S. HRG. 112–26

HYDROPOWER

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

TO

RECEIVE TESTIMONY ON: S. 629, TO IMPROVE HYDROPOWER, AND FOR OTHER PURPOSES; S. 630, TO PROMOTE MARINE AND HYDROKINETIC RENEWABLE ENERGY RESEARCH AND DEVELOPMENT, AND FOR OTHER PURPOSES; AND TITLE I, SUBTITLE D OF THE AMERICAN CLEAN ENERGY LEADERSHIP ACT OF 2009 (S. 1462 FROM 111TH CONGRESS)

MARCH 31, 2011

Printed for the use of the
Committee on Energy and Natural Resources

U.S. GOVERNMENT PRINTING OFFICE

66–811 PDF WASHINGTON : 2011

For sale by the Superintendent of Documents, U.S. Government Printing Office
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HYDROPOWER

THURSDAY, MARCH 31, 2011

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

The committee met, pursuant to notice, at 9:30 a.m. in room SD–366, Dirksen Senate Office Building, Hon. Jeff Bingaman, chairman, presiding.

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

The CHAIRMAN. OK. Why don't we get started.

Good morning. Welcome to today's hearing.

Today we hear testimony regarding 3 pieces of legislation—S. 629, which is the Hydropower Improvement Act of 2011, S. 630, which is the Marine and Hydrokinetic Renewable Energy Promotion Act of 2011, and also the energy and water integration provisions from Title I, Subtitle D, of ACELA, the American Clean Energy Leadership Act of 2009, which was S. 1462 in the previous Congress.

Today we will hear from administration and other witnesses about the potential we have to produce more hydropower in this country through improved efficiency at existing hydropower facilities and adding hydropower capabilities to existing structures. Developing additional energy from hydropower can help to decrease our dependence on fossil fuels, can help reduce the Nation's carbon emissions.

I'm glad to cosponsor the Hydropower Improvement Act with Senator Murkowski, and I appreciate her willingness to incorporate suggestions that I and others have made to encourage development of hydropower resources while protecting or even improving our natural resources. I am particularly interested in hearing about the opportunities for development of small hydropower projects that may be feasible, even in arid parts of the country like New Mexico.

In addition, I'm pleased to, that we'll hear testimony today regarding legislation to recognize the connection between energy and water. In 2009, Senator Murkowski and I introduced the Energy and Water Integration Act. We received testimony and comments on the bill during the last Congress. The committee reported the bill as part of ACELA with bipartisan support. The Energy and Water Integration Act takes a first step toward integrating energy and water policy. Developing new policies that integrate energy

and water solutions will become increasingly vital as populations grow and environmental needs increase, and a changing climate continues to affect our energy and water resources.

I'm glad to welcome the witnesses that we have here today to give their views on the bills. The committee appreciates everyone's efforts to be here.

Before I turn to the witnesses, let me call on Senator Murkowski for her opening comments.

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

Senator MURKOWSKI. Thank you, Mr. Chairman, and good morning.

I appreciate that we're having an opportunity this morning to really focus in on hydropower. As most folks know, I'm a pretty strong hydropower proponent. I consider it to be one of our hardest-working renewable resources and, unfortunately, one that sometimes gets overlooked a little bit in the clean energy debate. Coming from Alaska, we've got a lot of water, and we're figuring out how to harness it in good ways.

There's certainly no question that hydropower is, and must continue to be, part of our energy solution. It's the largest source of renewable electricity in the United States. The 100,000 megawatts of electro-, hydroelectric capacity we now have today provide about 7 percent of the Nation's electricity needs. Hydroelectric generation is carbon-free baseload power that allows us to avoid approximately 200 million metric tons of carbon emissions each year. It's clean, it's efficient, it's inexpensive. Yet, despite tremendous benefits, I'm amazed at how often it seems to be undervalued as a resource.

It's a misconception that the hydropower resource is tapped out. In Alaska, hydro already supplies 24 percent of our State's electricity needs, and over 200 promising sites for future hydropower development have been identified.

Today, as you mentioned, Mr. Chairman, we've got 2 hydropowers—hydropower bills that I have recently introduced. We've got S. 629—the Hydropower Improvement Act, which seeks to substantially increase our Nation's hydropower capacity. I'm pleased that a number of those on the committee here have agreed to cosponsor that—yourself, Senator Risch, Senator Wyden, Senator Cantwell. I thank them for their support.

This Act aims to spur on the development of a wide range of conventional projects to increase hydropower production—everything from efficiency improvements and capacity additions at existing facilities, to electrifying non-powered dams, to conduits at irrigation districts, to small hydro projects, to large pump storage facilities. We also include Federal assistance for needed environmental studies and mitigation efforts which should help all types of hydropower projects.

The other bill, S. 630, is the Marine and Hydrokinetic Renewable Energy Promotion Act. This is very similar to the provisions that this committee approved last Congress as part of ACELA, as you have noted. S. 630 is designed to speed up the development of renewable ocean energy—whether it's the wave, the current, tidal energy—in Alaska, all across the Nation.

The Electric Power Research Institute has estimated that our Nation's oceans resources could generate 252 million megawatt hours of electricity, or 6.5 percent of our entire electricity generation. But to reach this potential, ocean energy must gain the same financial and research incentives that are currently enjoyed by other forms of renewable energy.

Then, the last piece of legislation on today's agenda are then energy-water integration provisions. This legislation addresses the relationship between water and energy production. I think, given what we're seeing—the turmoil in North Africa and the Middle East—I find it interesting that the linkages between energy and water systems were first identified in studies in the 1970s, following the OPEC oil embargo. Since that time, though, I think it's fair to say that minimal investments in research and development have occurred.

Of course, all forms of energy production, distribution and use either requires water, or affects water resources in some manner. By identifying the relative linkages between energy and water systems and key research needs, we'll see a greater return on our investment in research, development and commercialization of energy and water technologies.

I look forward to the comments from the witnesses this morning, recognize that we've got some folks from here in town, and some that have traveled to be with us, so I appreciate their willingness to come and participate today.

The CHAIRMAN. All right. Thank you very much.

We have 2 panels.

This first panel are Government witnesses—the Honorable Michael Connor, who is the Commissioner of the Bureau of Reclamation, is not yet here. He was unavoidably delayed, but will be here shortly; Mr. Steven Chalk, who is the Chief Operating Officer and Acting Deputy Assistant Secretary for Renewable Energy at the Department of Energy; Mr. Jeff Wright, who is the Director of the Office of Energy Projects with FERC, the Federal Energy Regulatory Commission.

So, why don't we start with you, Mr. Chalk? Then you, Mr. Wright. If Mike Connors has arrived by the time you're through, we'll have him go ahead, or else we'll start with questions.

So, Mr. Chalk, go right ahead.

STATEMENT OF STEVEN G. CHALK, CHIEF OPERATING OFFICER AND ACTING DEPUTY ASSISTANT SECRETARY FOR RENEWABLE ENERGY, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

Mr. CHALK. Good morning, Chairman Bingaman and Ranking Member Murkowski, and the rest of the committee.

Thanks for the opportunity to discuss the 3 pieces of legislation today.

I've submitted detailed comments for the record, but I'd like to take this opportunity to give you a brief overview of the Department's activities on water power and the energy-water nexus.

Conventional hydropower currently provides 7 percent of U.S. generation, and 65 percent of our renewable energy comes from hydropower. The big advantage of hydropower, of course, is no cri-

teria pollutants and no greenhouse gasses associated with the actual energy production.

Conventional hydropower generation capacity in the U.S. has been on the decline. However, significant amounts of hydropower resources remain undeveloped. The vast majority potentially can be utilized with relatively low environmental risk, and without construction of any new large hydroelectric dams or impoundments. In fact, DOE's interim Hydropower Resource Assessment, which was completed in 2009, identifies additional hydropower capacity of 300 gigawatts—about 3 times our current capacity.

If S. 629, the Hydropower Improvement Act of 2011, is enacted, it would provide authorization to fund research; develop new technologies with improved costs and environmental performance characteristics, such as scale-up of fish-friendly turbines; and address environmental issues and other technical barriers to reduce the expense and the uncertainty of the regulatory process. It would also authorize funding to pursue efficiency and capacity upgrade opportunities at existing hydropower sites, as well as new opportunities to power existing dams where there are currently no turbines.

Marine and hydrokinetic—or MHK technologies, as we call them—are energy-conversion devices that extract energy from moving water from wave devices, oceans, rivers, tidal areas, and even salinity gradients. In March 2007 the Electric Power Research Institute reported that its conservative estimate indicated that MHK power—and this is only for wave and tidal sources alone—could provide an additional 13 gigawatts of capacity by 2025. If Senate Bill 630, the Marine and Hydrokinetic Renewable Energy Promotion Act of 2011, is enacted, it would authorize funding to enhance the current DOE research program aimed at reducing MHK costs, to optimize system and array designs, and validate performance and reliability.

DOE has already established National Marine Renewable Energy Centers which are similar to the test centers called for in Senate Bill 630. The goal of DOE's test centers is to provide open-water testing facilities which enable developers to test their technologies and validate their performance through a standardized, industry-recognized protocol. This third party testing capability could promote greater investment in deployment and commercialization of MHK technologies.

We are also pleased to comment on the chairman's bill from S. 1462, subtitle D, Energy and Water Integration. DOE estimates 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 could reduce water consumption by 70 to 80 percent compared to systems used today.

The various provisions of this bill could contribute to more comprehensive understanding of the water-related challenges to energy production, as well as the identification of technologies and practices that will optimize water and energy efficiency in production of electricity and fuels. In addition, the energy-water roadmap could contribute to establishing a cost-effective strategy for the Department's future energy technology research, development, dem-

onstration and deployment efforts for addressing emerging water-related challenges.

We recommend that any studies on this subject consider potential increases in water demand that will result from projected growth of energy production, and that interagency collaboration and consultation be part of these studies, as adequate water availability is an issue for every sector of the economy.

Finally, the President's fiscal year 2012 budget represents DOE's priorities for applied R&D in efficiency in renewable technologies.

So, thanks for the opportunity to testify today on the proposed legislation, and I will be happy to answer any questions that you may have.

[The prepared statement of Mr. Chalk follows:]

PREPARED STATEMENT OF STEVEN G. CHALK, CHIEF OPERATING OFFICER & ACTING DEPUTY ASSISTANT SECRETARY FOR RENEWABLE ENERGY, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

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. 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.

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[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

[5] http://www.eia.doe.gov/cneaf/electricity/epa/epa.pdf

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 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.

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[6] http://www.aaas.org/spp/cstc/docs/07 06 1ERPl report.pdf
[7] http://www.energy.gov/news/8793.htm
[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

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 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.

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.

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[10] http://www.ferc.gov/legal/staff-reports/03-17-11-energy-infrastructure.pdf

[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.

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

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 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.

The CHAIRMAN. Thank you very much.

Mr. Wright, why don't you go right ahead?

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

STATEMENT OF JEFF C. WRIGHT, DIRECTOR, OFFICE OF ENERGY PROJECTS, FEDERAL ENERGY REGULATORY COMMISSION

Mr. WRIGHT. Chairman Bingaman, Ranking Member Murkowski, other members of the committee, I appreciate the opportunity to appear before you to discuss specifically S. 629 and S. 630.

As a member of the Commission's staff, the views I express in my testimony are my own.

The Commission regulates over 1,600 non-Federal hydropower projects at over 2,500 dams pursuant to Part I of the Federal Power Act, or FPA. Together, these projects represent 54 gigawatts of hydropower capacity—more than half of all the hydropower in the U.S. The FPA authorizes the Commission to issue licenses and exemptions for projects within its jurisdiction.

About 71 percent of the hydropower projects regulated by the Commission have an installed capacity of 6 megawatts or less. The Commission has seen an increased interest in small hydropower projects, and has responded by implementing measures to facilitate efficient review of project proposals, including the following: (1) adding new web-based resources at the Commission's website to make it easier for applicants to understand and complete the licensing process, including application templates; (2) updating or creating MOU's with other agencies to improve coordination, such as the MOU with the State of Colorado, and the recently updated MOU with the Army Corps of Engineers; (3) continuing our small hydropower hotline and email address to answer applicant questions; and (4) educating potential hydropower developers through a new education and outreach program.

With this background I will turn to the draft legislation.

Section 7 of S. 629 would require the Commission to investigate the feasibility of implementing a 2-year licensing process. I support the goal of expedited licensing. It's always been our goal to act on applications as quickly as possible, and the Commission has established processes that allow for greater flexibility and efficiency.

However, the Commission operates under the constraints imposed by the FPA and by other legislation affecting the licensing process—the Clean Water Act, Coastal Zone Management Act, the Endangered Species Act, and the National Historic Preservation Act among them. Without the ability to waive sections of the FPA and other acts or to set enforceable schedules in licensing proceedings, a shortened process may be problematic.

Section 8 would establish various measures to promote conduit and small hydropower projects, which have been a major focus of the Commission's staff effort in the last few years.

I support section 8(a), which would amend section 30 of the FPA to allow conduit projects to be located on Federal lands. Section 8(a) would also require the Commission and the Commissioner of Reclamation to conduct regional public workshops on reducing barriers to conduit projects and report any recommendations to Congress. We are prepared to join them in this effort.

Section 8(b) would require the Commission to conduct regional public workshops on reducing barriers to small hydropower projects and to report the results of this effort to Congress. Noting the out-

reach described earlier, we are well prepared to undertake this effort.

Section 9 would amend the FPA to authorize the Commission to extend the term of a preliminary permit to up to 2 years, which I support. It might be worth considering, as an alternative, authorizing the Commission to issue permits for terms of up to 5 years, avoiding the need for developers to go through the process of seeking an extension.

Section 10 would require the Commissioner of Reclamation, in consultation with the Commission, to study barriers to non-Federal hydropower development at Bureau of Reclamation Projects, and to develop an MOU to improve the coordination and timeliness of such development. We have already begun working with the Bureau on this matter.

S. 630 would authorize the Secretary of Energy to take various steps to promote marine and hydrokinetic renewable energy technology. I have 2 comments on this.

Section 3 would allow the Secretary of Energy to issue grants to support national testing facilities for marine and hydrokinetic technology research, development and demonstration, which would be helpful in the development of new technologies. It may be worth considering either placing any test centers under the direct authority of DOE or another Federal agency, or providing an exemption from the provisions of Part 1 of the FPA for such test centers.

Second, section 6 of the bill would authorize the Secretary of Energy to issue grants to advance development to help fund the cost of environmental analysis, and the collection and dissemination of environmental data, and to support demonstration projects. This will help the regulatory process, and advance the development of the technology as a whole.

In conclusion, there is a great deal of hydropower potential throughout the country, including small projects, and marine and hydrokinetic projects. The Commission continues to adapt its procedures to facilitate the review and, where appropriate, the approval of such projects. The legislation under consideration will, as I have testified, assist in realizing that potential.

This concludes my remarks, and I'll be pleased to answer any questions you may have.

[The prepared statement of Mr. Wright follows:]

PREPARED STATEMENT OF JEFF C. WRIGHT, DIRECTOR, OFFICE OF ENERGY PROJECTS, FEDERAL ENERGY REGULATORY COMMISSION

ON S. 629 AND S. 630

Before the Committee on Energy and Natural Resources, United States Senate

Legislative Hearing , to improve hydropower, and for other purposes; S. 630, to promote marine and hydrokinetic renewable energy research and development, and for other purposes; and Title I, subtitle D of the American Clean Energy Leadership Act of 2009 (S. 1462 from 111th Congress).

Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee:

My name is Jeff Wright and I am the Director of the Office of Energy Projects at the Federal Energy Regulatory Commission (Commission or FERC). I appreciate the opportunity to appear before you to discuss S. 629, S. 630, and S. 1462. As a member of the Commission's staff, the views I express in this testimony are my own, and not those of the Commission or of any individual Commissioner.

I. Background

The Commission regulates over 1,600 hydropower projects at over 2,500 dams pursuant to Part I of the Federal Power Act (FPA). Together, these projects represent 54 gigawatts of hydropower capacity, more than half of all the hydropower in the United States. Hydropower is an essential part of the Nation's energy mix and offers the benefits of an emission-free, renewable, domestic energy source with public and private capacity together totaling about nine percent of U.S. electric generation capacity.

Under the FPA, non-federal hydropower projects must be licensed by the Commission if they: (1) are located on a navigable waterway; (2) occupy federal lands; (3) use surplus water from a federal dam; or (4) are located on non-navigable waters over which Congress has jurisdiction under the Commerce Clause, involve post-1935 construction, and affect interstate or foreign commerce.

The FPA authorizes the Commission to issue either licenses or exemptions for projects within its jurisdiction. Licenses are generally issued for terms of between 30 and 50 years, are renewable, and carry with them the right to exercise federal eminent domain to obtain property necessary for the construction, operation, and maintenance of a project. Exemptions are perpetual, and thus do not need to be renewed, but do not permit the use of eminent domain. Congress has established two types of exemptions. First, section 30 of the FPA allows the Commission to issue exemptions for projects that utilize for generation only the hydroelectric potential of manmade conduits that are operated for the distribution of water for agricultural, municipal, or industrial consumption, and not primarily for the generation of electricity. Conduit projects must be located on non-federal lands, and have a maximum capacity of 15 megawatts (40 megawatts if the exemptee is a state or local government entity). Second, in section 405(d) of the Public Utility Regulatory Policies Act, Congress authorized the Commission to grant exemptions for small hydroelectric power projects having an installed capacity of 5,000 kilowatts or less. To qualify for this type of exemption, a project must be located at an existing dam that does not require construction or the enlargement of an impoundment, or must use the hydropower potential of a natural water feature, such as a waterfall. Both types of exemptions are subject to mandatory fish and wildlife conditions provided by federal and state resource agencies.

The Commission has established three licensing processes, with the intent of allowing parties to select the process that is best suited to individual proceedings. The integrated licensing process (ILP) frontloads issue identification and environmental study to the period before an application is filed, and is thus well-suited to complex cases with substantial issues. The alternative licensing process (ALP) allows participants significant flexibility to tailor licensing procedures in a manner that may work well for unique cases. The traditional licensing process (TLP), in which environmental and other work can occur after the application is filed appears to work best for less controversial matters. The TLP may be the process that is best-suited for many simple cases involving exemptions or small, low impact licenses. Commission staff has also developed a pilot licensing process for hydrokinetic projects in which, with the assistance of federal and state resource agencies, a project can be licensed in as little as six months.

It is extremely important to note that project developers and other stakeholders, not the Commission, in most instances play the leading role in determining project success and whether the regulatory process will be short or long, simple or complex. The first key issue is site selection and proposed project operation. For example, the processing of applications tends to be expedited when applicants propose projects that: (1) are located at an existing dam where hydropower facilities do not currently exist, (2) would result in little change to water flow and use, (3) are unlikely to affect threatened and endangered species and are unlikely to need fish passage facilities, and (4) involve lands and facilities that are already owned by the applicant. To the extent that a proposed project, even one of small size, raises concerns about water use and other environmental issues, it may be difficult for the Commission to quickly process an application. It is important to remember that the small capacity of a proposed project does not necessarily mean that the project has only minor environmental impacts.

Another, and related, factor is the extent to which project developers reach out to affected stakeholders. If a developer contacts concerned citizens, local, state, and federal agencies, Indian tribes, and environmental organizations, and works with them to develop consensus as to what information is needed to understand the impacts of a project and what environmental measures may be appropriate, and to develop support for the project, the application and review process is likely to be simpler and quicker. Where a project comes as a surprise to affected entities or where a developer does not respond to expressed concerns, the Commission's job becomes

much more difficult, because the Commission must, and does, ensure that all expressed concerns are addressed.

A final, and again related, matter is the development of the full record that the Commission needs to act on an application. A potential applicant needs to work with Commission staff and with federal and state resource agencies and other stakeholders to determine what information is needed to support an application, and to provide the Commission with a complete application. Where Commission staff or other stakeholders must ask an applicant to provide information that is missing from an application, the regulatory process slows down.

The other entities with roles in the licensing and exemption process regarding small hydropower projects are also key to its success. The quickest, most efficient process can be achieved only where federal and state agencies, as well as other stakeholders, devote the resources early on to help project review move ahead, and where they display the flexibility to look at the merits of individual projects and the willingness to shorten the process in appropriate cases. Commission staff is dedicated to making the regulatory process as short and cost-effective as possible. We can only do that where applicants, resource agencies, and other stakeholders serve as willing partners in the process.

II. Commission Efforts Regarding Small and Innovative Projects

The majority of the hydropower projects regulated by the Commission are small projects, with about 71 percent having an installed capacity of 5 megawatts (MW) or less. In recent years, the Commission has seen a greatly increased interest in small hydropower projects, in innovative hydrokinetic projects, and in pumped storage projects, particularly closed loop pumped storage, which does not involve regular water withdrawals from rivers or other water sources. The Commission has responded by implementing a number of measures to facilitate efficient review of project proposals. In 2007, in order to provide personalized, responsive service to entities seeking to develop small hydropower projects, Commission staff established a dedicated phone line and email address for inquiries on small hydropower, developed a brochure to provide guidance to potential developers of small, low impact hydropower projects, and put these resources and a list of frequently-asked questions on the Commission's website.

In light of the continued growing interest in such development, the Commission held a technical conference on December 2, 2009, at its Washington, D.C. headquarters to explore issues related to licensing, and exempting from licensing, small non-federal hydropower projects in the U.S. The December technical conference generated discussion on recommendations that could improve the process for authorizing small hydropower projects. In addition to insights received from the panelists and attendees at the December conference, written comments were solicited and over 40 comment letters were received from industry representatives; federal, state, and local agencies; private citizens; and non-governmental organizations. At the Commission's April 15, 2010 meeting, staff reported on the conference and the comments received, and presented an action plan to assist and expedite the review of small hydropower proposals. The action plan adopted the following immediate changes: (1) adding new web-based resources to the Commission's website (www.ferc.gov) to make it easier for applicants to understand and complete the licensing process; (2) updating or creating Memoranda of Understanding (MOUs) with other agencies to improve coordination; (3) continuing our small hydropower hotline and email address to answer applicant questions; and (4) educating potential small hydropower developers through a new education and outreach program.

The Commission has, under its small hydro initiative, held numerous outreach meetings with small hydropower developers and interested stakeholders, and implemented web based tools, such as conduit application templates and application checklists, which potential applicants can use to prepare their applications. The small hydro website further contains guidance and sample letters that applicants can use to obtain waivers from fish and wildlife agencies for part of the prefiling consultation process. The Commission staff has also relaxed some of the standards, under Section 4.39 of its regulations, for exhibits and drawings for conduit applications. For those applicants that have filed complete and adequate applications, and for which the Commission has determined that impacts are minimal, the Commission has reduced the public notice period from 60 days to 30 days and the reply period from 45 days to 15 days. A number of conduit exemptions have been approved in as short as two months from the date that an application has been deemed complete.

Since the April 15, 2010 Commission meeting, we have signed an MOU with the State of Colorado to expedite the small hydro licensing process (August 2010); launched a small hydro program website (August 2010); participated in small hydro

workshops in Oregon (September 2010), Massachusetts (October 2010), and New Hampshire (November 2010); conducted two webinars on our small hydro website (November/December 2010); and updated our small hydro brochure. Upcoming outreach efforts will include: participating in small hydro workshops in Washington, DC, Vancouver, BC, and California as well as conducting another webinar this summer. We have also completed an update on our MOU with the Army Corps of Engineers.

The MOU with the State of Colorado provides an excellent example of a Federal-State solution for developing a pilot process to find flexible and innovative ways to reduce barriers to small hydro and conduit project development. In order to facilitate the Commission approval of such projects, the MOU provides that Colorado will prescreen any proposals and ensure that the applications are complete and meet Commission regulations before they are filed.

With this background, I will turn to the draft legislation.

III. S. 629

S. 629, the Hydropower Improvement Act of 2011, has the laudable goal of increasing hydropower capacity and generation in United States. I strongly support that goal, and offer comments on specific sections of the bill.

A. Sections 5 and 6

Sections 5 and 6 of the bill would authorize the Secretary of Energy to issue grants to increase hydropower generation, and to support hydropower research, development, and demonstration projects. I support these sections, which would assist in the development of additional renewable energy.

B. Section 7

Section 7 would require the Commission to investigate the feasibility of implementing a two-year licensing process, in particular, with respect to hydropower development at existing, non-powered dams, and for closed-loop pumped storage projects.

I support the goal of an expedited licensing process. Indeed, as I have discussed, it is Commission staff's goal to act on all license applications as quickly as possible, and the Commission has established processes that allow for great flexibility and efficiency. I am thus not certain whether an additional licensing process is necessary. During the last few years, we have been able to issue some licenses in a matter of a few months, where the project proponent had selected a site wisely, stakeholders had agreed on information needs, and state and federal agencies performed their responsibilities quickly. Moreover, the Commission operates under significant constraints imposed by the FPA, and by other legislation affecting the licensing process—the Clean Water Act, Coastal Zone Management Act, Endangered Species Act, and National Historic Preservation Act among them. In the absence of the ability to waive sections of the FPA and other acts, or to set enforceable schedules in licensing proceedings, it is not clear that the Commission, under its existing authorities, can mandate a shortened process.

C. Section 8

Section 8 would establish various measures to promote conduit and small hydropower projects. Again, this goal is consistent with Commission policy and has been a major focus of Commission's staff's effort in the last few years.

Section 8(a)(1) would amend section 30 of the FPA to allow conduit projects to be located on federal lands. I support this provision, which would remove the current bar on siting conduit projects on federal lands. This section would also amend the FPA to provide conditioning authority to federal land management agencies. These agencies already have the ability to impose conditions on proposed projects through the requirement that developers obtain special use authorizations under the Federal Land Management and Policy Act, so this amendment may not alter the current regulatory regime. As a general matter, however, I do have some concern that authorizing additional mandatory conditioning authority may slow down the licensing process and result in increased potential bars to hydropower development.

Section 8(a)(3) would require the Commission and the Commissioner of Reclamation to conduct regional public workshops on reducing barriers to conduit hydropower projects and thereafter report any recommendations to Congress. We have worked successfully with the Bureau of Reclamation in the past and are prepared to join Reclamation in this effort.

Section 8(b) would require the Commission to conduct regional public workshops on reducing barriers to small hydropower projects, and to report the results of this effort to Congress. Noting the outreach efforts described above, we are prepared to undertake this additional effort should Congress deem it helpful.

D. Section 9

Section 9 would amend the FPA to authorize the Commission to extend the term of a preliminary permit issued under FPA section 5 once for up to two years. Preliminary permits grant the permittee a "first-to-file" preference with respect to license applications for projects being studied under a permit. Commission staff has heard anecdotally that developers are concerned that the need for environmental studies in some instances makes it difficult to complete a license application within the current maximum three-year term of a permit, with the result that a developer which has invested substantial time and money studying a project may face the possibility of losing its project based on competition from other entities—particular those with statutorily-granted municipal preference—if it needs to seek a subsequent permit. I therefore support the proposed FPA amendment, which could ameliorate this problem. It might be worth considering, as an alternative, authorizing the Commission to issue permits for terms of up to five years, which could avoid the need for developers to go through the process of seeking an extension.

E. Section 10

Section 10 would require the Commissioner of Reclamation, in consultation with the Commission, to study barriers to non-federal hydropower development at Bureau of Reclamation projects and to develop a memorandum of understanding to improve the coordination and timeliness of such development. We have already begun working with the Bureau of Reclamation on this matter, and we have no objection to Section 10.

IV. The Marine and Hydrokinetic Renewable Energy Promotion Act of 2011

S. 630 would authorize the Secretary of Energy to take various steps to promote marine and hydrokinetic renewable energy technology. As a general matter, the bill is consistent with the Commission's initiatives to support the development of appropriate marine and hydrokinetic projects, which I have previously described. I have only two comments on the bill.

Section 3 of S. 630 would allow the Secretary of Energy to issue grants to support national testing facilities for marine and hydrokinetic technology research, development, and demonstration. Commission staff has informally discussed this concept with DOE staff over the last year or so, and I believe that testing centers could be extremely helpful in the development of new renewable technologies. Section 3 provides that test centers may be nonprofit institutions, state or local governments, national laboratories, or National Marine Renewable Energy Research, Development, and Demonstration Centers established pursuant to section 634 of the Energy Independence and Security Act of 2007. The Federal Power Act contains no provisions allowing the Commission to authorize the testing of jurisdictional hydropower facilities; accordingly, with some limited exceptions, tests centers operated by private entities or by state and local government may be required to be licensed by the Commission. Moreover, if a test center were to use a variety of technologies with differing environmental impact, the Commission might be required to issue separate authorizations for individual tests. This would not be the case for centers under the aegis of other federal entities, such as DOE, which do not fall within the Commission's jurisdiction. Therefore, to allow for the maximum flexibility and simplicity, it may be worth considering either placing any test centers under the authority of DOE or another federal agency or providing an exemption from the provisions of Part I of the FPA for such test centers.

Second, section 6 of the bill would authorize the Secretary of Energy to issue grants to advance the development of marine and hydrokinetic renewable energy; to help fund the costs of environmental analysis, the collection and dissemination of environmental data; and to support demonstration projects. The provision of grant funding to address the environmental information needs surrounding these new technologies directly addresses an issue of concern to federal agencies and other stakeholders. Environmental information is essential to the development and regulation of energy projects, yet, because marine and hydrokinetic technology is relatively new, and because these projects may be sited in areas, such as coastal zones, where the environment is not as well understood as onshore areas, much necessary information has yet to be developed. The cost of obtaining environmental information falls in large part on pioneering developers, and may thus discourage their efforts. The Commission and other federal agencies are partnering to reduce this burden by assembling and sharing environmental information. However, there are still issues which will require new studies, some of which are relevant to many developers. Federal funding to support gathering such information will help the regulatory process and advance the development of the technology as a whole.

V. The American Clean Energy Leadership Act of 2009

Title I, subtitle D of the American Clean Energy Leadership Act deals with the integration of energy and water resources. While this subtitle would not impose any direct requirements on the Commission, I note that the Commission recognizes the link between energy development and the use of our Nation's water resources. In siting natural gas and hydropower projects, the Commission conducts thorough analyses of the impact of proposed projects on water resources, authorizes only those projects that appropriately balance energy development and environmental protection, and imposes mitigation measures to ensure that approved projects are developed in an environmentally responsible manner.

VIII. Conclusion

There is a great deal of potential for the development of additional hydropower projects throughout the country, including small projects and marine and hydrokinetic projects. Working within the authority given it by Congress, the Commission continues to adapt its existing, flexible procedures to facilitate the review and, where appropriate, the approval of such projects. Commission staff remains committed to exploring with project developers, its sister federal agencies, Indian tribes, the states, local government, and other stakeholders every avenue for the responsible development of our nation's hydropower potential. The legislation under consideration will, as I have testified, assist in realizing that potential. This concludes my remarks. I would be pleased to answer any questions you may have.

The CHAIRMAN. Thank you very much.

Mike, I introduced you when we, at the beginning, and indicated you were unavoidably detained but would be here, and we look forward to your testimony. Go right ahead.

STATEMENT OF MICHAEL L. CONNOR, COMMISSIONER, BUREAU OF RECLAMATION, DEPARTMENT OF INTERIOR

Mr. CONNOR. Thank you, Mr. Chairman.

My apologies to the committee for being late.

I am pleased to be in familiar territory here, along with our Federal partners, to express the Department of the Interior's views on S. 629 and on Subtitle D of the American Clean Energy Leadership Act of 2009. I've submitted the written statements for the record.

With respect to S. 629, the Hydropower Improvement Act of 2011, there are a number of ongoing actions at Reclamation that relate to the provisions of the bill. As a threshold matter, I would say that our overall goal in carrying out those actions is to work in partnership with Federal, private and local governmental entities to identify and assess opportunities for sustainable hydropower development at Reclamation facilities.

Hydropower is a clean and efficient way to produce reliable energy, and is a renewable resource. Reclamation has nearly 500 dams and dikes, and owns 58 hydropower plants. Annually, these plants produce an average of 40 million megawatt hours of electricity, enough to meet the needs on an annual basis of over 9 million people.

This afternoon Reclamation will publish the Hydropower Resource Assessment at Existing Reclamation Facilities, a comprehensive review of the potential for new hydropower development at Reclamation facilities. In addition to the assessment, Reclamation will soon be publishing 2 Federal Register notices and make available Lease of Power Privilege opportunities at Granby and Pueblo dams in Colorado. These 2 facilities are identified as having good hydropower potential in the assessment I just mentioned.

I should also note that Reclamation and DOE are working on a funding opportunity announcement to conduct pilot studies on low-head hydropower units at Reclamation facilities.

Section 10 of S. 629 directs Reclamation to conduct a study of barriers to non-Federal hydropower development similar to the constraints analysis outlined in the assessment being released today. The assessment examines how regulations and legal requirements could potentially affect development of hydropower. Using historic data—land or water use regulations that could potentially affect development of hydropower, of hydropower sites—these were identified, and specific mitigation costs were accounted for in the economic analysis that's part of the assessment that's being released today.

Section 10 also calls for Reclamation and FERC to develop and issue a memorandum of understanding to improve the timeliness of non-Federal development of hydropower resources at Reclamation facilities. Reclamation and FERC have an existing MOU developed in 1992 that addresses issues related to the timely development of non-Federal hydropower. I agree that the MOU needs updating. Reclamation and FERC recently met to discuss how to improve timeliness of the processes developed in the MOU and resolution of authority issues, and those discussions will continue.

Section 8 of the bill allows low-head hydropower development on Reclamation-owned conduits to be eligible for inclusion in FERC's conduit exemption program. Currently, Reclamation is assessing the potential for developing low-head capacity on federally owned canals and conduits. A report similar to the Resource Assessment being released today is expected to be released for public review by year's end. Reclamation expects that the provisions in section 8 would address uncertainty in the approval process for new licenses and facilitate the development of new capacity at our existing facilities. Reclamation supports the opportunity to enter into new agreements to develop low-head hydropower potential in an environmentally sustainable manner.

Overall, the Department shares the committee's view that interagency coordination can leverage Federal and private sector investment in additional hydropower development. This administration is committed to increasing the generation of sustainable, affordable hydropower for our Nation. We hope that the assessment and the new efforts described will provide a lasting contribution to the power supplies, just as past investments in Reclamation's water power and infrastructure have done. We will, of course, continue to coordinate with other agencies, and look forward to working with Congress in this important area.

With respect to Subtitle D of S. 1462, I'll speak to sections 143 and 144, which involve the Bureau of Reclamation.

Section 143 directs Reclamation to study the energy used in water storage and delivery on major Reclamation projects, with an emphasis on opportunities to reduce consumption and costs. We share the committee's interest in this area.

Through our WaterSMART program, the Department is committed to integrating energy and water policies that promote sustainable use of our limited natural resources. WaterSMART grants and Title XVI Water Reuse projects funded in the last fiscal year

are expected to conserve an estimated 149,000 acre-feet of water once they're complete. With funds requested in fiscal year 2012, we'll seek to increase the total by an additional 140,000 acre-feet. Under WaterSMART, Reclamation incentivizes the conservation of energy in the delivery of water, and proposals receive additional consideration when they not only address water conservation, but also the use of renewable energy.

In fiscal year 2010, Reclamation's 37 water and energy efficiency grants included several proposals exploring the relationship between water and energy savings. Simply put, water conservation can yield significant energy savings, too.

Section 144 of the bill calls for specific research objectives and authorizes operations and cost recovery at the Brackish Groundwater National Desalination Research Facility in New Mexico. As the Chairman is well aware, desalination is one of an array of tools that will likely to be needed to face future water supply challenges that we face across the Nation.

The directives in section 144 are consistent with and build upon ongoing activities at the research facility. Reclamation is currently partnered with New Mexico State University in a =year research program with projects at the facility focused on research, education and outreach in water desalination. The bill calls on Reclamation to operate the facility to develop technologies that help create new water from municipal, agricultural, industrial or environmental uses. We support those goals and actions.

As members of the committee know, one of the authorities used to operate and maintain the desalination research facility stems from Public Law 104-298, commonly called "the Desal Act". The Desal Act has been funding research leading to pilot and demonstration testing at the facility. This provides a venue for the award of competitive, cost-shared funding with universities and private sector organizations for research on creating usable water supplies in a cost-efficient manner.

The Desal Act's current authority expires at the end of 2011, and its extension by Congress would enable this important work to continue. The research also helps enhance U.S. competitiveness in providing solutions to worldwide water issues in the 21st Century, and we would be pleased to work with the committee in this area.

This concludes my written statement. I will answer questions at the appropriate time. Thank you.

[The prepared statements of Mr. Connor follows:]

PREPARED STATEMENT OF MICHAEL L. CONNOR, COMMISSIONER, BUREAU OF RECLAMATION, DEPARTMENT OF THE INTERIOR

ON S. 629

Chairman Bingaman, Ranking Member Murkowski, and members of the Committee, I am Mike Connor, Commissioner of the Bureau of Reclamation (Reclamation). I am pleased to be here alongside the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) to discuss activities underway at the Department of the Interior (Department) as they relate to S. 629, the Hydropower Improvement Act of 2011.

Hydropower is a clean and efficient way to produce energy and is a renewable resource. Each kilowatt-hour of hydroelectricity is produced at an efficiency of more than twice that of any other energy source. Where hydropower does have environmental impacts, particularly on fish species and their habitats, we work with our partner bureaus and agencies to evaluate and mitigate these impacts. Further, hy-

dropower is very flexible and reliable when compared to other forms of generation. Reclamation has nearly 500 dams and dikes and 10,000 miles of canals and owns 58 hydropower plants, 53 of which are operated and maintained by Reclamation. On an annual basis, these plants produce an average of 40 million megawatt (MW) hours of electricity, enough to meet the entire electricity needs of over 9 million people on average.

Reclamation is the second largest producer of hydroelectric power in the United States, and today we are actively engaged in looking for opportunities to encourage development of additional hydropower capacity at our facilities. This afternoon, Reclamation will publish the Hydropower Resource Assessment at Existing Reclamation Facilities (Assessment), a comprehensive review of power potential at all Reclamation facilities. The Assessment benefitted from public comment received this past winter. The Assessment will detail our findings on hydropower potential, providing information on whether or not hydropower development at existing Reclamation facilities would be economically viable and warrant further investigation. In addition to the Assessment, Reclamation will be publishing two Federal Register notices in the near future regarding Lease of Power Privilege opportunities at Granby and Pueblo dams in Colorado (two facilities that were identified to have good hydropower development potential in the Assessment). Reclamation and DOE are also working on a funding opportunity announcement to conduct several pilot studies on a low-head hydropower unit at Reclamation facilities.

I am pleased to report on these recent activities as they relate to the directives in S. 629. Subsection 10(a) of the bill calls for study of non-Federal hydropower development at Bureau of Reclamation projects. Reclamation is directed to conduct a study of barriers to non-Federal hydropower development at Reclamation projects. This provision may duplicate efforts already underway. For example, the constraints analysis outlined in Chapter 3 of the Assessment, titled Site Analysis Methods and Assumptions (specifically, Chapter 3.5 of the Assessment), examines how land or water use regulations and legal requirements could potentially affect development of hydropower. These factors were taken into account when assessing the potential for hydropower development on existing Reclamation facilities. Further, the identified regulatory constraints have been mapped within Reclamation's regions using Geographic Information System (GIS) data. Local information for fish and wildlife and fish passage constraints, issues that could add significant development costs to a project site but are important to address from an environmental and natural resource standpoint, were identified by Reclamation's regional and area offices and accounted for in the Assessment as well.

Subsection 10(b) of S. 629 calls for Reclamation and FERC to develop and issue a memorandum of understanding to improve the coordination and timeliness of the non-Federal development of hydropower resources at Reclamation projects. Reclamation and FERC already have an MOU, signed in 1992, that addresses the establishment of processes for early resolution of issues related to the timely development of non-federal hydroelectric power at Bureau of Reclamation facilities. Reclamation and FERC recently met to discuss how to improve the timeliness of the processes developed in that MOU and other issues.

Section 8 of the bill would allow low-head hydropower development on Reclamation-owned conduits to be eligible for inclusion in FERC's conduit exemption program. Currently, Reclamation is assessing the potential for developing low-head hydroelectric generating capacity on our Federally-owned canals and conduits. A report, similar to the Resource Assessment, is expected to be released for public review by the end of this year. We expect that the provisions in section 8 of the bill would help address uncertainty in the approval process for new licenses and would facilitate the development of new capacity at existing facilities. Reclamation supports the opportunity to enter into new agreements with private or quasi-public entities to develop low-head hydropower potential in an environmentally-sustainable manner.

Overall, the Department shares the Committee's view that interagency coordination can leverage Federal and private sector investment in additional hydropower development. This consideration was foremost in the Department's signing a Memorandum of Understanding with the Department of Energy and U.S. Army Corps of Engineers on March 24, 2010, to increase communication between federal agencies and strengthen the long-term relationship among them to increase in a sustainable manner hydropower production at existing Federal facilities.

In conclusion, Reclamation recognizes the importance of hydropower. We hope that the Assessment and the new efforts described will provide a lasting contribution to the power supplies of our nation. We will of course continue to coordinate with other agencies and look forward to working with the Congress in this important area to avoid duplication, and utilize existing authority and resources.

This concludes my written statement. I am pleased to answer any questions the Committee may have.

ON S. 1462

Chairman Bingaman, Ranking Member Murkowski and Members of the Committee, I am Mike Connor, Commissioner of the Bureau of Reclamation (Reclamation). I am pleased to be here alongside the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) to provide the views of the Department of the Interior (Department) on the Reclamation-specific provisions in Subtitle D of the American Clean Energy Leadership Act of 2009, S. 1462 from the 111th Congress. This subtitle promotes the integration of energy and water policies to address the challenges that exist in making sustainable use of finite natural resources. Two sections of this bill call for specific deliverables from Reclamation: Section 143 and Section 144. Reclamation is continuing to explore ways to improve energy efficiencies within the scope of its projects.

Section 143: Energy Usage Study

Section 143 directs Reclamation to conduct a study on the quantities of energy used in water storage and delivery operations in major Reclamation projects, with an emphasis on identifying opportunities to reduce water and energy consumption and costs. The energy usage study required by Section 143 may provide a helpful data point for project managers and water customers. Facilitating sustainability of the Nation's natural resources is one of the Department's highest priorities. Through our WaterSMART program, the Department is committed to integrating energy and water policies to promote the sustainable use of all resources, including incorporating water conservation criteria and the water/energy nexus into the Department's planning efforts, including recommendations to reduce conflict in water management. Within existing operations and budget authority, Reclamation strives to operate its projects with the maximum amount of energy efficiency, and Reclamation is working to meet a Departmental Priority Goal for Water Conservation through implementation of the WaterSMART Program. This program was created by Secretarial Order 3297, issued on February 22, 2010 (available at http://elips.doi.gov/app___SO/act___getfiles.cfm?order___number=3297).

WaterSMART specifically recognizes that water and energy are inextricably linked and that water conservation can yield significant energy conservation benefits too.

WaterSMART Grants and Title XVI Water Reclamation and Reuse projects funded in FY 2010 are expected to enable the conservation of an estimated 149,000 acre-feet of water each year once complete. fiscal year 2011 grants are awaiting completion of the appropriations process. With funds requested in FY 2012, we will seek to increase the 2010 total by an additional 140,000 acre-feet. The energy savings associated with this conservation will vary greatly from project to project, but a study focused across the Reclamation program is likely to provide valuable context for Reclamation's water conservation efforts generally and identify new opportunities for increasing efficiency.

Overall, Reclamation has already been actively integrating energy and water policies under its existing activities. Under the WaterSMART Program's Water and Energy Efficiency Grants, which fund projects that help to meet the Priority Goal for Water Conservation, Reclamation incentivizes the conservation of energy in the delivery of water. Proposals that not only address water conservation but also explore the use of renewable energy and other energy efficiency improvements receive additional consideration during the selection process. In fiscal year 2010, through its WaterSMART program, Reclamation awarded 37 water and energy efficiency grants for amounts as high as $1 million, including a number of funded proposals that explored the relationship between water efficiency improvements and energy savings. We aim to continue these WaterSMART projects in FY 2011. If the legislation before the Committee today were enacted, the study authorized by Section 143 would need to compete for resources within the existing Reclamation program.

Section 144—Uses of the Brackish Groundwater National Desalination Research Facility

Section 144 calls for specific research objectives and authorizes operation, management, maintenance, and cost recovery at the Brackish Groundwater National Desalination Research Facility (Facility) in Otero County, New Mexico. The directives in Section 144 relative to the Facility in New Mexico would be consistent with ongoing activities at the Facility. Reclamation is partnered with New Mexico State University in a four-year research program with projects at or associated with the Facility focused on research, education, and outreach in water desalination. The bill lan-

guage calls on Reclamation to operate and manage the Facility as a state-of-the-art desalination research center to develop new water and energy technologies with widespread applicability, and create new supplies of usable water for municipal, agricultural, industrial, or environmental purposes. The bill also authorizes Reclamation to collect charges to offset the costs of operating and maintaining the Facility.

As members of the Committee may know, one of the authorities to operate and maintain the Facility stems from Public Law 104-298, as amended, commonly known as the Water Desalination Act of 1996. The Desalination Act has been funding research at the lab scale leading to pilot and demonstration testing at the Facility. The Facility, as well as Reclamation's desalination program generally, provides a venue for the award of competitive, cost-shared cooperative agreements with universities and public and private sector organizations for the purpose of research on converting unusable waters into usable water supplies. The Facility represents an avenue to advance the real-world potential of water desalination. The Desalination Act's current authority expires at the end of the 2011 fiscal year, and its extension by the Congress for a term of five years could enable this important research to continue. Providing these authorities could help Reclamation develop water-related technologies and other water management practices and may also potentially enhance U.S. competitiveness in providing solutions to world-wide water issues in the 21st century. We look forward to working with the Congress on S. 1462 to avoid duplication of activities that are already being performed by the Bureau of Reclamation.

This concludes my written statement. I am pleased to answer any questions the Committee may have.

The CHAIRMAN. Thans to all 3 of you for your excellent testimony.

Let me start with a few questions.

Maybe I'll ask you first, Mr. Chalk. You talked about the potential for more production of power from hydropower, as I understood your testimony. I'm just a little unclear as to where that potential comes. Is, there's some talk in your testimony also about conduit projects, and to what extent is that a significant part of the opportunity that has not yet been tapped? What are the other parts of the opportunity that haven't been tapped?

Mr. CHALK. Yes, sir. So, we identify possibly 300 gigawatts of potential hydro. I would say roughly 12 gigawatts of capacity is from existing hydropower facilities from upgrading efficiency and capacity. A lot of these facilities are very old, so the turbines aren't very efficient. So, if we can put modern turbines in there, we could get probably about 12 gigawatts of power——

The CHAIRMAN. That's 12 out of the 300?

Mr. CHALK. Twelve out of the 300.

If we look at existing dams—and there's 80,000 dams in the U.S.—most of those are not powered. But we could probably get an additional 12 gigawatts from 595 of those dams if we put powerhouses on those, as long as it can be done in an environmentally sensitive way.

The big potential, we estimate about 255 gigawatts, is in small hydro, and this potential is all over the country. In fact, there's 90 gigawatts of small hydro in Alaska. Incredible potential. Most of these locations have less than 5 megawatts of potential. So, that's where most of the growth could occur if we would look to grow hydropower. Then there's——

The CHAIRMAN. Does that includes these conduit projects? Is that part of what you call——

Mr. CHALK. Yes, it could. The conduit projects are gravity-fed, with the natural difference in height the source of the potential en-

ergy. We have developers that are going after that market. We're designing turbines for that market.

But if they're pumped already, we have to look at the pumping energy. We don't want to make power from the energy they use for pumping, because it just wouldn't make sense. So, if they're naturally gravity-fed from different elevations, if they're irrigation canals or somehow used by the municipality to move water, it's possible to get a small amount of capacity from that, and we have people looking at those markets.

Then the last area is pump storage, which really is more of a capacity thing than energy. It actually uses more energy, because you have to pump the water back up the hill, and then it takes more energy to do that than you get when you need the power. But this is really important for backstopping and firming up intermittent renewables like wind and solar. So, this is a really important area. We estimate there's roughly about another 34 gigawatts of this type of power that's available.

So, you add all of those up, it's a considerable amount of power that's available through conventional hydropower.

The CHAIRMAN. OK.

Mike, let me ask you about this resource assessment, hydropower resource assessment that you're releasing today. Could you give us a little more information about what that, what the main conclusions of that are, in your view?

Mr. CONNOR. Absolutely. Absolutely, Mr. Chairman.

The Assessment that we're releasing today has been a process that's been going on for about the last year. It started as a result of the MOU that we have between DOE and the Corps of Engineers and the Bureau of Reclamation to assess our existing facilities and build upon a previous study that was done as a result of section 1834 of the 2005 Energy Policy Act. So, we released the report at the end of last year for public review, took a lot of input, made some changes to the report, and that's what's being released today.

The conclusions of that report are fundamentally, we looked at our 530 sites that we have—Reclamation dams, diversion dams, conduits, tunnels, canals, et cetera. What we've ended up finding—some of those we set aside. We're going to do a further study on, I think, at least 52 of those sites, which are conduits and tunnels, and low-head hydropower opportunities, so we set that aside. We basically looked at 191 sites that had some potential.

What we've concluded is that 70 of those sites bear a much more rigorous analysis—basically, feasibility study analysis. But, 70 of those sites, basically, on our preliminary analysis—which is pretty rigorous. We looked at all the generation capacity, the output that we could get from those sites. We looked at the various environmental issues associated with them, development costs, and then we also looked at the economic benefits that could be yielded—so, 70 of those sites had a preliminary benefit-cost ratio in excess of 0.75, which warrants further consideration, from our perspective. Overall, the capacity of those 70 sites is about 225 megawatts of capacity that we could bring online, which would serve about 85,000 households.

So, it's pretty significant. It's not the numbers, the gigawatt numbers that Mr. Chalk were, was talking about. But the reality is that, through this screen we've put them at, they demonstrate that they're economically feasible, and that makes sense for developers to come in and want to do that.

The CHAIRMAN. Thank you very much.

Senator MURKOWSKI.

Senator MURKOWSKI. Thank you, Mr. Chairman.

Gentlemen, thank you for your testimony this morning.

Mr. Chalk, I like what you say about the potential. I clearly like what Secretary Chu has stated about hydropower, about it being an incredible source, and important for the Federal Government to tap this so that we can contribute to our clean energy portfolio.

But then you go on to say that the President's fiscal year 2012 budget represents DOE's priorities for applied R&D and energy efficiency in renewable energy technologies. So then, when you go to the budget, the proposed budget, it doesn't share that optimism that you have expressed and that the Secretary has stated. The water power program, excuse me, is cut by 20, by over 20 percent from fiscal year 2010 levels, while wind is plussed up by over 60 percent, solar is plussed up by over 87 percent, geothermal by 135 percent, biomass for 57.5 percent.

So, how am I to interpret this statement when you say that the Department's priorities are set by the budget? You clearly recognize the potential, and yet the support for it doesn't seem to be manifested.

Mr. CHALK. These are really tough choices we have to make considering we're trying to balance the Federal budget. We're to do this as best we can. They're very, very hard choices.

If you peel the onion back a little bit, you actually see our overall water power program is roughly flat and going down a little bit in fiscal year 2012. But the conventional hydro funding that we were talking about here is actually increasing. The program was zeroed out in 2006 and 2007, and we've been able to build it up. In fact, our 2012 request for conventional hydropower is $20 million of the total water program request of $38 million.

So, the conventional hydropower piece is growing, because in fiscal year 2010 it was $13 million, for instance. So, we're growing that by almost 50 percent. The——

Senator MURKOWSKI. But you have to admit that that's pretty minimal, given the totality of the, of what hydropower has to offer.

Mr. CHALK. I think it's a good start compared to where the program was a few years ago, zeroed out.

The other thing that we did under the Recovery Act is we put an additional $30 million into hydropower, and we ran a solicitation. That $30 million was leveraged 5 to 1 by private industry. We were able to get 30 megawatts of additional power at a relatively low levelized cost of energy—2 to 4 cents per kilowatt hour. In the projects, where we did capacity and efficiency upgrades, we were actually able to increase the generation anywhere from 10 to 20 percent from where they were for a relatively low cost. Again, the cost was estimated to be between 2 and 4 cents per kilowatt hour. So, we were able to leverage that money. The hydropower portion

of our water power budget is growing. We see lots of opportunities in the future.

The marine and hydrokinetic portion has gone down a little bit, but in that particular area, the marine and hydrokinetic devices are really where the wind program was 20 years ago. These device designs are just emerging. There's been very little open water testing—almost no testing like you have wind farms today. We call them "arrays," in the water. Almost no testing there.

So, we feel like the amount of money that we're putting into the marine and hydrokinetic is the right amount for the current state of development, which is rather immature. But there is great hope there, as well. Developers are going to have excellent opportunities to market and grow that area.

Senator MURKOWSKI. I hear what you're saying. I guess I look at those budget numbers and would suggest that we're clearly picking winners and losers. We recognize fully the enormous potential of hydropower, and yet we are not doing justice, if you will, in terms of where we're spreading those hard to come by Federal dollars.

Mr. Wright, I want to go to you very quickly, because I'm running out of time here. But, you mentioned the impediments to the licensing process, and I think that this is a very important issue that we deal with. You know that without the ability to waive sections of the Federal Power Act or to set some enforceable schedules, that there's little that FERC can do to shorten the licensing process under its current authorities.

Can you give me some suggestions? Is there any remedy that we might be able to look to here to make the licensing process more efficient while, at the same time, we still keep in place those necessary environmental protections?

Mr. WRIGHT. I think most basic—and this is, reflective of our natural gas program—is having a situation where FERC would be the lead agency, if you will, charged with setting the schedule. We would get together with those agencies, find out what the schedules would be to do their necessary permitting, set a schedule—you could have a schedule whereby, if they go over the time that they agreed to, their permit is deemed either approved or waived, if you will, and then we go forward with the license itself.

Senator MURKOWSKI. OK.

Mr. Chairman, I've got some other questions, but I will, I'll reserve them, or, have an opportunity to submit them later. Thank you.

The CHAIRMAN. All right.

Senator Coons.

Senator COONS. Thank you, Chairman. Thank you, Chairman Bingaman and Ranking Minority Member Murkowski. I'm grateful for your convening this hearing today.

I've long thought that this was an area that deserved more attention and investment in the renewable portfolio. My own State more than 200 years ago owed its early industrial development to river-based hydrokinetic power. So, your characterization of the enormous amount of hydroelectric power that is potentially accessible in existing dams and existing structures all over the United States will relatively modest investment is quite interesting to me, and

something I hope we'll pursue further. I hope this legislation will make progress.

In Delaware we've got an organization, UEK, that's doing demonstration projects on tidal hydrokinetic power at our very large Indian River Power Plant.

I'd like to hear more from your vision of how the DOE might partner the development of offshore wind with hydrokinetic technologies in a way that, as you mentioned, Mr. Chalk, would then provide for some firming up of intermittent sources—one of the major challenges with wind, whether onshore or offshore, is it's intermittent.

How do you see the technology development moving? What sorts of investments do you think would be responsible to accelerate that? What are the major challenges to the deployment of HDK technologies?

Mr. CHALK. Yes. There are a lot of synergies between offshore wind and some of these offshore water devices. Materials, for instance. We have to use composite materials to prevent erosion, corrosion, and other similar phenomena.

A major barrier is ensuring that we have the transmission for offshore wind, and for these smaller ocean or wave or tidal devices. Perhaps they could be tied together. How to finance that transmission, and how to go about installing it would actually be a significant hurdle that we would have to address.

But there are many synergies there. Essentially, instead of dealing with the hydrodynamics of air, you're dealing with water, which is many times more dense. So, we have a lot of synergies in our modeling efforts on how to optimize the designs of these devices. That's really probably the area that we're looking at the most right now.

Because the water devices are just emerging, we're trying to come up with reference models to help developers figure out what the best designs are, what are some of the benchmarks they ought to use in terms of the fluid mechanics codes, and things like that. All of that's being borrowed from the wind industry.

So, there's a tremendous amount of synergies here to take advantage of.

Senator COONS. The early estimates are that the West Coast has greater potential in MHK—at least, in current technologies, but I think there are ways in which the East Coast may also ultimately be a significant site. The University of Delaware has estimated 18 gigawatts in extractable power from the Gulf Stream from Florida through North Carolina, partly because it flows 24 hours a day, 7 days a week.

Have you done anything in moving toward an estimate of the potential of offshore MHK technologies?

Mr. CHALK. We have. First of all, with the Gulf Stream, we have a national test center at Florida Atlantic University——

Senator COONS. That's right.

Mr. CHALK [continuing]. Specifically looking at how to best extract energy from the Gulf Stream. We have estimates of 13 gigawatts of MHK capacity by 2025. A lot of this is going to depend, if we can get the cost down, on how much market penetration we actually get.

Senator COONS. Thank you.

I appreciate the chance to ask a question.

The CHAIRMAN. Senator Portman.

Senator PORTMAN. Thank you, Mr. Chairman.

Gentlemen, thank you for being here this morning. It's good hear the potential. Although Ohio is not a State that has a lot of hydro—it's about 1 percent of our electricity currently—we have potential in Ohio, too. It primarily is on the Ohio River.

As you probably know, we have four current projects underway. Each of them has the potential of creating a lot of jobs, economic development. They happen to be in areas of Ohio that are suffering from relatively high unemployment, so these are good jobs projects as well as good renewable energy projects.

But there's frustration and roadblocks, as you can imagine. One project, Mr. Wright, I want to talk to you a little bit about this morning, because FERC's been involved with it. I worked with this project years ago when I was in the House, and I'm still working on it. It is a joint venture by the city of Hamilton, Ohio, and American Municipal Power, AMP. It's a 84 megawatt plant. It's the Meldahal Hydro Plant, on the Ohio River, again. It's expected to be completed now in 2013, but the time period keeps getting pushed back because of various delays. City officials have recently approached me again to express their frustration with some of the permanent licensing issues. I will say, Mr. Wright, to the credit of your agency, their frustration is not so much with you. In fact, they have a good working relationship with you—I'm not just saying that to try to get you to help them more, but they actually do—but primarily with the Corps.

I understand that last night there was a new, or, I think us said a moment ago, updated Memorandum of Understanding with the Corps, and that FERC and the Corps are now going to be working more closely together, particularly, the early involvement of FERC and the Corps during some of the pre-filing stages, including the environmental review process—I hope the archeological review process, which has been one of the great frustrations at this particular site—and then, a schedule between FERC and the Corps, sharing of more data, and finally, establishing FERC as the lead agency.

I guess my question to you today is, one, Mr. Wright, do you have any specific thoughts on this project? Second, do you think this MOU is going to make a difference? Is this going to help move this progress—this project forward? More generally, since the committee's looking at this issue in the context of S. 629, is this going to help us to try to avoid some of these delays and—by the way, it's not just delays. We're killing projects through delay, because often the costs become prohibitive, particularly for these smaller municipalities. So, if you could comment on the MOU and comment on this particular project, I'd appreciate it.

Mr. WRIGHT. Thank you.

Briefly, with regard to the city of Hamilton and the AMP project, the Commission did work very quickly on getting a license out and moving forward. But, like you point out, our work with the Corps sometimes would come sequentially, and that leads us toward the MOU that was updated, or, signed yesterday with the Corps, so

that instead of sequential processing, if you will, we'll have more of a parallel processing. We'll bring the Corps in early on, so that we will be working together, so we will reach a decision, not only a FERC license decision, but a decision from the Corps—conditions, whatever they need to do to have the project on their facility—in a quicker timeframe and more responsive to the market and to the licensee.

Senator PORTMAN. How about the legislation that's being discussed today? Will S. 629 help? I notice there's a required report on the partnership between FERC and the Corps.

Mr. WRIGHT. We will definitely look into that if the bill goes forward. We will look into what we need to do to get to, for instance, the 2-year licensing—if that's a possibility at all. The MOU itself has a provision for us to get together for implementation. So, we will be working with the Corps to make sure this MOU works going forward.

Senator PORTMAN. But, in S. 629 have you looked at this requirement that there be a partnership between FERC and the Corps going beyond the MOU? Is that——

Mr. WRIGHT. Yes.

Senator PORTMAN [continuing]. Something you've looked at?

Mr. WRIGHT. Yes.

Senator PORTMAN. Do you think that'll help in terms of the kinds of problems we've had on these kinds of projects like the Ohio——

Mr. WRIGHT. I, anything will help. I believe that would be beneficial to the relationship between our agencies and to, and for the development of hydropower in an efficient and quick way.

Senator PORTMAN. Thank you.

I would ask that you provide the committee with any additional suggestions you have to streamline these processes, and particularly, if you have any thoughts on how to move this particular project forward, I would appreciate it. Thank you, Mr. Wright.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Senator Udall.

Senator UDALL. Thank you, Mr. Chairman.

Good morning, gentlemen. Let me pick up on Senator Portman's theme of partnerships.

Mr. Wright, I'm going to direct my questions and comments at you.

I'm particularly interested in the agreement that FERC has signed with the State of Colorado last August—and you referenced it in your testimony—and the agreement is for a pilot program to expedite permitting for certain types of small scale hydro projects. In exchange for an expedited permitting process, the State has agreed to do significant pre-screening of applicants for the Federal permits that are involved. It's important to note the agreement includes strict standards for minimal environmental impacts resulting from these proposed projects. I'm very encouraged by what FERC and the State of Colorado are attempting, which, as I understand the legislation we're discussing today, is exactly the kind of agreement that the Hydropower Improvement Act would promote.

So, in that vein, in your testimony you describe some of the reasons that permitting can take so long. I'm curious what you expect

will be the lessons learned from these pilot projects out of the pilot program.

So, a couple of questions: What parts of the permitting process do you feel should be streamlined, and that this pilot program will tease out? Going forward, which aspects of the pilot program do you believe will be applied to expedite the permitting process nationwide?

Mr. WRIGHT. Thank you, Senator.

What we're seeing with the Colorado MOU and the agreement with Colorado is, the State and the State's energy office will be actually vetting projects, if you will—whether they are conduits, 5-megawatt exemptions, other small hydro projects—they will be "running the traps," if you will, going to the State agencies, the Fish and Wildlife agencies, the other agencies that will be, that have a role in issuing these permits. So, by the time it comes to FERC, or we're presented with projects, sites have been chosen that are appropriate, consultation has begun with the agencies that are going to be involved with the permitting, and a relatively complete application will be filed with us.

That's, when those 3 things are done, we at FERC can get out licenses fairly quickly. We've done anywhere from 2 to 5 months when those "traps are run," if you will.

Senator UDALL. So, I hear you saying, then, that you believe all aspects of the permitting process could be applied nationally if this pilot program bears fruit.

Mr. WRIGHT. I would be, that would be my hope and dream—if we could do something like this and it is a success in Colorado, that it could be adapted and possibly spread nationwide.

Senator UDALL. So, let's move to Colorado itself. I'd like a little status update, if you will.

It's my understanding that the States receive proposals for prescreening, but no projects have been submitted for approval and permitting. Do you have a time when you think projects will begin? When do you expect to learn best practices from the pilot program that then could be applied in the ways we were just discussing?

Mr. WRIGHT. We're expecting 3 projects to be filed in the April to May timeframe that have been vetted by the Colorado Governor's Energy Office. Given that they achieve the goals of the MOU in terms of the hurdles they needed to get past to come to us, we would expect to be able to license those in anywhere, probably 3 to 6 months.

Senator UDALL. So, we're moving. There's——

Mr. WRIGHT. We are moving.

Senator UDALL. The whole of point of this is to move, to show the State, to show those who'd like to produce some innovative power, that we don't have to sit on our hands any longer.

Mr. WRIGHT. Yes.

Senator UDALL. Now, do you expect that changes to Federal permitting based on lessons learned from the Colorado program could be accomplished administratively? Or do you think we need to act legislatively? I know that's a speculative question, but——

Mr. WRIGHT. I could envision possibly a regulatory kind of change that may do this. But probably the structure of it is such that it may be a statutory change that may be necessary. Really,

only when we kind of, as you say, when we look back and see, kind of, lessons learned will we know exactly maybe what we need, in addition to what we agreed with in the beginning on the MOU.

Senator UDALL. I look forward to working with you.

I listened with interest to both the chairman and the ranking member's testimony. Particularly, I think, Senator Murkowski makes the case that there are almost, if not limitless, a very large number of micro-hydro projects that are just waiting to be developed.

Mr. WRIGHT. Right.

Senator UDALL. I hear this from ranchers, from farmers, from those who are involved in moving water from place to place in Colorado. We have extensive plumbing systems, if you will, to move water in our State. It just, it seems like it's an unrealized asset, and has great energy potential. So, I hope FERC will continue to move and work with all of us.

It's been a long time coming, if I might make that editorial comment. But this is some good news. Let's take advantage of it.

So, thank you.

The CHAIRMAN. Senator Murkowski, did you have any additional questions of this panel?

Senator MURKOWSKI. If I can just ask one quickly of Mr. Connor, please.

In your statement you asked for Congress to extend the Desal Act authorization. How long should it be extended? What cost annually? What are you thinking, in terms of parameters?

Mr. CONNOR. I think we haven't thought through a lot of the details there. I think the extension's been going on 2-year increments. So, I think maybe the—it was longer in the initial—I think the Act has proved to be very valuable, not just for the Bureau of Reclamation, but for a lot of other entities. So, I think it's an authorization that should be looked at as a long-term extension now. It's very valuable. We're doing good, a lot of good public-private partnerships through those efforts. So, from that standpoint, I think for us, the Bureau of Reclamation—I'm not sure, you know, it applies to different Federal entities—for us, you know, we're, probably budgeting in the realm already of anywhere between $2 million to $4 million per year specifically to create those research partnerships. So, that's, from our budget standpoint, where we're putting that to use.

Senator MURKOWSKI. Then, one last question for you, Mr. Wright, and this is as it relates to the marine hydrokinetic bill. You raise an interesting problem, that the FERC may be required to license the national test facilities that are called for in the bill, and that's clearly not the intention here. You offer up 2 possible solutions: 1, either place the centers under the authority of DOE, or to provide an exemption to part I of the fpa.

Do you have a preference as to which would be more effective?

Mr. WRIGHT. No. I think either one. We don't license Federal facilities, so, simply put, it's easy to go, or, put it under the aegis of an agency like DOE. Possibly, DOE doesn't want that responsibility. I don't know. That was just a thought. Maybe more efficient would be the exemption under part I of the FPA for a test facility for the marine and hydrokinetic research.

Senator MURKOWSKI. Any comment from DOE?

Mr. CHALK. I think we can work with the committee on that. I think of it as a small detail. You know, typically the government doesn't put its good housekeeping seal of approval—we have organizations like the UL, and for solar hot water heaters we have an independent certifying organization.

I think the real key here is to make sure we have protocols that have standardized testing procedures and we follow those so everything is tested in an uniform fashion. Then whoever the testing organization is can then certify that it was, in fact, done to that procedure. That way, results are comparable. You have apples to apples. I think that's really the important point here.

Senator MURKOWSKI. Let me ask just one quick question.

I'm reviewing Mr. Webber's article, "Water versus Energy." In it he suggests that we've got a Department of Energy, and given the incredible nexus between energy and water, that perhaps we need a Department of Water, that we've got different entities—EPA oversees water quality, USGS responsible for collecting data, but no Federal agency ensures the effective use of water.

Do we need a Department of Water?

Mr. CHALK. I think that's for others to determine.

[Laughter.]

Mr. CHALK. But I could tell you that they're very integrated. If you look at the challenges in siting a solar or thermal plant, it has a steam cycle to produce the energy, or a geothermal plant in the desert where there's no access to water, you have to come up with ways of, what we call dry cooling. You have to minimize water use. That's a tough R&D challenge because as you do that, a lot of times you reduce your efficiency in producing electricity.

In biomass, for instance, if we're going to grow sustainable energy crops, it's a requirement that we have to use very little water—not like irrigating corn that we have today. We have to grow those crops with virtually just natural rainfall. Another example would be in our appliance standards program where we regulate standards for energy and water use for washing machines and dishwashers.

So, it's very much integrated now, and it's very much an important factor.

Senator MURKOWSKI. But, it's integrated, most certainly.

But you have, you've got these agencies that all have their different initiative, their different missions. It may be that you're focused on washing the cleanest clothes in one area, but you're not really keyed into, is there going to be enough water in this area?

Mr. Connor, you look like you want to jump in.

Mr. CONNOR. Yes—probably ill-advised on my part, but I'll jump in on that one.

With, I think the idea is that water and energy policies have to be integrated. Sometimes that means, for the Bureau of Reclamation, we should be partnering with FERC. Sometimes that means we should be partnering with DOE. Sometimes it means we should be partnering up with the Department of Agriculture. That's what these MOUs are about.

Until somebody else decides whether there should be a Department of Water, I think that stovepipe approach to governing has

been very, very inefficient and has resulted in lost opportunities. I think that's what we're trying to do through these MOUs and these activities, is see those additional opportunities out there, get information to people that can bring in some private industry, or local governmental entities, to try and work with us on both energy and water policies. From that standpoint we'll start to have efficiencies and we'll start doing better in this area.

Senator MURKOWSKI. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Senator Wyden.

Senator WYDEN. Thank you, Mr. Chairman. I'm very glad you're holding this hearing today, Mr. Chairman. I saw your remarks yesterday talking about energy complacency, and I think they were spot-on. This gives us a chance—particularly with Senator Murkowski's leadership generally—in water-power technologies to really make a difference. So, I'm very much looking forward to working with you. I'm already a cosponsor of one of the Murkowski bills, and we're going to work out the issues on the wave energy legislation as well.

Mr. Chairman and colleagues, my home State has led the country in both conventional hydropower generation and in the development of wave energy technology. In fact, an Oregon company, Oregon Ironworks, is building the first commercial scale wave energy buoy in the United States, and it's going to be deployed off our coast at Reedsport.

Oregon State University has also been designated by the Department as a National Marine Energy Research Center and is developing a test bed on the coast that would allow U.S. designers and manufacturers to test their wave machines in real ocean conditions.

So, Oregonians are very proud of what has been accomplished already. But I think we recognize—and this is why the legislation today is so important—that there is much more to be done.

Now, the Hydropower Improvement Act is a piece of legislation that's going to help us tap the unused energy in existing dams and irrigation canals, and even city water systems, with minimal environmental impact. It's going to allow us to tap, in effect, untapped energy from water on its way to the kitchen tap that's now being wasted in water and irrigation systems, and it's my understanding that this bill is going to have broad support from hydro-developers, farmers and utilities. So, the opportunity to promote clean power generation and create domestic jobs, while at the same time addressing environmental safeguards that are going to be good for fish and other natural resources, are protected. So, I look forward to going forward with both of these bills.

As I indicated, Senator Murkowski and I are going to work on the wave energy bill. But it is definitely legislation that my colleague has correctly initiated, and certainly on the right track. I'm of the opinion that wave and tidal and low-impact hydro-technologies have an enormous amount of potential to help solve our energy problems, get beyond the complacency that Chairman Bingaman was talking about yesterday.

That's, really, what my question to you, Mr. Chalk, is all about. I think Senator Murkowski touched on this as well. That's this

budget question. I think my question is, is, what is it about the potential benefits for these low-impact water power technologies that the Department up to now how been unwilling to see? This is not only the smallest program in the Department's renewable energy budget—it's also a program which you proposed to cut 20 percent in the 2012 budget.

Now, I'd be the first to acknowledge that this is not the first administration in the history of our country to be disinterested in this. But, if we are going to get beyond this question of complacency on energy—and particularly, the exciting opportunities—why isn't there more support for these particular technologies that we're looking at today at the Department of Energy?

Mr. CHALK. Again, Senator Wyden, we really face difficult choices in coming up with the budget. It's very hard to try to keep overall balance in terms of the Federal budget and keeping the DOE budget as flat as possible.

It's been, it's a decrease, as you say, but relatively stable, I think. In fiscal year 2009 the budget was $40 million. It was $50 million in fiscal year 2010. The request was $40 million in 2011. Then, down $2 million, to $38 million in fiscal year 2012. So, it's relatively flat, decreasing a little bit.

Due to the maturity of the technology, we think the funding's right. A lot of these devices, like wave devices that you talked about, are really in the early stages of design, so we're still doing a lot of analytical work, a lot of modeling, a lot of short testing. Many of these devices have not even been scaled up to their full scale yet. So, we think the money in this particular instance is appropriate.

Now, as we gain success, perhaps in the out years, there will be growth in the budget. But at this particular time, given the maturity of the technology, we think our current funding request is appropriate.

Senator WYDEN. I guess what makes me question the commitment—I'm looking at a document indicating that the budget for renewable energy went up $1 billion in terms of the fiscal year 2012 request compared to the fiscal year 2010 current appropriations. So, it's up $1 billion, and you're proposing to cut one of the most promising sources by more than 20 percent.

Now, I don't think that passes the smell test. I just think we've got to turn this around.

My time is up, Mr. Chairman. I want to work with Senator Murkowski and you on this, because I think this is one of our best bets for the future. If we're going to get beyond what you correctly characterize as the early design stage, we've got to make it a priority now. When you look at these budget numbers, it is not a priority. That's what we've got to change, and on a bipartisan basis. I think you're going to find senators on this committee anxious to work with our chair and our ranking minority member to make it the priority that's warranted.

So, thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much.

We appreciate this panel testifying. Excellent testimony.

We have one other panel, so why don't we dismiss the 3 of you, and call the second panel forward.

The second panel is—I'll introduce them as they're coming forward—Mr. John Seebach, who is the Director of Hydropower Reform Initiative with American Rivers; Mr. Sean O'Neill, who is the President of the Ocean Renewable Energy Coalition; Mr. Andrew Munro, who's President of the National Hydropower Association; and Mr. Michael Webber, who is with the Center for International Energy and Environmental Policy at the University of Texas in Austin.

Thank you all for being here.

Mr. Seebach, why don't you go ahead?

If each of you would give us 5 or 6 minutes of testimony, making the main points you think we need to understand, we will include your full statement in the record as a thread, and then we'll have a few questions.

Mr. SEEBACH.

STATEMENT OF JOHN SEEBACH, DIRECTOR, HYDROPOWER REFORM INITIATIVE, AMERICAN RIVERS

Mr. SEEBACH. Chairman Bingaman, Ranking Member Murkowski, and members of the committee, good morning, and thank you for inviting me to testify at this hearing today.

My name is John Seebach, and I am the Director of American Rivers's Hydropower Reform Initiative.

I'm a lifelong kayaker. I'm a former river guide. I love rivers, and I'm committed to protecting them. American Rivers is, too.

We're the Nation's leading voice for healthy rivers and the communities that depend on them. We believe rivers are vital to our health, safety and quality of life.

American Rivers supports S. 629, the Hydropower Improvement Act.

We've been involved with improving hydropower wince we were founded nearly 40 years ago. We recognize that hydropower, done right, will be an important part of our Nation's future energy mix, especially given the urgent need to get off of fossil fuels. But the key lies in getting it right. When it's done wrong, hydropower can be far from clean.

Hydropower is unique among renewable resources because of the scale at which it can damage the environment when it's done poorly. Unless a hydropower dam is sited, operated, and mitigated appropriately, it can have enormous impacts on river health and the livelihoods of future generations that will depend on those rivers. Poorly done hydropower has caused some species to go extinct, and put others, including some with extremely high commercial value, at grave risk. That's not something we should take lightly.

Now, the good news is, we've come a long way over the past few decades. Thanks to modern environmental laws and values, coupled with FERC's regulatory process, hydropower's environmental performance is much better today.

When NHA approached us a couple years ago to share their vision for increasing hydropower capacity, we proposed linking that capacity—that increase in capacity, with a huge increase in environmental performance and quality as well. This joint vision, in my belief, should be the hallmark of a balanced hydropower policy, pursuing better environmental performance and new generation to-

gether, as 2 goals that we can achieve simultaneously, rather than an either-or, zero-sum game.

I'm proud that the Hydropower Improvement Act is the result of that spirit of collaboration, both among our organizations and among senators from both sides of the aisle here.

Here's why I think the Hydropower Improvement Act does a good job of getting this balance right.

First, the Act encourages appropriate hydropower development. It creates a competitive grant program for new hydropower projects, but it limits those grants to projects that improve existing water infrastructure, such as adding turbines to non-powered dams, canals, and pipes, or adding updated, more efficient equipment to existing hydropower dams.

Now, this is not a silver bullet. Some individual projects may have tricky environmental issues that make them inappropriate to build. But, as a class, these projects are likely to have far fewer serious impacts per kilowatt than any other type of new hydropower development. They're also more cost-effective. Many of these projects, if done right, can actually result in improved environmental outcomes.

Second, the Act considers the environmental cost of hydropower and proposes to do something about it. The competitive grant program I've just described also provides funding for environmental studies and mitigation measures. This is a great idea. Being able to measure environmental impacts and then do something to fix them is critical to getting hydropower right. It has to be done. Developers often complain that these measure—excuse me—these measures are costly. So, this will help otherwise good projects with a couple of environmental issues get past those issues and get built.

The Act also directs the Department of Energy to provide technical assistance on environmental issues and environmental studies. This will help ensure that developers will have better access to good ideas and best practices for dealing with tricky problems.

Finally, the Act aims to see if the regulatory process can be improved, while avoiding the stale concept that regulations are just barriers that need to be removed, or hurdles that need to be overcome. We're not fans of process for its own sake. Time is money for environmental NGO's just like it is for the industry. If we can find ways to make the regulatory process work more efficiently without sacrificing quality—great. But make no mistake, it is because—not in spite of—our existing regulatory system that hydropower is much cleaner today than it used to be. It's because of these rules that hydropower operators have done great things, like put water back into dewatered river reaches and build fish passage.

Sometimes getting to the solutions—especially when the problems are tricky—takes careful study and time, and sometimes that can take longer than 2 years. These laws and regulations are there for a good reason, and they work really well.

But that doesn't mean they can't be improved. We agree with NHA that there are quite a few good projects that could get licensed in 2 years or less, and we've seen that happened at FERC. A one-size-fits-all approach probably wouldn't work. We want good projects to go, to be—excuse me. We want good projects to get built

faster, but it's not good for rivers or, frankly, for the industry, if a bad project gets fast-tracked and does some real damage. Again, the Act gets this right by asking questions without dictating solutions, and creating a space where stakeholders can continue to work together to find the right answers.

This is a tricky problem to solve, but few things worth doing are easy to do. It'll require careful thought, improved cooperation among FERC and other Federal and State agencies, and probably some trial and error. But we're committed to working with NHA and others to see if it can be done in a way that achieves the twin goals of increasing capacity and improving environmental outcomes.

Thank you for the opportunity to testify before this committee today. I look forward to your questions.

[The prepared statement of Mr. Seebach follows:]

PREPARED STATEMENT OF JOHN SEEBACH, DIRECTOR, HYDROPOWER REFORM INITIATIVE, AMERICAN RIVERS, ON S. 629

Introduction

Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee: thank you for this opportunity to testify and share American Rivers' perspective on the three bills that are before your committee today.

American Rivers is the nation's leading voice for healthy rivers and the communities that depend on them. We believe rivers are vital to our health, safety and quality of life. American Rivers mobilizes an extensive network comprised of tens of thousands of members and activists located in every state across the county. We have been working to protect and restore the health of rivers that have been impacted by hydropower dams since we were founded in 1973. We also serve on the Steering Committee of the Hydropower Reform Coalition, a broad consortium of more than 150 national, regional, and local organizations with a combined membership of more than one million people. In doing so, we represent stakeholders—from canoeists to conservationists to lake homeowners—that seek to improve the water quality, fisheries, recreation, and general environmental health of rivers that have been damaged by antiquated hydropower dam operations. Coalition members are active in most of the hydropower licensing proceedings currently pending before the Federal Energy Regulatory Commission (FERC), the Bureau, and the Corps, and have constructively contributed to numerous hydropower-related policy discussions. Most recently, we worked with your staff, the staff of other Senate offices, and industry representatives as you developed S. 629, the Hydropower Improvement Act that is before your committee today.

We support S. 629, and while we believe that S. 630 has promise, we oppose section 9 of S. 630 as it is currently written.

2 Towards a balanced Federal hydropower policy that encourages environmentally responsible hydropower development and operation

American Rivers is emphatically not anti-hydropower. Conventional hydropower is one of the oldest and most well-established among a growing number of technologies that provide low-emissions alternatives to fossil-fuel energy. Nationally, hydropower provides about 96,000 megawatts of capacity, representing nearly 7% of total generation. We expect that hydropower will continue to be a part of our nation's energy mix for years to come, and accordingly we have signed dozens of agreements supporting the operation of hydroelectric dams that together provide our nation with thousands of megawatts of generating capacity. Reasonable modifications have dramatically improved the performance of these dams, providing fish passage, improving flows, enhancing water quality, protecting riparian lands, and restoring recreational opportunities.

American Rivers supports the development of new hydropower resources that can be brought online while avoiding significant additional harm to local ecosystems. In recent years, we worked closely with the National Hydropower Association to craft renewable energy legislation that provides incentives for new hydropower development. In short, we support hydropower that is developed and operated in a responsible manner that avoids harm to America's precious river resources. Given the very real environmental and social impacts of global climate change—especially on vital

freshwater systems—we understand the need to develop new sources of energy that can replace America's reliance on fossil fuels. Hydropower will be an important part of this mix.

However, we also know that the energy we receive from hydropower comes at an enormous cost to the health of our nation's rivers and communities. Hydropower is unique among renewable resources in the scale at which it can damage the environment. Hydropower's environmental and social impacts are serious and extremely well documented. Hydropower dam operations are responsible for the extinction and near-extinction of a number of species. Hydropower plants often divert water around entire sections of river, leaving them dry or constantly alternating between drought and flood-like conditions. Hydropower dams have flooded forests, destroyed fisheries, diminished recreational opportunities, and decimated the local—mostly rural—economies that depend on those resources.

The harm caused by most hydropower dams can be avoided if hydropower is sited, constructed, and operated in a responsible manner, particularly if management decisions are made at a basin-scale rather than at the individual project level. A few simple changes can make an enormous difference in the health of a river. Hydropower operators can change the timing of power generation to mimic a river's natural hydrologic conditions, stabilize lake levels and dam releases to protect riverside land from erosion, provide fish ladders and other measures that protect fish and allow them to pass safely upstream and downstream of dams, restore habitat for fish and wildlife, alter the design and operation of plants to maintain appropriate temperature and oxygen levels in rivers, and provide public access and release water back into rivers so that people can fish, boat, and swim. These types of changes have a miniscule impact on overall generation: when FERC studied more than 240 non-federal dams where such measures had been introduced, it found that such changes cost, on average, only 1.6% of power generation. Indeed, since many of these modifications involve replacing outdated generating equipment with more efficient modern technology, overall generating capacity has actually increased by 4.1%. The benefits to human and natural communities have been immense.

When it comes to water, climate changes everything—when, where and how much water is available, how water is used, and the ecosystems in which humans, fish and wildlife live. Warmer temperatures are increasing evaporation and lowering water levels in rivers and aquifers. Mountain snowpack, which acts as a natural reservoir that releases water throughout summer months, is shrinking and melting earlier in the year. Precipitation is also becoming more erratic and shifting towards winter months. As a result, droughts and floods alike are becoming more frequent and more intense. These changes may make our hydropower system less reliable in the coming decades. They also highlight the urgent need to improve the environmental performance of existing hydropower dams. Poorly operated hydropower plants radically alter the timing, magnitude, and duration of streamflows, change water temperature, and stress aquatic species. In other words, hydropower operations anticipate—and exacerbate—the impacts of climate change on our rivers and watersheds.

The threat of global warming demands urgent action on two major fronts. First, we must dramatically reduce greenhouse gas emissions. But even if we bring emissions under control, the carbon already in the atmosphere from historic emissions will cause inevitable changes to the climate. We must therefore also take immediate action to help both human and natural communities adapt to inevitable climate changes by making them more resilient. Resilient communities are able to withstand extreme events and recover quickly from disasters. By protecting and restoring healthy watersheds, increasing water efficiency and improving the quality of our infrastructure we can build resilient communities and ecosystems that stand a better chance of weathering the impacts of global warming.

Hydropower policy must play a role on both fronts. Developed responsibly, hydropower can increase our nation's portfolio of emissions-free energy. However, we must consider more than just increased megawatts. America is still blessed with many healthy, free-flowing watersheds, wetlands and floodplains that provide numerous services and values. We must preserve these intact systems and promote them as a vital part of our water supply and flood protection infrastructure. At the same time, we must rehabilitate rivers and streams that have been damaged by existing hydropower projects, and protect habitat from further degradation. A failure to improve the health of rivers now will doom more species to extinction as the world warms. Now and in the years to come, we need hydropower projects that are sited, built, and operated to produce power while minimizing impacts to the rivers that sustain America's human and natural communities. Federal agencies with a role in U.S. hydropower policy, including the Bureau of Reclamation, the U.S. Army Corps of Engineers, the Department of Energy, and the Federal Energy Regulatory

Commission must make the enhancement of environmental quality—at existing and new sites alike—a top priority.

A balanced and responsible hydropower policy must take seriously both the promise of hydropower and the risks of hydropower development. It must encourage responsible development while also continually holding developers and federal operators accountable for their environmental impacts and insisting on the strictest performance standards. It must remove obstacles to development while recognizing at the most fundamental level that a high level of environmental performance and the costs of achieving that performance are not an "obstacle" to development but a fundamental and necessary component of it. It must encourage new development to take place while also accepting that some sites are simply not appropriate for new or increased hydropower production. Congress must address both sides of this equation equally.

3 The Hydropower Improvement Act (S. 629)

The Hydropower Improvement Act (S. 629) is a good step towards a well-balanced U.S. hydropower policy like the one described above. American Rivers joined the National Hydropower Association in working with the bill's sponsors to help them to craft a bill that would meet the twin goals of encouraging the development of new hydropower capacity while enhancing hydropower's environmental performance. This bill represents a substantial improvement over the Hydropower Improvement Act (S. 3570) that was introduced in the previous Congress. American Rivers is pleased to support this bill. We would like to thank all of the parties involved with drafting this bill for their extremely hard work and willingness to incorporate our perspective.

American Rivers supports this bill for three main reasons. First, we believe that it appropriately distinguishes between those hydropower projects which should be encouraged and those which should not and directs its attention towards the former. Second, it has a strong focus on research and development that focuses on improving hydropower's environmental and technical performance, recognizing that both are equally important. Third, it encourages regulators and stakeholders alike to work together to find creative and innovative ways to improve the existing regulatory process without falling into the all-too-common trap of equating critical environmental protections with "regulatory barriers."

3.1 S. 629 encourages appropriate hydropower development

American Rivers supports the development of hydropower projects that are sited, constructed, and operated in a responsible manner so as to avoid harm to America's precious river resources. S. 629 recognizes that not all hydropower development is appropriate by focusing on those types of projects which can be brought online with the least impact to aquatic resources. Hydropower projects that re-use existing water and hydropower infrastructure are the best candidates for responsible development.

Section 5 of S. 629 would create a competitive grant program which would encourage projects which upgrade aging facilities or provide power to non-powered dams. This section also recognizes that solid environmental performance is critical to any new development, providing funding for studies and mitigation measures that can help to reduce a project's environmental footprint.

American Rivers has long advocated for policies that would encourage or require hydropower operators to upgrade aging turbines and generating equipment with updated, modern equipment. We believe that the public should receive the full benefit of each drop of water that passes through a turbine, and antiquated, inefficient equipment dilutes these benefits. Efficiency improvements are relatively lowcost, use turbines and equipment that is manufactured in the United States, and can often contribute to improved environmental outcomes. These efficiency upgrades are the simplest, most cost-effective, and lowest-impact means of increasing hydropower generation. The potential gains in generation are significant: in many cases, these upgrades can result in a 10-20% increase in generation from the same amount of water. There are substantial environmental benefits to these upgrades as well: modern turbines often feature designs which are less harmful to fish, and can operate efficiently across a different range of release levels, allowing for managed flow regimes which more closely mimic a natural river.

Turbines can also be added to many existing hydropower and non-hydropower dams. While these retrofits are not appropriate in every case, they offer new capacity for minimal additional environmental impacts when done right. In some cases, retrofitting existing dams for hydropower can leverage additional environmental improvements to the affected river reach. For instance, a pending retrofit at the Holtwood project on the Susquehanna River in Pennsylvania will more than double

that project's generating capacity while also providing for substantially improved fish passage. Several years ago, American Rivers worked closely with the hydropower industry and members of Congress to craft legislative language that would encourage such forward-thinking development. This language has since been incorporated into the federal law which provides a Production Tax Credit for Renewables, providing developers with an incentive to develop at existing dams that are currently operated for flood control, navigation, and water supply and that could be developed without harmful changes to river flows. S. 629 carries this basic concept further in two ways: Section 5 provides grant funding for these types of projects, while sections 7 and 8(b) encourage regulators and stakeholders to test new ways to improve the regulatory process for these projects in order to allow capacity to be brought online faster without sacrificing critical environmental safeguards. Finally, an increasing number of developers—especially in the west—are exploring offstream hydroelectric development. Some developers propose to place turbines in existing water conveyance pipes. Others are adding hydropower capacity to irrigation canals. Still others are placing turbines in municipal water treatment facilities. Many of these projects have the potential to create substantial environmental benefit. For instance, some irrigation districts are using the revenue from power sales to fund projects that will result in the more efficient use of water, leaving more water in the river to provide ecosystem services. S. 629 encourages these types of projects in five ways: Section 5 provides grant funding for developing these projects; Section 8(a)(1) updates the conduit exemption provisions in the Federal Power Act to allow projects on Federal land to qualify while preserving critical environmental protections; Section 8(a)(2) encourages federal agencies to better coordinate their review of these projects; Section 8(a)(3) opens a public dialogue about ways that the regulatory process for these projects might be improved to bring capacity online faster while protecting the environment and public health and safety; and the updated definition of "conduit" in Section 3 will prevent abuse of the existing exemption by ensuring that it is only applied to appropriate projects that use water infrastructure that was built for some other legitimate beneficial use.

3.2 S. 629 has an appropriate focus on hydropower research and development

Section 6 of S. 629 directs the Secretary of Energy to develop a plan for research and development which will facilitate new hydropower generation and improve the environmental performance of hydropower technology. It also provides dedicated funding for this work. This would build on the excellent work that the Department of Energy's Office of Energy Efficiency and Renewable Energy Water Power Program is already doing in this area, both on its own initiative and as part of the Federal hydropower MOU that was signed in 2010. This section appropriately places increased generation and improved environmental quality as co-equal goals. American Rivers is particularly heartened by this section's requirement that the secretary provide technical assistance to project proponents that will help them to address environmental issues through studies and mitigation measures, as well as the requirement that the Secretary consult with other federal agencies that play important roles in protecting non-power public resources affected by hydropower projects.

3.3 S. 629 aims to improve the regulatory process for hydropower without falsely equating critical environmental protections with "regulatory barriers"

Sections 7 and 8 of S. 629 direct FERC to explore ways "to improve the regulatory process and reduce delays and costs" associated with hydropower development. As a frequent participant in regulatory proceedings for individual hydropower projects, American Rivers has an interest in reducing inefficiencies in these regulatory proceedings as well as the costs associated with participating in them.

Our enthusiasm for regulatory reform, however, is tempered by our recognition that the existing permitting system for hydropower provides critical protections for the ecological health of rivers, public safety, recreation, and many other non-power values. American Rivers emphatically does not subscribe to the notion that our nation's environmental, health, and safety regulations constitute "barriers" in need of streamlining, "delays" that must be shortened, or "costs" that need to be reduced. Hydropower is not intrinsically clean energy: it must be sited, constructed, and operated in an appropriate manner, or it can cause enormous environmental damage. Laws like the Federal Power Act, the Clean Water Act, the National Environmental Policy Act, and the Endangered Species Act are critical to ensuring that hydropower is done right. We encourage this Committee to be clear that any proposed modification to the regulatory process for hydropower that would weaken any of these vital environmental protections would be unacceptable.

In our view, S. 629 largely gets this distinction right, recognizing FERC's willingness to innovate to help good projects get built more quickly. When developers

choose appropriate sites for hydropower projects and invest in addressing resource issues up front, FERC has shown remarkable flexibility in processing license applications quickly and efficiently. For example, we have seen FERC staff waive prefiling requirements with the concurrence of stakeholders in cases where there are no controversial resource issues. FERC recently published a list[1] on its website of more than 20 hydropower projects that have been permitted in less than one year since 2006. The Commission also recently signed an innovative Memorandum of Understanding with the State of Colorado[2] that identifies classes of projects that are likely to be permitted quickly, with FERC agreeing to expedite the processing of those applications where the state has conducted pre-screened to ensure that there are no complex or contentious resource issues at stake.

Despite FERC's willingness to be flexible, there are a number of points in the process where FERC can do better. For instance, FERC's Integrated Licensing Process was designed to synchronize FERC's NEPA scoping and record development with the information requirements of other state and federal agencies that have separate—and critical—statutory responsibilities. These other agencies can now can identify at the beginning of a licensing those information gaps that must be filled in order for them to complete their own processes. Some applicants are unwilling to provide this information because it might result in additional requirements to mitigate project impacts. The resulting stalemate is a perennial source of delay in licensing. While FERC staff have the authority to order applicants to provide this information, they often choose not to do so, arguing that the information is not necessary for FERC's licensing decision. This may be technically true—FERC may not consider the information necessary for its own analysis—but the reality is that FERC cannot issue a license until it has received a Water Quality Certification from the state and all required ESA consultation is complete. Staff may be able to work with agencies to narrow the scope of the necessary information, but ultimately those agencies must decide what information is necessary for them to act. The Commission should direct its staff to improve their cooperation with other federal and state agencies, especially where those agencies have identified a need for information that will enable them to fulfill their own responsibilities and clear the path for FERC to issue a license. By doing so, FERC would substantially increase the likelihood that licenses will be issued on time and with an appropriate set of environmental protections.

S. 629 directs FERC to solicit recommendations like these from the public and examine how it might implement such improvements to the licensing process. It then directs the Commission to test some of those ideas through a pilot process and ultimately report to Congress on what works, what does not, and how it intends to translate those lessons into more formal policies that improve the licensing process. This gives FERC the flexibility to conduct controlled experiments, further refining some of the tools it is already using to permit noncontroversial projects more quickly. Any resulting policy change will be better by virtue of having been tested in a real-world situation first.

S. 629 also gives FERC the ability to limit this flexibility to only those projects where it is likely to work. A one-size-fits-all two year process is unlikely to be appropriate for all projects. Hydropower projects that feature more complex resource issues often need more time to process, and this is entirely appropriate. Consider, for instance, two proposals to add hydropower to an existing dam. The first would add a turbine to an existing control structure at the base of the dam to capture uncontrolled flows that are already passing through the dam. The second proposes to divert water from behind an existing dam to a powerhouse two miles downstream, dewatering a section of river that is known as a highquality trout stream and a popular destination for canoeing. While the first project might be quite simple to license, the second would almost certainly require one or more season of studies in order to determine appropriate operating guidelines that would protect the river's fisheries and recreational resources; it would be very difficult to fit such a project into a two-year process without glossing over these complex resource issues.

American Rivers supports this inquiry, and we look forward to participating in the Commission's examination of its licensing processes. We also encourage the Committee to ensure that FERC will have sufficient resources to complete this undertaking. FERC has more new applications for preliminary permits and hydropower licenses before it now than at any other time in recent memory. The new requirements that S. 629 proposes to place on the Commission should not become a

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[1] http://ferc.gov/industries/hydropower/gen-info/licensing/small-low-impact/expedite-process/projectsexpedited.xls

[2] http://ferc.gov/legal/maj-ord-reg/mou/mou-co.pdf

workload burden for Commission staff that creates the very processing delays that it was designed to reduce.

4 Hydrokinetic and Marine energy (S. 630)

There has been a great deal of discussion about damless hydrokinetic technologies that use free-flowing rivers, waves, ocean currents, or other means to generate electricity. As a river conservation group, American Rivers does not claim to be an authority on Marine energy. However, we have followed the development of instream hydrokinetic technologies closely. Moreover, since ocean and instream hydrokinetic technologies are often lumped together, we have participated in a number of policy discussions that have addressed both technologies.

We are hopeful that these new technologies will eventually allow us to harness the power of moving water in a responsible manner that avoids the devastating impacts associated with dam-building. Unfortunately, there is still precious little information available about how these technologies interact in a natural setting. As of today, we are aware of only one instream hydrokinetic project that is currently licensed to generate in U.S. waters, and our understanding is that it is currently out of service. With so little information available, it is difficult to assess the environmental impacts of these technologies, let alone their commercial feasibility. We can only speculate as to what the costs and benefits of these technologies might be.

It is clear, then, that there is a need for more testing, as well as for research into the potential environmental impacts and new and innovative ways that those impacts might be avoided. There is also a need for strong siting criteria that take into account environmentally sensitive areas or areas that are vital to economic activity (like transportation or commercial fishing), and consider the risk that the cumulative impacts of additional development may simply be too high in some watersheds that are already highly impacted by existing hydropower development.

S. 630 largely addresses these needs, focusing on research, development, and the creation of testing zones where environmental and operating data can be collected in a controlled environment. The proposed amendments to The Energy Independence and Security Act of 2007 are an incremental improvement to a public policy that is already largely good. The adaptive management and environmental grant program, like the program proposed by Section 6 of S. 629, is a particularly good idea. While we believe that the information gaps about the environmental impacts of these technologies need to be filled before these projects are deployed at a full commercial scale, we also recognize that the cost of filling these gaps places the initial developers of these technologies in an extremely precarious financial situation. It makes sense to devote public resources towards filling these gaps, both at the macro level and the individual project level, in order to take some of this pressure off of the individual project developers. The bill also insures that the public receives a return on this investment by requiring that most information developed as a result of studies performed under this grant program be made publicly available. This is good policy, and will accelerate the responsible development of these technologies.

American Rivers is, however, opposed to section 9 of S. 930 as it is currently written. Section 9 would authorize federal funds to be granted for the construction of new hydropower dams. Given the relatively high economic, environmental, and social costs associated with new dam construction and the enormous amount of new hydropower capacity that can be developed without constructing new dams, we do not think it makes sense for federal funds to be obligated to projects that involve new dam construction. Rather, scarce taxpayer dollars should be directed towards projects that minimize environmental harm by making use of existing water infrastructure like the projects that would be eligible for grants under Section 5 of S. 629.

We understand that the intent behind this section was to encourage the development of new sources of renewable energy in remote communities that rely primarily on expensive sources of fossil-fuel fired generation for their electricity. We agree that this is a laudable goal, and we recognize that this bill attempts to give priority to grants to communities that find themselves in this situation. We recognize that in some rare and exceptional cases, the construction of a new hydropower dam may be the only feasible renewable energy alternative for some of these communities. If federal funds are to be obligated for the construction of new non-federal dams—something which in general we do not support—then it should only be limited to exceptional cases where the construction of a dam is truly a last resort. As it is currently written, the bill's support for new dam construction is too broad, and could be used to fund the constructions of dams that simply should not be built. We recommend that the Committee explore alternate approaches to achieving what is an otherwise worthy goal of encouraging renewable energy development, and we stand willing to offer our assistance.

5 Conclusion

A balanced U.S. energy policy must recognize that hydropower has impacts as well as promise, and it should address both. New hydropower development must be sited, operated, and mitigated responsibly, and it must simultaneously encourage increased generation and improved environmental stewardship at new and existing projects. American Rivers supports the development of new hydropower resources that can be brought online responsibly, avoiding significant additional harm to local ecosystems. S. 629 represents a substantial step forward down this path, and American Rivers is pleased to be able to support it.

Thank you again for this opportunity to testify before the Committee today. I look forward to answering your questions.

The CHAIRMAN. Thank you very much.

Mr. Munro, go right ahead.

STATEMENT OF ANDREW MUNRO, PRESIDENT, NATIONAL HYDROPOWER ASSOCIATION

Mr. MUNRO. Good morning, Chairman Bingaman, Ranking Member Murkowski, and members of the committee.

Thank you for this opportunity to share with you the National Hydropower Association's perspective on S. 629 and S. 630. We strongly support both measures, and we urge the committee to proceed swiftly to marking up these bills.

I'd also like to particularly acknowledge my Senator, Senator Maria Cantwell, who is, like myself, from "the other Washington." Thank you for being here.

My message today is simple: There's a real opportunity with these bills to increase U.S. hydropower capacity that will support our economy, support our environment, and increase our energy supplies. Think about this one statistic for a moment: Of the 80,000 dams that currently exist in the U.S., just 3 percent are utilized to generate electricity.

You're familiar with hydropower's current contributions—I heard those today—that it's the largest source of renewable electricity in the U.S., providing 7 percent overall of our generation, and 2 thirds of all renewable energy.

Hydropower also employs 300,000 Americans. Hydro-generation avoids 200 million metric tons of carbon emissions, and they did so in 2009 alone.

In addition, hydro provides many other benefits, including managing river flows for species and habitat protection, recreation, irrigation, flood control, and navigation. Importantly, hydropower, as well as pump storage, help to balance our electricity grid, provides a reliable grid, and also enables the greater use of variable energy, such as wind and solar, by balancing demand and supply.

I'm happy to say that I believe the old view of hydro, is, that it's tapped out is in the past. Today's hydro has a lot more to offer. According to a study by Navigant Consulting, hydropower can create 1.4 million jobs in the next 15 years, both inside and outside of the industry. These are domestic, good-paying, family sustaining jobs in manufacturing, construction, engineering, and operations. We could do this by adding 60,000 megawatts of additional sustainable hydropower capacity to the U.S. electric grid. In fact, 88,000 megawatts are in the FERC queue today.

The U.S. hydropower industry is committed to future growth that is sustainable in every way. NHA commends the sustainable nature of the Hydropower Improvement Act because it recognizes that

much of the near term growth can be achieved by increasing and maximizing capacity at existing U.S. infrastructure. For example, the bill supports adding electric-generating equipment to dams that have none today. As mentioned before, 97 percent of the dams are not used to generate electricity.

My utility, Grant PUD in the central part of Washington State, illustrates another sustainable way to expand our renewable capacity, through modernizing existing hydro-projects with more efficient technologies and environmental enhancement technologies.

At our Wanapum Dam on the mid-Columbia River we are installing new, advanced designed hydroturbines which boost the project's output by 12 percent and, maybe more importantly, has a fish passage rate of 97 percent, which is above our license requirement of 95 percent. We also built a 35-million-fish slide—it's a bypass system—which has a fish passage survival rate of 99 percent for steelhead that use the slide. These are modern technologies that improve safe fish passage, and increase energy output. We can have both fish and renewable generation at hydroelectric facilities.

While grants work spotlights growth opportunities in the industry, without the right Federal policy, such as the Hydropower Improvement Act, we will not realize this full potential.

Crucial near term policy changes are needed, such as a smarter, more efficient licensing process, and intergovernmental agency cooperation, which we've heard testimony today about.

Also, tax policies that encourage more investment in hydropower technologies in deployment and environmental efficiencies, reinvestment in the Federal hydropower system, as well as the renewed commitment to hydropower R&D initiative—and I'm glad to hear that today.

These 2 bills are an important policy step forward and should pass.

Briefly, we concur with the provisions in both bills that would direct the Department of Energy to ramp up domestic hydropower production and establish a competitive grants program to improve environmental performance as well as output. These are commonsense initiatives.

Last, I do want to acknowledge 2 organizations before you today—American Rivers and the National Hydropower Association. Over the past several years we have purposely committed ourselves to working together collaboratively to demonstrate leadership, and moving us in a sustainable energy future. We both jointly support the Hydropower Improvement Act, and we commend—I commend the sponsors of the legislation, appreciate Senator Murkowski taking the lead on this legislation, as well as all of the sponsors. We think that this is a smart bill, and it should proceed forward.

Thank you.

[The prepared statement of Mr. Munro follows:]

PREPARED STATEMENT OF ANDREW MUNRO, PRESIDENT, NATIONAL HYDROPOWER ASSOCIATION

ON S. 629 AND S. 630

Introduction

Good morning Chairman Bingaman, Ranking Member Murkowski and members of the Committee. I am Andrew Munro, President of the National Hydropower Asso-

ciation (NHA). I am also the Director of External Affairs for the Grant County Public Utility District located in the central part of the state of Washington. Grant County PUD is a consumer-owned utility that serves a rural, predominantly agricultural population. Hydropower, irrigation-canal hydro and wind power comprise our total combined generating capacity of approximately 2,000 MW. I would also like to acknowledge Senator Maria Cantwell, who is my Senator from the "other Washington".

The National Hydropower Association greatly appreciates this opportunity to discuss with you two important pieces of legislation—S.629, the Hydropower Improvement Act of 2011, and S.630, the Marine and Hydrokinetic Renewable Energy Promotion Act of 2011, both of which we strongly support.

My message today is simple—There is a real opportunity to increase U.S. hydropower generation that will strengthen our economy, environment and renewable energy supplies.

I will go into further details on each bill later in my testimony, but to summarize, NHA believes S.629 and S.630 represent significant steps forward to promote increased deployment of clean and renewable hydropower, pumped storage and marine and hydrokinetic (MHK) projects. We urge the Committee to proceed swiftly to mark-up on these bills, and we support full Senate passage as soon as possible.

Background

NHA is a national association dedicated exclusively to advancing the U.S. hydropower industry, including conventional hydropower, pumped storage, conduit power and marine and hydrokinetic technologies. We seek to secure hydropower's place as an available, reliable, affordable and sustainable energy resource that serves our national environmental, energy, and economic policy objectives.

NHA represents more than 180 companies in the hydropower industry, from Fortune 500 corporations to family-owned small businesses. Our members include both public and investor-owned utilities, independent power producers, project developers, manufacturers, law firms and environmental and engineering consultants.

Today, hydropower projects generate power in every region of the country and are America's leading source of domestic renewable electricity. Hydropower accounts for approximately 7 percent of the nation's total electricity generation and two-thirds of our renewable electricity generation. Hydropower capacity in the United States is currently about 100,000 MW. Hydropower generation avoids millions of metric tons of carbon emissions each year. In fact, regions that rely on hydropower as a primary energy source, such as Grant County and Washington State, reap the benefits of significantly cleaner air. Satellite imagery has shown that the Pacific Northwest, home to the most hydropower in the United States, is an island of low carbon emissions.

In addition to this clean energy, hydropower infrastructure also provides a myriad of other important benefits, including managing river flow for species and habitat protection, water supply, recreation opportunities, irrigation, flood control and navigation.

And importantly, hydropower and pumped storage assets provide essential grid reliability and stability services such as the ability to quickly meet changing demand in load, firming for intermittent variable energy resources, and blackstart capability in times of outage (such as the August 2003 East Coast blackout, where hydropower projects in New York and Canada operated continuously and also served as the base for restoring power to millions of Americans).

Hydropower is a proven renewable energy resource—one that has been in use in our country for well over 100 years. However, hydropower is also an energy resource for our future, with tremendous growth potential. One of the many myths about hydropower is that there are no new opportunities for growth in our industry. In fact, the opposite is the case.

Right now, there are proposed projects totaling over 88,000 MW with pending license applications and preliminary permits filed with the Federal Energy Regulatory Commission (FERC). These projects span every sector of the waterpower industry. And while not every single one of these projects may be built, the list demonstrates the universe of untapped hydropower potential that exists.

In 2009, NHA commissioned a study examining the hydropower industry's job-creation and growth potential. That assessment confirmed what Energy Secretary Steven Chu has described as an "incredible opportunity" to develop America's "lowest-cost energy option."

The study found that the industry could add up to 60,000 MW of capacity by 2025, which could support the creation of approximately 1.4 million cumulative direct, indirect and induced jobs across the country.

In the study, Navigant Consulting estimated that 9000 MW alone could come from upgrades and additions of capacity at existing hydro facilities, with another 10,000 MW by converting non-powered dams into generating assets.

The result of the study, confirmed by the project development pipeline before FERC, led NHA to adopt an ambitious, but achievable, goal of doubling the U.S. hydropower industry's contribution to the electric system. And in January, NHA, in response to President Obama's State of the Union address, committed to meet 20 percent of the 80 percent clean energy goal by 2035.

NHA believes America should take maximum advantage of our nation's infrastructure. Adding capacity and increasing efficiencies at existing hydropower facilities and installing generation equipment to existing non-powered dams are two near-term steps to reach this goal, as we also look to the long-term effort to expand hydropower resources. For example, only about 3 percent of the nation's approximately 80,000 dams currently generate hydropower; just 3 percent.

My utility, Grant County PUD, illustrates how our nation can better maximize our existing infrastructure and sustainably increase renewable energy generation—through modernizing existing hydro facilities with more efficient electric generating equipment and environmental enhancement technologies. The PUD is in the process of a major upgrade at one of our hydropower projects. At our Wanapum Dam, we are installing new, advanced-designed hydro turbines and new generators, which will result in a 12 percent generating capacity boost and support our fish survival rate of 95 percent. We also built a $35 million, 290-foot fish "slide" for which studies show a fish survival rate of 99 percent for steelhead salmon using the slide.

These are examples of modern technologies that allow hydropower operators to improve safe fish passage, while also expanding renewable energy generation. We can have both fish and renewable generation at hydropower facilities.

While Grant PUD's work spotlights the opportunities for growth in the hydropower industry, additional policy support from the federal government is needed to promote these opportunities nationwide. Simply put, conducting business as usual will not provide the incentive to fully realize the untapped potential available throughout the country. Crucial near-term policy changes include:

- A more efficient licensing and permitting process with greater intergovernmental cooperation;
- Tax policies that encourage more investment in hydropower technologies and deployment;
- Re-investment in the federal hydropower system; and
- Renewed commitment to R&D initiatives.

In NHA's opinion, the Hydropower Improvement Act of 2011 and the Marine and Hydrokinetic Renewable Energy Promotion Act of 2011 take a substantial policy step forward to expand our hydro resources in a pro-active and balanced approach.

The Hydropower Improvement Act of 2011

As stated earlier in my testimony, NHA fully and strongly supports this bipartisan bill and commends the leadership shown by the original cosponsors of the legislation.

The Hydropower Improvement Act of 2011 sets a dynamic hydropower agenda for the nation. The bill will advance project deployment (from conduit power and small hydro to non-powered dams to pumped storage) by requiring better interagency coordination; through funding of competitive grants for increased production; and with continued support for research and development activities. All of this while ensuring continued environmental reviews and public participation are part of the process.

NHA believes the Hydropower Improvement Act of 2011 represents a commonsense result, achieved through outreach to the agencies, industry, the environmental community and other stakeholders. It not only seeks to stimulate deployment and increase clean energy generation, but takes a moderate approach that respects and values the environmental principles and the public participation standards that have been an important part of the hydropower development process. I will now highlight some of the provisions of particular interest to NHA and the hydropower industry.

Section 7 of the bill would promote development at existing non-powered dams and closed-loop pumped storage by requiring FERC to investigate a 2-year pilot licensing process for these projects.

NHA and the industry appreciate the work of Congress, FERC, and other agencies and stakeholders on past improvements to the regulatory environment for hydropower development (for example, the consensus provisions contained in EPAct of 2005 and the 2003 integrated licensing process (ILP)). However, the hydropower regulatory process, in comparison to those for other energy resources such as wind

or natural gas, remains considerably longer. The ILP is structured to be completed in 5 to 5.5 years followed by the time needed for construction, while the development timeline for wind and natural gas projects, for example, can be as short as 18–24 months.

At a time when project developers are competing for a limited pool of funding from investors, or when utilities are seeking the quickest return on investment for their customers and shareholders, hydropower project development is put at a competitive disadvantage. Section 7 attempts to address this disparity. It does not mandate a 2-year process, but requires FERC to examine the possibility and move forward with a pilot process or report back to Congress if such a process is deemed not practicable. However, NHA believes a 2-year process is possible and improvements can be made while maintaining environmental standards and resource protection.

Section 5 of the bill creates a competitive grants program for increased hydropower production. While the section focuses on existing infrastructure and conduits, it also includes applications to develop and perform environmental studies and carry out environmental mitigation measures. These costs can be significant and affect the economics of projects, particularly small projects. Providing a mechanism to support these activities is a win-win, ensuring that environmental data is collected and mitigation, if needed, conducted while gaining the benefits of additional renewable electricity generation.

Section 8 allows for conduit projects on federal lands and directs FERC and other federal agencies to enter into a Memorandum of Understanding (MOU) to better coordinate reviews of these projects. It also requires regional workshops to seek public input to reduce barriers and investigate improvements to the regulatory process for small hydro and conduit projects. NHA believes there is significant growth potential in the small hydro/conduit power sectors of the industry.

NHA has seen numerous towns and counties across the country re-examine the feasibility of retrofitting their local dam infrastructure to add power generation equipment as well as to invest in irrigation power projects and others. Increasing the efficiencies in the process to support these projects makes sense—as we have seen recently with the MOU between FERC and Colorado to simplify the procedures for developing small-scale hydro in the state.

NHA also supports the provisions in the bill to increase deployment of federal hydropower resources. Section 13 requires a report to Congress updating the status of the federal hydropower MOU signed by the Departments of Energy (DOE) and Interior and the Army Corps of Engineers (Corps). Section 10 requires FERC and the Bureau of Reclamation (Bureau) to complete a new MOU to improve the coordination and timeliness of non-federal hydropower development at Bureau projects.

The federal system makes up approximately 50 percent of U.S. hydropower generation. As such, the Bureau and the Corps will play a major role in meeting the growth potential goals of the industry. NHA and the industry want to work as partners with these agencies. Recently, we were pleased to see the Bureau re-examine potential opportunities for new hydro facilities on their projects as well as the outreach they have conducted on conduit opportunities. NHA also understands that the Corps and FERC are close to updating their MOU on non-federal hydropower development at Corps facilities.

Section 6 of the bill requires the Department of Energy continue to fund R&D activities and provides for a new technical assistance program to assist applicants applying for a new license or for re-licensing. NHA believes the DOE waterpower program is critical to support advancements in technology research and project deployment, with tremendous benefits for hydropower projects both federal and non-federal. We appreciate the work of the Department and the recent funding levels that have supported it (though the FY 2012 budget proposes a funding cut). We believe Congress must continue to invest, not retreat, from the waterpower program—the smallest of the renewable energy programs at the Department. NHA understands that the Department will be releasing new details on the status of the U.S. hydro system as well as potential development on non-powered dams. It is work such as this that highlights the importance of the waterpower program.

Lastly, the bill directs a series of studies to be conducted including: a DOE study of pumped storage project opportunities on federal and non-federal lands near existing or potential sites of intermittent renewable resource development; another DOE study of potential from existing conduits; and a Bureau of Reclamation study on barriers to non-federal development at Bureau projects. These studies and reports will provide the baseline resource data on the growth potential for these sectors—data that is currently incomplete or has never been compiled.

With all of these provisions, the Hydropower Improvement Act is a comprehensive piece of legislation that recognizes the vital role of hydropower as an affordable, reli-

able, available and sustainable domestic energy source and sets a course to significantly increase its contribution to our nation's electricity supply.

The Marine and Hydrokinetic Renewable Energy Promotion Act of 2011

NHA also strongly supports the Marine and Hydrokinetic Renewable Energy Promotion Act of 2011, S.630. Marine and hydrokinetic technologies represent a huge opportunity to create reliable, clean energy. While these technologies are currently in various stages of research, development and deployment, thousands of megawatts of potential are available from ocean energy projects from New England to the West Coast and Alaska, and in-river hydrokinetic projects proposed along the Mississippi River and others.

Focusing on these new technologies, the National Hydropower Association established an Ocean, Tidal and New Technologies Council. The council examines potential growth opportunities of emerging technologies, shares information among industry members, and provides a forum in which to discuss the various challenges ocean, tidal, hydrokinetic and emerging water technologies face.

The Marine and Hydrokinetic Renewable Energy Promotion Act particularly addresses the needs of the MHK industry by creating programs to develop these technologies, test devices, gain environmental and other data, and deploy. Section 3 is a critical piece of the bill, as it provides for the establishment of MHK test facilities to demonstrate technologies in actual operating environments here in the United States.

The international MHK industry has seen the benefit of such facilities, particularly in Europe. The United Kingdom established the European Marine Energy Center in Scotland almost a decade ago.

The center has directly assisted the advancement of the European MHK industry by providing independent assessment of devices' energy conversion capabilities, structural performance and survivability; research and engineering support; testing validation; and other services. In addition to the test centers, Section 5 of the bill would establish a similar device verification program and Section 6 would also create an MHK grants program.

Finally, the bill also seeks to better coordinate and reduce duplication of activities across the federal agencies supporting MHK development. As in the conventional hydropower industry, NHA believes that regulatory improvements are possible for MHK project development, while still maintaining environmental standards and resource protection.

The United States must lead in the development and deployment of MHK technologies, not lag behind. Not only will this increase the amount of our clean energy generation, but it will create new markets, both domestically and internationally, for U.S. companies and American products and technologies—markets that will stimulate domestic job growth and new economic opportunities.

Conclusion

In closing, I would like to acknowledge collaboration demonstrated by the organizations appearing before you today. Over the past several years, American Rivers and the National Hydropower Association have mutually and purposely called upon our respective organizations to demonstrate leadership together in an effort to move our country forward on sustainable energy policy.

We have jointly supported hydropower technologies in renewable energy and tax policies over the past several years. Speaking for NHA, I encourage Congress and the Administration to join us in working together on a balanced and sustainable energy future—that grows our economy, expands renewable energy and enhances our environment. The Hydropower Improvement Act of 2011 has built on that partnership and we look forward to further collaboration on the bill to move it forward. NHA also appreciates the cooperative relationship with the Ocean Renewable Energy Coalition. Both of our organizations believe that marine and hydrokinetic technologies will play a critical role in meeting our country's clean energy goals and we both support policies that promote their commercial development.

Every state in the Union is already home to hydropower projects, hydro equipment manufacturing plants, companies that benefit from the hydropower supply chain and consumers who enjoy hydro's lower electricity costs. This job-sustaining sector of our economy has the potential for substantial growth, and we believe the bills you are considering today provide key support to fully realizing this growth.

There is much at stake and hydropower, America's leading affordable, reliable, and renewable domestic energy resource, stands ready to help meet our common clean energy goals. We look forward to working further with the Committee and other groups on these bills, as we also continue to advance additional policies to stimulate development of the country's untapped hydropower resources.

I thank the Committee for providing me this opportunity to testify on hydropower's current and future role in meeting our nation's environmental, energy and economic objectives and look forward to answering your questions.

The CHAIRMAN. Thank you very much.

Mr. O'NEILL.

STATEMENT OF SEAN O'NEILL, PRESIDENT, OCEAN RENEWABLE ENERGY COALITION, DARNESTOWN, MD

Mr. O'NEILL. Thank you, Mr. Chairman and Ranking Member Murkowski, and your, thank all of your colleagues today for devoting time to this very important topic—time and resources.

The Ocean Renewable Energy Coalition is the national trade association for what we call the MHK industry—marine and hydrokinetic, including wave, tidal, ocean thermal energy, and offshore wind.

I hope today to provide some additional justification and some context in asking for your support of S. 630. This bill adds important elements to EPA 2005 and EISA 2007. Specifically, and most importantly, the bill would provide much needed research and development funds to continue the excellent work that the Department of Energy has done, and other agencies, to foster the responsible commercialization of this industry.

S. 630 adds advanced systems engineering and systems integration to identify critical interfaces and develop open standards for marine and hydrokinetic renewable energy. It also provides for 3 open water test centers and a device verification program. Combined, these 3 programs address technology development from turbine design, to how arrays function and affect efficiency and environmental performance, as well as grid integration and environmental data collection. These synergistic programs will bring technology from initial testing to pre-commercial demonstrations and ultimately full grid integration.

The MHK industry benefits greatly from other industries—other renewables, the marine industry, the maritime, traditional power. For example, when I mention the test centers I think about the National Wind Test Center just north of Denver, Colorado, where they had a 10-diameter, 1-kilowatt turbine when they first started in 1977. Today they've got 3 megawatt turbines that are 100 meters in diameter. They're still improving that technology.

The wind industry also initiated a turbine verification program to assist in the performance verification and grid integration, and continues to be actively involved in improving international standards and other R&D.

We're actively involved in creating international standards in the MHK industry because of funding from the Department of Energy, and we're helping to prompt the global development of this new renewable energy technology.

Now, the test centers have been identified to support wave, tidal, and ocean current research, and S. 630 will provide greatly needed support to those 3 already identified test centers. Utility systems engineering will provide the last, and key, element for ultimate grid integration for these new energy sources.

Our industry has learned a lot from the international community as well, where Marine Current Turbines in the United Kingdom

has a 1.2 megawatt tidal turbine operating in Strangford Lough, Northern Ireland—1.2 megawatt that has been operating, is grid connected, providing 1,500 homes with power, and also demonstrating the environmentally friendly nature of this technology, despite the fact it's only be operating since 2008. While this is only anecdotal information, it's similar to the Roosevelt Island Tidal Project that Verdant Power had in New York City, where we witnessed fish swimming around the tidal turbines. With marine current turbines, we've been watching marine mammals swim around that, and, nicely coexisting with the turbines in Strangford Lough.

Measuring environmental performance is another key facet in S. 630. The Adaptive Management Grant Program provides public funding for environmental studies of our public waterways, our oceans, with the data being placed in the public domain. This is a key element that was developed in 2007 with the help of committee staff, my friend over here—John Seebach—and other environmental organizations and industry. It addresses the common need to put public information and more environmental data into the public domain.

Last, S. 630 encourages cooperative efforts between universities, industry, national labs, and government agencies. Similar to the great work done by committee staff on this bill, the industry is witnessing new rulemaking and accelerated decisionmaking processes that are helping get projects in the water, like ORPC's project in Eastport, Maine, or Columbia Power Company's recent wave buoy deployment in Puget Sound; Ocean Power Technologies' PowerBuoy in the Marine base at Kaneohe Bay, and Verdant Power's Roosevelt Island Tidal Energy Project, which is undergoing its final commercial licensing.

We are at a stage right now where these young companies need your support in order to continue the great work that they've been doing in the past several years.

Thank you very much for the opportunity to speak. Thank you for your support of this promising new industry.

[The prepared statement of Mr. O'Neill follows:]

PREPARED STATEMENT OF SEAN O'NEILL, PRESIDENT, OCEAN RENEWABLE ENERGY COALITION, DARNESTOWN, MD

ON S. 630

Thank you, Mr. Chairman. I thank you and your colleagues for devoting your time and resources to this important topic. The Ocean Renewable Energy Coalition is the national trade association for marine and hydrokinetic renewables, otherwise known as MHK, including wave, tidal, ocean thermal energy, and offshore wind. We're made up of 54 companies ranging from small technology and project developers, to large investor-owned utilities, publicly owned utilities, engineering consulting and law firms.

I hope today to provide some additional justification and context in asking for your support of S. 630, the Marine and Hydrokinetic Promotion Act of 2011. This bill adds important elements to the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007. Specifically, and most importantly, the Bill would provide much needed research and development funding to continue the excellent work done by the Department of Energy and other agencies to foster the responsible commercialization of this industry.

S. 630 adds advanced systems engineering and system integration methods to identify critical interfaces and develop open standards for marine and hydrokinetic renewable energy. It also provides for three open water test centers and a device verification program. Combined these three programs address technology develop-

ment from turbine design to how arrays of devices affect efficiency and environmental performance as well as grid integration and environmental data collection. These synergistic programs will bring technology from initial testing to pre-commercial demonstrations and ultimately full grid integration.

The marine and hydrokinetic renewable energy industry benefits greatly from other industries including: other renewables, maritime, and traditional power. For example, when I mention test centers the National Wind Test Center just north of Denver, Colorado began operating in 1977 with a single 1 kilowatt machine with a turbine ten feet in diameter. Today, single turbines with one hundred meter diameters are producing more than three megawatts. The wind industry also initiated a turbine verification program to assist in performance verification and grid integration, and continues to be actively involved in research and development, and improvement of international standards today.

The MHK industry has benefited from all these experiences and, with the help of federal funding, is actively involved in the creation of international standards to prompt global development of this new renewable energy technology. Test centers have been identified to support wave, tidal and ocean current research and S. 630 will provide greatly needed support to bring these centers into fully functioning reality. Utility systems engineering will provide the key element for the ultimate grid integration of this new energy source.

Our industry has also learned a great deal from the international community where devices are in the water, grid connected, and establishing a record of accomplishment in technology and environmental performance. For example, Marine Current Turbines based in the United Kingdom has successfully operated a one point two (1.2) megawatt tidal device in Strangford Lough, Northern Ireland since 2008. The project is grid connected and provides enough electricity for 1500 homes. While anecdotal at this time, the experience in Strangford Lough is demonstrating the environmentally benign nature of this technology. Similar to the fish that swam around the turbines at Verdant Power's Roosevelt Island Tidal Energy Project in New York City, marine mammals are co-existing nicely with the Marine Current Turbines tidal device.

Measuring environmental performance is another key facet of S. 630. The Adaptive Management Grant program provides public funding for environmental studies of our public waterways and oceans with the data being placed in the public domain. This is a key element that was developed in 2007 with input from Committee Staff, environmental organizations, and industry. It addresses the common need for more publicly available data on our oceans and waterways.

Lastly, S. 630 encourages cooperative efforts between universities, industry, national labs and government agencies. Similar to the great work done by Committee staff in preparing this bill, cooperation across sectors is bearing fruit and the industry is witnessing new rulemakings and accelerated decision making that is allowing pilot and demonstration projects to be deployed. Projects like Ocean Renewable Power company's tidal energy facility in Eastport Maine, Columbia Power Company's recent wave buoy deployment in Puget Sound; Ocean Power Technologies' PowerBuoy at the Marine Base in Kaneohe Bay, Hawaii; and Verdant Power's Roosevelt Island Tidal Energy Project which is undergoing its final commercial licensing.

Thank you for the opportunity to speak. And thank you for your support of this promising new industry.

The CHAIRMAN. Thank you very much.

Dr. Webber, you're our final witness. Go right ahead.

STATEMENT OF MICHAEL WEBBER, PH.D., ASSISTANT PROFESSOR, DEPARTMENT OF MECHANICAL ENGINEERING, ASSOCIATE DIRECTOR, CENTER FOR INTERNATIONAL ENERGY AND ENVIRONMENTAL POLICY, CO-DIRECTOR, CLEAN ENERGY INCUBATOR, THE UNIVERSITY OF TEXAS AT AUSTIN, AUSTIN, TX

Mr. WEBBER. Mr. Chairman and members of the committee, thank you so much for your invitation to testify on the nexus of energy and water.

My name is Michael Webber. I'm the Associate Director of the Center for International Energy and Environmental Policy at the University of Texas at Austin.

My testimony today will make four main points. The first point is that energy and water are interrelated. The second point is that the energy-water nexus is already under a strain today. The third point is that trends imply these strains will be exacerbated because of population growth, economic growth, climate change, and because of policy choices. The fourth point is that there are policy actions available at the Federal level that can help, and I will elaborate on each of these points during this testimony.

The first point is that energy and water are interrelated. We use energy for water, and water for energy. We use energy to heat, treat and move water. For example, the public water supply system requires about 4 percent of national energy consumption, about 6 percent of national electricity consumption. This is about the same as lighting, or about a quarter of all light duty vehicle transportation, so this is a big enough number to care and make it relevant.

We also use water for energy directly, the other way around. We use water for hydroelectric power, as you've heard, and indirectly as a coolant for thermoelectric power plants. These are power plants that you use heat to generate steam to make power. We use water as a critical input for the production of biofuels.

In particular, the thermoelectric power sector, like nuclear, coal, natural gas, is the single largest water user in the United States. They withdraw about 200 billion gallons of water every day. This is about the same as agricultural, in terms of withdrawals, or use. That's an average of between 1 to 40 gallons of water for every kilowatt hour of electricity.

In this room, during this testimony at this hearing today over a couple of hours, several kilowatt hours of electricity will be used for the lights and the cameras and things like that. That implies a couple hundred gallons of cooling water were used to generate electricity for this hearing. Very little of that water is actually consumed. Most of it is returned to the water source from which it was taken, but it's at a different temperature and a different quality.

The use of water depends on the fuel type and the generation technology, and the cooling system. Nuclear power plants tend to use the most water, followed by coal, followed by natural gas, followed by wind, and solar PV. So, the type of fuel that your using and the type of cooling system you are implementing affects how much water you need.

The second point is that the energy-water relationship's already under strain today. This strain introduces vulnerabilities from one sector to another. For example, we can have heat waves, or droughts, that can strain energy, and we can have energy outages that can strain water. For example, we have heat waves—there was one in 2003 in France that killed over 10,000 people, where the nuclear power plants had to dial back their output by about 15 percent because the river temperatures were to hot to effectively cool the power plants without violating thermal pollution limits. We also have droughts in places like in the southeastern United States 3 years ago, where nuclear power plants were within days of shutting off because of water availability problems. Then we had blackouts in New Mexico and Texas a few weeks ago that were caused because a couple power plants went offline when their water pipes froze. So, you can have heat waves, droughts, or

freezes that affect your water availability—if you don't have the water, then you don't have power.

It goes the other way around—if you don't have power, you can't get the water treatment or movement you always need, so we have hurricanes that can knock power out, then you might have water outages afterwards.

The good news is—there's a corollary. If you have energy, then you have water availability, and vice versa. With unlimited energy, we have unlimited water, and with unlimited water, we have unlimited energy.

The third point is that the strains in this nexus will be exacerbated because of population growth—more people who need energy and water, economic growth—which means we all want more energy and water than we used to, climate change—which intensifies the hydrological cycle affecting droughts and heat waves and snow melt, and things that affect the energy system, and policy choices, where we are electing to move toward more energy-intensive water and more water-intensive energy.

More energy-intensive water shows up in places where we need to move water from further away or drill deeper because of water tables falling, or use more low-quality sources, like desalination or brackish sources, and that implies more energy.

More water-intensive energy is because of motivation for domestic decarbonized sources, which means we might go to, more toward nuclear power, which uses more water than coal or natural gas, and the counter-trend there is actually solar and wind, and other forms, natural gas, that use less water for electricity. Then, in the transportation fuel sector, all the unconventional fossil fuels require more water to produce. Electricity needs a little more water to produce than conventional gasoline. But, in particular, biofuels need a lot of water. So, this is something for us to be aware of as we move forward.

In particular, the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007 have biofuels mandates that are essentially water mandates, depending on how we make these biofuels. They dictate that water use for biofuels go up by a couple trillion gallons a year out of 36 trillion gallons a year—our national consumption.

The fourth point is that there are different policy actions that can help. Because rivers, watersheds, basins and aquifers can span several States and several countries, it's hard for one State to always manage the water, so there is a role for Federal engagement on energy-water issues. But there are some policy pitfalls to be aware of.

First of all, energy and water policymaking are disaggregated—they have different funding oversight, different agencies and committees with no clear authority. Water planners often assume the have the energy they need, and energy planners often assume they have the water they need. Energy tends to be top-down, with strong Federal agencies and weak local agencies, and water's the other way around—strong local agencies and weak Federal agencies. Then, the data on water quantity are sparse, out of date, error-prone, or inconsistent, so there's a lot of problems. People talk about water in the East in terms of gallons—in the West they use

acre-feet—a acre-foot has hundreds of thousands of gallons, so there's a mismatch in the language they use, and that leads to problems.

The good news is, there are policy opportunities at the energy-water nexus. Conservation is synonymous. If you want to achieve energy conservation, then you should push for water conservation. If you wish to achieve water conservation, push for energy conservation. because they go hand in hand.

There's a big role federally for collecting, maintaining and making available accurate, updated and comprehensive water data—perhaps through the U.S. Geological Survey, or the Energy Information Administration. The EIA has a lot of energy stats. We could use an equivalent for water. Policymakers need good data to make good decisions.

We can invest in water-related R&D to match increases in energy-related R&D. The energy industry gets mocked for spending less on R&D that the dog food industry, and the water industry spends even less than the energy industry. We have increased energy R&D in the last few years, but not water R&D, so it would be great to see more of that. That includes low-energy water treatment, novel approaches to desalination, leak detectors to find water leaks—15 percent of our water supply actually leaks underground. We could encourage resource substitution of fuels that have water, emissions and security benefits, like natural gas, solar PV, and wind.

We could support the use of reclaimed water for irrigation or process fueling, and look at dry or hybrid wet-dry cooling at power plants. We could also look at strict standards in building codes for water efficiency. So, we have a lot of opportunities.

In summary, the energy-water nexus is complicated and important, and I'm very pleased to know you're being attentive to this matter.

That concludes my testimony. I'll be pleased to answer questions at the appropriate time.

[The prepared statement of Mr. Webber follows:]

PREPARED STATEMENT OF MICHAEL E. WEBBER, PH.D., ASSISTANT PROFESSOR, DEPARTMENT OF MECHANICAL ENGINEERING, ASSOCIATE DIRECTOR, CENTER FOR INTERNATIONAL ENERGY & ENVIRONMENTAL POLICY CO-DIRECTOR, CLEAN ENERGY INCUBATOR THE UNIVERSITY OF TEXAS AT AUSTIN, AUSTIN, TX

Mr. Chairman and Members of the Committee, thank you so much for the invitation to speak before your committee on the nexus of energy and water. My name is Michael Webber, and I am the Associate Director of the Center for International Energy and Environmental Policy and Assistant Professor of Mechanical Engineering at the University of Texas at Austin. I am here to share my perspective on important trends and policy issues related to this nexus.

My testimony today will make four main points:

1. Energy and water are interrelated,
2. The energy-water relationship is already under strain,
3. Trends imply these strains will be exacerbated, and
4. There are different policy actions that can help.

I will briefly elaborate on each of these points during this testimony.*

However, regionally, that number can be much higher. In California, where water is moved hundreds of miles across two mountain ranges, water is responsible for

*All figures and tables have been retained in committee files.

more than 19% of the state's total electricity consumption. Similarly large investments of energy for water occurs wherever water is scarce and energy is available.

In addition to using energy for water, we also use water for energy. We use water directly through hydroelectric power generation at major dams, indirectly as a coolant for thermoelectric power plants, and as a critical input for the production of biofuels. The thermoelectric power sector-comprised of power plants that use heat to generate power, including those that operate on nuclear, coal, natural gas or biomass fuels-is the single largest user of water in the United States. Cooling of power plants is responsible for the withdrawal of nearly 200 billion gallons of water per day. This use accounts for 49% of all water withdrawals in the nation when including saline withdrawals, and 39% of all freshwater withdrawals, which is about the same as for agriculture.

The amount of water required by powerplants depends on the type of fuel, power generation process, and cooling technology. Nuclear is the most water-intensive, while solar PV, wind, and some uses of natural gas are very water lean.

Typically, anywhere between 1 to 40 gallons of water is needed for cooling for every kilowatt-hour of electricity that is generated. However, while power plants withdraw vast amounts of water, very little of that water is actually consumed; most of the water is returned to the source though at a different temperature and with a different quality. Thus, while power plants are major users of water, they are not major consumers of water, which is in contrast with the agriculture sector, which consumes all the water it withdraws.

The Energy-Water Relationship Is Already Under Strain

Unfortunately, the energy-water relationship introduces vulnerabilities whereby constraints of one resource introduce constraints in the other. For example, during the heat wave in France in 2003 that was responsible for approximately 10,000 deaths, nuclear power plants in France had to reduce their power output because of the high inlet temperatures of the cooling water. Environmental regulations in France (and the United States) limit the rejection temperature of power plant cooling water to avoid ecosystem damage from thermal pollution (e.g. to avoid cooking the plants and animals in the waterway). When the heat wave raised river temperatures, the nuclear power plants could not achieve sufficient cooling within the environmental limits, and so they reduced their power output at a time when electricity demand was spiking by residents turning on their air conditioners. In this case, a water resource constraint became an energy constraint.

In addition to heat waves, droughts can also strain the energy-water relationship. During the drought in the southeastern United States in early 2008, nuclear power plants were within days or weeks of shutting down because of limited water supplies. Today in the west, a severe multi-year drought has lowered water levels behind dams, reducing output from their hydroelectric turbines. In addition, power outages hamper the ability for the water/wastewater sector to treat and distribute water.

While constraints in one resource introduce constraints on the other, the corollary of that relationship is also true: with unlimited energy, we could have unlimited freshwater; with unlimited water, we could have unlimited energy.

Trends Imply These Strains Will Be Exacerbated

While the energy-water relationship is already under strain today, trends imply that the strain will be exacerbated unless we take appropriate action. There are four key pieces to this overall trend:

1. Population growth, which drives up total demand for energy and water,
2. Economic growth, which can drive up per capita demand for both energy and water,
3 Climate change, which intensifies the hydrological cycle, and
4. Policy choices, whereby we are choosing to move towards more energy-intensive water and more water-intensive energy.

Population Growth Will Put Upward Pressure on Demand for Energy & Water

Population growth over the next few decades might yield another 100 million people in the United States over the next four decades, each of whom will need energy and water to survive and prosper. This fundamental demographic trend puts upward pressure on demand for both resources, thereby potentially straining the energy-water relationship further.

Economic Growth Will Put Upward Pressure on Per Capita Demand for Energy & Water

On top of underlying trends for population growth is an expectation for economic growth. Because personal energy and water consumption tend to increase with affluence, there is the risk that the per capita demand for energy and water will increase due to economic growth. For example, as people become wealthier they tend to eat more meat (which is very water intensive), and use more energy and water to air condition large homes or irrigate their lawns. Also, as societies become richer, they often demand better environmental conditions, which implies they will spend more energy on wastewater treatment. However, it's important to note that the use of efficiency and conservation measures can occur alongside economic growth, thereby counteracting the nominal trend for increased per capita consumption of energy and water. At this point, looking forward, it is not clear whether technology, efficiency and conservation will continue to mitigate the upward pressure on per capita consumption that are a consequence of economic growth. Thus, it's possible that the United States will have a compounding effect of increased consumption per person on top of a growing number of people.

Climate Change Is Likely To Intensify Hydrological Cycles

One of the important ways climate change will manifest itself it through an intensification of the global hydrological cycle. This intensification is likely to mean more frequent and severe droughts and floods along with distorted snowmelt patterns. Because of these changes to the natural water system, it is likely we will need to spend more energy storing, moving, treating and producing water. For example, as droughts strain existing water supplies, cities might consider production from deeper aquifers, poorer-quality sources that require desalination, or long-haul pipelines to get the water to its final destination. Desalination in particular is energy-intensive, as it requires approximately ten times more energy than production from nearby surface freshwater sources such as rivers and lakes.

Policy Choices Exacerbate Strain in the Energy-Water Nexus

On top of the prior three trends is a policy-driven movement towards more energy-intensive water and water-intensive energy.

We are moving towards more energy-intensive water because of a push by many municipalities for new supplies of water from sources that are farther away and lower quality, and thereby require more energy to get them to the right quality and location.

At the same time, for a variety of economic, security and environmental reasons, including the desire to produce a higher proportion of our energy from domestic sources and to decarbonize our energy system, many of our preferred energy choices are more water-intensive. For example, nuclear energy is produced domestically, but is also more water-intensive than other forms of power generation. The move towards more water-intensive energy is especially relevant for transportation fuels such as unconventional fossil fuels (oil shale, coal-to-liquids, gas-to-liquids, tar sands), electricity, hydrogen, and biofuels, all of which can require significantly more water to produce than gasoline (depending on how you produce them). It is important to note that the push for renewable electricity also includes solar photovoltaics (PV) and wind power, which require very little water, and so not all future energy choices are worse from a water-perspective.

Almost all unconventional fossil fuels are more water-intensive than domestic, conventional gasoline production. While gasoline might require a few gallons of water for every gallon of fuel that is produced, the unconventional fossil sources are typically a few times more water-intensive. Electricity for plug-in hybrid electric vehicles (PHEVs) or electric vehicles (EVs) are appealing because they are clean at the vehicle's end-use and it's easier to scrub emissions at hundreds of smokestacks millions of tailpipes. However, most powerplants use a lot of cooling water, and consequently electricity can also be about twice as water-intensive than gasoline per mile traveled if the electricity is generated from the standard U.S. grid. If that electricity is generated from wind or other water-free sources, then it will be less water-consumptive than gasoline. Though unconventional fossil fuels and electricity are all potentially more water-intensive than conventional gasoline by a factor of 2-5, biofuels are particularly water-intensive. Growing biofuels consumes approximately 1000 gallons of water for every gallon of fuel that is produced. Sometimes this water is provided naturally from rainfall. However, for a non-trivial and growing proportion of our biofuels production, that water is provided by irrigation.

Note that for the sake of analysis and regulation, it is convenient to consider the water requirements per mile traveled. Doing so incorporates the energy density of the final fuels plus the efficiency of the engines, motors or fuel cells with which they

are compatible. Conventional gasoline requires approximately 0.2 gallons of water per mile traveled, while irrigated biofuels from corn or soy can consume 20 to 100 or more gallons of water for every mile traveled.

If we compare the water requirements per mile traveled with projections for future transportation miles and combine those figures with mandates for the use of new fuels, such as biofuels, the water impacts are significant. Water consumption might go up from approximately one trillion gallons of water per year to make gasoline (with ethanol as an oxygenate), to a few trillion gallons of water per year. To put this water consumption into context, each year the United States consumes about 36 trillion gallons of water. Consequently, it is possible that water consumption for transportation will more than double from less than 3% of national use to more than 7% of national use. In a time when we are already facing water constraints, it is not clear we have the water to pursue this path. Essentially we are deciding to switch from foreign oil to domestic water for our transportation fuels, and while that might be a good decision for strategic purposes, I advise that we first make sure we have the water.

There are Different Policy Actions That Can Help

Because there are many rivers, watersheds, basins and aquifers that span several states and/or countries, there is a need for federal engagement on energy-water issues.

Unfortunately, there are some policy pitfalls at the energy-water nexus. For example, energy and water policymaking are disaggregated. The funding and oversight mechanisms are separate, and there are a multitude of agencies, committees, and so forth, none of which have clear authority. It is not unusual for water planners to assume they have all the energy they need and for energy planners to assume they have the water they need. If their assumptions break down, it could cause significant problems. In addition, the hierarchy of policymaking is dissimilar. Energy policy is formulated in a top-down approach, with powerful federal energy agencies, while water policy is formulated in a bottom-up approach, with powerful local and state water agencies. Furthermore, the data on water quantity are sparse, error-prone, and inconsistent. The United States Geological Survey (USGS) budgets for collecting data on water use have been cut, meaning that their latest published surveys are anywhere from 5 to 15 years out of date. National databases of water use for power plants contain errors, possibly due to differences in the units, format and definitions between state and federal reporting requirements. For example, the definitions for water use, withdrawal and consumption are not always clear. And, water planners in the east use "gallons" and water planners in the west use "acre-feet," introducing additional risk for confusion or mistakes.

Despite the potential pitfalls, there are policy opportunities at the energy-water nexus. For example, water conservation and energy conservation are synonymous. Policies that promote water conservation also achieve energy conservation. Policies that promote energy conservation also achieve water conservation.

Thankfully, the federal government has some effective policy levers at its disposal. I recommend the following policy actions for the energy-water nexus:

1. Collect, maintain and make available accurate, updated and comprehensive water data, possibly through the USGS and EIA. The Department of Energy's Energy Information Administration maintains an extensive database of accurate, up-to-date and comprehensive information on energy production, consumption, trade, and price available with temporal and geographic resolution and standardized units. Unfortunately, there is no equivalent set of data for water. Consequently, industry, investors, analysts, policymakers and planners lack suitable data to make informed decisions.

2. Invest heavily in water-related R&D to match recent increases in energy-related R&D. R&D investments are an excellent policy option for the federal government because state/local governments and industry usually are not in a position to adequately invest in research. Consequently, the amount of R&D in the water sector is much lower than for other sectors such as pharmaceuticals, technology, or energy. Furthermore, since energy-related R&D is expected to go through a surge in funding, it would be appropriate from the perspective of the energy-water nexus to raise water-related R&D in a commensurate way. Topics for R&D include low-energy water treatment, novel approaches to desalination, remote leak detectors for water infrastructure, and air-cooling systems for power plants. In addition, DoE's R&D program for biofuels should emphasize feedstocks such as cellulosic sources or algae that do note require freshwater irrigation.

3. Encourage resource substitution to fuels that have water, emissions and security benefits. Some fuel sources such as natural gas, wind, and solar PV are domestic, need much less water, and reduce emissions of pollutants and carbon.

4. Support the use of reclaimed water for irrigation and process cooling. Using reclaimed water for powerplants, industry, and agriculture can spare a significant amount of energy and cost. However there are financing, regulatory and permitting hurdles in place that restrict this option.

5. Support the use of dry and hybrid wet-dry cooling at powerplants. Not all powerplants need wet cooling all the time. Finding ways to help plants upgrade their cooling to less water-intensive versions can spare significant volumes of water to meet public supply or in-stream flow requirements.

6. Establish strict standards in building codes for water efficiency. Building codes should include revised standards for low-flow appliances, water-heating efficiency, purple-piping for reclaimed water, rain barrels and so forth in order to reduce both water and energy consumption.

7. Invest aggressively in conservation. Water conservation can be a cost-effective way to save energy, and energy conservation can be a cost-effective way to save water. Therefore, conservation has cross-cutting benefits.

The energy-water nexus is a complicated, important issue, and so I am very pleased to know that you are being attentive to the matter.

Mr. Chairman, that concludes my testimony. I'll be pleased to answer questions at the appropriate time.

SUMMARY—TRENDS AND POLICY ISSUES FOR THE NEXUS OF ENERGY AND WATER

There are four main points:

1. Energy and water are interrelated,
2. The energy-water nexus is already under strain,
3. Trends imply these strains will be exacerbated, and
4. There are different policy actions at the federal level that can help.

Point #1: Energy and Water Are Interrelated

- We use energy for water, and we use water for energy.
- Energy for Water—US public water supply requires 4% of national energy and 6% of national electricity consumption
- Water for energy—Half of all water withdrawals are for power plant cooling (most is returned to the water source); water needs vary with fuel type and cooling system

Point #2: The Energy-Water Relationship Is Already Under Strain

- The energy-water relationship is already under strain: constraints are cross-sectoral
  - Heat waves and droughts can constrain energy
  - Energy outages can constrain water
- Corollary: with unlimited energy, we could have unlimited freshwater and vice-versa

Point #3: Trends Imply These Strains Will Be Exacerbated

- Trends imply that the strain will be exacerbated unless we take appropriate action

1. Population growth, which drives up total demand for energy and water,
2. Economic growth, which can drive up per capita demand for energy and water,
3. Climate change, which intensifies the hydrological cycle (droughts and heat waves) causing more energy for water storage, conveyance and treatment
4. Policy choices: moving to energy-intensive water & water-intensive energy.

- Energy-intensive water: Long-haul, Deeper aquifer production, Desalination
- Water-intensive energy: Motivation: domestic, decarbonized sources

—Nuclear power and biofuels
—Counter trend: natgas/Solar PV/wind lower the water use of electricity

Point #4: There are Different Policy Actions That Can Help

- Because Rivers, watersheds, basins and aquifers can span states and countries
  - There is a need for federal engagement on energy-water issues.

- There are some policy pitfalls at the energy-water nexus.
- There are policy opportunities at the energy-water nexus
  - Water conservation and energy conservation are synonymous.
  - Collect, maintain and make available accurate, updated and comprehensive water data, possibly through the USGS.
  - Invest in water-related R&D to match increases in energy-related R&D.

—Low-energy water treatment,
—Novel approaches to desalination,
—Remote leak detectors for water infrastructure,
—Air-cooling systems for power plants
—Biofuels that don't require freshwater irrigation (algae, cellulosic)

- Encourage resource substitution to fuels with water/emissions/security benefits

—Natural gas, solar PV, wind

- Support the use of reclaimed water for irrigation and process cooling.
- Support the use of dry and hybrid wet-dry cooling at power plants

—R&D and infrastructure swap-outs

- Establish strict standards in building codes for water efficiency.

—low-flow appliances, water-heating efficiency, purple-piping for reclaimed water, rain barrels, etc.

- Invest aggressively in conservation

The CHAIRMAN. Thank you. Thank you for the testimony.

Thank you all for your testimony.

Senator Murkowski wanted to make a statement here, and I'll defer to her.

Senator MURKOWSKI. Thank you, Mr. Chairman.

I apologize, gentlemen. I have to excuse myself to go attend another hearing.

I appreciate the testimony that you each have provided, and the level of detail.

Dr. Webber, I really appreciate it, because you've given a whole laundry list of things. You speak very quickly, but I heard it all.

[Laughter.]

Mr. WEBBER. I saw the timer ticking down. Yes.

Senator MURKOWSKI. That's right. But, I also appreciated your article about Water versus Energy, and just the very, the way that you articulated the nexus. I don't think it's something that we appreciate as fully as we need to. When we're talking about energy we need to understand how water really is so integrally tied in there. I think you've laid it out well. I'm not sold on the idea of creating yet another department here. I don't think from a budget perspective we're there yet. But I do agree that we must do more to really understand what that nexus is, and how it works.

I'd also like to recognize you, Mr. Seebach and Mr. Munro, as representatives from American Rivers and the National Hydropower Association. I do think that through your efforts we do have a better piece of legislation that is moving forward. I appreciate the collaboration there. I really think that that has helped us.

Mr. O'Neill, I'm really excited about what our potential is with our ocean energy resources, and look forward to working with you on that.

I do have questions. I will present those to you for your written responses. Again, I appreciate you being here.

Thank you for the courtesy, Mr. Chairman.

The CHAIRMAN. All right. Thank you.

Senator Shaheen, go right ahead. Why don't—you haven't had a chance to ask questions. Go right ahead.

Senator SHAHEEN. Thank you, Mr. Chairman.

Thank you all very much for your testimony. It was particularly fascinating, and a good reminder of just how related energy and water are.

I'm particularly interested, Mr. O'Neill, in what you had to say about the potential of our oceans and rivers for energy production. This is an interest for me because at the University of New Hampshire, where I'm from, New Hampshire, they're doing some of the cutting-edge research around tidal and wave energy. We also have one of the fastest-flowing rivers in North America, so it makes a good place to do some of that research.

Can you talk a little bit about how much potential there is, or, we think there is, in terms of ocean and river energy? Then, if you, if we have breakdowns, how that breaks down for the Northeast?

Mr. O'NEILL. Thank you very much.

I want to call you Governor Shaheen, Senator Shaheen.

Senator SHAHEEN. I get that a lot.

Mr. O'NEILL. Actually, when you were Governor I was working for the Merrimack River Watershed Counsel.

Senator SHAHEEN. Ah. Good. I knew I liked you.

Mr. O'NEILL. The Electric Power Research Institute has estimated 250 megawatt hours—252 million megawatt hours of wave potential alone in the United States. A lot of that is in Alaska. Professor Martin Wosnick at UNH, who's doing a lot of that cutting-edge research that you mentioned—we do have great rivering resources in New Hampshire. You also have, up north in Maine, especially, you've got tremendous tidal resources. But we're looking at—the first rivering resource assessment was done in 1986, and that has stood alone by itself until just recently, when DOE funded the Electric Power Research Institute to update that. We're looking at probably 3.5 percent of our capacity in the United States coming from tidal and rivering resources. So, when you can, add wave and tidal and river resources together, it's about 10 percent.

Senator SHAHEEN. What's the, what are the best projections on how long it's going to take us to get to commercialization for the research that's being done? If I could ask you to also talk about, what are the biggest obstacles to moving forward with the research, to get all of these efforts to commercialization?

Mr. O'NEILL. Fear of the unknown. We do not have a real-time experience in research and development on projects in the water. That data is just starting to come out. Most of it's coming from overseas right now. I mentioned the Strangford Lough project.

Permitting is a very difficult aspect of this technology because we're not exactly certain. We've—in our gut we understand that these are going to be pretty benign, but the risk of catastrophic disaster is tiny when we look at the anecdotal evidence in terms of the Verdant project or MCT—we saw that the fish are actually swimming around the turbines. So, we're getting that anecdotal information. It is going to be technology-specific. It's going to be site-specific. So, getting past those things.

Now, people have been really working hard at this. FERC has been working hard at it. The Bureau of Ocean Energy Management

Resources and Enforcement has been working hard at this. We have ARPA-E at the Department of Energy that has a categorical exclusion rulemaking in process right now. We've got the Army Corps of Engineers that wants to have a national permit that would include test center transmission lines.

So, we're making great headway. We're standing on the shoulders of other renewables. I think it was Mr. Chalk this morning who mentioned that we're 20 years behind wind. I think 5 years ago that would be right on point. But I think we're making—just in the last 3 months, the great progress that has happened is, has just been tremendous. So, we're getting there much quicker than we thought.

Senator SHAHEEN. My time is almost up, but if I could just do one follow-up.

How big an issue is funding to do the research and get the dollars that are needed?

Mr. O'NEILL. Once you start funding these companies and projects like this, if the funding goes away for 6 months or for a year, those companies could die on the vine.

Senator SHAHEEN. Is there much private sector investment?

Mr. O'NEILL. About $500 million is, in equity valuation today.

Senator SHAHEEN. Can you compare that for us to, say, what's going on in wind or solar?

Mr. O'NEILL. It's tiny compared to wind——

Senator SHAHEEN. Yes.

Mr. O'NEILL. [continuing]. Or solar. In fact, one of the problems that we've had is, when wind and solar first started they had huge utility-scale tests, where you had 9 square miles in the Mojave Desert in California. Now, they learned a lot from those tests. The wind industry also had over 4,000 turbines in the same area. Huge, huge utility-scale projects. But when you're working in public waterways—and I think our friends from FERC——

Senator SHAHEEN. Sure.

Mr. O'NEILL. [continuing]. Have described that. It takes a lot of, as many as 17 to 25 State and Federal agencies to get your permits.

Senator SHAHEEN. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Let me just ask, and maybe, Dr. Webber, you'd have a point of view on this, or any of the rest of you. But my impression from the previous panel is that we're talking here about very low-cost power generation, as compared to other ways that we can generate power. I mean, the investment is not that great. I think, one of the witnesses—maybe Mr. Chalk—talked about how 30, I guess, $30 million had gone, had been, come out of the Stimulus Act—or maybe it was $30 billion——

Mr. O'NEILL. Million.

The CHAIRMAN.—$30 billion was used for projects—hydroelectric projects, as I understood it, and that those projects were producing power in the range of 2 to 3 cents per kilowatt hour. I thought I heard him say that. Two to four cents per kilowatt hour.

If that's true, what's the problem that is keeping utilities from making this choice when they need to add power, or need to add renewable power? Why is it that they are not going ahead and

choosing this if, in fact, you can produce power at 2 to 4 cents per kilowatt hour, rather than at 10 cents per kilowatt hour, which might be the cost of solar?

Mr. WEBBER. The, with a lot of these opportunities for power, the capital costs up front are very expensive. But once you've paid to build it, the cost of incremental generation's quite cheap. So, once you've built a hydroelectric system it generates power very cheaply, but it costs money up front to build it. So, sometimes that price is just the marginal cost of each additional kilowatt hour.

The CHAIRMAN. So, you think the 2 to 4 cents per kilowatt hour is just the marginal cost once the capital investment's been made?

Mr. WEBBER. Typically, for the numbers I see—these gentlemen can correct me if I'm wrong—so, that's one issue, is that capital costs versus marginal costs. A lot of the water-based technologies are very cheap to operate, very inexpensive to operate. Very clean to operate. But are expensive up front to build. Then, for some States, like, Texas, New Mexico, others, there water resources are unavailable. So, this is geographically unequal. Some State have better resources available than others. So, you have, first of geographical or geological resource constraint, and after that, price competition. Usually for the capital, once its built it's very cost-competitive.

The CHAIRMAN. Mr. Munro, did you have a thought on this?

Mr. MUNRO. Yes, Mr. Chairman.

So, as a public utility in the Northwest, we, part of integrated resource plan, we evaluate all the various resources from, you know, coal to hydroelectric generation, to nuclear, and so, we look at it from a variety of lenses, one being cost, another being, how clean is it? Another being, is, how quickly can you get this online? So, from our perspective, the most inexpensive research right now is conservation. So that's where we put a lot of our efforts. Of course, we're upgrading our current hydro facilities.

The costs on new hydro can range, as you mentioned, but, I'll put it to a megawatt hour, it's about $70 to $95 a megawatt hour. Compare that to a combined cycle gas plant, it's about $90. Then you look at other resources—they get more expensive, other renewables are more expensive. So, actually, we considered a combined cycle gas plant primarily because we could get that permitted in 2 years, versus the Cle Elum hydro project we were looking at—it's an existing dam—we looked at about a 5-year plus timeline to get that online.

So, we've shelved the gas plant for right now, but we think that, like, a policy like the Hydropower Improvement Act, we believe that will help us have a smarter, you know, process. We're encouraged by that.

But, again, we're going to pursue conservation. We'd like to do more hydro, like to see pump storage, because of it's ability to integrate intermittent resources.

The CHAIRMAN. So, from your perspective, it's not so much that the power from hydropower is more expensive than natural gas—it's not.

Mr. MUNRO. Right.

The CHAIRMAN. But, it just takes so much longer to get the permits and to get it constructed, and online.

Mr. MUNRO. That's true. Also, gas is a firm—it's a real firm resource, meaning it's there when you need it. You know, hydropower would be a great alternative because of its renewable nature. But, that's absolutely right. There's more to it than that, but you've basically got the gist of it.

The CHAIRMAN. OK. All right.

Senator Shaheen, did you have other questions? If so, go ahead.

Senator SHAHEEN. I'm sorry—Mr. Seebach's testimony, but, are there, can you talk a little bit about what kinds of environmental mitigation measures that we ought to be looking at in terms of hydropowers? We're thinking about getting—in New Hampshire we have a lot of small hydropower dams. Many of them are community owned. Many of them are not producing electricity anymore, and one of the concerns is just what the impact would be on the environment, the fish in particular, of starting those again. In fact, I have to say, when I was Governor one of the things that we were very proud of was that we dismantled a number of those dams because we thought it was going to be better for the rivers and the environment in the rivers. So, could you speak a little bit to that issue?

Mr. SEEBACH. Yes, Senator. Thank you.

I think, hydropower is very site-specific, so there are a series of impacts that we look at when we're evaluating a project. Obviously, things like fish passage—ensuring that if part of the river is being dewatered to divert water to a powerhouse, that that section of river has adequate flows to support aquatic life.

But I think when you're looking at individual projects, the keys are really some of the same things that Mr. Wright said in his testimony. The first important thing is that you're choosing a good site and that you have good project design. So, a good site is a site that does not have significant resource issues. There's a difference between building on a dam—on a stretch of river that doesn't have a high value fishery compared to, say, building a new dam in a fish—in a river with a critical run of salmon, for example.

I think the second thing that developers can do is reach out early and often to stakeholders, both environmental groups, and particularly resource agencies and regulators, to make sure that they understand what will be required of them, and to really keep those lines of communication clear and, really, work hard to provide that information as quickly as possible.

I think the other thing that's really important to making sure projects are appropriately mitigated is improved coordination between the multiple Federal agencies that work on hydropower projects, and, the Federal and State agencies. I think there are things they do well together. But I think it could be done better.

Senator SHAHEEN. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you all very much. It's been useful testimony.

We will ask that any additional statements, written statements that anyone wants to provide to the committee be provided no later than Tuesday. We're hoping that sometime in the next couple of weeks we can have a markup and proceed with these bills.

Thank you all very much.

[Whereupon, at 11:14 a.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

RESPONSES OF JEFF C. WRIGHT TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Some of the testimony we have received today has asserted that the licensing process for hydropower projects is much slower than the process for other types of renewable energy such as wind and solar projects—if that is the case, are there steps that FERC has taken to make the licensing process for hydropower projects more efficient, and are there any areas where there is still room for improvement?

Answer. The Commission has taken a number of steps to improve the efficiency of the hydropower licensing process. These include developing three separate licensing processes, so that developers and other stakeholders can select the process that is best suited for a particular case, as well as the expedited pilot process for hydrokinetic projects; creating model applications and other web-based tools designed to make the process of small hydropower development easier; entering into memoranda of understanding with several states and with federal agencies; conducting public outreach; and working one-on-one with potential applicants.

There is undoubtedly room for improvement, but the Commission's ability to shorten the licensing process is greatly constrained by current law. The Federal Power Act gives federal land management and resource agencies the authority to impose mandatory conditions on hydropower licenses. The courts have held that the statute does not give the Commission the authority to set deadlines for these agencies to act. In addition, the Commission must comply with other statutes, such as the Clean Water Act, the Endangered Species Act, the Coastal Zone Management Act and the National Historic Preservation Act. As with the Federal Power Act, the Commission lacks authority to require the agencies with authority under those statutes to act within a set timeframe. As a result, licensing proceedings are often delayed, after the Commission has reviewed the application and prepared its environmental analyses, waiting for other entities to act. Approximately one-fourth of the applications currently pending before the Commission have been delayed, in some cases for up to six years, because other agencies have not completed their respective processes. As I stated in my testimony, if Congress were to make clear that the Commission can establish enforceable schedules for license application processing, delays of this nature could be eliminated.

With respect to small hydropower projects, we have taken several steps to make the licensing process more efficient. When adequate consultation has been conducted, we have been able to waive some pre-filing consultation requirements (with resource agency cooperation) and combine environmental scoping with pre-filing consultation. We have also been able to combine public noticing requirements and shorten comment periods to expedite the licensing process. On some projects, encouraging applicants to coordinate with resource agencies during pre-filing has resulted in obtaining these agencies' final terms and conditions with the license or exemption application.

Question 2. I am aware of at least one project in New Mexico, for the City of Santa Fe, that was able to receive an authorization to proceed with a "conduit" hydropower project within two months of filing an application. The project is estimated to save the City approximately $20,000 per year in electricity costs. What are some suggestions you might make for applicants to enable them to quickly move through the application process? For example, your testimony suggests that the process

works most efficiently when applicants work in advance with resource agencies and other stakeholders—how are you encouraging applicants to do that?

Answer. The main reason that the City of Santa Fe's conduit application was processed so quickly was that the city's application was substantially complete when filed. The city had discussions with Commission staff prior to filing the application. Staff referred the city to the Commission's small hydro website, where there was guidance on how to move efficiently through the prefiling process, including several templates that the applicant could use to prepare its application and request waivers of consultation from resource agencies. The City followed that guidance. In addition, the city, after preparing its initial consultation document, submitted that draft document to Commission staff for review, and staff was able to point out portions of the document that required revision before the application was filed. When the application was filed, because the City demonstrated that proposed project would likely have few potential environmental effects, staff was able to shorten the public notice period, further facilitating the application's swift approval.

Commission staff has made substantial efforts to alert developers and other stakeholders of the tools that the City used to shorten the authorization process. Staff has conducted a number of outreach sessions, attended by over 100 potential small hydro developers, as well as by other stakeholders and is planning more over the next six months. I believe that the Commission's enhanced web site is also serving as a valuable tool. In addition, Commission staff is available to the public and spends a substantial amount of time working with potential applicants, as it did with the City, to ensure that they understand the application process and prepare the best possible application. This one-one-one approach continues to be very successful.

RESPONSES OF JEFF C. WRIGHT TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. Currently, there are proposed projects totaling over 88,000 MW with pending license applications and preliminary permits filed with FERC. That alone should demonstrate that the hydropower resource is not tapped out. For what types of projects are you receiving applications? What trends do you see in applications?

Answer. Although relicense applications still outnumber applications for new projects, we have seen an increase in the number of applications for new projects (licenses and exemptions) in recent years. The number of currently pending applications (94, representing about 12,304 MW) breaks down as follows: original licenses (26, representing about 2,000 MW); 5-MW exemptions (7, representing about 3 MW); conduit exemptions (3, representing about 1 MW); and relicenses (58, representing about 10,300 MW). Nearly all of the pending applications for original licenses are for conventional hydro projects at existing dams; one is for a pumped storage project and three are for hydrokinetic projects.

There has also been a sharp rise in the number of preliminary permits the Commission has issued in recent years, including competition for permits. Of the nearly 400 permits that are in effect (representing about 49,600 MW), 25 are for conventional projects (3,500 MW), 90 are for hydrokinetic projects (10,200 MW), and 48 are for pumped storage projects (35,900 MW). There are also over 300 permit applications pending which could represent a significant amount of potential additional capacity. I note, however, that the capacity numbers for projects in the permit stage are not firm, because there is competition for the permit at many sites and only one entity will receive the permit; and if an application is ultimately filed, the capacity of the proposed project often changes.

Question 2. S. 629 opens federal lands to the conduit "exemption" licensing process for the first time. In response to concerns raised by environmental groups, the legislation authorizes the federal land management agencies to impose conditions on proposed projects on their lands. The Fish and Wildlife Service and the National Marine Fisheries Service already have this authority. In your testimony before the Committee, you noted some concern with this authorization of additional mandatory conditioning authority because it may slow down the licensing process. Please elaborate on this point.

Answer. In authorizing the Commission to issue conduit exemptions—and subsequently exemptions to small project of 5 megawatts or less—Congress provided in section 30(c) of the Federal Power Act that exemptions must include fish and wildlife conditions imposed by federal and state resource agencies. In our experience, this process has worked reasonably well, with little delay and few conflicts arising regarding conditions for exemptions. While I recognize the valid interest that federal land management agencies have in protecting the lands entrusted to their supervision, I also have some concern that the more entities that have mandatory conditioning authority under the Federal Power Act or other Federal statutes, the more

likely it is that the exemption process will become more cumbersome and slow, and that conditions will be imposed that make projects infeasible. This concern could be to some extent ameliorated if Congress were to make clear that the Commission can establish enforceable schedules for processing hydropower cases.

Question 3. Please elaborate on how assembling and sharing environmental information may speed up the advance of the marine hydrokinetic industry. How expensive is the permitting process at present for individual projects and how long does it take to complete baseline studies? In 2007 there were discussions regarding funding a generic environmental impact statement for hydrokinetic devices. This proposal somewhat replaces that idea. Please comment on its ability to expedite the licensing of such devices.

Answer. Because marine hydrokinetic technology is relatively new and the sites for proposed projects—particularly offshore—are not well-studied, it is necessary to develop the information needed to understand the potential environmental impacts of these projects, as well as technological issues. To the extent that this information can be developed and shared in a centralized manner, rather than requiring each applicant to fund and perform its own studies, time, effort, and money can be saved. Some of the pioneer developers in the marine hydrokinetic industry consider their collected environmental data to be proprietary, due to the high costs that they incur in collecting them. Aiding to fund some of the costs of these studies would alleviate some of the economic burden of these pioneer developers and promote information-sharing. Also, the assembling and sharing of information would facilitate efficient government oversight of the development of the industry by expanding the baseline knowledge of environmental effects and monitoring methods. Further, a greater understanding of the environmental effects and monitoring methods related to marine hydrokinetics could foster public acceptance and so help to advance the industry. The expense of the application process varies too widely to give a fixed number, but the three developers who have filed applications for hydrokinetic projects reported costs of, approximately, $1 million, $2 million and $3 million. Because these were among the first hydrokinetic projects and involved some testing of equipment, I cannot say whether these figures will be predictive of costs in future cases. From the Commission's limited experience to date with marine hydrokinetic project proposals, the baseline studies necessary for project authorization typically take one to two years.

Question 4. S. 629 calls on FERC to conduct a series of regional workshops for both conduit and small hydropower projects. You noted in your testimony that the Commission has already done local outreach on small hydro projects. Given the Commission's previous work in this area, do you think additional regional public workshops for small hydro projects are unnecessary?

Answer. As I discussed in my testimony, the Commission has conducted extensive outreach with respect to small hydro and, based on what we heard, has set up a number of web-based tools, including "fill-in-the-blank" applications, to provide information to those interested in developing small hydro projects and to make the application process easier. To date, we have conducted a number of outreach sessions, attended by over 100 potential small hydro developers, as well as by other stakeholders and we are planning more over the next six months. Given this outreach and regulatory effort, I am not certain that additional workshops are necessary. However, we are certainly prepared to conduct them, should Congress deem it appropriate.

Question 5. Please describe the recent Memorandum of Understanding the Commission entered into with the State of Colorado, and please specifically describe the simple application process for certain types of micro-conduit hydropower projects.

Answer. The Memorandum of Understanding (MOU) between the Commission and the State of Colorado established simplified procedures for developing small-scale hydropower projects in Colorado. Under the MOU, Colorado has developed a pilot program to assist developers in consulting with the relevant agencies, developing applications for small projects, and prescreening those applications for compliance with the Commission's regulations. In turn, Commission staff has agreed to waive certain consultation requirements (when all relevant agencies agree to do so), combine public noticing requirements, and shorten comment periods, in order to expedite the licensing of these projects. The MOU states that Colorado's pilot program will continue until 20 projects have completed the program, at which point Colorado and FERC will evaluate the effectiveness of the pilot program. Should the procedures or some aspects thereof prove successful, both Colorado and FERC intend that these approaches be continued. Beginning in May 2011, Colorado proposes to submit three conduit exemption applications in a six-month period. This approach shows great promise for expediting action on small hydropower projects and we look forward to working with Colorado.

RESPONSES OF JEFF C. WRIGHT TO QUESTIONS FROM SENATOR WYDEN

Question 1. Micro-hydropower conduit projects application requirements—We hear from small conduit developers in Oregon that the Commission has made its conduit exemption application process more user-friendly, with changes like the Commission's new template. However, we also hear that more can be done. Farmers and small developers assert that particular aspects of the application are burdensome and unnecessary for no-impact micro-hydropower projects. For example, FERC's requirement of three copies of surveyor-stamped maps and drawings from three different angles have been cited as adding to the cost of these small, no-impact projects. As a result, developers have cited costs to move through the FERC conduit exemption process that range from $6,000 to $8,000 in a good case, and often up to $10,000 or $20,000. For very small projects, these costs can become prohibitive. For example, a typical 5 kw irrigation pipe turbine may generate $300 of electricity a month during the irrigation season, or $1,500 a year. What additional actions could FERC take to reduce application requirements for no-impact micro-hydropower projects, such as projects involving municipal pressure reduction valves and existing irrigation conveyances?

Answer. The Commission is prepared to consider any suggestions for ways to make the small hydro process simpler and less expensive. This may be particularly fruitful for conduit projects, with respect to which the Commission already has issued a categorical exemption from NEPA review, based on the premise that construction of the conduit on which such a project is located has already been approved by a state or federal agency, which has examined and required appropriate mitigation for the environmental impacts of that action. It is more difficult to develop similar, generally-applicable steps for non-conduit small hydro, because the small size of an in-stream project will not always guarantee minor environmental impacts (for example, a 200-kilowatt project could be located on a stretch of river where there are endangered species or important spawning grounds). However, the "pre-approval" approach being taken by the State of Colorado holds great promise. Where state and federal resource agencies, along with other stakeholders, have been able to agree that a proposed project has few environmental impacts, the Commission has already been able, under its existing processes, to authorize the project very quickly, with little, if any, additional burden on the applicant. As I discussed in response to a question from Senator Murkowski, giving the Commission the ability to set enforceable schedules in hydropower licensing proceedings would help ensure that these cases are resolved in a timely manner. With respect to the surveys and maps that you mention, the requested data is needed so that the Commission can plot, using the global information system (GIS), the precise locations of projects it authorizes. However, we would certainly be willing to consider whether there are less expensive ways to develop this important information.

Question 2. Micro-hydropower outreach requirements—Another concern raised by Oregon developers of micro-hydropower projects is the significant outreach required to consult with stakeholders. The same 5 kw turbine in a rural Oregon irrigation pipe requires outreach to over a dozen different agencies, agencies that invariably have no concerns with the project. Why can't the Commission establish a process whereby Commission staff consolidates outreach notifications for micro-hydropower projects by maintaining lists of stakeholders in various states, and then once a month Commission staff could send a batched notice out of any pending micro-hydropower projects? Is it really necessary to maintain the typical three-stage consultation process for this class of projects?

Answer. I agree that it makes sense to simplify the process for the consideration of micro-hydropower projects as much as possible. The Federal Power Act establishes a regulatory scheme that is premised on notice to the public and on shared decisionmaking, in which agencies other than the Commission have statutory authority to be consulted and to impose conditions with respect to proposed hydropower projects. It is not possible for the Commission to predict in advance whether local, state, and federal agencies will express concerns about, or decide to impose conditions on, any given project. Moreover, the Commission cannot waive statutory notice requirements or authority that Congress has given to other entities. If, however, those entities—particularly the federal and state resource agencies—show a willingness to waive some or all of the consultation and conditioning process or to sign off in advance on certain types of projects, it might be possible for the Commission to establish an expedited process, such as that which you suggest. We are willing to consult on batches of similar projects, and have already done so in some instances.

RESPONSES OF MICHAEL E. WEBBER TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Your testimony points out that this issue is not just a western issue, but that water shortages in other areas of our country may also impact power generation. For example, you note that during the drought in the southeastern U.S. in 2008, nuclear power plants were within days or weeks of shutting down because of limited water supplies. How can a greater understanding of the connection between energy sources and water supplies help to avoid those types of conflicts?

Answer. The relationship between water and energy is a global issue, though some regions of the world, such as the western U.S., feel the tensions in this relationship very acutely. A greater understanding of the connection between energy sources and water supplies can help avoid those types of conflicts by: 1) integrating decision-making such that water planners and energy planners work together, 2) pursuing synergistic R&D programs (for example, to develop energy-lean sources of water and water-lean sources of energy), and 3) building resiliency into our energy system so that it is less vulnerable to water scarcity and building resiliency into our water system so that it is less vulnerable to energy shortages.

Question 2. Your testimony highlights the need to investigate the water supply needs associated with electricity generation AND transportation fuels, which our legislation seeks to do. You have also indicated that a "switch from gasoline to electric vehicles or biofuels is a strategic decision to switch our dependence from foreign oil to domestic water". Can you please elaborate on your thoughts there?

Answer. Today, petroleum-based fuels supply more than 95% of our energy for transportation. Because of converging desires to switch to lower-carbon, less volatile, and domestic forms of transportation fuels, a variety of policy mechanisms support the displacement of imported petroleum with electricity, biofuels, unconventional fossil fuels, hydrogen, and natural gas. In general, gasoline and diesel are relatively water-lean to produce. By contrast, most of the alternative transportation fuels-in particular biofuels, unconventional fossil fuels, some forms of electricity, and some forms of hydrogen-are more water-intensive. Thus, by switching from imported petroleum to these domestic options, we are essentially substituting the use of domestic water for petroleum. While this tradeoff has important strategic benefits, it can be problematic from a water resources perspective.

Question 3. As someone who has been thinking about the connection between energy and water for a longer time than most of us, do you have any recommendations for how to get out ahead of this issue before we are dealing with a crisis situation such as shutting down power plants?

Answer. I recommend that the federal government use its convening power to bring together leading experts in national labs, academia and industry, possibly through the National Academies or some similar institution, to develop an energy-water roadmap. This roadmap could serve policymakers in many ways, including the following: identifying cross-sectoral vulnerabilities, creating a geographically-resolved inventory of energywater relationships nationwide, laying out a strategic research plan for relevant technical innovation, and making recommendations for federal, state and local policymakers. In addition, it would be valuable for the federal government to gather data that are lacking. Because many water and energy systems span several states, it is difficult for any one state agency to gather all the pertinent information that planners need.

Question 4. Many of us are familiar with the concept of "peak oil". Can you please elaborate on the concept of "peak water"?

Answer. "Peak Water" is a reference to the concept of declining productions rates for freshwater. In contrast with "Peak oil," which refers to a finite resource (petroleum), water is very abundant globally. However, most of that water is available in a form, location, or time of year that is inconvenient or unusable for many people. Consequently, significant amounts of energy are invested to move that water in place, time and form (through pipelines, storage reservoirs and treatment plants) such that it is clean, potable, and available when and where we want it. If energy sources become constrained or prohibitively expensive, then clean, piped water might also become constrained or prohibitively expensive in certain locations or particular times of year. Consequently, "Peak Energy" could trigger a decline in production of freshwater.

RESPONSES OF MICHAEL E. WEBBER TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. Please describe how the United States can satisfy all the expected water needs of newly proposed power plants, including concentrated solar, in arid and semi-arid regions.

Answer. Traditional steam-electric (or thermoelectric) power plants, including many of those powered by nuclear, coal, biomass, natural gas, or concentrated solar

power, use extensive amounts of water for cooling. Locating these power plants in arid or semi-arid regions, where water resources are scarce, exposes the plants to the risk that they will compete with other municipal, agricultural, industrial or ecological needs for that water. Ensuring that the water needs will be met by the power plants will be challenging if conventional cooling technologies and freshwater sources are used. However, novel dry-cooling and wet-dry-hybrid cooling systems require much less water for power plants, and therefore might be a promising option. For example, some new concentrated solar power systems that use dry cooling have been proposed in Nevada. While these types of systems significantly reduce the amount of water that is needed by power plants, they have a tradeoff of 1) requiring more capital up front to build the cooling systems and 2) reducing the operating efficiency of the power plant. Other options include the use of reclaimed water or saline water for cooling, or building power plants with water-lean combinations of fuels and technologies, such as solar PV, wind turbines, and natural gas simple cycle combustion turbines.

Question 2. Does your research show any regions in the country that are not expecting a significant water problem over the next decade?

Answer. Generally speaking, the northern latitudes of the U.S. have more abundant sources of water available. However, even "water-rich" regions of the country can be exposed to periods of drought. In addition, water abundance can lead to flooding, which also puts the energy sector at risk. Thus, the risk of water problems are widespread.

Question 3. What are the most significant data gaps inhibiting our understanding of the current and potential future demand for water by the energy sector? Does you research indicate that currently funded efforts to improve federal water and energy data address these gaps within the next few years, or will key data remain uncollected?

Answer. The current funding for data collection at the energy-water nexus is insufficient to provide adequate information to policy makers for informed decision making. There are many data gaps, a few of which are listed here: 1) data about water withdrawals, consumptions, diversions, and returns by sector, county, and time of year are lacking, 2) data about the energy use by the water sector (in particular by water treatment plants, wastewater treatment plants, residential sector, commercial sector, agriculture and industry) are lacking, and 3) water flows (withdrawals, evapotranspiration, returns) for agriculture based on crop, time of year and location are unknown.

Question 4. What are the benefits and the opportunity cost to the economy and society of the energy sector's growing water use?

Answer. The energy sector's growing water use, primarily for irrigating biofuels crops, provides a benefit of displacing some petroleum use, but introduces a risk of competition for water resources. By displacing petroleum, we reduce our exposure to oil price volatility tied to geopolitical events. However, we exchange those risks for water-related risks driven by climate and weather systems. These risks can show up in the form of higher energy prices, which can impact economic growth. Developing more energy-efficient water systems and more water-efficient energy systems can be economically beneficial because they mitigate the downside risks. Building more energy-intensive water systems and more water-intensive energy systems exacerbates the exposure to risk.

Question 5. Options to reducing freshwater use by the energy sector include using impaired water sources or increasing reuse of water within the energy sector. What are the most significant barriers to using impaired water to meet energy sector water demands? For instance, what are the barriers to using saline water for power plant cooling, and is currently funded research anticipated to significantly reduce this barrier?

Answer. Using reclaimed water or saline water at power plants reduces the need for freshwater in the power sector and can save on water costs for plant operators. Such systems have been built. For example the Palo Verde nuclear power plant in Arizona, and the Sand Hill natural gas power plant in Austin, Texas both use reclaimed water. And, coastal nuclear power plants use saline water. However, these water sources can be more corrosive or cause mineral build-up and thus might require more expensive piping and heat exchanger materials and additional maintenance. Furthermore, in some cases the use of reclaimed water requires permitting approval from relevant agencies and significant up-front capital-intensive infrastructure investments to connect reclaimed water sources from wastewater treatment plants to the electricity stations. Supporting R&D in the areas of demineralizing water, creating novel materials that have improved fouling-resistance, and improving the efficiency of cooling systems would be worthwhile.

Question 6. Please describe the current research being undertaken to understand the water intensity for MWh of electricity for different fuels and different generation technologies.

Answer. A variety of research groups, including mine at the University of Texas at Austin, are studying the water intensity of power plants based on fuels, generation technologies, and cooling technologies. The Department of Energy's (DoE) National Renewable Energy Laboratory (NREL) released a report on the topic in Spring 2011. While the basic relationship of water for power plants based on fuel type, generation technology and cooling system is known, additional research to understand the relationship under varying climatic conditions and usage patterns is warranted.

Question 7. How have other countries integrated freshwater concerns into efforts to promote domestic and clean energies? What are some ways in which water quantity and quality impacts have been integrated into clean energy and biofuel policies internationally?

Answer. In general, most countries globally fail to properly integrate energy and water policymaking. Thus, the water quantity and quality impacts of biofuels and other energy options have not been integrated broadly into international energy policies. Israel, which has scarce resources of both energy and water, seems to have sophisticated thinking in terms of integrating water and energy policymaking. Many countries have not addressed the issues directly, and are at risk of confronting serious shortages in one commodity or the other.

Question 8. Please describe the impact on energy use with stricter treatment standards for water and wastewater. Are there any energy related tradeoffs that may occur with stricter treatment standards?

Answer. In general, stricter water treatment standards correlate with higher energy intensity of the water and wastewater treatment plants. That is, raising water quality standards tends to cause higher energy consumption for water treatment. At the same time, treatment plants improve their efficiency year-over-year. The consequence of these two competing effects (tighter standards driving energy consumption up and improved efficiency driving energy consumption down) is to roughly cancel each other out.

RESPONSES OF JOHN SEEBACH TO QUESTIONS FROM SENATOR BINGAMAN

Question 1.1 Your testimony describes a "basin-scale" approach to hydropower development—can you please elaborate on what that means and how it is different that what the normal practice is today?

Answer. When the operation, management, and environmental impacts of multiple facilities located on the same river basin are addressed in a coordinated manner, it is possible to get an increase in generation and significant improvements in environmental quality. The Federal Power Act requires that the Federal Energy Regulatory Commission (FERC) balance all of the competing interests that are potentially affected by hydropower development in order that the American public would receive the greatest amount of benefit from its waterways. FERC must ensure that its licenses for hydropower projects:

> "shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes" 16 U.S.C. §803(a)(1).

While the Federal Power Act envisioned that FERC would prepare comprehensive plans on a broad "waterway" scale (and the Federal Power Commission—FERC's predecessor—did in fact prepare a handful of such plans in the 1920s), FERC interprets its comprehensive planning responsibility to mean its comprehensive analysis of an individual project. As a result, FERC generally treats a basin as the sum of its parts rather than a coherent whole. Each individual hydropower project in a river basin is analyzed separately on its own terms, the subject of its own relatively narrow comprehensive plan. "Waterway" simply refers to the stretch of river in the immediate vicinity of the project. The Commission does not perform a larger-scale analysis to determine how the individual pieces could be fit together in order to maximize the public interest.

This narrow, project-level approach to planning leads to missed opportunities. Individual hydropower projects do not exist in a vacuum. The decision to construct and operate a hydropower dam requires a number of tradeoffs between multiple beneficial uses of a waterway: energy, the health of commercial fisheries, water quality, water allocation, power generation, flood control, and recreation. In the context of a single dam, it can be difficult to strike an equitable balance. However, when one steps back and consider an entire river basin, considering multiple dams on a connected set of rivers and tributaries, opportunities to achieve a much better balance begin to emerge.

For instance, consider Maine's Penobscot River basin. For decades, a series of dams in this basin blocked access to high-quality habitat and all but wiped out the river's valuable Alewife, Atlantic Salmon, and Shad fisheries. When these projects were relicensed by FERC, parties examined the entire basin and came up with a plan that would restore more than 1000 miles of habitat—and millions of fish—by removing two dams, bypassing a third with a nature-like fishway, and installing fishways at others. This plan also allows the remaining dams to generate more power, concentrating environmental restoration measures where they are most needed and concentrating power production where it will have the least impact on the basin as a whole. Had the Penobscot River been considered as a whole rather than the sum of its parts before any of its dams were built, this is likely how it would have been developed in the first place.

The Penobscot agreement demonstrates how the coordinated review and planning of hydropower in a basin can result in more power and better environmental outcomes. Unfortunately, the unique circumstances on the Penobscot—where all of the dams were owned by a single entity and subject to the jurisdiction of a single agency—are the exception rather than the rule. There is an urgent need for the type of basin-scale planning and coordination of hydropower projects that led to the Penobscot agreement.

The "Integrated Basin Scale Opportunity Assessments" initiative in the DOE/DOI/Corps hydropower MOU signed in 2010 is an excellent first step. This pilot program will develop methods for such planning and test them in several pilot basins to see if additional opportunities for generation and environmental restoration will emerge. We encourage Congress to follow this work closely and, should it be successful, direct FERC and the federal hydropower operators to cooperate to address multiple projects in a coordinated fashion to increase power generation and environmental outcomes at the basin—not project—scale. For instance, when FERC is licensing a new project or relicensing an existing project in a basin where the Corps or the Bureau also operate hydropower projects, those agencies should participate as cooperating agencies in FERC's analysis and use that opportunity to review the operations of their own projects in coordination with the FERC-licensed projects in order to maximize power production and environmental performance.

Question 1.2 With regard to S. 630, the Marine and Hydrokinetic Renewable Energy Promotion Act, you emphasize the need to continue to collect data regarding the environmental impacts associated with the technologies that are emerging for hydrokinetic energy development. What are some of the potential impacts we should be concerned about?

Answer. A number of issues have been identified in individual licensing proceedings for these projects. These include (but are not limited to):

- Aquatic Species' interaction with devices and anchoring systems (including Marine mammals, sharks, fish, etc.). Potential risks include avoidance, behavior change, collision, entrainment, or mortality.
- Effects due to the removal of energy from waves and currents. Potential risks include altered sediment transport and changes in flow velocity, tidal exchange, and water quality.
- Effects of noise, vibration, lighting, EMF from transmission cables, and releases of chemicals (lubricants, oils, etc.) on aquatic and avian species.
- Effects of exclusion / restriction zones on recreation, navigation, commercial fishing, etc.

For a much more detailed discussion of some of these impacts, we recommend the following excellent documents:

- The U.S. Department of Energy's Wind and Hydropower Technologies Program's December 2009 "Report to Congress on the Potential Environmental Effects of Marine and Hydrokinetic Energy Technologies." (http://www1.eere.energy.gov/windandhydro/pdfs/doe___eisa__633b.pdf)

- The West Coast Framework's sections on environmental impacts: (http://www.advancedh2opower.com/framework/Hydrokinetics%20Knowledge%20Base/Environmental%20Effects.aspx)

Question 1.3 You indicate there may be some room for improvement with respect to the current FERC application processes. What are some suggestions you might make for applicants as they move through the permitting process? For example, your testimony suggests that the process works most efficiently when applicants work in advance with resource agencies and other stakeholders—how are you encouraging applicants to do that?

Answer. Over the past several years, we have heard from a number of potential developers of new hydropower projects. Many of these developers are responsible and committed to working with stakeholders to develop only those projects that can be brought online in an environmentally sensitive manner. Others do not share this ethic, and appear determined to withhold information from stakeholders, agencies, and regulators in order to limit their responsibility for mitigating environmental impacts. Still others (perhaps the largest group) simply lack experience with developing hydropower projects. We encourage all developers to emulate the first group.

First, developers should engage as soon as possible with key agency staff and stakeholders that are likely to take an interest in their proposed projects. Early and extensive public outreach is critical in ensuring the success of a hydropower project, and too often American Rivers or its partners learn about proposed hydropower projects only through formal notice of a preliminary permit or license application. Developers that approach stakeholders first and engage them constructively throughout the licensing process are more likely to meet with success.

Second, if this consultation reveals that a site has particularly sensitive resource issues, then the developer should seriously consider finding a site that is not similarly constrained. It may be possible to develop a good project at a site with sensitive resource issues, but it will take longer and cost more.

Third, developers should work with agencies and stakeholders to address information needs and potential resource issues, and then make a good-faith effort to provide requested information in a timely manner. Once resource issues are quantified, the developer should work with agencies and stakeholders to develop mutually acceptable solutions. Again, time spent fighting over whether or not information is needed or a proposed environmental mitigation measure is necessary will only increase the costs and time associated with licensing.

FERC staff can also play a role in improving the process. First, FERC should regularly update its statelevel or regional mailing lists of stakeholders and agency staff that have previously expressed interest in hydropower licensings and require potential license applicants to demonstrate that they have made a good-faith effort to contact those individuals or organizations early in the process.

Second, FERC could do more to reach out directly to new developers (either through workshops or individually) to guide them through the process. FERC staff have done a tremendous job of improving the quality of this outreach and education over the past several years, but they are constrained by resources and the record number of new applications that they are being asked to process. If FERC were given the resources necessary to assign one or two full time staff members to developer outreach, they could significantly improve the quality of new license applications.

Third, FERC must cooperate better with its sister federal and state agencies that have a defined role in recommending license conditions to protect public resources, as well as agencies that have independent responsibilities under the Clean Water Act or the Endangered Species Act. These agencies need reliable, accurate scientific information in order to fulfill their responsibilities. Some applicants are unwilling to provide this information because they are reluctant to incur the cost of studies, especially if that information may require them to do more to mitigate project impacts. Unlike FERC, most resource agencies lack the tools to compel applicants to provide this information. The resulting stalemate is a perennial source of delay in licensing.

While FERC staff have the authority to order applicants to provide this information, they often choose not to do so, arguing that the information is not necessary for FERC's licensing decision. This may be technically true—FERC may not consider the information necessary for its own analysis—but the reality is that FERC cannot issue a license until it has received a Water Quality Certification from the state and all required ESA consultation is complete. FERC Staff may be able to work with agencies to narrow the scope of the necessary information, but ultimately those agencies must decide what information is necessary for them to act. FERC should improve its cooperation with other federal and state agencies, especially where those

agencies have identified a need for information that will enable them to fulfill their own responsibilities and clear the path for FERC to issue a license. FERC must bear the responsibility for delays that result when it fails to support other agencies' stated information needs.

RESPONSES OF JOHN SEEBACH TO QUESTIONS FROM SENATOR MURKOWSKI

Question 2.1 Although your organization is generally opposed to the construction of new dam infrastructure, the lower 48 states are in a different situation than Alaska. Alaska has both tremendous hydropower potential and a desire to get its villages off of diesel power. What are your thoughts on the construction of new conventional hydropower facilities in Alaska?

Answer. American Rivers is generally opposed to the construction of new dams, but we are not categorically opposed: we approach each proposal with an open mind. Our decision to support or oppose any given project is based on the unique facts and circumstances of the proposal and the natural resources that would be affected. The tradeoffs that would be involved in developing a new hydropower project in Alaska are the same set of tradeoffs that must be addressed in evaluating any hydropower project that is being proposed anywhere in the world: the power from a given project must be weighed alongside the economic, environmental, and social costs associated with developing it. Alaska is different from the lower 48 states in a number of ways, and those differences will certainly inform the way that these tradeoffs are calculated. But we cannot say—especially in the hypothetical—how these differences might affect a decision to build or not build an individual dam. Each river and each proposed dam is different.

While each project is different, the process for developing then should not be. The decision to build a project or not should be a fair one. American Rivers has advocated for years that decisions about hydropower dam operations should be based on an open public process that features the highest quality scientific information, a robust analysis of alternatives, and fully transparent decisionmaking. Proposals to build new conventional hydropower projects should be held to an equally high standard, and if a new project is deemed by regulators to be in the public interest, then its ecological and social impacts must be accurately quantified and fully mitigated.

Question 2.2 Section 9 of S. 630, the Marine and Hydrokinetic bill, is a provision intended to clarify that the Renewable Energy Deployment Grant Program I authored in the 2007 energy bill is open to all states and not limited to only Alaskan utilities. I believe you are concerned that this provision may be used to help fund new dam construction, is that correct? Do you have any proposals to modify this provision further in a way that your organization may find acceptable? Do you support the requirement that aid be prioritized to areas where electricity costs exceed 125% of the national average or where it will be used to replace fossil fuel projects?

Answer. Yes, our primary concern was with the provision being used to fund new dam construction with Federal tax dollars. Hydropower dams are unique among renewable energy projects in terms of the scale of environmental damage that they can cause, and we do not support federal funding for the construction of new dams. Section 9 of S. 630 expands the existing provision both in terms of geographic scope and the type of hydropower projects that could qualify: instead of being limited to small hydroelectric projects in Alaska, the provision would expand the grant program to large or small hydropower dams constructed anywhere.

As we wrote in our testimony, we understand that the intent behind this section was to encourage the development of new sources of renewable energy in remote communities that rely primarily on expensive sources of fossil-fuel fired generation for their electricity, and we support this goal. Assuming that the goal of the program in Section 9 of S. 630 is to help remote communities transition away from expensive and inefficient fossil fuel projects, the following recommendations may help the program to achieve its goal in an environmentally sustainable manner.

First, if any federal funding is to be used to construct non-federal hydropower dams, it should only be limited to exceptional cases where the construction of a dam is truly a last resort and the only feasible alternative to fossil-fuel burning generation. We recommend the following changes to the program in order help ensure that this is the case:

- Section 9 needs to clarify that the grant program should not be used to help utilities comply with state or municipal Renewable Energy Standards. The federal taxpayer should not be asked to foot the bill for utilities' compliance with applicable state or local laws.
- Section 9 should also clarify that all new energy generation will be used locally instead of exported.

- As it is currently written, the program would prioritize grants to two kinds of utilities: those with high energy costs or those that intend to replace an existing fossil fuel project. The goals of Section 9 would be better met if utilities were required to meet both of these criteria instead of one or the other. To demonstrate actual replacement of fossil fuel generation, all recipients must be required to demonstrate that a corresponding amount of fossil-fuel fired capacity is actually taken offline as the result of the grant. This would ensure that the aid goes only to those communities that truly need of it.
- The requirement that grant funds be prioritized to communities meeting the above criteria is not sufficient to ensure that the program is used to accomplish its goal. The program must be limited to communities that meet these criteria.

Second, we recommend that the definition of eligible hydropower be restricted so that any new hydropower is least likely to cause new environmental damage. While American Rivers cannot support any federal funding for new dam construction, the following types of hydropower may help to minimize the environmental impacts of the program:

- Efficiency upgrades, hydropower capacity added to existing upgrades, conduit hydropower, and marine and hydrokinetic energy should be eligible for grants.
- New conventional hydropower construction should be limited to projects where all essential project works (dams, powerhouses, etc.) are located above a natural fall line above which no ocean going fish such as salmon may migrate. New conventional projects should not create a significant new bypassed or dewatered reach of river, and should not significantly modify natural flows.

RESPONSES OF SEAN O'NEILL TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. The testimony we have heard today indicates that the technology associated with hydrokinetic energy is still emerging and that further studies of the environmental impacts of certain projects may still be necessary. I was interested to note that you indicated that some current testing indicates that fish and other animals may be able to "co-exist nicely" with certain types of devices. Can you give us a little more explanation of what technologies have been found to work well?

Answer. Since 2008, the U.S. Department of Energy has supported several studies with funding from its Water Power R&D program on potential environmental impacts of pre-commercial marine and hydrokinetic (MHK) renewable energy devices. These studies are based on hypothetical evidence of environmental effects with the exception of a few pilot demonstrations, to be discussed below. OREC has urged that our limited federal dollars are best spent studying actual environmental effects of pilot scale projects while in the water.

Great care has been taken in the development of marine and hydrokinetic technologies to limit any potential negative environmental effects of these devices. The limited experience to date with deployed pilot projects has provided anecdotal evidence of the environmentally benign nature of these wave and tidal energy convertors.

For example, the Ocean Power Technologies wave power project in Hawaii underwent an extensive environmental assessment by an independent environmental firm in accordance with the National Environment Policy Act (NEPA). This study featured evaluation of potential effects on: the seabed, fish and benthic organisms, mammals, vegetation, and water quality. The project study resulted in a finding of no significant impact (FONSI), which is the highest such environmental rating.

Regarding a notable tidal energy project, Marine Current Turbines in Ireland submitted their final Environmental Impact Study to the regulatory authority, the Environment and Heritage Service (EHS) in Northern Ireland in June 2005. The license for the temporary installation for the SeaGen tidal system for a five-year duration was first issued in December 2005, revised in February 2007 and again in February 2008.

Pre-installation environmental monitoring commenced in May 2004. A baseline report was completed and submitted to EHS in August 2006. The environmental impact of SeaGen will be continuously monitored by an independent science team throughout the licensed five-year installation period.

It took SeaGen from July 2008 until March of this year to generate the first million kWh largely due to license restrictions placed on its operation to check that SeaGen did not have any adverse effect on marine life. The restrictions were lifted in March by the regulating authority and 24/7 operation has commenced.

Another example here in the United States involves Ocean Renewable Power Company (ORPC), based in Maine. ORPC initiated a project during the summer of

2009 when the University of Maine received funding from the U.S. Department of Energy to conduct research associated with the development of tidal power. A primary focus of the research was to develop an understanding of how fish would be affected by tidal power development. At the time, ORPC had initiated planning for an in-stream tidal power deployment in the Cobscook and Passamaquoddy Bays of eastern Maine.

Data collected thus far using industry-standard fish monitoring equipment and study protocols note different behavioral responses to these tidal devices. Individual fish have responded to the devices with avoidance and some moved through the device and continued to move with the water current. However, data analysis is not complete enough to determine if these will be the only interactions at a tidal power device site.

To date, there has been no known marine mammal or fisheries impact as a result of any MHK device installation. Once the many oversight agencies allow for more timely permitting, the industry can deploy these devices to demonstrate predicted benign environmental effects, and employ adaptive management where needed.

Question 2. It appears that other countries may be ahead of us in terms of hydrokinetic research capabilities. How is your organization working to build off of the expertise that exists in other countries and what suggestions do you have for how to improve our countries capabilities?

Answer. The development of a substantial marine hydrokinetic industry in the U.S. could drive billions of dollars of investment into heavy industrial and maritime sectors, as well as in advanced electrical systems and materials common to many renewable technologies. Federal investments would stimulate private funds in the construction, manufacturing, engineering and environmental science sectors. The further development of each industry has the potential to employ a significant skilled workforce.

Unfortunately, the U.S. is falling behind in the race to capture the rich energy potential of our oceans. Many countries, particularly in Europe, recognize the potential of wave and tidal energy as part of comprehensive renewable energy policy and have deployed viable, operating, electricity generating projects using the emission-free power of ocean waves, currents, tidal forces. The U.S. is just beginning to acknowledge the importance of these technologies.

A 2009 report conducted by the U.S. Navy found that the U.S. has lost world leadership in ocean wave and tidal energy technology development and deployment. The report finds that the U.K. is at least five years (or more) ahead of the U.S. government-led efforts with support for renewable ocean power at approximately $900 million vs. $50 million in the U.S.

For example, the U.K. has a head start on the U.S. in MHK technology development, testing and deployment. They can permit projects within six months and have accelerated decision-making of marine renewable siting protocols. The U.K. also has an aggressive target of 2GW of marine renewable energy in U.K. waters by 2020. While Europe has nine open water marine energy testing centers, we currently have none available to the industry here in the U.S.

Congressional support has increased for the Department of Energy's MHK activities since they were first authorized in the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007. The DOE program was originally funded at $10 million in FY 2008. By FY 2010, that figure had grown to $50 million. However, these figures are somewhat misleading. While the MHK program is currently authorized at $50 million per year, the Department of Energy is using a considerable amount of the funding appropriated by Congress for this subprogram to support conventional hydroelectric activities. The result is that the DOE MHK activities are underfunded.

OREC has been promoting a multi-pronged strategy that will propel the U.S. to the forefront of the race to commercialize MHK technologies. Critical to this effort will be a coordinated, comprehensive federal effort, led by DOE and the U.S. Navy, to develop our national marine renewable energy resources. This strategy includes:

- Technology advancement, verification and acceptance through support for research, development, testing and deployment;
- Clear, timely, predictable, and workable regulatory framework for siting and permitting of marine renewable projects, particularly for limited pilot projects;
- Stable incentive regime structures that facilitate rapid advancement of technology deployment;
- Close federal agency coordination and review of lessons learned here and abroad in both wind and hydrokinetic power technology development and deployment; and,

- Development of standards and certifications to provide confidence to customers and financial markets.

The Ocean Renewable Energy Coalition (OREC) is actively involved with the international marine and hydrokinetic industry and governments on several fronts. OREC's president and several of its members are participating in the International Electrotechnical Committee's Technical Committee 114, the international standards setting body that the United States participates in through the American National Standards Institute.

In addition, OREC is one of the principal sponsors of the Global Marine Renewable Energy Conference (GMREC), along with the International Energy Agency's Ocean Energy System Implementing Agreement Executive Committee. Now in its fourth year, GMREC brings together marine and hydrokinetic experts from over a dozen countries. Conference sponsors include organizations from Scotland, Ireland, the United Kingdom, Norway, Australia, Ireland, Portugal, Denmark and Scotland.

RESPONSES OF SEAN O'NEILL TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. S. 630 contains an adaptive management program to provide grants to help the industry collect data for permitting and to do demonstration projects. How important is that provision to help the industry get past the so-called "Valley of Death" between device creation and more widespread deployment of marine hydrokinetic devices?

Answer. One of the greatest impediments to the responsible commercialization of MHK devices is environmental permitting. Where land based renewables, at one point, could install pilot and demonstration devices by obtaining a single site plan approval from a local or county planning board, the MHK industry operates in oceans and public waterways-oftentimes requiring a multitude of permits from federal and state resource agencies. The Adaptive Management Grant program acknowledges the public nature of our oceans and waterways, as well as the need for environmental data to be placed in the public domain. These grants also acknowledge the importance of deploying technologies and gaining real-life, real-time data rather than speculating on hypothetical effects.

This is a critical piece of S. 630 that will support these companies surviving the "Valley of Death" and, ultimately, setting the stage for timely, responsible deployments. Federal grant funding would stimulate private investments thereby reducing the overall long term costs of industry commercialization efforts.

Question 2. Your testimony gives examples of developers that are making progress in developing and deploying wave and current devices. Please assess the current health of the industry and whether there is need for federal assistance.

Answer. The MHK industry has benefited from federal investments in technology research, development and limited pilot deployments. If this funding is significantly decreased or eliminated the viability of several wave and tidal energy companies could be in jeopardy. The funding invested to date from DOE would be lost if these technology development partners are allowed to fail.

While the efforts, to date, by Congress and the Department of Energy have been an important down payment to help develop this technology and industry, more remains to be done. In order to capture the energy, environmental and economic benefits of utilizing our vast marine-based renewable resources, it will require a mix of new incentives, updated regulatory regimes, tax treatment on par with other renewable energy technologies (particularly with regard to accelerated depreciation and investment and production tax credits), and general outreach and education.

However, the most important action that can be taken by the federal government in the short term is to provide significant resources for research, development and deployment of various ocean, tidal and offshore renewable energy systems, including funding for test center infrastructure build-out. We need to join the international race to get pilot projects into the water and monitor the environmental effects and efficiencies of these technologies. Increased federal support will create thousands of high paying "green" jobs, hasten deployment of these technologies, give confidence to investors and help attract private capital.

Federal funding of a sustained ocean energy R&D program and required regulatory activities would enable the United States to leverage its technological superiority in shipbuilding and offshore oil and gas production, creating jobs and diversifying these maritime industries toward developing new domestic energy supplies and capturing an emerging global export market. In the absence of such funding, however, the United States will have to depend on foreign suppliers for ocean renewable energy technology, and we will have missed a significant economic development opportunity.

We also encourage your consideration of the creation of multi-agency and public-private partnerships to provide efficiencies for permitting pilot projects in one year or less, participation in a DOE/Industry discussion on how to accelerate deployment of devices, and the development of cooperative agreements with Canada and the British Isles to accelerate resolution of technical, market and policy barriers for commercialization of the MHK industry.

Question 3. In previous years the Committee has discussed permitting as a major problem adding to the cost of deploying devices. In the months since the memorandum of understanding between FERC and the former MMS on permitting, has there been any improvement in the permitting/licensing process? Also, please elaborate on the needs that the industry still faces to make deployment of devices more economic.

Answer. While the memorandum of understanding between FERC and the former MMS helped clarify some aspects of jurisdiction, the process of obtaining permits remains a challenge. It is estimated that securing a permit would require the involvement of a multitude of federal and state agencies. It is also estimated that working through the existing regulatory framework could take between five and ten years. The combination of these two issues creates an unacceptable level of risk for the investment community.

All emerging technologies, including new power generation technologies such as MHK, rely heavily on a clear, timely and predictable regulatory framework related to deployment. This is especially true in the case of the first-in technologies, such as wave and tidal generators. In order to responsibly develop the nation's MHK resources in a timely fashion, OREC suggests that an adaptive management approach be taken. Contrary to hypothetical studies of speculative effects, real-time in situ studies are required to accurately gauge environmental interactions. This would provide much greater value to understanding the real-life impacts from MHK technologies and not compete with the capital required to continue to advance and test the technology.

RESPONSES OF ANDREW MUNRO TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Your testimony indicates you believe it is critical for Congress to continue to support the Department of Energy's hydropower research programs. Can you think of some examples of how that research work has benefited the hydropower industry?

Answer. The DOE's hydropower research program has been tremendously valuable to support technological advancements and the growth of this clean energy resource. However, the program is well underfunded.

Some have questioned the need for robust R&D funding for hydropower, stating that it is a mature and proven technology. My response is that just as the automobile is a mature technology, we continue to innovate that technology and look at ways to improve its performance. The same should be done for hydropower.

Grant PUD's R&D investments have benefited directly from the work that the Department has conducted on advanced hydropower turbine systems (AHTS). Grant PUD's Wanapum Dam modernization effort was supported by the DOE's AHTS program.

Some background, the hydropower industry has long supported the DOE R&D program for the next generation of hydro turbines—the Advanced Hydropower Turbine System (AHTS). The aim of the program is to design, develop, test and deploy a new generation of turbine designs that provide greater protection for fish and aquatic habitat and higher operational efficiency. The program follows a two-track approach—develop new turbine technology and improve upon existing technology. The program seeks to make available technology that will simultaneously optimize environmental performance and increase the generation efficiency of our nation's existing hydroelectric facilities.

In addition to Grant PUD, several federal hydropower projects have installed advanced designed turbines based off the work on the DOE AHTS program. Also, work continues on a second turbine design that has never been tested in a commercial application for which the DOE program is providing support.

Beyond turbine work, there have been many other important DOE hydropower initiatives for which funding has been critical throughout the years. The short list below includes some, but certainly not all, of the Department's activities:

- updated national resource assessments,
- research into optimization methods and alternative operations strategies and opportunities for spill reduction,

- field testing of new technologies to increase dissolved oxygen content of discharged water,
- grid services research (develop and deploy technologies that increase operational flexibility, including pumped storage; modification of regional computer models to better assess potential capacity expansion of pumped storage to facilitate introduction of other variable renewable resources into the market),
- new materials research,
- sensor and control testing to improve energy efficiency and environmental performance,
- fish passage research (includes development of baseline biological methodologies and data for key species for improvements in dam infrastructure, such as turbines, fishways, and fish screens; demonstration of new technology to determine fishway effectiveness in real-world applications; methods to measure and predict indirect fish mortality and non-lethal injury rates), as well as
- research into the marine and hydrokinetic technologies to test equipment and support deployment.

In 2010, the Department also held a series of workshops with industry, federal agencies and environmental stakeholders to discuss R&D initiatives to promote small hydropower projects, pumped storage, and develop better environmental mitigation techniques.

Lastly, with the signing of the federal hydropower MOU in March 2010, there are a series of DOE activities, such as basin-scale planning and other initiatives, that require continued support if they are to reach a successful conclusion. After developing this collaboration among the agencies and renewing focus on federal hydropower deployment, it would be a tremendous setback to retreat from the DOE program.

NHA also understands that the Department is scheduled to unveil new data on growth potential on existing non-powered dams as well as new data on the existing fleet of hydropower units that would provide data on the opportunity for nationwide capacity additions and upgrade possibilities.

Question 2. As you may know, we have recently released a White Paper on the proposed Clean Energy Standard. Does the National Hydropower Association plan to submit comments to us in connection with the role that hydropower might play in determining how to develop a Clean Energy Standard?

Answer. Yes, NHA intends to submit comments on the CES white paper and we commend both you and Senator Murkowski for seeking input on the policy.

In January, NHA sent a letter of support to President Obama on his CES goal as outlined in the State of the Union, committing to meet 20 percent of the 80 percent target by 2035. NHA believes this goal will be difficult, if not impossible, to meet without including both existing and new hydropower generation as qualifying resources under the CES.

In the past, NHA has supported consensus definitions on the treatment of hydropower for the purposes of a renewable energy standard (RES), specifically those contained in S.1462, the American Clean Energy and Leadership Act. However, a CES is a different policy paradigm than an RES. Therefore, NHA believes the treatment of hydropower under a CES must be re-examined.

NHA highlights two particular examples—existing hydropower generation and pumped storage. If a CES policy provides for a substantial increase in the percentage of generation that will be required to come from clean resources, and if existing generation from other clean resources qualifies (wind, nuclear, etc.), then existing hydropower generation must also qualify. Hydropower should be treated equitably in comparison to other resources when it comes to existing generation.

Secondly, NHA believes that energy storage, specifically pumped hydropower storage, will play a critical role to firm and integrate intermittent energy resources, increasing their contribution to the CES goal. As such, NHA believes a mechanism should be included in the policy to provide recognition of clean generation from pumped storage projects—both existing and new.

As work continues on the CES policy, additional questions both on the treatment of various hydropower resources and the mechanics of the program will be raised. NHA commits to continued dialogue with you, other Members of Congress, the Administration and stakeholders on how to address these issues.

Responses of Andrew Munro to Questions From Senator Murkowski

Question 1. The National Hydropower Association (NHA) has called for additional policy support from the federal government in order to promote hydropower opportunities across the country. Specifically, NHA highlights the need for a more efficient licensing and permitting process with greater intergovernmental cooperation. The

Committee tried to address some of these issues in S. 629 with a possible 2-year licensing process for closed loop storage and non-powered dams as well as greater cooperation among agencies for conduits and small hydro. Beyond these measures, is there more that can be done? Please elaborate on how the lengthy licensing process puts hydropower at a competitive disadvantage relative to other renewable energy projects.

Answer. Throughout its history, NHA has played an active role in various forums to improve the hydropower licensing process. In anticipation of the passage of the bill and a FERC solicitation of input on potential solutions to address the length of the permitting and licensing process, NHA has formed a regulatory working group to examine these issues. We look forward to a proposal from the Commission on this issue, and anticipate that there are licensing improvements to be made that may be accomplished administratively, or require a rulemaking process, or perhaps necessitate a statutory change.

The workgroup has recently reviewed all projects licensed between 2006 and 2011 and those pending licensing now, to analyze trends regarding the length of the licensing process throughout the industry. This preliminary review showed that projects took an average of 4.7 years to license—from submission of the Notice of Intent and the Pre-Application Document (or its equivalent) to license issuance. For projects that are still awaiting a license, the process to date has taken an average of 3.9 years so far.

This data is generally consistent with the schedule in FERC's Integrated Licensing Process (ILP) regulations, but it highlights the fact that even when the process works as anticipated, it remains lengthy and costly when compared to other energy projects. As mentioned in NHA's written testimony, the development timeline for other energy projects can be as short as 18-24 months (for example, wind and natural gas).

This significant difference places hydropower development at a disadvantage and contributes to holding back investment in worthwhile projects—an unfortunate result at a time when we should be supporting policies that promote a diversified energy portfolio for our country.

NHA can provide some preliminary themes that have emerged from the working group, though further consultation and examination on the issues continues with final NHA policy recommendations to come.

The work group has noted that resource agencies (federal and state) should be encouraged or required to participate early in study discussions and development in order to minimize additional information requests, resolve disagreements early, and allow speedy processing of permit applications later in the process. All resource agencies performing their own environmental reviews should be encouraged or required to work concurrently with the FERC process to coordinate and not duplicate the environmental review process.

Also noted, for all federal and state reviews of a proposed hydropower facility, evaluation and conditioning of new projects should be consistently limited to impacts created by the hydropower project. FERC's ILP regulations do require a "nexus" between a requested project and project-related effects. However, other agencies with related review and consultation responsibilities often rely on a different standard. Because the current regulatory landscape does not provide for consistent treatment of environmental baseline analysis and study requests, time is spent attempting to address and manage issues that are not within the scope of project impacts. Addressing this issue—particularly for proposed projects at existing impoundments utilizing existing infrastructure—could reduce licensing and permitting time and expense significantly.

Lastly, one area where the working group has seen some greater efficiencies in the process is that of exemptions. Broadening the scope of projects that could be approved by the exemption process could help lower approval costs and advance some projects along sooner.

We look forward to the opportunity to engage with FERC, other agencies and stakeholders to discuss and find solutions to these process issues.

Question 2. What is the biggest thing Congress can do to help the hydrokinetic energy industry take off? Is it establishing the adaptive management program, supporting research, funding test centers, developing device verification, or all of the above? Should Congress also be examining tax assistance policies?

Answer. NHA believes all of the policies identified in the question are important to providing the support needed to fully realize the growth opportunities for marine and hydrokinetic technologies (MHK).

We do strongly agree that Congress must also focus on tax policies as part of this equation. As you are aware, both marine and hydrokinetic and conventional hydro-

power technologies receive disparate treatment under various federal incentives for renewable energy deployment.

To start, though the production tax credit (PTC) was a program in place for many years, it was only until 2008 that MHK technologies were included (hydropower was included in 2005). So while other renewable resources were able to utilize this incentive, waterpower technologies were placed at an economic disadvantage, affecting the ability to effectively raise capital and find financial support.

Additionally, once included under the PTC, waterpower technologies received only half-credit compared to other renewable technologies, such as wind and geothermal. Again, this disparate treatment picks winners and losers within the renewable community. NHA supports your efforts, and those of others, to equalize the credit for all qualifying technologies.

Lastly, NHA continues to strongly support other incentives for renewable energy deployment such as extension and additional funding for the clean renewable energy bonds (CREBs) program, the investment tax credit (ITC) and Section 1603 grants program, the Section 48C ITC for renewable energy equipment manufacturers and other discrete tax items such as accelerated and bonus depreciation.

The longer-term extension of incentives is an issue of particular importance to both MHK and conventional hydropower resources. Short-term extensions do not provide the certainty for the industry in project planning. The development timeline for projects can take several years, with no assurance that the incentives will actually be in place when projects are scheduled to actually come online.

We appreciate your efforts on these fronts and highlight that tax issues remain a priority agenda item for NHA and the waterpower industries.

Question 3. NHA's goal is to double the U.S. hydropower industry's contribution to the electric system from today's 100,000 MW capacity figure. You noted in your testimony that in response to President Obama's call for an 80 percent Clean Energy Standard by 2035, the hydropower industry is committed to meet 20 percent of that standard. As you know, Chairman Bingaman and I recently released a White Paper on the CES which asks stakeholders to comment on a number of design questions. If Congress were to adopt such a standard, how do you think hydropower should be treated?

Answer. NHA refers to our response above (Senator Bingaman; Question 2) and restates our appreciation to you and Senator Bingaman for seeking input on a CES policy. NHA reiterates that hydropower will play an indispensable role in meeting any CES goal and must be recognized as a qualifying resource under the policy.

We look forward to working with you, other Members, the Administration and stakeholders to answer questions and work toward solutions on addressing hydropower's inclusion in a CES.

Question 4. In your testimony you talk about the benefits that the United Kingdom European Marine Energy Center in Scotland has realized. Please elaborate on what we can learn from them and how we should be fashioning aid to the industry in the United States. Please provide examples of what has and has not worked for marine hydrokinetics in Europe.

Answer. The U.K. has a longer history of support for MHK industries. In fact, when the U.S. was eliminating funding for the Department of Energy R&D program for both MHK and waterpower technologies, Europe, and the U.K. in particular, were ramping up funding. This leadership not only provides technical and financial support needed for a new industry, but it sends an important signal to the marketplace that private investment in the technology is sought and will be supported.

As a result, it is not a surprise that some of the very first actors pursuing projects in the U.S. were European developers. However, as the U.S. has placed a greater emphasis on MHK development and increased its support both at DOE and by including MHK in renewable energy and tax policies, we are seeing an increase in American MHK developers.

Some activities that have been supported by the U.K. over the years include:

- Establishing the "European Marine Energy Centre" in Orkney, Scotland.
- Launching the "Carbon Trust, Marine Energy Challenge" an initiative whereby device developers could get access to high level engineering design and verification through partnering with engineering companies.
- Awarding over #25 M to support the ongoing development of marine energy devices.
- Launching a #50M support fund which directed #8M in funding for test centers with #42M available to support demonstration projects. Project funding comprises both capital and revenue funding.

RESPONSES OF STEVEN G. CHALK TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Regarding the Energy and Water Integration Act, your testimony indicates that the "clean technology grant program" would create a helpful incentive for industry to develop strategies to minimize water consumption in energy process. What is your assessment of what an appropriate budgeting authority for that type of a program would be?

Answer. The Department is not currently in the position to provide an appropriate budget number without further analysis of the provisions. Funding levels would vary significantly depending upon whether the focus of the grant program is on funding the assessments of current energy-water use and the identification of opportunities for efficiency improvements or funding the deployment of commercial technology to address the identified opportunities for efficiency improvements (e.g., renewable desalination technologies, newer efficient pump technology, biogas utilization, etc). The potential investment would have the highest return by focusing on applied R&D for technologies that can provide significant reductions in water use, while also balancing other requirements.

Question 2. Your testimony regarding S. 629, the Hydropower Improvement Act, refers to the "Hydropower Advancement Project" and indicates that it is focused on the most cost-effective, least-controversial types of new hydropower development. Can you please give us an example of what some of those projects are?

Answer. DOE's Hydropower Advancement Project (HAP) is focused on upgrades at existing facilities to increase unit and plant efficiency and capacity. The initial phase of HAP will create a catalog of industry best practices for operation, maintenance and evaluation of overall plant performance. This catalog will become the basis of a standardized assessment manual for use in evaluating existing hydropower stations and identifying opportunities to increase generation and maximize ancillary benefits. DOE intends to select up to 50 hydropower facilities at which these standardized assessments will be performed. These assessments will identify opportunities to improve efficiency and increase energy capacity and production at existing hydropower plants. DOE will then conduct detailed feasibility studies at three to five selected projects that stand to gain significant performance improvements through the implementation of the recommendations identified in the assessments, and that indicate a favorable return on investment.

Examples of energy-increasing improvements projects include:

- Redesign Turbines using advanced computational fluid dynamics methods that were not available when older power plants were built, to improve turbine efficiency and performance. Redesigned turbines will have improved flow characteristics to extract more energy from the same amount of water.
- Upgrades of generators and other electrical equipment to increase efficiency and generation.
- Installation of automated monitoring systems to alert operators to the buildup of debris in front of intakes. Such debris causes excessive energy loss and reduces the efficiency of the turbine.
- Installation of advanced control systems that automatically optimize plant configuration to achieve maximum efficiency.

Question 3. Regarding S. 630, the Marine and Hydrokinetic Renewable Energy Promotion Act, do I understand your testimony correctly that you believe the current marine and hydrokinetic test facilities DOE is already sponsoring provide sufficient research capabilities such that the creation of new test centers would not be necessary? In your opinion, how would the new facilities authorized by S. 630 help to advance the existing research capabilities?

Answer. DOE is currently funding three competitively-selected marine and hydrokinetic (MHK) test facilities, which are designated as National Marine Renewable Energy Centers (NMRECs). These NMRECs are appropriately located geographically to address the full range of marine and hydrokinetic resources (ocean wave, ocean and tidal current, and ocean thermal) that are of primary interest, and hold the most promise for contributing to our nation's clean energy goals. As such, additional test centers would be duplicative of efforts currently underway.

The NMRECs are currently developing capabilities for researching, developing, testing and evaluating MHK technologies. Ultimately the NMRECs are planning to develop open-water, multi-berth test sites where device performance and reliability can be validated through rigorous industry-recognized testing protocols. S. 630 would accelerate the development of the NMREC facilities and provide critical domestic testing capabilities for the nascent MHK industry.

Question 4. During the last Congress, we enacted the SECURE Water Act. Section 9505 of that Act asks DOE to prepare an assessment of the potential impacts of cli-

mate change on hydropower production in the U.S. Can you please tell us what the status is on that report?

Answer. As called for in Section 9505 of the Omnibus Public Land Management Act of 2009 (P.L. 111-11), DOE has the lead for producing an assessment of the effects of global climate change on water availability and generation at federal hydropower facilities. DOE has been engaged in extensive interactions with the four Power Marketing Administrations (PMAs), the Department of the Interior's Bureau of Reclamation, and the U.S. Army Corps Engineers in order to produce this report, and has designed an approach to complete the assessment. DOE is currently working with the PMAs to develop recommendations from the PMA Administrators, as required by the legislation.

Developing the appropriate methods to project future climate change and scale these projections down so that they are relevant to the 140 federal hydropower projects presents significant technical challenges. Due to these technical challenges and the time required to consult with a large number of federal and state agencies, DOE will be requesting an extension with a revised delivery of the report at the end of CY 2011 (December 2011).

RESPONSES OF STEVEN G. CHALK TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. In March 2010, DOE, along with DOI, and the Corps of Engineers, signed a Memorandum of Understanding on hydropower, the goal of which was to increase energy generation from Federal hydro facilities and maintain environmental protections. What steps has the Department taken to implement the MOU? Has the MOU resulted in any additional hydropower capacity to date? Have the agencies identified any ways to make the licensing process more efficient?

Answer. Through the Hydropower MOU, DOE, DOI and the U.S. Army Corps of Engineers agreed to cooperate more closely and align priorities to support the development of environmentally sustainable hydropower. The MOU signatories agree to focus on increasing energy generation at federally-owned facilities and explore opportunities for new development of low-impact hydropower.

Since signing the MOU, DOE, DOI and the Corps have hosted a series of technology workshops focusing on pumped storage hydropower, innovative low-cost small hydropower and environmental mitigation technologies. A workshop on new turbine technology is scheduled for May 2011, and a Request for Information has been developed for technologies that could be deployed at federal facilities.

DOE has been working closely with the Corps and DOI's Bureau of Reclamation (BOR) to identify federal facilities where hydropower generation could be increased or added.

On March 31, 201, BOR released the Hydropower Resource Assessment at Existing Reclamation Facilities report pursuant to the 2010 MOU. The report estimates that additional hydropower opportunities at 70 facilities could create enough clean, renewable energy to annually power more than 85,000 households. The report was general in nature and more detailed analysis would be needed to determine the feasibility of expansion at these facilities.

DOE is also currently helping BOR to assess power production potentials within their canal and irrigation infrastructure. DOE's Oak Ridge National Lab is working on a Non-Powered Dam Resource Assessment and presented preliminary results at the National Hydropower Association's Annual Conference on April 5, 2011. While the MOU has not directly resulted in any additional hydropower capacity to date, these resource assessments will help identify the best locations for future hydropower improvement projects.

On April 5, 2011, DOE released a Funding Opportunity Announcement announcing $26.6 million for hydropower in four topic areas: 1) sustainable small hydropower research, development and testing; 2) environmental mitigation technologies to increase electricity generation while mitigating fish and habitat impacts; 3) financial and technical assistance for pumped storage hydropower projects in the licensing or pre-construction process; and 4) advanced hydropower system testing at a non-powered BOR facility. Topic area 4 is co-sponsored by DOE and DOI's BOR, and is anticipated to result in additional hydropower capacity.

As directed by the MOU, a staff-level interagency working group has been formed of federal agencies involved in the regulation, management or development of hydropower assets for the purpose of sharing information on all initiatives, efforts and projects related to hydropower. This group also includes the Fish and Wildlife Service, National Park Service, NMFS, Forest Service, USGS, Bureau of Indian Affairs, EPA, Power Marketing Administrations, BLM and FERC.

The interagency working group has established a regulatory sub-committee that is working to better understand the time and costs associated with regulatory and

permitting processes. While licensing is under the jurisdiction of FERC, DOE has taken the lead as an unbiased third party to examine the permitting and licensing processes for private development at federal facilities. DOE is interviewing project developers in order to identify redundancies that could be eliminated, as well as examples of efficient review and coordination that could be replicated. The end result will be the identification of ways to make the licensing process more efficient.

The Bureau of Reclamation and the U.S. Army Corps of Engineers also have separate MOUs with FERC that focus on reducing the licensing and permitting time of projects at their facilities. The FERC and the U.S. Army Corps of Engineers entered into a revised MOU on March 30, 2011, to enhance the effectiveness and efficiency for non-federal hydropower development decision making, including addressing 404 permit and 408 approval processes.

Question 2. I understand that the Department is looking at potential locations for pumped storage—something we call for in S. 629, the Hydropower Improvement Act. S. 629 directs DOE, along with the USGS, to identify suitable locations on both federal and non-federal lands that may help with integrating intermittent renewable resources. How does the Department's initiative differ from S. 629's provisions in this area?

Answer. DOE's pumped storage hydropower (PSH) initiative is focused on integrating variable renewable resources and identifying and addressing the barriers to deployment in the United States. In September 2010, DOE sponsored a PSH workshop where experts from the industry, manufacturers, laboratories, environmental groups, and government agencies were convened to identify the major PSH deployment barriers. The barriers identified in this workshop include permitting time and cost, lack of models that identify the full value of PSH, lack of uniform markets for ancillary services provided by PSH, high capital cost, and long payback period. DOE has also studied PSH projects filed with FERC and is working with PSH developers to identify the most favorable sites for pumped storage for variable renewable energy resources integration.

To address the PSH barriers identified in the workshop and to better integrate variable renewable energy resources, DOE included two relevant topic areas in its hydropower funding opportunity announced on April 5, 2011. The first topic will provide technical and financial assistance to aid projects in the early stages of development (licensing and pre-construction planning). The second topic will provide for improved modeling of hydropower benefits such as load following voltage and frequency regulation and the ability to integrate variable renewables such as wind and solar.

While DOE is pursuing several activities, including those described above, that are in line with the objectives of the Hydropower Improvement Act S. 629, we are not conducting a study to identify Federal and non-Federal land for pumped storage sites in coordination with the USGS as would be required in Section 12 of S. 629.

APPENDIX II

Additional Material Submitted for the Record

ASSOCIATION OF CALIFORNIA WATER AGENCIES,
March 28, 2011.

Hon. JEFF BINGAMAN
Chairman, Energy and Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

Hon. LISA MURKOWSKI,
Ranking Member, Energy and Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

DEAR CHAIRMAN BINGAMAN AND RANKING MEMBER MURKOWSKI;

The Association of California Water Agencies (ACWA) is pleased to support the Energy and Water Integration Act of 2011 and appreciated the opportunity to testify in support of this legislation last Congress. ACWA's 450 public water agency members supply over 90 percent of the water delivered in California for residential, agricultural, and industrial uses.

As highlighted in a 2005 report by the California Energy Commission, saving water saves energy. Your bill recognizes the importance of the energy/water nexus and calls for baseline studies examining numerous aspects of this relationship. The clean technology grant programs in your bill will provide an opportunity to demonstrate both water and energy savings available from new technologies. Additionally, the rural water utilities program will help small systems save money by providing assistance to help agencies conserve both energy and water.

Thank you for your hard work on this legislation. ACWA appreciates your leadership on this issue and looks forward to working with you in the future.

Sincerely,

DAVID REYNOLDS,
Director of Federal Relations.

ASSOCIATION OF CALIFORNIA WATER AGENCIES,
March 23, 2011.

Hon. JEFF BINGAMAN,
Chairman, Energy and Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

Hon. LISA MURKOWSKI,
Ranking Member, Energy and Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

DEAR CHAIRMAN BINGAMAN AND RANKING MEMBER MURKOWSKI;

The Association of California Water Agencies (ACWA) is pleased to support S. 629, the Hydropower Improvement Act of 2011. ACWA's 450 public water agency members supply over 90 percent of the water delivered in California for residential, agricultural, and industrial uses.

Your bill, S. 629, will help small scale projects move forward more quickly. In California, water systems are looking to install in-conduit microturbines in their water distribution systems to generate hydropower. Currently, many of these small projects are exempt from FERC jurisdiction. However, obtaining an exemption can take six months or more and cost upwards of fifty thousand dollars. Your bill, S. 629, will help reduce this regulatory burden.

Thank you for your hard work on this legislation. ACWA appreciates your leadership on this issue and looks forward to working with you in the future.

Sincerely,

DAVID REYNOLDS,
Director of Federal Relations.

ALLIANCE FOR WATER EFFICIENCY,
March 31, 2011.

Hon. JEFF BINGAMAN,
Chairman, Energy & Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

Hon. LISA MURKOWSKI,
Ranking Member, Energy & Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

DEAR CHAIRMAN BINGAMAN AND RANKING MEMBER MURKOWSKI:

The Alliance for Water Efficiency is pleased to support the committee's interest in integrating energy and water programs. Water and energy are interconnected issues, and your bill highlights the importance of better managing this connection. We strongly support provisions in a 2011 bill that would mandate baseline studies to examine numerous aspects of this relationship. Further, clean technology grant programs would provide an opportunity to demonstrate both water and energy savings available from new technologies. Additionally, a rural water utilities program would help small systems save money by providing assistance to help agencies conserve both energy and water.

The Alliance for Water Efficiency is a non-profit stakeholder organization whose mission is to promote the efficient and sustainable use of water. One of our primary activities is working with water utilities to help them design and implement cost-effective water conservation programs, programs which save energy as well as water. We have been working with the American Council for an Energy Efficient Economy to develop a list of policy priorities for national consideration. We will be sending that report to you shortly.

Thank you for your attention to the water and energy issue. We very much appreciate your leadership.

Sincerely,

MARY ANN DICKINSON,
President and CEO.

NATIONAL RURAL WATER ASSOCIATION,
Duncan, OK, April 9, 2011.

Hon. JEFF BINGAMAN,
Chairman, Energy & Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

Re: The Energy and Water Integration Act of 2011

The National Rural Water Association (NRWA), the country's largest community-based water organization, appreciates your assistance and support to rural and small communities reducing energy consumption, utilizing renewable energy sources (including energy generation from existing sanitation facilities), reducing water loss, and realizing the cost-savings for their citizens.

We are writing in support of your legislation, "The Energy and Water Integration Act," and we encourage you to introduce the legislation in this Congress and support its passage into law.

Providing safe public drinking water and adequate public sanitation requires one of the greatest demands of energy in society. Most of the country's over 50,000 water and wastewater systems are small, with limited economies of scale, and often lacking technical and financial resources. Initiating an on-site technical assistance network to reach-out to all drinking water and wastewater supplies to assist in the adoption of comprehensive energy conservation plans would result in dramatic energy and cost savings in every participating community.

Small communities want to implement the most advanced energy plans possible—and the small water and sanitation systems provision in the Energy and Water In-

tegration Act would provide the shared technical resources to achieve this important objective.

Thank you for your leadership and assistance. Please contact us if we can be of any assistance.

JOHN MONTGOMERY,
MIKE KEEGAN.

FAMILY FARM ALLIANCE,
Klamath Falls, OR, March 16, 2011.

Hon. LISA MURKOWSKI,
U.S. Energy and Natural Resources Committee, 304 Dirksen Senate Bldg., Washington, DC.

DEAR SENATOR MURKOWSKI:

On behalf of the Family Farm Alliance, I thank you for introducing "The Hydropower Improvement Act of 2011". This bill is a major step towards allowing the United States to substantially increase the capacity and generation of clean, renewable hydropower resources, improve environmental quality and support hundreds of thousands of green energy jobs.

The Family Farm Alliance is a grassroots organization of family farmers, ranchers, irrigation districts and allied industries in 16 Western states. Many of our members operate existing irrigation canals and ditch systems that may provide opportunities to develop in-canal, low-head hydroelectric projects that have tremendous potential for producing significant amounts of renewable energy with virtually no negative environmental impacts. Historic irrigation structures can be retained while the system is updated with modern clean-energy producing technologies. Increased revenues from the sale of this renewable energy can result in lower irrigation costs to farmers. And, importantly, irrigation water delivery services can continue while utilizing flows for clean, emissions-free "green" energy production.

The Hydropower Improvement Act of 2011 seeks to substantially increase our nation's hydropower capacity in an effort to expand clean power generation and create domestic jobs. The legislation establishes a competitive grants program and directs the Energy Department to produce and implement a plan for the research, development and demonstration of increased hydropower capacity. The bill provides the Federal Energy Regulatory Commission with the authority to extend preliminary permit terms; to work with federal resource agencies to streamline the review process for conduit and small hydropower projects; and to explore a possible two-year licensing process for hydropower development at non-powered dams and closed loop pumped storage projects. The Act also calls for studies on the resource development at Bureau of Reclamation facilities and in conduit projects, as well as on suitable pumped storage locations. By utilizing existing authorizations, the bill does not represent new funding.

Thank you for this opportunity to provide input on this matter, which is very important to the family farmers and ranchers of our membership.

Sincerely,

DAN KEPPEN,
Executive Director.

STATEMENT OF THE COLORADO GOVERNOR'S ENERGY OFFICE, DENVER, CO

ON S. 629

The Governor's Energy Office applauds the bipartisan effort to boost hydropower development in the United States through the introduction of a progressive bill such as S. 629, the Hydropower Improvement Act of 2011.

Introduction—The Governor's Energy Office

"The Governor's Energy Office promotes sustainable economic development in Colorado through advancing the state's energy market and industry to create jobs, increase energy security, lower long-term consumer costs, and protect our environment."

In the last few years, Colorado has become a national leader in clean technology innovation. The new markets for clean energy developed in Colorado have made the state a magnet for clean energy companies, such as wind, solar and natural gas, clean-tech workers and venture capital. The state has set the pace in energy efficiency as well, with policy and private sector innovations that are leading businesses, industries and homeowners to significantly reduce their energy costs.

The Governor's Energy Office (GEO) has played an important role in these achievements since its inception in January of 2007. The GEO has strengthened the foundation for clean energy with forward-thinking programs and partnerships that have generated widespread adoption and deployment of renewable energy and energy efficiency in communities, businesses, non-profits and utilities across Colorado.

Fiscal year 2010 was a capstone year for the GEO. The agency played a critical role in historic legislation that will dramatically increase clean electricity generation. It continued efforts to reduce consumption by promoting greater energy efficiency in Colorado. It directed millions of American Recovery and Reinvestment Act dollars to Coloradans through programs that created jobs in the renewable energy and energy efficiency sectors. It doubled weatherization services to help thousands of low-income Colorado families save money and it launched a popular new website-rechargecolorado.com-and rebate program to help consumers more easily adopt efficiency and green energy measures. To date, more than $11 million in rebates have been issued resulting in more than $90 million in economic activity throughout the state.

The GEO led new efforts to create innovative financing programs that will facilitate the adoption of clean energy and energy-saving upgrades while also addressing the current lack of capital available. In four fast-paced years, the GEO has spurred new jobs, saved energy, cut pollution and reduced Colorado's reliance on imported energy.

Hydropower—An untapped resource

The Governor's Energy Office values small hydroelectric projects as a clean and environmentally-friendly source of renewable energy.Hydropower developed in an environmentally responsible way is a clean source of base-load energy and a job creator. Furthermore, the U.S. Energy Information Agency's latest forecast estimates that by the year 2016 the levelized cost of electricity produced by hydropower plants will be in average lower than coal. The Idaho National Laboratory has identified a combined potential of more than 1,400 MW in Colorado alone for projects under 5 MW, which represents over 10% of the peak demand of electricity in the state. For all these reasons, the GEO has taken a keen interest to promote the development of this wonderful resource.

Market barriers for Small Hydropower

A vast majority of the hydro projects in the US must be permitted by the Federal Energy Regulatory Commission (FERC). The current permitting process employed by FERC needs to be streamlined and simplified to encourage the responsible development of small-scale hydropower projects. The Governor's Energy Office, the National Hydropower Association, a few state energy offices, a host of private developers and other organizations across the United States agree that the resources needed today to obtain a hydropower permit from FERC represent a disproportionate burden for the developers of small projects. As a result, the development of this renewable resource is stifled nation-wide. Colorado has not been immune to this effect: in 31 years, only 26 small hydropower projects in the state have received an exemption permit from FERC, in spite of having over 5,000 sites with an excellent hydro resource, an accessible transmission line and no major environmental concerns.

The Governor's Energy Office has taken a proactive stance to correct this situation by working with FERC to find opportunities to streamline their current framework. The result of this effort is a signed MOU agreement that will not just shorten the time needed to receive a permit but also simplify and clarify the process, making it cost-effective for small projects. As part of this initiative, GEO used Recovery Act funding to contract a group of experts, known as the Renewable Energy Development Team (REDT), to assist the best projects in the state in navigating the FERC permitting process. In February, the GEO launched the Small Hydro Permitting Pilot Program, which has already reviewed more than 2MW of potential projects, from which six projects are ready for FERC full review.

The Hydropower Improvement Act of 2011

As mentioned before, the Governor's Energy Office commends Senator Murkowski and the cosponsors of this bill for the effort and their resolution to improve the conditions under which hydropower is developed in this country.

In this bill, we see a few parallels with the Small Hydro Permitting Pilot Program that the state designed in collaboration with FERC. It is our intention to share the results of our Pilot Program with FERC and other federal authorities in order to make systemic changes to the way hydropower is permitted at the federal level. The GEO finds that this bill will advance a more consistent and supportive policy for

this clean and low-cost resource, which will help the United States move forward towards energy independence and a cleaner future for our children.

The GEO would like to highlight Section 8, intended to promote conduit and small hydropower projects, which offer a great opportunity to increase the installed hydropower capacity without compromising our environment. Through the Small Hydro Permitting Pilot Program at the GEO we have come to realize that the part of FERC's permitting process where resource agencies and other stakeholders participate is particularly important to address to have an efficient process. The GEO applauds the intention to sign an MOU with the relevant federal organizations and encourages the bill sponsors to include state agencies as well. Through interactions with FERC, the GEO has discovered that, in the case of Colorado, there are four state agencies involved in every application, and one federal agency; hence, the importance to involve the agencies working at a state level. This section also states a provision to expedite the approval of conduit projects through the aggregation of projects. This is a great step, but there are other ways to improve the permitting process.

Other opportunities include:

- Increase the engagement of the state agencies involved in permitting hydropower projects locally. While conditions will be different for every state, increasing state engagement is a key component to increase the efficiency of the process. The workshops included in this same section will help enormously to discover the needs of each state and their particular set of agencies involved in the regulation of hydropower. The GEO thinks that these workshops will be enormously positive and applauds this effort.
- Section 5 has great merit since the Federal Government is in a unique position to incentivize the development of minimal-impact projects throughout the country. By targeting existing plants and conduits, as well as non-powered dams, the proposed grants will go to the projects that offer the least impact to the environment, promoting the development of truly clean energy sources. This opportunity should be intensified and closely monitored
- In this same line, the funding of the research and development program-outlined in Section 6-to look at increasing efficiencies and minimizing environmental impacts is a big step forward in the right direction.
- Section 7 looks to permit non-powered dams in two years or less. We recommend working further with FERC to refine the language of this section, since it is known that FERC has been able to reduce the time needed for this type of permits in general, and in some particular cases, the permit was issued in less than a year. The GEO commends the intention of receiving public input in this section since it has received several comments from the public stating that the federal standards for dam safety add an unjust burden at dams that comply with the state's regulations. Colorado's dam safety program is well known nationally for its sound standards and high reliability. During the public input process the GEO will certainly offer more details and hopefully find a way to improve the collaboration between the state and the federal government in this matter.

Conclusion

The Small Hydropower Permitting Pilot Program that the Governor's Energy Office in Colorado is administering aims not just to permit 20 projects, create more jobs and develop more projects, but to generate systemic changes by informing the public and the government at every level about ways to improve the current federal permitting process, without compromising the federal authority or environmental standards. The GEO wishes to congratulate the sponsor and cosponsors of this bill and encourage Congress to pass this landmark effort to improve the conditions under which hydropower is developed in this country.

CALLEGUAS MUNICIPAL WATER DISTRICT,
Thousand Oaks, CA, March 30, 2011.

Hon. JEFF BINGAMAN,
Chairman, Energy and Natural Resources Committee, 304 Dirksen Senae Office Bldg., Washington, DC.

Hon. LISA MURKOWSKI,
Ranking Member, Energy and Natural Resources Committee, 304 Dirksen Senate Office Bldg., Washington, DC.

Re: Support S. 629-Hydropower Improvements

DEAR CHAIRMAN BINGAMAN AND RANKING MEMBER MURKOWSKI,

On behalf of Calleguas Municipal Water District (Calleguas) I am writing to express our support of S. 629, Hydropower Improvements. Calleguas is a member agency of the Metropolitan Water District of Southern California and supplies drinking water for more than 75 percent of the population in Ventura County, California.

S. 629 will help small scale projects move forward more quickly through financial assistance programs and stream-lined permitting. Currently, many of these small projects are exempt from FERC jurisdiction. However, obtaining an exemption can take six months or more and cost upwards of fifty thousand dollars. S. 629 will help reduce this regulatory burden.

Calleguas supports installing in-conduit generators in water distribution systems to generate clean, renewable energy of hydropower resources. The district currently maintains four in-conduit hydroelectric generation stations with a combined capacity of 3.25 megawatts as part of its water transmission system and has plans to develop a fifth generator as a component of new pressure regulating facility to be constructed soon. Again, we want to thank you for your efforts on this issue and underscore our support of this important legislation.

Sincerely,

SUSAN B. MULLIGAN,
General Manager.

LARGE PUBLIC POWER COUNCIL,
Alexandria, VA, April 20, 2011.

Hon. HARRY REID, MAJORITY LEADER,
United States Senate, U.S. Capitol, Washington, DC.

DEAR MAJORITY LEADER REID: I am writing on behalf of the Large Public Power Council (LPPC) to voice our solid support for the Hydropower Improvement Act of 2011 (S. 629) and urge floor action in the Senate on this important piece of clean energy legislation.

We are pleased that this bi-partisan legislation, introduced by Senators Jeff Bingaman and Lisa Murkowski, passed out of the Senate Energy and Natural Resources Committee on April 12, LPPC believes it will foster and facilitate the growth of responsible hydropower development in the United States.

The Large Public Power Council represents 25 of the largest locally owned and operated not-for-profit electric systems in the nation. LPPC member utilities are located in 11 states and Puerto Rico; and own and operate more than 86,000 megawatts of generation capacity and over 35,000 circuit miles of high voltage transmission lines. LPPC member utilities supply electricity to some of the largest cities in the country—including Los Angeles, Seattle, Omaha, Phoenix, Sacramento, Jacksonville, San Antonio, Orlando and Austin.

For over 100 years, hydropower has been the most widely employed renewable energy resource in the United States. Hydropower is the nation's largest renewable resource for electric generation, currently producing seven percent of the nation's electricity—and avoiding 225 million metric tons of carbon emissions each year.

In addition to generating clean electricity, hydropower has the ability to firm and stabilize variable renewable resources such as wind and solar, thereby integrating additional renewable electric power into the transmission grid.

We believe that this legislation will increase the nation's hydropower capacity, will expand renewable power generation and create major job growth and economic opportunities throughout the United States. These include good paying engineering, manufacturing, construction and operations jobs that could revitalize communities.

The LPPC strongly supports the Hydropower Improvement Act of 2011 and urges floor action in the Senate on this important piece of clean energy legislation.

We appreciate your leadership as Majority Leader on national energy issues and stand ready to assist you and the bill's numerous co-sponsors in promoting hydropower as a low cost, reliable and emissions free source of power to our nation's electricity consumers.

Sincerely,

JORGE CARRASCO,
LPPC Chair.

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