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U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Water Power Technology Office

Subject: Request for Information: DE-FOA-0002561: Testing Capabilities and Facilities to Validate Hydropower Technology Innovations.

Submitted via electronic mail to: WPTORFI@ee.doe.gov

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The National Hydropower Association (NHA)[1] appreciates the opportunity to respond to the Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE), Water Power Technology Office's (WPTO) recent request for information (RFI), and to provide the industry's perspectives and insights on testing hydropower technology innovations. NHA offers the below recommendations in new technologies and innovation, testing facilities in a federal and non-federal facility setting and diversity of test settings.

[1] National Hydropower Association (NHA) is a national non-profit trade association dedicated exclusively to representing the U.S. hydropower industry. NHA's membership consists of over 250 organizations, including consumer-owned utilities, investor-owned utilities, independent power producers, equipment manufacturers, environmental and engineering firms, and attorneys.

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Topic 1: Innovative Hydropower Technology, Technical Procedures, and Best Practices In Need of Testing

Question 1.2: What are new and emerging technologies in need of testing? What is the footprint of these technologies and testing needs across the hydropower technology landscape of Figure 1? Are the necessary testing capabilities (i) non-existent or (ii) existent but unavailable?

NHA offers the below hydropower innovations whose commercialization and adoption are presently inhibited by lack of testing and validation.

- Field validation of proof of concept in modular unit installation related to both civil and mechanical designs. For example, turbine testing on a larger scale accommodating multiple "site specific" conditions with varying flow, head, geometry, environment, etc.
- Designs in aquatic habitat improvement, including fish passage, total dissolved gas, dissolved oxygen, water temperature, aerating runners, and surface water pumps.
- Adaptive management in operations to meet environmental, aquatic environments or other functions.
- Testing and proof of concept for new approaches in the application of digital technology with respect to monitoring the health of dam structures.
- Valve designs have been tested historically via CFD and FEA modeling and some lab facility small-scale testing. For example, testing of a new gate (25ft by 40 ft) or valve that is subject to very high pressures could be confirmed in a testing facility.
- Validation of Computational Fluid Dynamic (CFD and Finite Element Analysis (FEA) for components through full scale data collection.
- Full scale testing of modeling results, acceptance of new equipment designs by regulatory agencies and non-governmental organizations (NGO) could be enhanced
- Innovations in other industries that may be easily transferred to hydropower, for example sensors.
- Closed loop pumped storage and conventional hydropower powertrain testing technologies.
- Potential use of a coordinator to encourage innovation within the engineering industry, specific innovative ideas could be presented to these firms in civil works – structural water conveyance.

- Application of environmentally acceptable Lubricants (EAL) in full scale operating conditions, the risk of damage to the turbine outweighs the costs in fines of more harmful oils.

Topic 2: Availability of Hydropower Testing Facilities and Capabilities

Question 2.2: Are centralized multi-capable facilities a necessity for your development pathway or can dispersed testing facilities generally meet your requirements/expectations? How can facilities be coordinated efficiently to facilitate access to and cooperation among hydropower technology developers and stakeholders?

NHA sees the benefit of both a centralized multi-capable facility and dispersed testing facilities. A centralized multi-capable facility allows for the testing of several technologies at one point and could include testing of pumped storage technologies. For testing of fish impacts, the facility should exhibit many of the attributes of existing hydropower facilities such as head, flow and tailwater conditions. A centralized facility with the ability to holistically test modular hydropower units and innovations in civil structure design would be optimal.

Dispersed testing facilities may allow for the testing of technologies subject to a variety of environmental conditions and necessities. For example, the differences in fish species and water environments. The Pacific Northwest, Northeast and Southeast have varying water conditions and regulations. Multiple test sites would also allow for testing equipment under various operating heads (small to large).

NHA inquires as to how the knowledge gained from the deployment of technologies at test facilities will be shared with the hydropower industry, the broader group of stakeholders and the public.

Topic 3: Suitability and Availability of Federal Water Infrastructure to Support Hydropower Technology Testing

Question 3.4: Considering that most federal dams are owned and operated by the Corps of Engineers, Bureau of Reclamation, or Tennessee Valley Authority, what could or should be the role of those agencies in developing and operating test facilities within infrastructure that they own?

NHA concurs, that developing and operating test facilities within federal agencies, such as the Corps of Engineers, Bureau of Reclamation and Tennessee Valley Authority infrastructure would be beneficial to the industry. Testing in large structures as appropriate would provide

tremendous value to the industry in understanding the impacts these larger scale technologies may have on operations. Many of the facilities within the federal fleet have similar attributes as those within the non-federal fleet. In addition, the non-federal fleet will not face potential environmental compliance issues that often deter owners from testing new technologies.

The testing of individuals components one at a time would be beneficial to the industry. For example, testing of new sensors, where they are most useful and help structure effective data management. Under this test case, a federal facility will be able to test and determine what data is most valuable and useable by plant staff.

A small demonstration hydropower unit could also help support an adaptive management requirement where a hydropower unit is not present today. NHA also offers the concept of testing a variable speed unit within an existing pumped storage facility.

Topic 4: Priorities, Roles, Business Models, and Access for DOE-Sponsored Hydropower Test Facilities

Question 4.3: How can DOE ensure that hydropower technology testing facilities are available to many different users for many different needs?

With respect to a business model for a hydropower test facility or network of facilities, NHA recommends a setup similar to Testing & Expertise for Marine Energy (TEAMER). TEAMER acts as a coordinator for marine energy test facilities under the WPTO and has proven successful in coordinating testing for marine energy technology developers.

Topic 5: General Comments

Question 5.1: What other information about testing of innovations in hydropower technology, advanced technical procedures, new best practices and new operating scenarios do you see as important for DOE to know in planning and implementing hydropower research and development?

For innovation to scale, risk is necessary. However, often industry is not able to take on risks in its operations with respect to environmental compliance. What is the incentive for testing a new technology when the risks can be higher than the reward?

NHA recently held a workshop focused on the challenges in deployment of new technologies and innovation. Within the workshop, the risk of implementation of experimental technology with respect to the operating license was identified as a key challenge in the application of a new technology to an existing facility. Operating within one's license has stymied innovation

and adaptation of new technology. NHA suggests DOE work closely with FERC with respect to environmental compliance parameters of a DOE facility.

In addition to exploring testing at federal facilities, NHA recommends that WPTO consider funding opportunities to entice owners and operators to allow testing at their facility. These funding opportunities may cover the costs and potential risk associated with facilitating the testing of new technologies. Additionally, the coordination of tours of these volunteer facilities will provide the ability for other operators to view the new technology at work, gaining an in-person perspective, and ask questions of the technology developers and operators of the facility.

An increase in volunteer testing facilities may also provide a greater variety of testing environments conducive to specific testing needs. For example, specific dam characteristics such as height, location, flow and environment are necessary.

Within NHA's recently held workshop, participants mentioned the need to understand what technologies and research is available to industry. NHA recommends that WPTO submit research to its recently released Waterpower Research Portal (WaRP), a repository of current and ongoing research in conventional hydropower, pumped storage, small hydro, and marine energy.

Once again, NHA appreciates the opportunity to respond to this RFI. DOE has been invaluable in helping the industry better understand and address its challenges, while being a steward for natural resources and facilitating access to affordable and reliable energy. NHA hopes the feedback provided within this response is valuable as the department takes next steps in considering best routes with respect to testing of hydropower technologies. We look forward to future discussions.