U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Request for Information: Marine and Hydrokinetic Environmental Monitoring Technologies and Field Testing Opportunities DE-FOA-0001372

DATE: June 22, 2015

SUBJECT: Request for Information (RFI)

DESCRIPTION: The Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) invites input from the public regarding a potential funding opportunity to advance the readiness of technologies used to monitor for potential environmental impacts associated with marine and hydrokinetic (MHK) energy devices and technologies used to address research questions aimed at reducing the overall uncertainty of environmental impacts surrounding MHK devices. EERE seeks input on a proposed framework for conducting both technology field testing and validation activities, and focused research and development (R&D) to advance marine environmental monitoring technologies towards commercialization. Additionally, EERE requests input on how to prioritize funding for activities addressing market barriers.

BACKGROUND: The mission of the Water Power Program, located within the Wind and Water Power Technologies Office in EERE, is to accelerate U.S. deployment of clean, affordable, and reliable water power technologies, including MHK, to promote energy security, economic growth, and environmental quality. For more information about the Water Power Program, please visit our website at http://water.energy.gov.

The Water Power Program is committed to supporting technological innovations that facilitate the growth of the MHK industry. In addition to technology R&D, the Program funds R&D to address market barriers that affect the deployment of MHK devices, including the potential environmental impacts of MHK. To acquire the necessary permits for deployment, MHK developers must comply with state and federal laws protecting marine resources, such as the Endangered Species Act, Marine Mammal Protection Act, Magnuson-Stevens Fishery Conservation and Management Act, and the Clean Water Act. As a result, developers often must take measures to monitor for the potential impacts of their facilities on the surrounding environment and species of concern.

To date, regulatory and permitting processes for many MHK projects have been time and cost intensive. In most cases, uncertainty regarding the environmental effects of the technologies and subsequent uncertainty in the permitting requirements for projects has driven this process. As part of the environmental review and monitoring process, MHK developers are often asked to perform a number of baseline studies examining the presence, behavior, and abundance of species in their prospective sites. Once projects are in operation, developers may be required to perform extensive monitoring of the potential impacts of their projects on any present species. However, the extreme, high-energy, and often low-light conditions of MHK sites pose unique

challenges for environmental baseline determination and effective operational project monitoring for which commercial, off-the-shelf technologies do not exist. Additionally, such monitoring can produce large streams of data for which limited automated processing tools exist. Environmental review and monitoring will remain challenging until sufficient tools and methodologies are created to allow for the collection of adequate and accurate data.

More research, development, field testing, and validation of technologies to assess environmental performance of MHK devices will be needed in order to reduce environmental uncertainty and enable the industry to mature. Ultimately, the MHK community needs cost-effective tools that have been demonstrated to be effective in harsh marine environments where MHK devices are likely to be deployed. While some tools are needed for monitoring at operational devices, continuous monitoring is likely to be cost-prohibitive over all time scales for some variables. Consequently, additional tools can and should be designed to conduct basic research at a select number of projects to help inform risk levels, with an ultimate goal of reducing the environmental uncertainty that is a current hurdle for the industry.

PURPOSE: The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders aimed at accelerating the development and commercial readiness of environmental monitoring technologies for use by MHK device developers.

Further described below, EERE is seeking particular input on:

1) A proposed framework for funding the advancement of environmental monitoring technologies aimed at reducing the uncertainty of impacts due to acoustic outputs, electromagnetic fields produced by MHK devices and their associated cables, and physical interactions with marine animals.

2) The relative need for the advancement of environmental monitoring technologies.

3) The state of development of technologies for measuring environmental impacts of MHK devices.

This is solely a request for information and not a Funding Opportunity Announcement (FOA). EERE is not accepting applications.

DISCLAIMER AND IMPORTANT NOTES: This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details,

including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

PROPRIETARY INFORMATION: Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, **respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit business sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [list applicable pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0001372. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure” and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

EVALUATION AND ADMINISTRATION BY FEDERAL AND NON-FEDERAL PERSONNEL: Federal employees are subject to the non-disclosure requirements of a criminal

statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

REQUEST FOR INFORMATION CATEGORIES AND QUESTIONS:

CATEGORY 1: **Potential Funding Opportunity Structure**

The high energy environments where MHK devices would be deployed create a number of challenges for evaluating the environmental performance of MHK devices. Although there are monitoring instruments currently being utilized by researchers and MHK developers, there are a variety of challenges associated with the technical performance and costs of using these instruments, particularly for deployment, retrieval and data analysis. In Fiscal Year 2014 EERE supported the enhancement of existing, or creation of new technologies to monitor for potential environmental impacts associated with MHK devices. This encompassed a wide range of technologies over a range of technology readiness levels (TRLs). To build upon this earlier solicitation, and help move environmental monitoring technologies towards commercialization, EERE is considering funding the testing, improvement, and validation of more mature environmental monitoring instrumentation (TRL 5-7). Testing would occur in a semi-sheltered open-water setting, and then in fully-energetic conditions, at a deployed MHK device if possible. The goal of this potential funding opportunity would be to help develop and identify effective monitoring tools and data processing methods for use by the MHK and research communities. Based on the current understanding of the major environmental concerns raised by regulatory agencies, EERE is considering the following breakout of activities by stressor and receptor type. If EERE ultimately pursues a FOA along these lines, the funding allocated for each topic would be informed by the relative need for improvement of monitoring technologies for each stressor-receptor relationship.

EERE is considering the following three Topic Areas for a possible future FOA:

Topic Area 1: Acoustic Outputs
This topic area would support the testing, enhancement and validation of technologies designed to monitor baseline acoustic environmental conditions as well as noises produced by an operational MHK device, and data processing techniques to analyze the collected data.

Topic Area 2: Electromagnetic Fields
This topic area would support the testing, enhancement and validation of technologies designed to measure baseline electromagnetic fields and the changes in electromagnetic fields attributed to MHK devices, associated subsea cables, junction boxes, and other related equipment.

Topic Area 3: Marine Organism Monitoring
This topic area would support the testing, improvement and validation of technologies to monitor for baseline marine organism activity, interactions with MHK devices, and methods for processing the large amounts of data typically collected during these activities. This topic area could include visual methods such as visual cameras or LiDAR, acoustic methods such as acoustic cameras, or any alternative methods. This topic area could include single devices or integrated monitoring packages that utilize multiple different sensor types.

Even after environmental data has been collected, data processing and analysis is time and cost intensive. Considering this, the software utilized for data analysis would also be evaluated. The desired end goal of research funded under each of these topic areas would be to provide MHK developers and researchers with reliable, effective and cost-efficient technologies to evaluate the environmental performance MHK devices with regards to the acoustic output, electromagnetic fields and marine organism monitoring.

The activities within this funding opportunity would be completed over a three year period. All projects under each topic area would undergo the same testing and validation structure, outlined below:

Year 1 (Anticipated non-federal cost share: 20%)
During the first year, award recipients would test and demonstrate baseline instrumentation performance at a pre-determined, semi-sheltered open water field setting using known targets or stressor levels. For example, to test instrumentation to measure acoustic output, performance would be measured against an artificial sound source with known characteristics. To test and validate EMF measurements, a cable with known properties and a known electricity load would be operated and measurements compared to these values. For marine organism monitoring, a known assemblage of false or live targets could be utilized. An objective third party would help conduct testing and data analysis efforts. Projects would be expected to demonstrate technical and cost performance, and develop detailed plans for performance improvements and cost reductions possible over the remainder of the project and beyond. At the end of year 1, there is anticipated to be a go/no-go decision with a down-select based on initial technical performance, and awardee plans for performance and cost improvements by the project end. Estimated future cost for instrumentation, deployment, and analysis when the technology is proven and ready for full commercial deployment (TRL 9) would also be considered.

Year 2 (Anticipated non-federal cost share: 20%)
During year 2, awardees would make technological improvements to their devices, and undergo a second round of testing at the same pre-determined, semi-sheltered open water field setting. A go/no-go decision point at the end of year 2 would evaluate improvements in technical performance and cost reduction relative to that which was proposed. If satisfactory progress is accomplished, the awardee would progress to the third year.

Year 3 (Anticipated non-federal cost share: 50%)
In year 3, instruments would be tested at a fully-energetic site, near a deployed MHK device if possible. The majority of testing and data collection would be performed by an objective third party. This testing opportunity would evaluate technical and cost performance in an environment representative of those where MHK devices would be deployed. It would also provide a cross-comparison among awardees in the same topic area and a comparison to existing, commercially available instrumentation.

Testing Location and Facilities
EERE proposes conducting year 1 and 2 activities at a pre-determined location with access to extensive facilities and objective, third party staff with relevant areas of expertise.

The proposed location for year 1 and 2 activities would include:

- Direct access to 2+ m/s tidal flow and average significant wave heights of 1 meter within a 5-minute boat ride.
- Over 8,000 square feet of general purpose laboratory space.
- Over 6,000 square feet of wet laboratory space supplied with heated and cooled freshwater and seawater.
- Direct access to a research dock and outdoor experimental tanks.
- A marine scientific dive team with experience working in coastal zones, estuaries, and riverine environments with wide variations in current, temperature, and visibility.
- Two research vessels.

Field testing in year three would occur at a yet to be determined, fully energetic field site, ideally around an operating MHK device.

EERE welcomes input on the approach outlined above. Specifically, we welcome feedback on the following questions:

1) Is the technology testing and advancement approach outlined in Category 1 the optimal approach to supporting the advancement of environmental monitoring technologies? If not, what improvements would you suggest?

2) Are the environmental conditions and facilities available at the proposed test site sufficient to adequately assess the technical and cost performance of environmental monitoring technologies? If not, what additional facilities or capabilities are needed?

3) What is the appropriate level of funding to conduct the suggested activities for each topic area?

4) Given your understanding of the current state of environmental monitoring technologies and areas of regulatory concern, are acoustic outputs, electromagnetic fields and marine

animal monitoring the most important topics to be targeted? How should EERE prioritize research investments across the three proposed topic areas? If these are not the most important needs, which environmental monitoring technologies should be prioritized?

5) Should EERE consider adding a topic area to support the development of novel, early-stage environmental monitoring technologies?

6) What is the best way to assess estimated future cost for instrumentation, deployment, and analysis when the technology is proven and ready for full commercial deployment (TRL 9)?

CATEGORY 2: Needs, Interests and Alternative Approaches

1) EERE's current program to address the potential environmental impacts of MHK development includes the collection of data around existing devices, processing and analysis of existing data, disseminating of existing knowledge to a larger audience and supporting the advancement of environmental monitoring technologies. How would you prioritize the importance of these different activities? Are there other activities to address market barriers that you consider a higher priority?

2) Some environmental monitoring technologies may be better suited to address basic research-level questions which could ultimately reduce or retire perceived risks associated with MHK technologies. Should EERE consider funding the development of technologies to support research level questions or should priority be placed on technology for monitoring to address regulatory requirements?

3) What else not considered here should EERE address as it develops a program to help remove market barriers to the deployment of MHK technologies?

CATEGORY 3: Survey of Environmental Monitoring Technologies

To facilitate advancements and commercialization of environmental monitoring technologies, EERE needs to understand the types of technologies available and their developmental status. EERE requests input from technologists and vendors on the status of their particular technologies.

To ensure consistency in characterization of where a technology is on the pathway to commercialization, EERE utilizes a Technology Readiness Level framework to provide a

common yardstick for measuring technological progress from basic scientific research (TRL 1) to full commercial readiness (TRL 9), per Table 1 below.

Table 1: Technology Readiness Levels

	TRL 1	**Basic Research:** Initial scientific research has been conducted. Principles are qualitatively postulated and observed. Focus is on new discovery rather than applications.
	TRL 2	**Applied Research:** Initial practical applications are identified. Potential of material or process to solve a problem, satisfy a need, or find application is confirmed.
	TRL 3	**Critical Function or Proof of Concept Established:** Applied research advances and early stage development begins. Studies and laboratory measurements validate analytical predictions of separate elements of the technology.
	TRL 4	**Lab Testing/Validation of Alpha Prototype Component/Process:** Design, development and lab testing of components/processes. Results provide evidence that performance targets may be attainable based on projected or modeled systems.
Suggested TRL for potential FOA	**TRL 5**	**Laboratory Testing of Integrated/Semi-Integrated System:** System Component and/or process validation is achieved in a relevant environment.
	TRL 6	**Prototype System Verified:** System/process prototype demonstration in an operational environment (beta prototype system level).
	TRL 7	**Integrated Pilot System Demonstrated:** System/process prototype demonstration in an operational environment (integrated pilot system level).
	TRL 8	**System Incorporated in Commercial Design:** Actual system/process completed and qualified through test and demonstration (pre-commercial demonstration).
	TRL 9	**System Proven and Ready for Full Commercial Deployment:** Actual system proven through successful operations in operating environment, and ready for full commercial deployment.

1) Please describe your monitoring technology in detail. What is its intended function? What stressor(s) (e.g. acoustic output, physical interactions, EMF) and receptors (e.g. fish, marine mammals) does it address? Is your technology a single device or an integrated package comprised of multiple sensors?

2) Is your technology designed to be compatible with a specific MHK device type or could it be utilized at a variety of MHK devices (i.e. wave, tidal and ocean current)?

3) What is the technology readiness level of your technology (see Table 1 above)?

4) What are your next steps towards commercialization and what resources are required to complete these steps?

5) Can you provide published work or internal analysis indicating actual or theoretical effectiveness (preliminary test results, proof of concept, etc.?)

This is a Request for Information (RFI) only. EERE will not pay for information provided under this RFI and no project will be supported as a result of this RFI. This RFI is not accepting applications for financial assistance or financial incentives. EERE may or may not issue a Funding Opportunity Announcement (FOA) based on consideration of the input received from this RFI.

6) Can you estimate the costs associated with the deployment of your system at an operational MHK device? This could include cost of the monitoring system itself, boat time and personnel for deployment/data collection, and time/resources for data analysis.

7) Under what conditions would you consider participating in an initiative to demonstrate your technology and have its performance objectively validated by a third party? For example, would you feel comfortable participating in such an initiative if EERE made analyses of performance public?

8) What other factors or sensitivities should EERE consider in developing this technology testing and validation program?

REQUEST FOR INFORMATION RESPONSE GUIDELINES: Responses to this RFI must be submitted electronically to MHKRFI1372@ee.doe.gov no later than 5:00pm (EDT) on Friday, August 7, 2015. Responses must be provided as attachments to an email. ***Responses must be provided as a Microsoft Word (.docx or .doc) attachment to the email, of no more than 10 pages in length, 12 point font, 1 inch margins.*** Only electronic responses will be accepted.

Please identify your answers by responding to a specific category and question. Respondents may answer as many or as few questions as they wish.

EERE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address.