RFI: Marine and Hydrokinetic Metrics
DE-FOA-0001903

DATE: May 21, 2018
SUBJECT: Request for Information (RFI)

Description

The Water Power Technology Office (WPTO), within the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE), is requesting feedback on Marine and Hydrokinetic (MHK) metrics in the U.S. for system and subsystem performance. Specifically, the WPTO is looking for feedback on (1) the performance metrics identified within the document titled "Existing Ocean Energy Performance Metrics" relating to performance in the U.S. marine resource, as well as any additional applications, assumptions, benefits, drawbacks, or other considerations for those metrics, (2) any performance metrics not captured within the "Existing Ocean Energy Performance Metrics" documents, (3) considerations for baseline reference values documenting the current state of the U.S. MHK industry identified by metric and resource type, and (4) feedback specifically on Technology Readiness Level (TRL) definitions as referenced in the document and as those TRL definitions relate to the U.S. MHK industry.

Background

MHK energy technologies convert the energy of waves, tides, and river and ocean currents into electricity. Resource assessments show the U.S. has 1,250–1,850 terawatt-hours per year of untapped, technically extractable MHK resource potential, equivalent to nearly 30 percent of total electricity generation in the U.S. Developing just one-sixth of the available wave energy in the five Pacific states could power more than five million homes. MHK is a predictable, forecastable resource with generation patterns typically complementary to other renewable resources such as onshore wind and solar, enhancing its potential to augment grid stability.

Industry deployment of MHK technologies for bulk power generation is nascent, and significant research and development is required to realize cost-competitiveness at the utility scale for MHK technologies. Achieving mission success requires significant research efforts to mature technologies to improve performance, dramatically reduce levelized cost of energy (LCOE) and risks, while simultaneously addressing other barriers which inhibit testing and deployment of devices. Development of commercial MHK technologies is complex and difficult, with challenges including: (1) the unique and complex engineering issues faced in designing devices that can efficiently convert dynamic MHK resources into usable energy; (2) the related but distinct difficulties of reliably deploying and operating MHK systems in harsh marine

environments; (3) additional barriers related to permitting processes and access to testing infrastructure which limit the ability of technology developers to rapidly move through multiple, iterative design and testing cycles; and (4) limited information developed or available on the technologies and potential markets, along with undeveloped supply chains.

Due to the challenges outlined above, availability of performance data from tank and open water testing is limited, requiring numerous assumptions to be made when estimating LCOE for MHK devices. Additional metrics to measure and evaluate success and maturity within the MHK industry have been used historically, though each of these metrics have their own assumptions.

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research institutions, government agencies, and other stakeholders on the challenges described in the section above related to assumptions and uncertainties with metrics in the U.S. that are used to evaluate MHK system and subsystem performance. In addition to LCOE, various other metrics, as documented in "Existing Ocean Energy Performance Metrics" (collocated with this RFI on EERE Exchange, https://eere-Exchange.energy.gov/), have historically been utilized to evaluate and track progress within the MHK industry. EERE is specifically interested in feedback on the application and limitations of those metrics that are currently used or have been used previously, and is also soliciting suggestions for new metrics or new applications of existing metrics. Feedback is requested on the content within the document titled "Existing Ocean Energy Performance Metrics", including possible gaps, additional limitations, or further considerations. The results of this RFI may be used to inform the WPTO's strategic planning in future years, contribute to evaluation criteria for potential future funding opportunities, and provide a baseline for U.S. input into international efforts related to Marine Renewable Energy (MRE) metrics.

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 on this topic 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

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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-0001903. 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: Documented Metrics

1. Which of the metrics identified within the Performance Metrics document, which can be found as a supporting document to this RFI uploaded on EERE Exchange at https://eere-Exchange.energy.gov/, are most useful during MHK device design and testing?
2. Are the metrics identified at the appropriate system and/or integration level (i.e. subsystem/component, system/device, and system of systems/farm)? Could any of the identified metrics be useful at a higher or lower level of system development?
3. Are there any additional applications, assumptions, benefits, drawbacks, or other considerations for the metrics listed in the Performance Metrics document?
4. As a developer, what metric, or suite of metrics, do you use to discuss investment opportunities with a private investor? If some or all of the metrics you use are not included in the Performance Metrics document, please note that in your response and provide a short description about what the metric is, how it is used, and any known assumptions/limitations associated with the metric.
5. As an investor, what metric, or suite of metrics, do you use to evaluate potential investment opportunities? If some or all of the metrics you use are not included in the Performance Metrics document, please note that in your response and provide a short description about what the metric is, how it is used, and any known assumptions/limitations associated with the metric.
6. Who do you regard as the clients and users for the metrics?

Category 2: Gap Identification

1. Within the Performance Metrics document, are there any metrics that are missing? Are there additional metrics that you use or are aware of that provide a meaningful way for measuring or evaluating performance of a component, subcomponent, system, or farm? If so:
    a. What is/are the metrics?
    b. How is it used/applied and what are the caveats and assumptions that are imbedded in its application?
    c. How can the MHK community most effectively use the metric(s)?
2. What in your view are the requirements that metrics need to satisfy?
3. How often or in which time intervals should metrics be reevaluated, both the values against the state of the art as well as the applicability of a metric to the industry?

Category 3: Baseline Reference Values

1. When considering the metrics described in the Performance Metrics document, which ones do you believe could be assigned a value, or range of values, reflecting the state of the art of the industry, i.e. baseline reference value? What would the value(s) be?

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2. Are there metrics that should be assigned with individual threshold values that need to be satisfied by any test system (component to farm) independently of any other metrics?
3. How would the baseline reference values change, if at all, when progressing through the range of Technology Readiness Levels (TRLs)? Should a singular, targeted value remain constant over TRL? Or should a range of values become broader or narrower as TRL increases? What is your experience on how a value may have changed during your technology development?
4. Metrics carry a significant importance in relation to all aspects of the efficient, successful and, as far as possible, de-risked development of economically competitive MHK technology. The determination of the values of these metrics requires methodologies, tools, simulation, testing and processes such as design reviews at the different development stages. What do you regard as the appropriate amount of attention and effort for the determination of these metrics values and assessments through the above described means? Please express your answer explicitly and also quantify the appropriate portion of cost (in %) and time (in %) of a given technology development project that should be allocated for the assessments and metric value determination.

Category 4: Consideration of TRL Definitions

1. Considering the TRL definitions referenced within the Performance Metrics document, which set of definitions to you typically use? Are there other TRL definitions that you use that are not referenced or that you would find more appropriate for the MHK industry?

Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to WPTORFI@ee.doe.gov no later than 5:00pm (ET) on July 31, 2018. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than 10 pages in length, 12 point font, 1 inch margins. Only electronic responses will be accepted.

Please identify your responses by responding to a specific question or topic if applicable. Responses should list the specific page number, and should be identified as one of three categories:

1. **Critical**: A critical comment indicates non-concurrence of the entire document until the comment is satisfactorily resolved. A critical comment raises concerns with issues such as, the concept contains content that conflicts with policy, strategy, and other issues of known canon or with a passage that is patently wrong. A critical comment must contain the suggested changes in the content to merit consideration.
2. **Substantive**: A substantive comment is provided because a section in the document appears to be or is potentially unnecessary, incorrect, misleading, confusing, or

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inconsistent with other sections. A substantive comment must contain the suggested changes in the content to merit consideration.

3. **Administrative**: An administrative comment corrects what appears to be a typographical, format, or grammatical error. If such errors change the intended meaning of the text, the entry should be designated as substantive. Administrative comments must contain the suggested changes in the content to merit consideration.

Respondents may answer as many or as few questions as they wish, or provide additional information they believe is useful but not directly in response to any of the above questions.

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.

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