to tap this valuable asset so it can continue to contribute to our clean energy portfolio and energy security."[13] S. 629 and S. 630 both contain provisions that would help realize this goal; however, both bills contain authorizations significantly in excess of the 2012 Budget request within EERE for Water Programs. The President's FY 2012 budget represents DOE's priorities for applied R&D in energy efficiency and renewable energy technologies.

Transitioning to a clean energy economy will be greatly enhanced if we also identify ways to minimize or eliminate water use associated with energy generation. The ACELA provisions could be the catalyst to finding these solutions.

I would be pleased to address any questions the Committee might have.

[13] http://www.energy.gov/news/8793.htm