18. WATER TECHNOLOGIES

EERE's Water Power Technologies Office (WPTO) (http://energy.gov/eere/water/water-power-program) works with national laboratories, industry, universities, and other federal agencies to conduct research and development activities through competitively selected, directly funded, and cost-shared projects.

WPTO pioneers research and development efforts in both marine and hydrokinetic (MHK) and hydropower technologies to improve performance, lower cost and ultimately support the United States' ability to sustainably meet its growing energy demand. MHK technologies capture energy from waves, tides, ocean, and river currents, as well as from ocean thermal gradients. Hydropower and MHK technologies generate renewable electricity that supports domestic economic prosperity and energy security while enhancing the reliability and resiliency of the US power grid.

For FY 2021 solicitation, WPTO is seeking applications for MHK technologies only. MHK technologies are at an early stage of development because of the fundamental challenges of generating power from dynamic, low velocity, and high-density waves and currents, while surviving in corrosive marine environments.

These challenges are intensified by high costs and lengthy permitting processes associated with in-water testing. To achieve the mission and help to realize the vision, the MHK Program must support research and development (R&D) efforts that lead to significant reductions in the cost of MHK energy that enable industry to be competitive in U.S. electricity markets.

Applications to either subtopic must:

• Propose a tightly structured program which includes technical milestones that demonstrate clear progress, are aggressive but achievable, and are quantitative;

• Include projections for price and/or performance improvements that are tied to a baseline; • Explicitly and thoroughly differentiate the proposed innovation with respect to existing commercially available products or solutions;

• Include a preliminary cost analysis; and

• Justify all performance claims with theoretical predictions and/or relevant experimental data.

Note: In addition to the sub-topics (a) and (b) below, WPTO is supporting subtopic e under Topic 20 – Joint Topic: CABLE Materials and Applications entitled Electric Systems—Generators and Motors.

Grant applications are sought only in the following subtopics:

a. Co-Development of Marine Energy Technology at Smaller Scales (CMETTS) - This subtopic seeks proposals for the development and design of new marine energy prototypes specific to the needs of an identified end user in the blue economy.

   CMETSS seeks to advance near-term marine energy opportunities in the blue economy by supporting the development of solutions tightly coupled to end-user needs. Specifically, this subtopic seeks to support the development of industry projects that link marine energy technologies together with blue economy energy end users to co-develop solutions specific to energy constraints.

A common underlying input for many of the activities in the blue economy is energy: fuel for ships, batteries for underwater vehicles, or high-pressure seawater for desalination systems.

While some activities have access to cheap and reliable sources of energy, others do not. Energy inaccessibility limits operations and adds unnecessary costs. Removing or reducing these energy constraints through energy innovation could open new pathways for sustainable economic development.

Recognizing this opportunity and the potential for marine energy to ease energy constraints, WPTO released a report in 2019 titled "Powering the Blue Economy: Exploring Opportunities for Marine Renewable Energy in Maritime Markets".

The report describes eight non-grid applications where marine energy could provide consistent, reliable power. This report serves as the foundation for the recently launched Powering the Blue Economy Initiative that supports R&D for non-grid applications of marine and hydrokinetic energy. Blue economy markets present new opportunities and unfamiliar applications of marine and hydrokinetic energy technology developers.

Upfront engagement with end users and coastal communities is essential to successful technology integration to achieve design goals.

Moreover, applications of marine energy are not limited to electricity generation and can include marine energy for propulsion or pumping. The CMETSS topic is market agnostic but requires SBIR Phase I applicants to make a case for their proposed application through an initial analysis of the market's value and broader impact in their proposal. Should the project be awarded, a more refined market analysis will be required as a deliverable during the period of performance.

In FY 2021, applicants to this subtopic are strongly encouraged to explore new co-development topics that are not duplicative with other efforts underway with WPTO such as the *Ocean Observing Prize DEVELOP Competition* - focused on wave energy powered rechargeable autonomous underwater vehicles, and solutions fit for the *Waves to Water Prize* - developing wave energy powered desalination suited for disaster relief and recovery.

Areas of interest including and beyond applications cited in the Powering the Blue Economy report can include, but are not limited to, lightweight devices, short duration deployments, disposable materials, or other novel and innovative features.

Applicants must identify and demonstrate at least one end-user whom they will work with during the project. WPTO encourages engaging with end users to understand their power requirements and the functional requirements required.

As an example, of the type of engagements the program has done with end-users, please see the published *"Enabling Power at Sea: Opportunities for Expanded Ocean Observations through Marine Renewable Energy Integration"*. The identified end-use partner(s) may be listed as project participant(s).

Applicants must demonstrate that a prototype, with an identified partner, can be designed and built with funds provided in Phase II. An assessment of the proposed marine and hydrokinetic resource necessary for energy harvesting for the technology should be provided in the Phase I application and refined during the period of performance.

While the system should be designed for a particular end-user for the purpose of this solicitation, the solution should demonstrate potential for applicability for other applications or purposes.

It is expected that Phase I work would be centered on end-user and customer discovery for the proposed concept; collecting end-user or customer requirements; converting collected customer requirements into system design requirements; using those design requirements to inform preliminary prototype design; and performing preliminary proof-of-concept testing or modeling of system components. One of the deliverables for Phase I will include a table of design specifications for the system and how each relates to a customer need.

In Phase II, the awardee(s) will refine system designs based on the findings from Phase I and proceed to build a functioning prototype to be tested and/or deployed. Phase II awardees must also present a detailed plan for technology commercialization.

For Phase I proposals, competitive applicants should demonstrate knowledge, experience, and/or capabilities in developing marine technologies and include the following in their proposals:

• A preliminary design of the proposed system with estimated physical dimensions;

• A clear description on how the system would function;

• The end-user or customers that will be engaged during the project;

• Identification of the marine energy resource that would be utilized;

• The method or methods by which customer needs will be converted into design requirements or specifications, for example: Quality Function Deployment, Design Structure Matrix, Kano Method, or Axiomatic Design;

• Identification and description of the proposed performance metrics which will be used to assess the system in comparison to incumbent technologies, such as levelized cost of energy, levelized avoided cost of energy, or other similar metrics. Please refer to “Existing Ocean Energy Performance Metrics” for examples;

• A description of the intended deployment location(s) and the available energy in the chosen marine energy resource, including identification of any key environmental, social, and regulatory challenges;

• The state-of-the-art for incumbent technologies and how the proposed design is an improvement in performance or reduction in cost;

• Details of work to be performed in Phase I including resources required and intended performance targets; and Return to Table of Contents 81

• Initial description of Phase II work including the scale of the demonstration prototype, the intended test location or facility, and potential end-user partners.