Statement of the National Hydropower Association to the Energy and Water Subcommittee on the Department of Energy Waterpower Program

The National Hydropower Association (NHA)[1] appreciates the opportunity to submit this statement regarding hydropower funding priorities for the FY 2009 appropriations budget cycle. **NHA requests $54 million in FY 2009 Energy & Water Appropriations** for the Department of Energy's Waterpower Program.

Hydropower's current and future potential as the nation's most robust, renewable energy resource.
Congress is currently examining the implications of climate change on the environment, economy, and energy security of the United States. Crucial to the climate debate is the need for policymakers to work together to promote the development, deployment and expanded use of existing renewable resources, as well as innovative new technologies, that can play a significant role in addressing climate issues while maintaining a reliable and affordable electricity supply system. Hydropower of today and new water power technologies of tomorrow can provide significant benefits to these national energy and environmental goals.

Currently, hydropower provides sizeable benefits. As the leading renewable energy resource in the country, it accounts for 7% of all of the nation's electricity in terms of actual generation and approximately 9% in terms of actual capacity. Overall, hydropower accounts for 77% of actual renewable electricity generation and 83% of the nation's renewable energy capacity.

As an important source of electricity, hydropower offers advantages over other generation options. Importantly, hydroelectric units are able to start, stop, and change output quickly, which provides important grid stability and reliability benefits. As such, hydro has the ability to firm intermittent resources such as wind and solar, a benefit which comes all the more important as the nation moves to incorporate more renewables in its energy portfolio. Finally, hydropower's non-power benefits include water supply, flood control, irrigation, navigation and recreation.

Hydropower's potential contribution is notable – from efficiency improvements and capacity upgrades at existing projects, to new development at existing non-powered dams, to significant new capacity gains from emerging waterpower technologies, such as ocean, tidal and instream hydrokinetic projects. According to a March 2007 Electric Power Research Institute (EPRI) report titled, "Assessment of Waterpower Potential and Development Needs," **the potential for increases in capacity, mostly without the need to build dams, is conservatively estimated at 23,000 MW by 2025, with an overall estimate of 85,000 to 95,000 MWs with appropriate public policy support.** This includes:

- 2,300 MW capacity gains at existing conventional hydropower facilities;
- 5,000 MW of new conventional hydropower at existing non-powered dams;
- 2,700 MW of new small and low head power conventional hydropower (<30 MW installed capacity);
- 10,000 MW from ocean wave energy technologies; and
- 3,000 MW from hydrokinetic technologies (river-based).

Realization of these capacity gains will require continued and increased research, development, demonstration and deployment (RDD&D) support and other economic incentives as well as planning, testing and impact evaluation assistance. As stipulated in EPAct 2005, the Secretary of Energy is required to conduct R&D for conventional and new waterpower technologies.[2]

[1] NHA is a non-profit, national trade association dedicated to promoting the nation's largest renewable resource and advancing the interests of the hydropower and new ocean, tidal and instream hydrokinetic industries and the consumers they serve.
[2] EPAct 2005, Title IX, Sec. 931 – "*Conduct a program of research, development, demonstration and commercial application for cost competitive technologies that enable the development of new and*

NHA's statement requests full funding of the suite of initiatives identified in the EPRI report under the Department of Energy's new Waterpower R&D program at a level of $54 million per fiscal year.

Waterpower Technology Development Needs

Through direct contact with NHA members, which include hydropower owners and operators, ocean, tidal and instream hydrokinetic technology developers, and the analysts and experts cited in the EPRI report, NHA analyzed the report's suite of development recommendations and concluded that the EPRI report provides a useful model, a roadmap from which to guide activities under the DOE Waterpower R&D program. As such, this statement highlights and summarizes the various R&D initiatives outlined in the report. These directives are intended to address the needs left unfunded by the previous RDD&D program for hydropower and would expand the Department's efforts.

I. Waterpower Realization Committee—to provide the initial guidance and future oversight to benchmark results of the RDD&D program in terms of real waterpower capacity and generation gains. This committee, made up of representatives from industry, government resource agencies and non-governmental organizations would guide RDD&D efforts and monitor progress to ensure the realization of the capacity gains. The Committee would measure on an annual basis the capacity gains from the various initiatives and make recommendations for refinement of the program, as necessary.

II. Waterpower Performance Initiatives. The suite of activities and programs available to meet the goals of the program are outlined below.

A. Advanced Water Energy Science.

Statement of Need: The industry has identified the need for advanced scientific techniques to support the following activities:

- Advance Water Energy Science
    i. Work that would support the industry's need to better predict flow measurement. Accurate flow values are needed for a variety of operation and environmental performance topics.
    ii. Modeling work to improve hydraulic modeling techniques.
    iii. Turbine research in order to develop better materials resistant to cavitation and erosion damage.
    iv. Generator research in order to discover materials suitable for use as stator core; build one prototype stator core; and study it over a period of time.

- Meteorological Forecasting and Optimal Dispatch of Energy/Water Systems. Work in this area will examine and determine the benefits of integrating wind and other intermittent renewable energy resources with hydropower and pumped storage resources. Specific work could include:
    i. Near-term forecasting of meteorological conditions will help identify needs for improving meteorological data and instrumentation.
    ii. Long-term projections of global climate change and effects of other cycles and other factors on regional meteorological conditions and future regional electricity and water demand, energy and electricity supply mix, and fuel costs.
    iii. Research into the integration of meteorological information and load, energy price, and other forecasts with energy and water system operations.

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incremental hydropower capacity, adding diversity of the energy supply of the United States, including: (i) Fish-friendly large turbines. (ii) Advanced technologies to enhance environmental performance and yield greater energy efficiencies. (…) The Secretary shall conduct research, development, demonstration, and commercial application programs for – (i) ocean energy, including wave energy (…) and (iv) kinetic hydro turbines."

- Integration and Control of Renewable Energy Technologies. Greater opportunities to adopt renewable energy technologies and their integration with water resources can be realized if research is provided to develop advanced integration and control mechanisms. Funding could be directed to the development and demonstration of hybrid control systems to include real time pricing, resource optimization and optimal economic value methodologies.

B. Hydropower Environmental Performance

Statement of Need: The following objectives will improve hydropower performance by maximizing hydroelectric generation and protecting fisheries resources.

- Complete RDD&D for Fish-Friendly Turbines. Continued work on fish-friendly turbine development offers the opportunity to address energy and environmental impacts and needs. Activities under this category include:
    i. Continue prototype Alden/Concepts NREC turbine development in preparation for commercialization. Additional fish survival testing.
    ii. Continue testing of the advanced turbines at Wanapum dam.
    iii. Perform power efficiency testing, and
    iv. Deploy and evaluate the Alden/Concepts NREC design at School Street Project, NY or other location.

- Bioengineering for Fish Passage and Entrainment Mitigation. Technologies are needed to solve the problem of fish mortality involving hydropower structures. Continued work activities include:
    i. Basic research on the effect of hydraulic process on fish movement.
    ii. Utilize biocriteria in the development of new turbine and fish passage designs.
    iii. Conduct demonstrations of new technology to determine effectiveness in real-world applications.

- Water Quality Mitigation Technology. New and more cost-effective and less water intensive solutions are needed to address dissolved oxygen and water temperature issues involving water quality. Research is needed to:
    i. Review state of the art techniques for addressing these issues.
    ii. Develop new technologies and target test sites for testing.
    iii. Conduct cost-shared demonstrations of new technologies.

- Advanced Weirs for Flow Re-regulation and Aeration. More work is needed to optimize the design of weirs and demonstrate how they can be used to improve the efficiency of existing projects. Research activities could include hydraulic design studies, coupled with model tests and prototype demonstrations.

C. Hydropower Operational Performance

Statement of Need: Improved forecast models and the implementation of advanced technologies can play a crucial role in enhancing the operational performance of hydropower facilities. The following objectives will improve operations at facilities.

- Hydropower Operation Decision Support Analysis. Need to understand various hydropower generation sensitivities to various processes. Research activities could include:
    i. Determination of sources of hydropower generating variability across spatial and temporal scales.
    ii. Develop improved climate/meteorological stream flow forecast models
    iii. Incorporate understanding and forecast models into optimization and decision support models.
    iv. Demonstrate benefits of using improved decisions support models.

- Demonstration testing of the advanced hydropower turbine system (AHTS) to Increase Use of Efficient Designs. Demonstration activities will help potential users understand and overcome potential risks of using new technologies.

- Advanced Electrical Equipment for Renewable Integration. More research into these technologies would increase efficiency and reliability by providing ancillary services to the electric grid.

III. Waterpower Technology Development – This part of the program would use funds to advance hydrokinetic and ocean energy technology in four program areas:

Hydrokinetic Resource Assessment

Statement of Need: New generation technologies are on the threshold of implementation, but require additional site assessment and a mapping program to outline the criteria for development. A complete resource assessment and criteria protocol for hydrokinetic sites in the U.S. is required and should be available to potential developers, similar to the resource assessment for small hydropower completed by DOE.

Hydrokinetic Environmental Profiling

Statement of Need: Advanced technologies on the threshold of implementation often are stalled because prospective users cannot justify implementation risks and lack of knowledge among developers regarding the environmental and institutional barriers. Research to develop minimum time environmental data collection and analysis techniques for use in site evaluation of hydrokinetic machines is needed. This research would standardize monitoring techniques for evaluating the environmental impacts of hydrokinetic technologies and help expedite the deployment of these technologies.

Hydrokinetic Technology Improvement

Statement of Need: Instream kinetic, tidal/wave energy and kinetic hydropower and pressure systems for manmade conduit systems all require test support and demonstration funding to support development, deployment and realization of their potential. Research is needed to determine proof of concepts with single prototype units and demonstrate operational viability and environmental effects with pre-commercial multiple unit projects. Support is also needed to identify universities, labs, and other entities where proof of concepts and operational tests can be conducted and environmental effects assessed.

Advanced Ocean Energy

Statement of Need: Federal funding of ocean energy RDD&D and required regulatory activities would enable the U.S. to develop new domestic energy supplies, create jobs and capture an emerging global export market. Research is needed to develop an ocean wave energy technology industry to commercial deployment level including research into marine resources and converters; energy conversion, delivery and storage; environmental and cost monitoring; and field deployment.

Conclusion:

Hydropower is already a major source of energy for the nation. The nascent ocean, tidal and instream hydrokinetic technologies are at the beginning stages of commercial deployment. Yet both technologies have a tremendous growth potential that could be realized through sustained federal RDD&D support. These renewable resources are clean, climate-friendly technologies that can provide significant base load power to the U.S. at a time when our demand for electricity continues to increase dramatically. By expanding the funding for the DOE Waterpower R&D program, the nation could soon realize the tremendous energy and environmental benefits of maximizing existing hydropower projects and infrastructure as well as the suite of emerging waterpower technologies.