

Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)

**Advancing Wave Energy Technologies through Open Water
Testing at PacWave**

Funding Opportunity Announcement (FOA) Number: DE-FOA-0002415

FOA Type: Mod 0004

CFDA Number: 81.087

FOA Issue Date:	07/06/2021
Informational Webinar:	7/22/2021
Submission Deadline for Concept Papers:	8/13/2021 5:00pm ET
Submission Deadline for Full Applications:	10/05/2021 5:00pm ET
Expected Submission Deadline for Replies to Reviewer Comments:	11/08/2021 5:00pm ET
Expected Date for EERE Selection Notifications:	January 2022
Expected Timeframe for Award Negotiations:	June 2022

- Applicants must submit and a Concept Paper by 5:00pm ET on the due date listed above to be eligible to submit a Full Application.
- To apply to this FOA, applicants must register with and submit application materials through EERE Exchange at <https://eere-Exchange.energy.gov>, EERE's online application portal.
- Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the applicant/selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancelation of further award negotiations and rescission of the selection.

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Modifications

All modifications to the FOA are [HIGHLIGHTED] in the body of the FOA.

Mod. No.	Date	Description of Modification
0001	7/21/2021	Add additional text to Table 3. TA1 (both TA1a and TA1b) Scope, deliverables, schedule on pages 15 and 16.
0001	7/21/2021	Revise Topic Area 3 requirements in Section III.E. Limitation on Number of Concept Papers and Full Applications Eligible for Review on page 39.
0002	8/09/2021	Revise Topic Area 1 Anticipated Period of Performance to 48 months: Table 1 on page 11, revised Topic Area 1 award duration to up to 48 months on page 12, and BP2 duration to 39 months in Table 3 on page 16. Change wording on page 12 to say between instead of at least.
0002	08/09/2021	Replace "Project partners" with "subrecipients" and "subcontractors" with "vendors" on pages 42, 49,50, and 51.
0003	08/09/2021	For Topic Area 1, as detailed in Table 3, it is assumed that all technical work for Budget Period 1 (BP1) will take place during the first 6 months of the project. Once the continuation application is submitted, a bridge task may be proposed to continue efforts on some non-essential work. Examples of work allowed in the bridge task: completing BP1 activities; preparing for Budget Period 2 (BP2) activities; participation in the go/no-go activities; and negotiating BP2 after a successful Go decision. Note that no BP2 tasks will be allowed to take place in this bridge task. To allow for this, the words "No budget" were removed from Table 3. And language for BP2 is updated to "Up to 85% of total project budget" in Table 3.
0004	9/16/2021	This modification adds word "design" to TA1 BP2 title in Table 3 to clarify BP expectations: "BP2: Design, fabrication, deployment, testing, and decommissioning". This modification also updates Appendix G to include the following resources: <ul style="list-style-type: none"> Ocean Energy Systems (OES) Task 12 Performance Metrics International Framework for Ocean Energy is an

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		<p>international stage gate metrics framework to be used by technology developers, investors and funders:</p> <ul style="list-style-type: none"> ○ https://www.ocean-energy-systems.org/documents/47763-evaluation-guidance-ocean-energy-technologies2.pdf/ ● Techno-Economic Performance Metrics by Sandia National Laboratory, which includes: <ul style="list-style-type: none"> ○ https://energy.sandia.gov/programs/renewable-energy/water-power/research-capabilities/techno-economic-performance-metrics/ ○ Existing Ocean Energy Performance Metrics: https://energy.sandia.gov/download/56788/ ○ Lessons Learned Based on SNL Experience in Reviews of SPA Controls Awardees: https://energy.sandia.gov/download/56799/
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Table of Contents

I. Funding Opportunity Description	8
A. Background and Context	8
<i>i.</i> Background and Purpose	8
<i>ii.</i> Technology Space and Strategic Goals	9
<i>iii.</i> Diversity, Equity, and Inclusion.....	10
B. Topic Areas	12
Topic Area 1. Testing WEC Technologies at PacWave	13
Topic Area 2. Advancing WEC Designs for PacWave	19
Topic Area 3. Wave Energy R&D at PacWave	25
B.1. Technical Information Relevant to All Topic Areas in this FOA	27
<i>i.</i> PacWave Information and PacWave Support	27
<i>ii.</i> National Laboratory and Oregon State University Support.....	29
<i>iii.</i> Insurance Requirements.....	31
<i>iv.</i> Decontamination and Decommissioning.....	32
C. Applications Specifically Not of Interest.....	32
D. Authorizing Statutes.....	32
II. Award Information	33
A. Award Overview	33
<i>i.</i> Estimated Funding.....	33
<i>ii.</i> Period of Performance	33
<i>iii.</i> New Applications Only	33
B. EERE Funding Agreements	34
<i>i.</i> Cooperative Agreements.....	34
III. Eligibility Information	34
A. Eligible Applicants.....	34
<i>i.</i> Individuals.....	34
<i>ii.</i> Domestic Entities.....	34
<i>iii.</i> Foreign Entities.....	35
<i>iv.</i> Incorporated Consortia	35
<i>v.</i> Unincorporated Consortia	36
B. Cost Sharing.....	36
<i>i.</i> Legal Responsibility	36
<i>ii.</i> Cost Share Allocation.....	37
<i>iii.</i> Cost Share Types and Allowability.....	37
<i>iv.</i> Cost Share Verification	38
<i>v.</i> Cost Share Payment.....	38
C. Compliance Criteria	39
<i>i.</i> Concept Papers.....	39
<i>ii.</i> Full Applications	39
<i>iii.</i> Replies to Reviewer Comments.....	39
D. Responsiveness Criteria.....	40
E. Limitation on Number of Concept Papers and Full Applications Eligible for Review	40
F. Questions Regarding Eligibility.....	40

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 Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov Include FOA name and number in
 subject line.

IV. Application and Submission Information	40
A. Application Process	41
i. Additional Information on EERE Exchange	42
B. Application Forms	42
C. Content and Form of the Concept Paper	42
i. Concept Paper Content Requirements	43
D. Content and Form of the Full Application	44
i. Full Application Content Requirements	44
ii. Technical Volume	45
iii. Resumes	52
iv. Letters of Commitment	52
v. Statement of Project Objectives (SOP)	52
vi. SF-424: Application for Federal Assistance	53
vii. Budget Justification Workbook	53
viii. Summary/Abstract for Public Release	53
ix. Summary Slide	53
x. Subrecipient Budget Justification (if applicable)	54
xi. SF-LLL: Disclosure of Lobbying Activities (required)	54
xii. Waiver Requests: Foreign Entities and Foreign Work (if applicable)	55
xiii. U.S. Manufacturing Commitments	55
xiv. Data Management Plan (DMP)	56
xv. Diversity, Equity and Inclusion Plan	57
E. Content and Form of Replies to Reviewer Comments	58
F. Post Selection Information Requests	59
G. Dun and Bradstreet Universal Numbering System (DUNS) Number and System for Award Management (SAM)	59
H. Submission Dates and Times	59
I. Intergovernmental Review	59
J. Funding Restrictions	60
i. Allowable Costs	60
ii. Pre-Award Costs	60
iii. Performance of Work in the United States (Foreign Work Waiver)	61
iv. Construction	61
v. Foreign Travel	62
vi. Equipment and Supplies	62
vii. Domestic Preference – Infrastructure Projects	62
viii. Lobbying	62
ix. Risk Assessment	63
x. Invoice Review and Approval	63
xi. Additional Requirements	63
V. Application Review Information	64
A. Technical Review Criteria	64
i. Concept Papers	64
ii. Full Applications	64
iii. Criteria for Replies to Reviewer Comments	66
B. Standards for Application Evaluation	66
i. Program Policy Factors	66

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Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov Include FOA name and number in subject line.

C. Evaluation and Selection Process.....	67
<i>i.</i> Overview.....	67
<i>ii.</i> Pre-Selection Interviews.....	67
<i>iii.</i> Pre-Selection Clarification	68
<i>iv.</i> Recipient Integrity and Performance Matters.....	68
<i>v.</i> Selection	69
D. Anticipated Notice of Selection and Award Negotiation Dates	69
VI. Award Administration.....	69
A. Award Notices	69
<i>i.</i> Ineligible Submissions.....	69
<i>ii.</i> Concept Paper Notifications.....	69
<i>iii.</i> Full Application Notifications.....	70
<i>iv.</i> Successful Applicants.....	70
<i>v.</i> Alternate Selection Determinations.....	70
<i>vi.</i> Unsuccessful Applicants	70
B. Administrative and National Policy Requirements.....	71
<i>i.</i> Registration Requirements.....	71
<i>ii.</i> Award Administrative Requirements	72
<i>iii.</i> Foreign National Access.....	72
<i>iv.</i> Subaward and Executive Reporting.....	72
<i>v.</i> National Policy Requirements	72
<i>vi.</i> Environmental Review in Accordance with National Environmental Policy Act (NEPA)	73
<i>vii.</i> Applicant Representations and Certifications	73
<i>viii.</i> Statement of Federal Stewardship	75
<i>ix.</i> Statement of Substantial Involvement.....	75
<i>x.</i> Subject Invention Utilization Reporting.....	75
<i>xi.</i> Intellectual Property Provisions.....	76
<i>xii.</i> Reporting	76
<i>xiii.</i> Go/No-Go Review	76
<i>xiv.</i> Conference Spending.....	77
<i>xv.</i> Uniform Commercial Code (UCC) Financing Statements	77
<i>xvi.</i> Implementation of Executive Order 13798, Promoting Free Speech and Religious Liberty	77
<i>xvii.</i> Table of Personnel.....	77
<i>xviii.</i> Pending and Current Sources of Support	78
VII. Questions/Agency Contacts	79
VIII. Other Information	79
A. FOA Modifications.....	79
B. Government Right to Reject or Negotiate.....	79
C. Commitment of Public Funds	79
D. Treatment of Application Information	79
E. Evaluation and Administration by Non-Federal Personnel	81
F. Notice Regarding Eligible/Ineligible Activities	81
G. Notice of Right to Conduct a Review of Financial Capability.....	81
H. Requirement for Full and Complete Disclosure	81
I. Retention of Submissions.....	81
J. Title to Subject Inventions.....	81
K. Government Rights in Subject Inventions.....	82

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<i>i.</i> Government Use License	83
<i>ii.</i> March-In Rights	83
<i>iii.</i> Rights in Technical Data.....	83
<i>iv.</i> Copyright	84
L. Export Control	84
M. Personally Identifiable Information (PII)	84
M. Annual Independent Audits	85
N. Informational Webinar.....	85
Appendix A – Cost Share Information	86
Appendix B – Waiver Requests and Approval Processes: 1. Foreign Entity Participation as the Prime Recipient; and 2. Performance of Work in the United States (Foreign Work Waiver)	91
Appendix C – Glossary	94
Appendix D – List of Acronyms	96
Appendix E – Definition of Technology Readiness Levels	97
Appendix F – DOE Marine Energy Data Repository Plan.....	99
Appendix G – Example performance Metrics	101
Appendix H – Design Standards	102
Appendix I – General Measurement List for Open Water Deployment Projects.....	106

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I. Funding Opportunity Description

A. Background and Context

i. Background and Purpose

The Office of Energy Efficiency and Renewable Energy (EERE) is issuing, on behalf of the Water Power Technologies Office (WPTO), a Funding Opportunity Announcement (FOA) titled “Advancing Wave Energy Technologies through Open Water Testing at PacWave.” This FOA supports open water Research and Development (R&D) at the PacWave test site¹ that is needed to advance wave energy converter (WEC) technologies towards commercial viability. This FOA will only fund projects that will perform testing at the PacWave South test site. Projects that propose testing at the PacWave North test site will not be considered for funding. Accordingly, the remainder of this solicitation refers to “PacWave South” simply as “PacWave”.

WEC technologies are still in the early stages of development. Due to limited available infrastructure, prior to PacWave, there have been few opportunities to conduct in-water deployments in the United States. Conducting in-water demonstrations are critical to understanding performance of systems, and are necessary to developing cost-competitive WEC technologies. Over the last decade, WPTO has supported a broad spectrum of foundational R&D for WECs, including the development of numerical modeling tools, the design and optimization of systems and components, characterization of systems through tank and laboratory testing, advancement in materials and controls, and limited open water systems testing activities. By building on this foundational R&D and preliminary testing, and through this FOA, WPTO seeks to develop systems that can serve emerging blue economy markets², address in-water R&D assessments of components and systems, and develop systems capable of providing electricity to utility grids to help meet the Nation’s growing renewable energy needs in the long-term.

Through WPTO’s support, the WEC industry and R&D community have developed technologies and system designs to the point where comprehensive open water testing is critical for commercialization. To meet the open water testing needs of the WEC community, the WPTO made a significant investment in the PacWave wave energy test facility that is being

¹ PacWave is an open ocean wave energy testing facility consisting of two sites, each located just a few miles from the deep-water port of Newport, Oregon on the ever-energetic Pacific Ocean. See the PacWave website and the “PacWave Information and Support” section for additional details - <http://pacwaveenergy.org/>

² WPTO broadly categorizes the blue economy into two themes: (1) Providing power at sea to support offshore industries, science, and security activities and (2) Meeting the energy and water needs of coastal and rural island stakeholders in support of resilient coastal communities. More information about blue economy application of WEC technologies can be found in the Powering the Blue Economy™ report at, which investigates opportunities for marine energy to provide power for remote locations, microgrids, maritime industry activities, or ocean R&D expeditions economy report, which investigates opportunities for marine energy to provide power for remote locations, microgrids, maritime industry activities, or ocean R&D expeditions.

constructed off the coast of Newport, Oregon. This pre-permitted, highly-energetic, and grid-connected deep water wave energy testing facility enables system and component testing across a range of scales. PacWave will play a critical role in the development of the WEC industry and early PacWave testing campaigns will significantly advance WEC technologies.

Building a clean energy economy and addressing the climate crisis is a top priority of the Biden Administration. This FOA will advance the Biden Administration’s goals to achieve carbon pollution-free electricity by 2035 and “deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050”³ to the benefit of all Americans. The Department of Energy is committed to pushing the frontiers of science and engineering, catalyzing clean energy jobs through research, development, demonstration, and deployment (RDD&D), and ensuring environmental justice and inclusion of disadvantaged communities.

The R&D activities to be funded under this FOA will support the government-wide approach to the climate crisis by driving the innovation that can lead to the deployment of clean energy technologies, which are critical for climate protection. Specifically, this FOA will support the EERE goal of expanding and diversifying the Nation’s energy portfolio and will make progress on the EERE performance metric of increasing the viability and deployment of renewable energy technologies. Specifically, this FOA supports research that will enable the WEC industry to become commercially competitive in high-cost, early adopter markets, while gaining experience that will enable WEC technologies to be cost competitive at the utility scale. Ultimately, this FOA will lead to the development of WEC technologies that can capture highly predictable and reliable wave energy resources that will help meet the world’s growing renewable energy needs.

ii. Technology Space and Strategic Goals

This solicitation is focused on advancing WEC systems that vary in size from utility-scale, grid-connected devices, to smaller non-utility, non-grid-connected devices that provide power for blue economy applications. Specifically, this FOA will support R&D projects across three Topic Areas (TAs). TA1 focuses on the deployment and testing of WECs for remote, microgrid, and open-source R&D applications at PacWave. TA2 will support the development of WEC system designs that can be fabricated, deployed, and tested in future open water testing campaigns at PacWave. TA3 is an open topic area that will support R&D projects at PacWave that advance WECs and supporting technologies. The overall goals of this FOA across all three TAs are to:

1. Advance WEC technologies and validate performance to International Standards;⁴

³ Executive Order 14008, “Tackling the Climate Crisis at Home and Abroad,” January 27, 2021.

⁴ See [Appendix H](#) for Design Standards

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2. Quantify and better understand cost and performance characteristics of WEC technologies;
 3. Develop open water testing data sets that can be used to validate and improve WEC designs, design methods, and numerical models;
 4. Advance supporting technologies that are necessary to enable a commercially competitive WEC industry. Examples of supporting technologies include but are not limited to, mooring systems, anchors, grid-interconnection hardware, wave measurement technologies, and environmental monitoring technologies;
 5. Advance WEC installation, operations, and maintenance strategies;
 6. Identify future R&D needed to advance WEC technologies towards commercial viability; and
 7. Develop WEC system designs that advance that state-of-the-art.

The R&D performed under this FOA will be the first round of device testing performed at the PacWave facility. In addition to the advancements in R&D, these projects will help the wave energy industry, and the PacWave team, gain open water testing experience needed to accelerate the pace of technology development and de-risk future PacWave testing campaigns and commercial WEC deployments. Accordingly, marine energy technical data gathered by applicants that pertains to the PacWave test site and its environmental characteristics must be made immediately available to the community through one of the knowledge hubs identified in [Appendix F](#). This data will include, but is not limited to, wave, wind, and ocean current resource measurements, geotechnical measurements, and environmental monitoring measurements that will help improve WEC system designs for PacWave and reduce the costs of future deployments. Other data gathered under this FOA must be released consistent with the objectives of this FOA and as negotiated in the Statement of Project Objectives (SOPO).

Applicants are encouraged to collaborate with Universities and other educational institutions to help develop a robust pipeline of well-trained students as future marine energy experts in the United States.

iii. Diversity, Equity, and Inclusion

It is the policy of the Biden Administration that:

[T]he Federal Government should pursue a comprehensive approach to advancing equity⁵ for all, including people of color and others who have been

⁵ The term “equity” means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality.

historically underserved, marginalized, and adversely affected by persistent poverty and inequality. Affirmatively advancing equity, civil rights, racial justice, and equal opportunity is the responsibility of the whole of our Government. Because advancing equity requires a systematic approach to embedding fairness in decision-making processes, executive departments and agencies (agencies) must recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity.

By advancing equity across the Federal Government, we can create opportunities for the improvement of communities that have been historically underserved, which benefits everyone.⁶

As part of this whole of government approach, this FOA seeks to encourage the participation of underserved communities⁷ and underrepresented groups. Applicants are highly encouraged to include individuals from groups historically underrepresented^{8,9} in STEM on their project teams. As part of the application, applicants are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to

⁶ Executive Order 13985, “Advancing Racial Equity and Support for Underserved Communities Through the Federal Government” (Jan. 20, 2021).

⁷ The term “underserved communities” refers to populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life, as exemplified by the list of in the definition of “equity.” E.O. 13985. For purposes of this FOA, as applicable to geographic communities, applicants can refer to economically distressed communities identified by the Internal Revenue Service as Qualified Opportunity Zones; communities identified as disadvantaged or underserved communities by their respective States; communities identified on the Index of Deep Disadvantage referenced at <https://news.umich.edu/new-index-ranks-americas-100-most-disadvantaged-communities/>, and communities that otherwise meet the definition of “underserved communities” stated above.

⁸ According to the National Science Foundation’s 2019 report titled, “Women, Minorities and Persons with Disabilities in Science and Engineering”, women, persons with disabilities, and underrepresented minority groups—blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives—are vastly underrepresented in the STEM (science, technology, engineering and math) fields that drive the energy sector. That is, their representation in STEM education and STEM employment is smaller than their representation in the U.S. population. <https://nces.nsf.gov/pubs/nsf19304/digest/about-this-report> For example, in the U.S., Hispanics, African Americans and American Indians or Alaska Natives make up 24 percent of the overall workforce, yet only account for 9 percent of the country’s science and engineering workforce. DOE seeks to inspire underrepresented Americans to pursue careers in energy and support their advancement into leadership positions. <https://www.energy.gov/articles/introducing-minorities-energy-initiative>

⁹ See also. Note that Congress recognized in section 305 of the American Innovation and Competitiveness Act of 2017, Public Law 114-329:

(1) [I]t is critical to our Nation’s economic leadership and global competitiveness that the United States educate, train, and retain more scientists, engineers, and computer scientists; (2) there is currently a disconnect between the availability of and growing demand for STEM-skilled workers; (3) historically, underrepresented populations are the largest untapped STEM talent pools in the United States; and (4) given the shifting demographic landscape, the United States should encourage full participation of individuals from underrepresented populations in STEM fields.

submit a Diversity, Equity, and Inclusion Plan that describes the actions the applicant will take to foster a welcoming and inclusive environment, support people from underrepresented groups in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project; and the extent the project activities will be located in or benefit underserved communities. (See Section IV.D.xv.). The plan should include SMART (Specific, Measurable, Assignable, Realistic and Time-Related) milestones supported by metrics to measure the success of the proposed actions. This plan will be evaluated as part of the technical review process.

Further, Minority Serving Institutions¹⁰, Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, or entities located in a underserved community that meet the eligibility requirements (See Section III) are encouraged to apply as the prime applicant or participate on an application as a proposed partner to the prime applicant. The Selection Official may consider the inclusion of these types of entities as part of the selection decision (See Section V.B.i.).

B. Topic Areas

This FOA will support PacWave testing projects across the three Topic Areas identified in [Table 1](#).

Table 1. FOA Topic Area Summary

Topic Area Number and Title	Number of Awards	WEC Annual Average Power Output at PacWave Range	Award Size Range (Fed Share)	TA total	Anticipated Period of Performance	Cost Share Requirement
1. Testing WEC Technologies at PacWave <ul style="list-style-type: none"> 1a: Testing WEC Technologies for Remote and Microgrid Commercial Applications 	Up to 3	100 W-15+ kW	\$250 K-\$9M	Up to \$15 M	Up to 48 Months	10%
<ul style="list-style-type: none"> 1b: Testing WEC Technologies for Open-Source R&D Applications 	Up to 1					
2: Advancing WEC Designs for PacWave	Up to 3	100 W+	\$1 M-1.8 M	Up to \$5 M	Up to 24 Months	10%

¹⁰ Minority Serving Institutions (MSIs), including Historically Black Colleges and Universities/Other Minority Institutions) as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See <https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>.

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3: Open Topic: Wave Energy R&D at PacWave	Up to 6	N/A	\$250 K - \$5 M	Up to \$7 M	Up to 48 Months	10%
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For Technical Information on PacWave facility relevant to all Topic Areas in this FOA, ([see Section I.B.1](#)).

Topic Area 1. Testing WEC Technologies at PacWave

Up to \$15M in Federal funds – \$250 K-\$9 M in DOE funds per award – 10% Cost Share requirement – Up to 4 awards – Award duration up to 48 months – Two budget periods

TA 1 Overview

This topic area is broken into two sub-topics, TA1a and TA1b. TA1a projects must advance WEC technologies intended for remote and microgrid commercial applications. TA1b projects must test an open-source WEC system and generate publicly available data and knowledge that will advance the entire WEC industry. At a minimum, all TA1 projects should be comprised of the following activities:

- Deploy and test a WEC system capable of achieving an annual average power output greater than 100 W in the PacWave wave resource. Applicants can propose to test a system that has been previously fabricated or applicants can propose to fabricate and test the WEC system as part of the work scope of this FOA. Devices tested under this award **are not required** to produce electricity, and may capture wave energy and convert it to any relevant form (e.g. pneumatic, mechanical, or electrical).
- Ensure the WEC and ancillary systems are designed and fabricated to meet International Electrotechnical Commission (IEC) and the Institute of Electrical and Electronics Engineers (IEEE) standards as described in [Appendix H](#).
- Deploy the WEC in 2023/2024 and test the WEC for a duration of **between at least** 6-24 months.
- Perform a comprehensive set of measurements to quantify system performance and loads. (See "[TA1 Required Measurement and Data Reporting](#)" and [Appendix I](#) for details.)

Connecting the WEC to the electrical grid is **optional** for TA1 projects.

Specific requirements for TA1a and TA1b applications are:

TA1a: Testing WEC Technologies for Remote and Microgrid Commercial Applications:

Examples of end uses for remote and microgrid WEC technologies include providing power for isolated and island communities, disaster recovery, and other blue economy applications. Applicants that propose to test WECs for this remote or microgrid application topic area should present a clear commercialization plan that identifies and

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quantifies end user needs, intended end uses for the WEC technology, and why testing as part of a TA1a project is a critical step on the technology development and commercialization pathway. Applicants must propose to test a WEC system that is pre-permitted for PacWave, as described in the “[PacWave Information and PacWave Support](#)” section.

TA1b: Testing WEC Technologies for Open-Source R&D Applications: These projects must provide publicly available WEC test data that will benefit the entire WEC R&D community. Projects must make all relevant marine energy technical project data publicly available and the WEC design and device properties must be made open-source as a project deliverable. Applicants are encouraged to propose projects that generate high quality data for numerical model validation, quantify system power performance, quantify operational loads, quantify extreme loads, and measure other relevant data that will advance the state of WEC technologies. Modular open-source systems that can be easily modified or used to test various WEC components or control strategies as part of future testing campaigns are encouraged. Applicants are also encouraged to consider making existing proprietary devices open-source so that they can be used for open-source testing under TA1b. A commercialization plan is not required for open-source TA1b projects. Instead, applicants must submit a stakeholder engagement plan that describes what marine energy technical data and device information they plan to make publicly available and open-source, how they will engage with the industry and R&D community to ensure the work performed provides maximum benefit. Levelized Cost of Energy (LCOE) calculations are not required for open-source TA1b projects.

TA1 Requirements for Eligibility

- Applicants must have an existing WEC system design or an existing WEC (i.e., already fabricated) that has achieved a TRL 4 or greater for TA1a and a TRL of 3 or greater for TA1b, as defined in [Appendix E](#).
- Applicants must propose to test a WEC at PacWave that achieves an annual average power output greater than 100 W.
- Applicants must propose to test a WEC design that is pre-permitted for PacWave, as described in the “[PacWave Information and PacWave Support](#)” section.

TA1 Budget, Scope, and Schedule

The suggested level of federal funding that applicants should request for TA1 projects is dependent on the size of the device that will be deployed, as described in Table 2. Note that Table 2 only **suggests** maximum federal funding levels and does not place strict limits on the amount of federal funding that applicants can request, regardless of device size. In all cases, applicants should request appropriate levels of federal funds to complete their proposed

project within the overall funding constraints of TA1 ([see Table 1](#)) and **must justify project costs** in their application and budget justification submissions.

Table 2. Suggested TA1 budget based on device size.

Annual average power produced at PacWave	Recommended maximum federal budget
100 W – 2 kW	Up to \$4 M
2 kW – 5 kW	Up to \$5.75 M
5 kW – 10 kW	Up to \$7.5 M
10+ kW	Up to \$9 M

The required scope and deliverables for TA1 projects are identified in [Table 3](#). **Note that no procurement, fabrication, or deployment activities may take place during BP 1.**

Table 3. TA1 (both TA1a and TA1b) Scope, deliverables, schedule

Description Duration Budget	Minimum Required Scope	Minimum Required Deliverables
BP1: Project Planning Up to 6 months Up to 15% of total project budget	<ul style="list-style-type: none"> • Develop project plans and budgets for: <ul style="list-style-type: none"> ○ Project management; ○ Meeting insurance requirements; ○ WEC system modification or fabrication, as applicable; ○ Risk management following the National Renewable Energy Laboratory (NREL) risk management framework¹¹ or another equivalent risk management method ○ WEC instrumentation, in accordance with the requirements identified in sections “TA1 Technical Specifications, Standards, and Certification”, and “TA1 LCOE Calculations and Performance Metrics”; ○ Implementation of IEC TC 114 and IEEE standards identified in Appendix H, with a commitment to share relevant feedback with TC 114; ○ Marine energy data management, reporting, and archiving; ○ Testing activities, including: <ul style="list-style-type: none"> ▪ Installation, operation, maintenance, and decommissioning (IOM&D). Including identification of supporting contractors for vessels and needed dockside and office facilities; 	<ul style="list-style-type: none"> • A comprehensive report that details the work performed in BP1 • Project plans identified in the BP1 “Minimum Required Scope” section of this table • A short report describing non-commercially sensitive marine energy technical data that will be made immediately publicly available • Project technical data, relevant public reports, and academic publications uploaded to the appropriate marine energy data repository (see Appendix F) as it becomes available, as negotiated with and agreed to by DOE • Report describing LCOE and system performance metrics for the WEC system. The report must include a description of how these predictions will be verified during BP2 (TA1a only). • Plan proposing path forward for accredited measurements and WEC design/system certification

¹¹ <https://www.nrel.gov/docs/fy15osti/63258.pdf>

	<ul style="list-style-type: none"> ▪ Performance metrics, mechanical, and electrical loads that will be measured; ▪ Coordination with PacWave team to perform and/or support environmental monitoring measurements required by the PacWave Federal Energy Regulatory Commission (FERC) license. • Enter into necessary contractual agreements with the PacWave facility; • Perform any necessary simulations, calculations, or design activities to inform other BP1 tasks (as stated above, no procurement, fabrication, or deployment activities may take place during BP1); • Estimate LCOE using NREL System Advisory Model (SAM) tool and system performance metrics for the WEC system, as described in the “TA1 LCOE Calculations and Performance Metrics” section (TA1a only); • Identification of non-commercially sensitive marine energy technical data that will be made immediately open-source and publicly available. See section “TA1 Required Measurement and Data Reporting” for more details; • Develop a preliminary commercialization plan, including the cost of competing technologies currently serving the target applications (TA1a only); • A stakeholder engagement strategy (TA1b only); • Hold monthly meetings with DOE to provide project updates; • Identify accredited measurements that will be made (if applicable) and plan for advancing the system design towards certification; WEC design/system certification plan can include one or multiple designs/systems (example: mooring, mechanical, structural, Power Take-Off (PTO)). 	
<p>Go/No-Go Decision</p> <p>Up to 3 months</p> <p>No budget</p>	<p>Participate in go/no-go meeting. Go/no-go decision criteria will include but not be limited to:</p> <ul style="list-style-type: none"> • Satisfactory completion of BP1 work scope and deliverables; • Likelihood that the project can be completed on schedule and within budget in BP2; • Demonstration of financial viability and connection to stakeholder needs. 	<ul style="list-style-type: none"> • Presentation to DOE summarizing work performed during BP1 accompanied by a Continuation Report that includes all information listed under BP1 Minimum Required Deliverables section of this table.

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<p>BP2: Design, fabrication, deployment, testing, and decommissioning</p> <p>Up to 39 months</p> <p>Up to 85% of total project budget</p>	<ul style="list-style-type: none"> • Perform any necessary simulations, calculations, or design activities; • Perform any laboratory testing needed to de-risk the project; • Fabricate, assemble, and deploy the WEC system at PacWave; • Execute the project plans developed during BP1; • Work with the PacWave team to perform and/or support environmental monitoring measurements required by the PacWave FERC license; • Quantify LCOE and performance metrics for the WEC system through open water testing, as described in the “TA1 LCOE Calculations and Performance Metrics” section (TA1a only); • Compare the measured LCOE and performance metrics to the BP1 predictions (TA1a only); • After testing is complete, remove the WEC system and all supporting infrastructure (e.g., anchors and moorings) from the PacWave site and decommission the system; • Identification of future R&D activities needed to advance technology towards commercial viability (TA1a only); • Develop a commercialization plan (TA1a only) or a stakeholder engagement strategy (TA1b only); • Update project plans, as needed, and hold quarterly meetings with DOE to provide project updates; • Make accredited measurements (if applicable) and finalize plans for advancing the system design towards certification. WEC design/system certification plan can include one or multiple designs/systems (example: mooring, mechanical, structural, Power Take-Off (PTO)). 	<ul style="list-style-type: none"> • A comprehensive report that details the work performed in BP2 • A test report that details all installation, operation, maintenance, and decommissioning (IOM&D) activities at PacWave and all measurements made during testing • Project technical data, relevant public reports and academic publications uploaded to the appropriate marine energy data repository (see Appendix F) as it becomes available, as negotiated with and agreed to by DOE • A report summarizing non-commercially sensitive data gathered and data made immediately publicly available via the appropriate marine energy data repository (see Appendix F) as it becomes available, as negotiated with and agreed to by DOE • A report summarizing LCOE and performance metrics and how BP1 predicted and BP2 measured values compare (TA1a only) • A report identifying lessons learned and future R&D needs • A commercialization plan (TA1a only) or a stakeholder engagement strategy (TA1b only) • Lessons learned on making accredited measurements and WEC design/system certification
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TA1 Technical Specifications, Standards, and Certification

Projects must consider relevant International Electrotechnical Commission (IEC) Technical Committee 114 - Marine energy - Wave, tidal and other water current converters technical specifications and Institute of Electrical and Electronics Engineers (IEEE) standards in the design, testing, and validation of the WEC system. Details on relevant IEC and IEEE standards are provided in [Appendix H](#). Applicants will be required to demonstrate that their WEC design adheres to the following technical specifications and standards, as applicable to their project:

- IEC TS 62600-2 – Design Requirements
- IEC TS 62600-10 – Moorings
- IEEE 1547 – Grid Interconnection

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During testing, applicants should follow the technical specifications listed below, as applicable to their project:

- IEC TS 6200-3 – Loads Measurements
- IEC TS 6200-30 – Electrical Power Quality
- IEC TS 6200-40 – Acoustic Measurements
- IEC TS 6200-100 – Wave Energy Converter Performance
- IEC TS 6200-103 – Wave Energy Converter Scale Testing

Applicants are strongly encouraged to work with NREL to make accredited measurements during testing in accordance with IEC and IEEE standards, as discussed in the “[National Laboratory and Oregon State University Support](#)” section. Applicants are also encouraged to work with third-party certification company towards certification of the WEC system, if applicable to the proposed WEC technology. DOE views making accredited measurements and making progress towards system certification as essential steps to developing a mature WEC industry that can attract private funding. Accordingly, applicants are encouraged to include plans for making accredited measurements and making progress towards certification in their application.

Given the nascent nature of the IEC WEC technical specifications, WPTO anticipates that in some cases the standards may need to be modified or augmented to be correctly applied for TA1 testing activities. In this case, the applicant must provide feedback to IEC TC 114 and is encouraged to suggest how the standards could be improved in the future.

TA1 LCOE Calculations and Performance Metrics

LCOE calculations must be performed using the NREL System Advisory Model (SAM) (<https://sam.nrel.gov/>). Applicants must calculate LCOE using the PacWave resource and a resource that is representative of an early commercial deployment location. Projects must estimate LCOE and performance metrics in BP1 and verify the predictions through open water testing in BP2, as described in [Table 3](#). In the case where LCOE is not a relevant metric for a TA 1 WEC device (e.g., a wave powered desalination system where cost of water is the relevant metric), applicants must propose the correct metric for their system and how it will be predicted in BP1 and validated through open water testing in BP2. Note that open-source projects do not need to report LCOE.

In addition to LCOE, applicants must identify key WEC system performance metrics that will be validated during PacWave testing. Examples include peak-to-average mechanical power and capture width ratio, as defined in [Appendix G](#). Applicants must clearly describe the performance metrics for their system and why the metric is relevant and important.

TA1 Required Measurement and Data Reporting

A central part of TA1 projects is ensuring the WEC system performance is comprehensively characterized during open water testing. Accordingly, measurements needed to quantify the quantities identified in the “[TA1 LCOE Calculations and Performance Metrics](#)” section must be made during testing. Applicants should make the measurements necessary to comply with the IEC and IEEE standards and technical specifications identified in the “[TA1 Technical Specifications, Standards, and Certification](#)” section must be made during open-water testing. Further, applicants will be required to make all necessary measurements to quantify device performance and to validate design methods and numerical models that were used to design the WEC system. These measurements will include, but are not limited to, measurements of device motions, mechanical loads, electrical loads, mooring and anchoring loads, environmental measurements, system reliability, loads during installation, loads during operational sea states, and loads during extreme sea states. [Appendix I](#) presents an extensive list of data that TA1 projects should consider measuring. In their FOA application, applicants should present a detailed description of the measurement that will be made during the course of the project. At the completion of the project, these data must be submitted to the appropriate Marine Energy Data Repository ([See Appendix F](#)) as agreed to by the applicant during the DOE award negotiations. Note that marine energy technical data should not be confused with the Data Management Plan required in Section IV.D.xiv.

Applicants are encouraged to work with NREL to leverage the Modular Ocean Data Acquisition (MODAQ) instrumentation system¹² and work with NREL and Sandia National Laboratory (SNL) teams on data processing, quality assurance, quality control, and archiving, as described in the “[National Laboratory and Oregon State University Support](#)” section.

Marine energy technical data gathered by TA1 applicants that pertains to the PacWave test site and its environmental characteristics must be made immediately open-source, as described in the [Technology Space and Strategic Goals](#) section.

Topic Area 2. Advancing WEC Designs for PacWave

Up to \$5 M in Federal funds – \$1 - \$1.8 M in DOE funds per award – 10% cost share requirement – Up to 3 awards – Award duration up to 24 months – One budget period

TA2 Overview

Projects funded under TA2 must develop WEC system designs that, by the end of the award period, are ready for fabrication, deployment, and prototype testing at PacWave. The designs must incorporate the International Electrotechnical Commission (IEC) Technical Specifications (TS) and the Institute of Electrical and Electronics Engineers (IEEE) standards to ensure that

¹² <https://www.nrel.gov/water/open-water-testing.html> <https://www.nrel.gov/water/open-water-testing.html>

designs are final and fully ready to utilize for future shipyard fabrication and open-water testing via future funding opportunities (See [TA2 Technical Specifications, Standards, and Certification section](#) and [Appendix H](#)). Projects must include engineering design and analysis, numerical modeling, and any tank and laboratory testing that is needed to complete the scope and deliverables. To provide a high level of confidence that designs will perform as expected at PacWave-South test site, awardees must either (1) demonstrate that the design tools and methodologies being used have been previously verified and validated or (2) perform tank or laboratory testing to verify and validate the design tools and methodologies being used. At a minimum, TA2 projects should be comprised of the following activities:

- Design a WEC capable of two years of continuous testing and operations at PacWave-South test.
- Design the WEC and ancillary systems in accordance with the IEC and IEEE standards as described in [Appendix H](#).
- Develop robust manufacturing, deployment, testing, and decommissioning plans for a future PacWave test. The plans must clearly describe how PacWave testing will advance the proposed WEC system towards commercialization.
- Design a system that has an annual average power rating greater 100 W when deployed in the PacWave resource.

TA2 projects that develop WEC designs for grid-connected and/or non-grid-connected applications are **both encouraged**. TA2 is seeking applications for WEC systems that are designed for remote, microgrid, and/or utility-scale applications. Accordingly, TA2 is soliciting device designs across a range of system scales, from small devices that produce as little as 100 W of annual average power in the PacWave resource, to large kW-scale systems that would be appropriate for early adopter utility-scale markets. TA2 designs can be developed to produce electricity, another relevant form of energy, or a useful product (e.g., desalinated water).

TA2 Requirements for Eligibility

- Applicants must propose to develop a WEC system design that is capable of two years of continuous testing and operations at PacWave.
- The system design must be capable of generating an annual average power output greater than 100 W in the PacWave resource.
- Applicants must propose to develop a WEC that is pre-permitted for PacWave, as described in the "[PacWave Information and PacWave Support](#)" section.

TA2 Budget, Scope, and Schedule

The suggested level of federal funding that applicants should request for TA2 projects is dependent on the size of the device that will be designed, as described in [Table 4](#). Note that [Table 4](#) only **suggests** federal funding levels and does not place strict limits on the amount of federal funding that applicants can request, regardless of device size. In all cases, applicants

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should request appropriate levels of federal funds to complete their proposed project within the overall funding constraints of TA2 ([see Table 1](#)) and **must justify project costs** in their application and budget justification submissions.

Table 4. Suggested TA2 budget based on device size.

Annual average power produced at PacWave	Recommended maximum federal budget
100 W – 1.5 kW	Up to \$1 M
2 kW – 5 kW	Up to \$1.4 M
5+ kW	Up to \$1.8 M

Successful completion of TA2 work scope and deliverables will be verified during a preliminary design review performed during month 6 of the project and a final design review performed during month 18. WPTO, along with the National Laboratories will work with awardees to perform these design reviews.

The required scope and deliverables for TA2 projects are identified in [Table 5](#).

Table 5. TA2 Scope, deliverables, schedule

Description Duration Budget	Minimum Required Scope	Minimum Required Deliverables
Month 1-6	<ul style="list-style-type: none"> Develop the preliminary WEC design; Perform preliminary calculations and simulations to estimate device performance and loads; Demonstrate that design tools and methodologies that are being used are validated or develop a plan for how to validate the design tools and methodologies during the remainder of the period-of-performance; Develop plans to incorporate IEC and IEEE standards identified in Appendix H into the device design; Develop a preliminary commercialization plan that identifies the intended market and describes how the project is moving the technology towards commercial viability; Quantify LCOE and performance metrics for the WEC system, as described in the “TA2 LCOE Calculations and Performance Metrics” section; Submit a preliminary design report summarizing the work performed; Participate in preliminary design review performed by DOE, NREL, PNNL, and SNL; 	<p>A preliminary design report that includes preliminary:</p> <ul style="list-style-type: none"> CAD Design drawings; Power performance estimates and load estimates for the intended commercial deployment resource and the PacWave resource; Design weight estimates; LCOE estimate following the guidance contained in Appendix G; Installation, operation, maintenance, and Decommissioning (IOM&D) concept; Unresolved open design issues and resolution plans with cost estimates; Complete development of the risk management plan and risk register following the “Marine and Hydrokinetic Technology Development Risk” risk register template - https://www.nrel.gov/docs/fy15osti/63258.pdf. The risk management plan and risk register must consider risks that could be encountered during a potential device manufacturing, deployment, and testing project;

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	<ul style="list-style-type: none"> • Develop a plan and identify WEC design/system for potential third party certification <ul style="list-style-type: none"> ○ WEC design/system certification plan can include one or multiple designs/systems (example: mooring, mechanical, structural, PTO) 	<ul style="list-style-type: none"> • Preliminary estimates for the identified performance metrics; • Plan for how to design for IEC and IEEE standards as defined in Appendix H; • Demonstration that design calculations have been validated by laboratory testing or plans and budget for any remaining laboratory testing needed during the duration of the project. <p>A preliminary commercialization plan that provides the following information:</p> <ul style="list-style-type: none"> • The intended market for the WEC device; • The anticipated size of the target market; • How the device will be deployed commercially (e.g., individually or in arrays); • How this project will advance the technology towards commercial viability; • The device target dimensions, power rating, and other relevant characteristics of the device for commercialization (note any differences with the design being developed as part of this award); • Plan proposing WEC design/system third-party certification. <p>Project technical data, relevant public reports, and academic publications uploaded to the appropriate marine energy data repository (see Appendix F) as it becomes available, as negotiated with and agreed to by DOE.</p>
<p>Month 7- project completion. Maximum project duration is 24 months.</p>	<ul style="list-style-type: none"> • Develop the final WEC design; • Perform calculations and simulations to determine device performance and loads; • Complete final estimates for the project metrics identified in the “TA2 LCOE Calculations and Performance Metrics” section; • Develop a final commercialization plan; • Complete any necessary tank testing or component testing and use the data to validate the design tools and methodologies that were used to design the WEC system, as appropriate; • Incorporate IEC and IEEE standards identified in Appendix H into the device design; • Develop manufacturing plan and estimate system fabrication, deployment, operations, maintenance, and decommissioning costs for a 2-year deployment at PacWave; 	<p>A final design report that includes final:</p> <ul style="list-style-type: none"> • CAD Design drawings; • Power performance estimates and load estimates for the device in the intended commercial deployment resource and at in the PacWave resource; • Design loads calculations; • Design weight calculation; • Fabrication costs estimate; • Installation, Operation, Maintenance, and Decommissioning (IOM&D) plan and cost estimate; • Complete development of the risk management plan and risk register following the “Marine and Hydrokinetic Technology Development Risk” risk register template - https://www.nrel.gov/docs/fy15osti/63258.pdf. The risk management plan and risk

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	<ul style="list-style-type: none"> • Work with a third-party engineering firm to perform a manufacturing feasibility study prior to the final design review; • Participate in the final design review meeting and give presentation to DOE, NREL, PNNL, and SNL on the project and device design status; • Work with third-party certification company towards WEC design/system certification. 	<ul style="list-style-type: none"> • register must consider risks that could be encountered during a potential device manufacturing, deployment, and testing project; • Final calculations of the metrics as discussed in the “TA2 LCOE Calculations and Performance Metrics” section; • Unresolved open design issues and resolution plans; • Design, fabrication, and operation plans to ensure that device can operate at PacWave for a duration of at least 2 years; • Demonstration of conformity to IEC and IEEE standards as defined in Appendix H; • Lessons learned from IEC and IEEE technical specification and standards implementation; • Report on tank and/or laboratory testing. <p>A final commercialization plan that provides the following information:</p> <ul style="list-style-type: none"> • The intended market for the WEC device; • The anticipated size of the target market; • How the device will be deployed commercially (e.g., individually or in arrays); • How this project will advance the technology towards commercial viability; • The device target dimensions, power rating, and other relevant characteristics of the device for commercialization (note any differences with the design being developed as part of this award); • WEC design/system certification lessons learned. <p>Project technical data, relevant public reports, and academic publications uploaded to the appropriate marine energy data repository (see Appendix F) as it becomes available, as negotiated with and agreed to by DOE</p>
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TA2 Technical Specifications, Standards, and Certification

Projects must consider relevant IEC and IEEE standards in the design of the WEC system, along with manufacturing, installation, and testing plans. Details on relevant IEC and IEEE standards are provided in [Appendix H](#). Applicants will be required to demonstrate that their WEC design adheres to the following technical specifications and standards, as applicable to their project:

- IEC TS 62600-2 – Design Requirements
- IEC TS 62600-10 – Moorings

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- IEEE 1547 – Grid Interconnection

Applicants should also follow the technical specifications listed below, as applicable to their project:

- IEC TS 6200-3 – Loads Measurements
- IEC TS 6200-30 – Electrical Power Quality
- IEC TS 6200-40 – Acoustic Measurements
- IEC TS 6200-100 – Wave Energy Converter Performance
- IEC TS 6200-103 – Wave Energy Converter Scale Testing

Given the nascent nature of the IEC WEC technical specifications, WPTO anticipates that in some cases the standards may need to be modified or augmented to be correctly applied for TA2 projects. In this case, the applicant must provide feedback to IEC TC 114 and is encouraged to suggest how the standards could be improved in the future.

Applicants are strongly encouraged to work with NREL to plan for making accredited measurements in accordance with IEC and IEEE standards, as discussed in the “[National Laboratory and Oregon State University Support](#)” section. Applicants are also encouraged to work with third-party certification company to develop plans for how to certify the WEC system, if applicable to the proposed WEC technology. DOE views making accredited measurements and making progress towards system certification as essential steps to developing a mature WEC industry that can attract private funding. Accordingly, applicants are encouraged to include plans for making accredited measurements and making progress towards certification in their application.

TA2 LCOE Calculations and Performance Metrics

LCOE calculations must be performed using the NREL System Advisory Model (SAM) (<https://sam.nrel.gov/>). Applicants must calculate LCOE using the PacWave resource and a resource that is representative of an early commercial deployment location. In the case where LCOE is not a relevant metric for a TA2 WEC design (e.g., a wave powered desalination system where cost of water is the relevant metric), applicants must propose the correct metric for their system and describe how it will be calculated.

In addition to LCOE, applicants must identify key WEC system performance metrics that will be targeted during the design process. Examples include peak-to-average mechanical power and capture width ratio, as defined in [Appendix G](#). Applicants must clearly describe the performance metrics for their system and why the metric is relevant and important.

TA2 Required Data Reporting

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subject line.*

A central part of TA2 projects is ensuring the WEC system being designed has a credible path to achieving commercial viability. Accordingly, calculations needed to determine the quantities identified in the “[TA2 LCOE Calculations and Performance Metrics](#)” section must be performed during the design process. Further, applicants must strive to verify and validate the design methods and numerical models that are used to design the WEC system, if possible. In their FOA application, applicants should present a detailed description of the design methods and calculations that are anticipated to be used over the course of the project. At the completion of the project, data gathered must be submitted to the appropriate Marine Energy Data Repository ([See Appendix F](#)) as agreed to by the applicant during the DOE award negotiations. Note that marine energy technical data should not be confused with the Data Management Plan required in Section IV.D.xiv.

Applicants are encouraged to work with NREL to incorporate plans for using the Modular Ocean Data Acquisition (MODAQ) instrumentation system¹³ in their design. Applicants are also encouraged to work with NREL and SNL teams on data processing, quality assurance, quality control, and archiving, as described in the “[National Laboratory and Oregon State University Support](#)” section.

TA2 Design Reviews

Successful completion of TA2 work scope and deliverables will be verified during a preliminary design review performed during month 6 of the project and a final design review performed at the completion of the project. WPTO, NREL, PNNL, and SNL will work with awardees to perform these design reviews.

Topic Area 3. Wave Energy R&D at PacWave

Up to \$7M in Federal funds – \$250k - \$5M in DOE funds per award – 10% Cost Share requirement – Up to 6 awards – Award duration up to 48 month – Two budget periods

TA 3 Overview

PacWave has been designed to advance WEC technologies through open water testing. Beyond deploying and testing WEC systems, there are numerous opportunities to leverage the PacWave facility to support R&D on system components and other supporting technologies that will advance the industry as a whole. This topic area seeks applications that directly leverage the PacWave test facility to perform impactful research. This topic area will support projects that advance WEC systems, components, and/or supporting technologies.

Applicants are encouraged to submit any applications that have the potential to advance the WEC industry and topics of interest include but are not limited to:

¹³ <https://www.nrel.gov/water/open-water-testing.html>

- WEC component testing in an open ocean environment. For example, projects could investigate:
 - Materials and coatings
 - Moorings, anchoring systems, and grid connection components
 - Power take off system performance
- Environmental monitoring technologies
- Instrumentation and prognostic health monitoring systems
- Wave measurement systems
- WEC-powered microgrid testing

The WPTO particularly encourages submissions that augment the WPTO's existing portfolio¹⁴ and that will benefit multiple Marine Energy device types. Further, WPTO expects that marine energy industry stakeholders have unanticipated ideas for impactful research that directly utilizes the PacWave facility and provide a broader benefit to the R&D community and industry. Accordingly, applications for R&D projects that fall outside the scope of the suggested topics identified in the above list are encouraged. Regardless of the proposed project, the applicant is responsible for identifying and describing the impact and benefit of the proposed project.

TA3 Schedule, Scope, and Budget

It is imperative that the level of funding for a proposed scope of work is thoroughly justified in the application. The specific tasks, schedule, and budget should be proposed and justified by the applicant.

Specific tasks and deliverables requirements will be negotiated with selected applicants. As applicable, DOE anticipates deliverables to include, though not be limited to, the following:

- Project management plan
- Risk management following the NREL risk management framework¹⁵ or another equivalent risk management method
- Final report for immediate public release describing project progress, system/component performance, lessons learned from open water deployment, opportunities identified for further improvement, and next steps in technology development and commercialization
- Project technical data as it becomes available after the 5-year moratorium and relevant public reports and academic publications uploaded to appropriate marine energy data repository (see [Appendix F](#)), as negotiated with and agreed to by DOE

¹⁴ I.e., ideas that didn't fit, and/or have not been submitted to prior Small Business Innovation Research (SBIRs) solicitations and FOAs see former funding announcements list on [water.energy.gov](http://energy.gov/eere/water/water-power-closed-funding-opportunities) site at <http://energy.gov/eere/water/water-power-closed-funding-opportunities>)

¹⁵ <https://www.nrel.gov/docs/fy18osti/68363.pdf>

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- A report summarizing non-commercially sensitive data gathered and data made immediately publicly available via the appropriate marine energy data repository (see [Appendix F](#)) as it becomes available, as negotiated with, and agreed to by DOE. This may include:
 - Non-commercially sensitive information that could be helpful to the marine energy industry, such as use of specific materials such as steel
 - Ocean measurements that are made as part of the project
 - Environmental monitoring data and permitting lessons learned

TA3 Requirements for Eligibility

- Applications proposing open-water testing activities must provide evidence that the device, or apparatus can be tested safely in the PacWave environment, and provide evidence of previous prototype testing and performance in a less energetic environment.
- The technology being tested under this TA must have a TRL greater than 3, as defined in [Appendix E](#).
- Applicants must propose to test a technology that is pre-permitted for PacWave, as described in the “[PacWave Information and PacWave Support](#)” section.

TA3 Data Reporting and Performance Metrics

A central part of TA3 projects is advancing technologies that advance WECs and the WEC industry at large. To this end, applicants must identify key project performance metrics that will be validated or improved over the course of the project. Applicants must clearly describe the performance metrics for their project and why the metric is relevant and important. Note that marine energy technical data should not be confused with the Data Management Plan required in Section IV.D.xiv.

Data gathered by TA3 applicants that pertains to the PacWave South test site and its environmental characteristics must be made immediately open-source, as described in the [Technology Space and Strategic Goals](#) section.

[Appendix I](#) presents an extensive list of data that TA3 projects should consider measuring.

B.1. Technical Information Relevant to All Topic Areas in this FOA

i. PacWave Information and PacWave Support

Projects funded under this TA1 and TA3 will be required to perform testing activities at the PacWave South test site. Projects that propose testing activities at the PacWave North test site **will not** be considered for an award under this FOA.

PacWave South is a state-of-the-art, pre-permitted, grid-connected wave energy test facility that is a partnership between Oregon State University, the US Department of Energy, the State of Oregon, and local stakeholders. The site will consist of four ocean berths, each of which will have a dedicated, 5MW-capable power and data transmission cable connection to an onshore grid-connection station. The facility is currently under development and is scheduled to be commissioned during the Summer of 2023. Detailed information about the PacWave facility is provided on the PacWave website and in the PacWave Client Handbook¹⁶. Accordingly, this FOA only provides a high-level description of the PacWave test facility.

The PacWave site is currently pre-permitted to test point absorbers, attenuators, and oscillating water column WECs, as well as any hybrid WEC systems that are comprised of the aforementioned three types of WECs. In addition, PacWave is pre-permitted for anchor and mooring systems needed to secure WECs at the test berths and for supporting buoys and instrumentation that are needed to support WEC deployment and testing. Applicants to this FOA must submit applications to test WEC systems, components, and supporting instrumentation that qualify for pre-permitting, as described above and in the PacWave Client Handbook.

The details of the support that PacWave staff will provide to its clients are defined in the PacWave Client Handbook. In summary, PacWave staff will be able to provide the following:

- Access to PacWave existing test infrastructure
- Manage the grid connection agreement with the Central Lincoln People's Utility District (CLPUD).
- Environmental monitoring measurements during deployments that are required by existing state and federal permits.
- Limited logistical support (e.g., identifying marine industry and supply chain contractors, identifying office space and warehouse space).

Applicants of this FOA will be responsible for all other activities necessary to support their proposed scope, including but not limited to, providing the WEC or other technology, drymate connector hardware to connect to the cable system (if applicable), anchors and mooring systems, IOM&D, and electrical connections. Further details on PacWave and client responsibilities are provided in the PacWave Client Handbook.

After selection, all applicants will be required to collaborate with the PacWave team to plan and execute testing projects. Specifically, applicants to this FOA will be required to satisfy the following requirements:

¹⁶ <http://pacwaveenergy.org/for-clients/>

- Enter into a contract with PacWave that formalizes the relationship between PacWave and the applicant and sets expectations and responsibilities for all project activities.
- Comply with all requirements identified in the PacWave Client Handbook.
- Collaborate with the PacWave team to make any environmental monitoring measurements that are required under PacWave's state and federal permits.
- Collaborate with the PacWave team to develop IOM&D experience that will de-risk future WEC deployments at PacWave.
- Work with PacWave to prepare a Biological Assessment for the project that considers Endangered Species Act listed species. Awardees must then work with PacWave to engage the US Fish and Wildlife Service and the National Marine Fisheries Service in a consultation regarding the project.

The PacWave Handbook and website thoroughly describe the wave, wind, tidal, geophysical, and geotechnical characteristics of the PacWave test site and no further description of these characteristics is provided herein.

DOE has allocated funding outside of this FOA for PacWave to support FOA applicants. Accordingly, applicants do not need to reserve funds to pay for PacWave support out of their project budget. Applicants **are not permitted** to communicate with or collaborate with PacWave staff to develop applications to this FOA. Instead, applicants should identify the areas in which they would like PacWave support in their application. The details and scope of this support will be finalized during award negotiations through discussions between the applicant, DOE, and PacWave. Questions regarding PacWave should be submitted to the FOA mailbox.

PacWave support **cannot** be leveraged to procure or fabricate the WEC system, system components (e.g., moorings and anchors), or to pay for IOM&D activities.

ii. National Laboratory and Oregon State University Support

Collaboration with National Renewable Energy Laboratory (NREL), Pacific Northwest National Laboratory (PNNL), Sandia National Laboratory (SNL), and Oregon State University (OSU) is encouraged. DOE has allocated funding outside of this FOA for NREL, PNNL, SNL, and OSU to support FOA applicants. Accordingly, applicants do not need to budget to pay for this support out of their project budget. Applicants **are not permitted** to communicate with NREL, PNNL, SNL or OSU staff about laboratory support on this FOA before FOA awards are made. Instead, applicants should identify the areas in which they would benefit from NREL, PNNL, SNL, and OSU support in their application. The types of support that are available is described below. For awarded projects, the details and scope of the support that will be provided will be finalized during award negotiations between the applicant,

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DOE, and the institution/s providing support. Questions regarding NREL, PNNL, SNL, or OSU should be submitted to the FOA mailbox. It is important to note that the institutions that will provide the requested support may be different from what applicants request, depending on capabilities, staff availability, and facility availability. Applicants are strongly encouraged to leverage the capabilities of NREL, PNNL, and SNL in the following areas:

- **Measurement Systems, Instrumentation, Data Acquisition, Control Systems, and Data Quality Assurance/Quality Control (QA/QC)** – NREL and SNL can support deployments to ensure that the instrumentation, data acquisition, and control systems will operate robustly and accurately during a deployment. This can include support on real-time control, data acquisition systems (e.g., Modular Ocean Data Acquisition: MODAQ), instrumentation, mechanical load measurements (e.g., fiber optic strain, acceleration and pressure measurements) and integration thereof. NREL and SNL can also provide data QA/QC and metric analysis using lab-developed capabilities, such as Marine and Hydrokinetic Toolkit (MHKIT).
- **Accredited Measurements** – Applicants are encouraged to work with NREL to leverage NREL’s ISO/IEC 17025 accreditation¹⁷ to perform accredited testing to IEC TC 114 standards ([see Appendix H](#)). Accredited test results can be used for device certification and to demonstrate system viability to project financiers and insurance companies. The ISO/IEC 17025 accreditation confirms that NREL has the quality assurance procedures in place and the expertise to provide high-quality testing more broadly. This is essential for the industry to attract private funding in the future.
- **Environmental Monitoring** – PNNL’s expertise in environmental monitoring around marine energy converters can be leveraged for technical assistance and monitoring support for measurements and assessment of several device interactions including underwater noise to the IEC TC 114 -40 technical specification, electromagnetic fields, and changes in pelagic and benthic habitats defined in the OES-E 2020 State of the Science Report¹⁸.

In addition, applicants can request R&D support from NREL, PNNL, SNL and OSU in areas where each institution has expertise, as identified on the institution’s websites:

- NREL: <https://www.nrel.gov/water/marine-energy.html>,
https://openei.org/wiki/PRIMRE/Telesto/National_Labs_Testing_Capabilities
- PNNL: <https://www.pnnl.gov/marine-energy> , <https://www.pnnl.gov/marine-and-coastal-research-laboratory>
- SNL: <https://energy.sandia.gov/programs/renewable-energy/water-power/>
- OSU: <https://pmec.oregonstate.edu/>

¹⁷ <https://www.nrel.gov/water/accredited-testing.html>
<https://www.iso.org/ISO-IEC-17025-testing-and-calibration-laboratories.html>

¹⁸ Copping, A.E. and Hemery, L.G., editors. 2020. OES-Environmental 2020 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. Report for Ocean Energy Systems (OES). DOI: 10.2172/1632878.

The specific areas in which applicants are encouraged to work with NREL, PNNL, SNL, and OSU include:

- Wave modeling;
- Wave measurements and site characterization;
- Wave and site data analysis;
- Support designing and fabricating to IEC Technical Specifications;
- Geotechnical measurements and modeling;
- Mooring system design and analysis;
- Component and material reliability analysis and testing;
- Development and implementation of risk management strategy;
- Open water testing support and laboratory testing support;
- System performance and loads modeling;
- Extreme event modeling;
- Structural design support;
- High fidelity modeling using computational fluid dynamics (CFD) and finite element analysis (FEA) modeling;
- System performance modeling;
- System design optimization;
- LCOE modeling and analysis;
- Control systems engineering consultation; and
- IOM&D planning and execution.

NREL, PNNL, SNL and OSU support **cannot** be leveraged to procure or fabricate the WEC system, system components (e.g., moorings and anchors), or to pay for IOM&D activities. NREL, PNNL, SNL, and OSU support **can** be leveraged to procure, fabricate, and deploy data acquisition systems, testing instrumentation, and environmental monitoring systems.

iii. Insurance Requirements

Under TA1 and TA3 applicants will be required to secure relevant insurance for project activities that meet the Federal and PacWave insurance requirements. For Federal insurance information, see the following CFR:

- See 2 CFR §200.310 for insurance requirements for real property and equipment acquired or improved with Federal funds. https://www.ecfr.gov/cgi-bin/text-idx?SID=9c4c0e615095a78a6c53dd4f90ee057e&mc=true&node=se2.1.200_1310&rgn=div8
- 2 CFR §200.447 Insurance and indemnification. https://www.ecfr.gov/cgi-bin/text-idx?SID=97018fa7e85ec7d7d44767d9a26f7f2c&mc=true&node=se2.1.200_1447&rgn=div8

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- 2 CFR 910.360(d) Real property and equipment. <https://ecfr.io/Title-2/Section-910.360>

For PacWave requirements, see PacWave Client Handbook, <http://pacwaveenergy.org/for-clients/>

iv. Decontamination and Decommissioning

Notwithstanding any other provision of Awards made as a result of this FOA, the Government shall not be responsible for or have any obligation to the recipient for (1) Decontamination and/or Decommissioning (D&D) of any of the recipient's facilities, or (2) any costs which may be incurred by the recipient in connection with the D&D of any of its facilities due to the performance of the work under Awards performed as a result of this FOA, whether said work was performed prior to or subsequent to the effective date of the Award.

For PacWave requirements, see PacWave Client Handbook, <http://pacwaveenergy.org/for-clients/>

All work under EERE funding agreements must be performed in the United States. See Section IV.J.iii. and [Appendix B](#).

C. Applications Specifically Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D. of the FOA):

- Applications that fall outside the technical parameters specified in Section I.A., I.B., and I.B.1 of the FOA.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications that do not include plans to test devices or technologies at PacWave South.

D. Authorizing Statutes

The programmatic authorizing statute is The Energy Act of 2020, in Division Z of the FY 2021 Consolidated Appropriations Act, Public Law 116-260 (12/27/2020). Section 3001. Water Power Research and Development of the Energy Act of 2020 authorizes program activities for the Water Power Technologies Office. Section 3001 amends Subtitle C of the Energy Independence and Security Act (EISA) of 2007, Public Law 110-140, by adding, *inter alia*, Section 635. Marine Energy Research, Development and Demonstration

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Awards made under this announcement will fall under the purview of 2 Code of Federal Regulation (CFR) Part 200 as amended by 2 CFR Part 910.

II. Award Information

A. Award Overview

i. Estimated Funding

EERE expects to make a total of approximately \$27M of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making up to 10 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between \$250K and \$9M.

EERE may issue awards in one, multiple, or none of the topic areas identified in [Table 1](#) above.

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods, including the initial budget period, is not guaranteed.

ii. Period of Performance

EERE anticipates making awards that will run from 36 months up to 48 months in length, comprised of one or more budget periods. Project continuation will be contingent upon several elements, including satisfactory performance and Go/No-Go decision review. For a complete list, see Section VI.B.xiv. At the Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, the extent milestone objectives are met, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

iii. New Applications Only

EERE will accept only new applications under this FOA. EERE will not consider applications for renewals of existing EERE-funded awards through this FOA.

B. EERE Funding Agreements

Through cooperative agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States government.

i. Cooperative Agreements

EERE generally uses cooperative agreements to provide financial and other support to prime recipients.

Through cooperative agreements, EERE provides financial or other support to accomplish a public purpose of support or stimulation authorized by federal statute. Under cooperative agreements, the government and prime recipients share responsibility for the direction of projects.

EERE has substantial involvement in all projects funded via cooperative agreement. See Section VI.B.ix of the FOA for more information on what substantial involvement may involve.

III. Eligibility Information

To be considered for substantive evaluation, an applicant's submission must meet the criteria set forth below. If the application does not meet these eligibility requirements, it will be considered ineligible and removed from further evaluation.

A. Eligible Applicants

i. Individuals

U.S. citizens and lawful permanent residents are eligible to apply for funding as a prime recipient or subrecipient.

ii. Domestic Entities

For-profit entities, educational institutions, and nonprofits that are incorporated (or otherwise formed) under the laws of a particular state or territory of the United States and have a physical location for business operations in the United States are eligible to apply for funding as a prime recipient or subrecipient. Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995 are not eligible to apply for funding.

State, local, and tribal government entities are eligible to apply for funding as a prime recipient or subrecipient.

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DOE/NNSA FFRDCs are not eligible to apply for funding as either a prime recipient or subrecipient.

Oregon State University who is an acting administrator of the PacWave Facility is not eligible to apply as a prime recipient or a subrecipient.

Non-DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

iii. Foreign Entities

Foreign entities, whether for-profit or otherwise, are eligible to apply for funding under this FOA. Other than as provided in the “Individuals” or “Domestic Entities” sections above, all prime recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a state or territory of the United States and have a physical location for business operations in the United States. If a foreign entity applies for funding as a prime recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a state or territory of the United States to be the prime recipient. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

Foreign entities may request a waiver of the requirement to designate a subsidiary in the United States as the prime recipient in the Full Application (i.e., a foreign entity may request that it remains the prime recipient on an award). To do so, the applicant must submit an explicit written waiver request in the Full Application. [Appendix B](#) lists the necessary information that must be included in a request to waive this requirement. The applicant does not have the right to appeal EERE’s decision concerning a waiver request.

In the waiver request, the applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to have a foreign entity serve as the prime recipient. EERE may require additional information before considering the waiver request.

A foreign entity may receive funding as a subrecipient.

iv. Incorporated Consortia

Incorporated consortia, which may include domestic and/or foreign entities, are eligible to apply for funding as a prime recipient or subrecipient. For consortia incorporated (or

otherwise formed) under the laws of a state or territory of the United States, please refer to “Domestic Entities” above. For consortia incorporated in foreign countries, please refer to the requirements in “Foreign Entities” above.

Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the EERE Contracting Officer.

v. Unincorporated Consortia

Unincorporated Consortia, which may include domestic and foreign entities, must designate one member of the consortium to serve as the prime recipient/consortium representative. The prime recipient/consortium representative must be incorporated (or otherwise formed) under the laws of a state or territory of the United States. The eligibility of the consortium will be determined by the eligibility of the prime recipient/consortium representative under [Section III.A.](#) of the FOA.

Upon request, unincorporated consortia must provide the EERE Contracting Officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This agreement binds the individual consortium members together and should discuss, among other things, the consortium’s:

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members’ efforts on the project;
- Provisions for members’ cost sharing contributions; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

B. Cost Sharing

The cost share must be at least 10% of the total allowable costs for research and development projects (i.e., the sum of the government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-federal sources unless otherwise allowed by law. (See 2 CFR 200.306 and 2 CFR 910.130 for the applicable cost sharing requirements.)

i. Legal Responsibility

Although the cost share requirement applies to the project as a whole, including work performed by members of the project team other than the prime recipient, the prime recipient is legally responsible for paying the entire cost share. If the funding agreement is terminated prior to the end of the project period, the prime recipient is required to

contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The prime recipient is solely responsible for managing cost share contributions by the project team and enforcing cost share obligation assumed by project team members in subawards or related agreements.

ii. Cost Share Allocation

Each project team is free to determine how best to allocate the cost share requirement among the team members. The amount contributed by individual project team members may vary, as long as the cost share requirement for the project as a whole is met.

iii. Cost Share Types and Allowability

Every cost share contribution must be allowable under the applicable federal cost principles, as described in Section IV.I.i. of the FOA. In addition, cost share must be verifiable upon submission of the Full Application.

Project teams may provide cost share in the form of cash or in-kind contributions. Cost share may be provided by the prime recipient, subrecipients, or third parties (entities that do not have a role in performing the scope of work). Vendors/contractors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

Cash contributions include, but are not limited to: personnel costs, fringe costs, supply and equipment costs, indirect costs and other direct costs.

In-kind contributions are those where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. Allowable in-kind contributions include, but are not limited to: the donation of volunteer time or the donation of space or use of equipment.

Project teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding was not provided to the state or local government by the federal government.

The prime recipient may not use the following sources to meet its cost share obligations including, but not limited to:

- Revenues or royalties from the prospective operation of an activity beyond the project period;

-
- Proceeds from the prospective sale of an asset of an activity;
 - Federal funding or property (e.g., federal grants, equipment owned by the federal government); or
 - Expenditures that were reimbursed under a separate federal program.

Project teams may not use the same cash or in-kind contributions to meet cost share requirements for more than one project or program.

Cost share contributions must be specified in the project budget, verifiable from the prime recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are considered part of total project cost, the cost share dollars will be scrutinized under the same federal regulations as federal dollars to the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

Applicants are encouraged to refer to 2 CFR 200.306 as amended by 2 CFR 910.130 for additional cost sharing requirements.

iv. Cost Share Verification

Applicants are required to provide written assurance of their proposed cost share contributions in their Full Applications.

Upon selection for award negotiations, applicants are required to provide additional information and documentation regarding their cost share contributions. Please refer to [Appendix A](#) of the FOA.

v. Cost Share Payment

EERE requires prime recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the prime recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated). As FFRDC funding will be provided directly to the FFRDC(s) by DOE, prime recipients will be required to provide project cost share at a percentage commensurate with the FFRDC costs, on a budget period basis, resulting in a higher interim invoicing cost share ratio than the total award ratio.

In limited circumstances, and where it is in the government's interest, the EERE Contracting Officer may approve a request by the prime recipient to meet its cost share requirements on a less frequent basis, such as monthly or quarterly. Regardless of the interval requested, the prime recipient must be up-to-date on cost share at each interval. Such requests must

be sent to the Contracting Officer during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to demonstrate that the prime recipient has complied with its cost share obligations to date. The Contracting Officer must approve all such requests before they go into effect.

C. Compliance Criteria

Concept Papers, Full Applications, and Replies to Reviewer Comments must meet all compliance criteria listed below or they will be considered noncompliant. EERE will not review or consider noncompliant submissions, including Concept Papers, Full Applications, and Replies to Reviewer Comments that were: submitted through means other than EERE Exchange; submitted after the applicable deadline; and/or submitted incomplete. EERE will not extend the submission deadline for applicants that fail to submit required information by the applicable deadline due to server/connection congestion.

i. Concept Papers

Concept Papers are deemed compliant if:

- The Concept Paper complies with the content and form requirements in Section IV.C. of the FOA; and
- The applicant successfully uploaded all required documents and clicked the “Submit” button in EERE Exchange by the deadline stated in this FOA.

ii. Full Applications

Full Applications are deemed compliant if:

- The applicant submitted a compliant Concept Paper;
- The Full Application complies with the content and form requirements in Section IV.D. of the FOA; and
- The applicant successfully uploaded all required documents and clicked the “Submit” button in EERE Exchange by the deadline stated in the FOA.

iii. Replies to Reviewer Comments

Replies to Reviewer Comments are deemed compliant if:

- The Reply to Reviewer Comments complies with the content and form requirements in Section IV.E. of the FOA; and
- The applicant successfully uploaded all required documents to EERE Exchange by the deadline stated in the FOA.

D. Responsiveness Criteria

All “Applications Specifically Not of Interest,” as described in Section I.C. of the FOA, are deemed nonresponsive and are not reviewed or considered.

E. Limitation on Number of Concept Papers and Full Applications Eligible for Review**Topic Area 1**

An entity may only submit one Concept Paper and one Full Application to **Topic Area 1** of this FOA. If an entity submits more than one Concept Paper and one Full Application to the same topic area, EERE will request a determination from the applicant’s authorized representative as to which application should be reviewed. Any other submissions received listing the same entity as the applicant for the same topic area will not be eligible for further consideration. This limitation does not prohibit an applicant from collaborating on other applications (e.g., as a potential subrecipient or partner) so long as the entity is only listed as the applicant on one Concept Paper and one Full Application for each topic area of this FOA.

Topic Area 2

An entity may only submit one Concept Paper and one Full Application to **Topic Area 2** of this FOA. If an entity submits more than one Concept Paper and one Full Application to the same topic area, EERE will request a determination from the applicant’s authorized representative as to which application should be reviewed. Any other submissions received listing the same entity as the applicant for the same topic area will not be eligible for further consideration. This limitation does not prohibit an applicant from collaborating on other applications (e.g., as a potential subrecipient or partner) so long as the entity is only listed as the applicant on one Concept Paper and one Full Application for each topic area of this FOA.

Topic Area 3

An entity may submit more than one Concept Paper and Full Application to **Topic Area 3**, provided that each application describes a unique, scientifically distinct project and provided that an eligible Concept Paper was submitted for each Full Application.

F. Questions Regarding Eligibility

EERE will not make eligibility determinations for potential applicants prior to the date on which applications to this FOA must be submitted. The decision whether to submit an application in response to this FOA lies solely with the applicant.

IV. Application and Submission Information

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A. Application Process

The application process will include two phases: a Concept Paper phase, and a Full Application phase. **Only applicants who have submitted an eligible Concept Paper will be eligible to submit a Full Application.**

At each phase, EERE performs an initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III of the FOA. EERE will not review or consider submissions that do not meet the eligibility requirements of Section III. All submissions must conform to the following form and content requirements, including maximum page lengths (described below) and must be submitted via EERE Exchange at <https://eere-exchange.energy.gov>, unless specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than EERE Exchange, submissions submitted after the applicable deadline, or incomplete submissions.** EERE will not extend deadlines for applicants who fail to submit required information and documents due to server/connection congestion.

A **Control Number** will be issued when an applicant begins the EERE Exchange application process. This control number must be included with all application documents, as described below.

The Concept Paper, Full Application, and Reply to Reviewer Comments must conform to the following requirements:

- Each must be submitted in Adobe PDF format unless stated otherwise;
- Each must be written in English;
- All pages must be formatted to fit on 8.5 x 11 inch paper with margins not less than one inch on every side. Use Calibri typeface, a black font color, and a font size of 12 point or larger (except in figures or tables, which may be 10 point font). A symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies. References must be included as footnotes or endnotes in a font size of 10 or larger. Footnotes and endnotes are counted toward the maximum page requirement;
- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page; and
- Each submission must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their Concept Papers, Full Applications, and Replies to Reviewer Comments at least 48 hours in advance of the submission deadline.** Under normal

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conditions (i.e., at least 48 hours in advance of the submission deadline), applicants should allow at least 1 hour to submit a Concept Paper, Full Application, or Reply to Reviewer Comments. Once the Concept Paper, Full Application, or Reply to Reviewer Comments is submitted in EERE Exchange, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made to any of these documents, the applicant must resubmit the Concept Paper, Full Application, or Reply to Reviewer Comments before the applicable deadline.

EERE urges applicants to carefully review their Concept Papers, Full Applications, and Replies to Reviewer Comments to allow sufficient time for the submission of required information and documents. All Full Applications that pass the initial eligibility review will undergo comprehensive technical merit review according to the criteria identified in Section V.A.ii. of the FOA.

i. Additional Information on EERE Exchange

EERE Exchange is designed to enforce the deadlines specified in this FOA. The “Apply” and “Submit” buttons will automatically disable at the defined submission deadlines. Should applicants experience problems with EERE Exchange, the following information may be helpful.

Applicants that experience issues with submission PRIOR to the FOA deadline: In the event that an applicant experiences technical difficulties with a submission, the applicant should contact the EERE Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The EERE Exchange helpdesk and/or the EERE Exchange system administrators will assist applicants in resolving issues.

B. Application Forms

The application forms and instructions are available on EERE Exchange. To access these materials, go to <https://eere-Exchange.energy.gov> and select the appropriate funding opportunity number.

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA, it must be broken into parts and denoted to that effect. For example:

TechnicalVolume_Part_1

TechnicalVolume_Part_2

C. Content and Form of the Concept Paper

To be eligible to submit a Full Application, applicants must submit a Concept Paper by the specified due date and time.

i. Concept Paper Content Requirements

EERE will not review or consider ineligible Concept Papers (see Section III of the FOA).

Each Concept Paper must be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated into a single Concept Paper.

The Concept Paper must conform to the following content requirements:

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific announcement Topic Area being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Technology Description	1 page maximum	Applicants are required to describe succinctly: <ul style="list-style-type: none"> • The proposed technology, including its basic operating principles and how it is unique and innovative; • Description of the device concept with schematic and anticipated dimensions; • Description of the proposed project that meets the objectives identified in the appropriate “Topic Area” sections; • A matrix that defines roles and responsibilities subrecipients, anticipated vendors, and other team members; and • Self-certification that the project meets the minimum requirements for projects identified in this TA description by including the following statement in your concept paper: “I, [APPLICANT NAME] certify that this project meets the minimum requirements outlined in the Topic Area 1 description under the appropriate TA: <ul style="list-style-type: none"> ○ TA1 Requirements for Eligibility ○ TA2 Requirements for Eligibility ○ TA3 Requirements for Eligibility

EERE makes an independent assessment of each Concept Paper based on the criteria in Section V.A.i. of the FOA. EERE will encourage a subset of applicants to submit Full Applications. Other applicants will be discouraged from submitting a Full Application. An applicant who receives a “discouraged” notification may still submit a Full Application. EERE will review all eligible Full Applications. However, by discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project in an effort to save the applicant the time and expense of preparing an application that is unlikely to be selected for award negotiations.

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EERE may include general comments provided from reviewers on an applicant’s Concept Paper in the encourage/discourage notification posted on EERE Exchange at the close of that phase.

D. Content and Form of the Full Application

Applicants must submit a Full Application by the specified due date and time to be considered for funding under this FOA. Applicants must complete the following application forms found on the EERE Exchange website at <https://eere-Exchange.energy.gov/>, in accordance with the instructions.

Applicants will have approximately 30 days from receipt of the Concept Paper Encourage/Discourage notification on EERE Exchange to prepare and submit a Full Application. Regardless of the date the applicant receives the Encourage/Discourage notification, the submission deadline for the Full Application remains the date and time stated on the FOA cover page.

All Full Application documents must be marked with the Control Number issued to the applicant. Applicants will receive a control number upon clicking the “Create Concept Paper” button in EERE Exchange, and should include that control number in the file name of their Full Application submission (i.e., *Control number_Applicant Name_Full Application*).

i. Full Application Content Requirements

EERE will not review or consider ineligible Full Applications (see Section III. of the FOA).

Each Full Application shall be limited to a single concept or technology. Unrelated concepts and technologies shall not be consolidated in a single Full Application. Full Applications must conform to the following requirements:

Component	File Format	Page Limit	File Name
Technical Volume	PDF	25	ControlNumber_LeadOrganization_Technical Volume
Resumes	PDF	1 page each	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	1 page each	ControlNumber_LeadOrganization_LOCs
Statement of Project Objectives	MS Word	15	ControlNumber_LeadOrganization_SOPO
SF-424	PDF	n/a	ControlNumber_LeadOrganization_App424
Budget Justification Workbook	MS Excel	n/a	ControlNumber_LeadOrganization_Budget_Justification

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Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS Powerpoint	1	ControlNumber_LeadOrganization_Slide
Subrecipient Budget Justification	MS Excel	n/a	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
SF-LLL Disclosure of Lobbying Activities	PDF	n/a	ControlNumber_LeadOrganization_SF-LLL
Foreign Entities and Foreign Work Waivers	PDF	n/a	ControlNumber_LeadOrganization_Waiver
U.S. Manufacturing Plan	PDF	n/a	ControlNumber_LeadOrganization_USMP
Data Management Plan	MS Word	n/a	ControlNumber_LeadOrganization_DMP
Diversity Equity and Inclusion Plan	PDF	5	ControlNumber_LeadOrganization_DEIP

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:

TechnicalVolume_Part_1

TechnicalVolume_Part_2

EERE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed 10MB.

EERE provides detailed guidance on the content and form of each component below.

ii. Technical Volume

The Technical Volume must be submitted in PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A.ii. of the FOA. Save the Technical Volume in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_TechnicalVolume".

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. However, EERE and reviewers are under no obligation to review cited sources.

The Technical Volume to the Full Application may not be more than 25 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other

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graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria (see Section V.A.ii of the FOA) when preparing the Technical Volume.

The Technical Volume should clearly describe and expand upon information provided in the Concept Paper. The Technical Volume must conform to the following content requirements:

SECTION/PAGE LIMIT	DESCRIPTION
Cover Page	The cover page should include the project title, the specific FOA Topic Area being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Project Overview (Approximately 10% of the Technical Volume)	<p>The Project Overview should contain the following information:</p> <ul style="list-style-type: none"> • Background: The applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • Project Goal: The applicant should explicitly identify the goals of the proposed PacWave testing and the critical success factors in achieving that goal. • DOE Impact: The applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.
Technical Description, Innovation, and Impact (Approximately 30% of the Technical Volume)	<p>The Technical Description should contain the following information:</p> <ul style="list-style-type: none"> • Relevance and Outcomes: The applicant should provide a detailed description of the technology, including the scientific and other principles and objectives that will be pursued during the project. This section should describe the relevance of the proposed project to the goals and objectives of the FOA, including the potential to meet specific DOE technical targets or other relevant performance targets. The applicant should clearly specify the expected outcomes of the project. • Feasibility: The applicant should demonstrate the technical feasibility of the proposed technology and capability of achieving the anticipated performance targets, including a description of previous work done and prior results. • Innovation and Impacts: The applicant should describe the current state-of-the-art in the applicable field, the specific innovation of the proposed technology, the advantages of proposed technology over

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	<p>current and emerging technologies, and the overall impact on advancing the state-of-the-art/technical baseline if the project is successful.</p>
<p>Workplan and Market Transformation Plan (Approximately 40% of the Technical Volume)</p>	<p>The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Milestones, Go/No-Go Decision Points, and Project Schedule. A detailed SOPO is separately requested. The Workplan should contain the following information:</p> <ul style="list-style-type: none"> • Project Objectives: The applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes. • Technical Scope Summary: The applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on Go/No-Go decision points). The applicant should describe the specific expected end result of each performance period. • WBS and Task Description Summary: The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard WBS for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as “we will then complete a proprietary process” is unacceptable). It is the applicant’s responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA. The summary provided should be consistent with the SOPO. The SOPO will contain a more detailed description of the WBS and tasks. • Milestone Summary: The applicant should provide a summary of appropriate milestones throughout the project to demonstrate

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	<p>success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project with at least one SMART technical milestone per year (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The applicant should also provide the means by which the milestone will be verified. The summary provided should be consistent with the Milestone Summary Table in the SOPO.</p> <ul style="list-style-type: none"> • Go/No-Go Decision Points: The applicant should provide a summary of project-wide Go/No-Go decision points at appropriate points in the Workplan. A Go/No-Go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. At a minimum, each project must have at least one project-wide Go/No-Go decision point for each budget period (12 to 18-month period) of the project. See Section VI.B.xiv. The applicant should also provide the specific technical criteria to be used to evaluate the project at the Go/No-Go decision point. The summary provided should be consistent with the SOPO. Go/No-Go decision points are considered “SMART” and can fulfill the requirement for an annual SMART milestone. • End of Project Goal: The applicant should provide a summary of the end of project goal(s). At a minimum, each project must have one SMART end of project goal. The summary provided should be consistent with the SOPO. • Project Schedule (Gantt Chart or similar): The applicant should provide a schedule for the entire project, including task and subtask durations, milestones, and Go/No-Go decision points. • Project Management: The applicant should discuss the team’s proposed management plan, including the following: <ul style="list-style-type: none"> ○ The overall approach to and organization for managing the work ○ The roles of each project team member ○ Any critical handoffs/interdependencies among project team members ○ The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices
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	<ul style="list-style-type: none"> ○ The approach to project risk management ○ A description of how project changes will be handled ○ If applicable, the approach to Quality Assurance/Control ○ How communications will be maintained among project team members ● Market Transformation Plan: The applicant should provide a market transformation plan, including the following: <ul style="list-style-type: none"> ○ Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation plan ○ Identification of a product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. Manufacturing Plan, and product distribution.
<p>Technical Qualifications and Resources (Approximately 20% of the Technical Volume)</p>	<p>The Technical Qualifications and Resources should contain the following information:</p> <ul style="list-style-type: none"> ● Describe the project team’s unique qualifications and expertise, including those of key subrecipients. ● Describe the project team’s existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project. ● This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives. ● Describe the time commitment of the key team members to support the project. ● Describe the technical services to be provided by NREL, PNNL, SNL, OSU, and PacWave, as applicable. ● For multi-organizational or multi-investigator projects, describe succinctly: <ul style="list-style-type: none"> ○ The roles and the work to be performed by each PI and Key Participant; ○ Business agreements between the applicant and each PI and Key Participant; ○ How the various efforts will be integrated and managed; ○ Process for making decisions on scientific/technical direction;

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	<ul style="list-style-type: none"> ○ Publication arrangements; ○ Intellectual Property issues; and ○ Communication plans
<p>Diversity, Equity, Inclusion (Address in the Diversity, Equity, and Inclusion Plan)</p>	<p>The Diversity, Equity, and Inclusion Plan should contain the following information:</p> <ul style="list-style-type: none"> ● Equity Impacts: the impacts of the proposed project on underserved communities, including social and environmental impacts. ● Benefits: The overall benefits of the proposed project, if funded, to underserved communities; and ● How diversity, equity, and inclusion objectives will be incorporated in the project. <p>See Section IV.D.xv. for more information on the contents of the Diversity, Equity, and Inclusion Plan.</p>
<p>Topic Area 1 Specific Technical Volume Requirements</p>	<ul style="list-style-type: none"> ● Description of the device with schematic and dimensions; ● A matrix that defines roles and responsibilities of subrecipients, anticipated vendors, and other team members; ● Detailed work plan to meet project objectives and meet the required scope and deliverables identified in Table 3; ● Discussion of how the technology is covered by PacWave’s existing permits; ● Description of how the project will ensure the system can operate reliably for the duration of the testing campaign at PacWave; ● A discussion of how the project will be quickly removed in the event of a critical system failure; ● Description of how the project is advancing the specific WEC technology towards commercial viability and the overall R&D value to the marine energy industry (not required for fully open-source TA1b projects); ● A risk management plan that describes technical risks and the risk mitigation strategy; ● A discussion of how the project will be insured (see the “Insurance Requirements” section) to mitigate the financial risks and to assure the device can be removed and decommissioned in the event of unexpected technical or financial challenges; ● A plan for how to work with NREL, PNNL, SNL, OSU and PacWave staff as discussed in the “National Laboratory and Oregon State University Support” and “PacWave Information and PacWave Support” sections; ● A detailed marine energy technical data management plan; ● Information to demonstrate that system performance has been quantified via numerical modeling, tank testing, or open water testing; and ● A commercialization plan (commercial projects only) that identifies:

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	<ul style="list-style-type: none"> a. How the project will advance the state of the WEC technology towards commercial viability; b. The target dimensions and power rating of the device for commercialization; c. Description of the intended market(s) of the WEC device and any associated requirements; and d. How the device will be deployed commercially (e.g., individually or in arrays), and the anticipated size of the target market. <ul style="list-style-type: none"> • A stakeholder engagement plan (open-source TA1b projects only) that: <ul style="list-style-type: none"> a. Describes what marine energy technical data and device information they plan to make publicly available and open-source; b. How the applicant will engage with the industry and R&D community to ensure the work performed provides maximum benefit.
<p>Topic Area 2 Specific Technical Volume Requirements</p>	<ul style="list-style-type: none"> • Description of the device concept with sketch and dimensions; • Detailed work plan to meet project objectives and meet deliverables identified in Table 5; • Description of the plan for how to incorporate IEC and IEEE standards, identified in Appendix H, into the device design; • Description of technical merit, innovation, and overall R&D value to MHK industry; • Description of technical risks and the risk mitigation strategy; • Description of numerical models and design methodologies that will be used to develop the device design; • Description of how design tools and methodologies have been or will be validated using previously gathered experimental testing data; or a description of what work will be performed during the period of performance to verify and validate the design tools and methodologies that will be used; • A matrix that defines roles and responsibilities of subrecipients, anticipated vendors, and other team members; • A discussion of the WEC design experience of subrecipients, anticipated vendors, and other team members; • Description of the intended market(s) of the WEC device and any associated requirements; • A plan for how to work with NREL, PNNL, SNL, OSU and PacWave staff as discussed in the “National Laboratory and Oregon State University Support” and “PacWave Information and PacWave Support” sections; • Discussion of how the project will advance the state of the WEC technology towards commercial viability; • Description of how the FOA metrics (see the “TA2 LCOE Calculations and Performance Metrics” section) identified in the application will be estimated during the period of performance and identification of targets values;

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	<ul style="list-style-type: none"> • How the project will advance the state of the WEC technology towards commercial viability, the target dimensions and power rating of the device for commercialization, the intended market for the WEC device, how the device will be deployed commercially (e.g., individually or in arrays), and the anticipated size of the target market.
<p>Topic Area 3 Specific Technical Volume Requirements</p>	<ul style="list-style-type: none"> • Discussion of how the technology is covered by PacWave’s existing permits or a permitting plan; • Description of how the project is advancing the specific WEC technology towards commercial viability and the overall R&D value to marine energy industry; • A risk management plan that describes technical risks and the risk mitigation strategy; • Description of the planned deployment, operation, and operation decommissioning strategy; • A matrix that defines roles and responsibilities of subrecipients, anticipated vendors, and other team members; • A plan for how to work with NREL, PNNL, SNL, OSU and PacWave staff as discussed in the “National Laboratory and Oregon State University Support” and “PacWave Information and PacWave Support” sections; • How the project will advance the state of the WEC technology towards commercial viability; and • Detailed marine energy technical data management plan.

iii. Resumes

Applicants are required to submit one-page resumes for key participating team members. Multi-page resumes are not allowed. Save the resumes in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_Resumes”.

iv. Letters of Commitment

Submit letters of commitment from all subrecipient and third party cost share providers. If applicable, also include any letters of commitment from partners/end users (one-page maximum per letter). Save the letters of commitment in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_LOCs”.

v. Statement of Project Objectives (SOPo)

Applicants are required to complete a SOPo. A SOPo template is available on EERE Exchange at <https://eere-Exchange.energy.gov/>. The SOPo, including the Milestone Table, must not exceed 15 pages when printed using standard 8.5 x 11 paper with 1” margins (top, bottom, left, and right) with font not smaller than 12 point. Save the SOPo in a single Microsoft Word file using the following convention for the title “ControlNumber_LeadOrganization_SOPo”.

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vi. SF-424: Application for Federal Assistance

Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period. Save the SF-424 in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_424".

vii. Budget Justification Workbook

Applicants are required to complete the Budget Justification Workbook. This form is available on EERE Exchange at <https://eere-Exchange.energy.gov/>. Prime recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the prime recipient and its subrecipients and contractors. Applicants should include costs associated with required annual audits and incurred cost proposals in their proposed budget documents. The "Instructions and Summary" included with the Budget Justification Workbook will auto-populate as the applicant enters information into the Workbook. Applicants must carefully read the "Instructions and Summary" tab provided within the Budget Justification Workbook. Save the Budget Justification Workbook in a single Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Budget_Justification".

viii. Summary/Abstract for Public Release

Applicants are required to submit a one-page summary/abstract of their project. The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (e.g., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as DOE may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the Summary for Public Release in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Summary".

ix. Summary Slide

Applicants are required to provide a single slide summarizing the proposed project. This slide is used during the evaluation process.

The Summary Slide template requires the following information:

- A technology summary;
- A description of the technology's impact;
- Proposed project goals;
- Any key graphics (illustrations, charts and/or tables);
- The project's key idea/takeaway;
- Project title, prime recipient, Principal Investigator, and Key Participant information; and
- Requested EERE funds and proposed applicant cost share.

Save the Summary Slide in a single Microsoft PowerPoint file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

x. Subrecipient Budget Justification (if applicable)

Applicants must provide a separate budget justification for each subrecipient that is expected to perform work estimated to be more than \$250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section above. Save each subrecipient budget justification in a Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Subrecipient_Budget_Justification".

xi. SF-LLL: Disclosure of Lobbying Activities (required)

Prime recipients and subrecipients may not use any federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Prime recipients and subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (<https://www.grants.gov/web/grants/forms/sf-424-individual-family.htm>) to ensure that non-federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with the application:

- An officer or employee of any federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

Save the SF-LLL in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_SF-LLL".

xii. Waiver Requests: Foreign Entities and Foreign Work (if applicable)

Foreign Entity Participation:

As set forth in Section III.A.iii., all prime recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. [Appendix B](#) lists the necessary information that must be included in a request to waive this requirement.

Performance of Work in the United States (Foreign Work Waiver)

As set forth in Section IV.I.iii., all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the prime recipient should make every effort to purchase supplies and equipment within the United States. [Appendix B](#) lists the necessary information that must be included in a foreign work waiver request.

Save the Waivers in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_Waiver”.

xiii. U.S. Manufacturing Commitments

Pursuant to the DOE Determination of Exceptional Circumstances (DEC) dated September 9, 2013, each applicant is required to submit a U.S. Manufacturing Plan as part of its application. The U.S. Manufacturing Plan represents the applicant's measurable commitment to support U.S. manufacturing as a result of its award.

Each U.S. Manufacturing Plan must include a commitment that any products embodying any subject invention or produced through the use of any subject invention will be manufactured substantially in the United States, unless the applicant can show to the satisfaction of DOE that it is not commercially feasible to do so (referred to hereinafter as “the U.S. Competitiveness Provision”). The applicant further agrees to make the U.S. Competitiveness Provision binding on any subawardee and any assignee or licensee or any entity otherwise acquiring rights to any subject invention, including subsequent assignees or licensees. A subject invention is any invention conceived of or first actually reduced to practice under an award.

Due to the lower technology readiness levels of this FOA, DOE does not expect the U.S. Manufacturing Plans to be tied to a specific product or technology. However, in lieu of the U.S. Competitiveness Provision, an applicant may propose a U.S. Manufacturing Plan with more specific commitments that would be beneficial to the U.S. economy and

competitiveness. For example, an applicant may commit specific products to be manufactured in the U.S., commit to a specific investment in a new or existing U.S. manufacturing facility, keep certain activities based in the U.S. or support a certain number of jobs in the U.S. related to the technology. An applicant which is likely to license the technology to others, especially universities for which licensing may be the exclusive means of commercialization the technology, the U.S. Manufacturing Plan may indicate the applicant's plan and commitment to use a specific licensing strategy that would likely support U.S. manufacturing.

If DOE determines, at its sole discretion, that the more specific commitments would provide a sufficient benefit to the U.S. economy and industrial competitiveness, the specific commitments will be part of the terms and conditions of the award. For all other awards, the U.S. Competitiveness Provision shall be incorporated as part of the terms and conditions of the award as the U.S. Manufacturing Plan for that award.

The U.S. Competitiveness Provision is also a requirement for the Class Patent Waiver that applies to domestic large business under this FOA (see Section VIII.J. Title to Subject Inventions).

Save the U.S. Manufacturing Plan in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_USMP".

xiv. Data Management Plan (DMP)

Note: All research and development (R&D) awards must submit a Data Management Plan (DMP) according to the timeline selected in the approved FRD.

Applicants are required to submit a DMP with their Full Application. Applicants must select one of the following two options:

Option 1 (when protected data is allowed): For the deliverables under the award, the recipient does not plan on making the underlying research data supporting the findings in the deliverables publicly-available for up to five (5) years after the data were first produced because such data will be considered protected under the award. The results from the DOE deliverables can be validated by DOE who will have access, upon request, to the research data. Other than providing deliverables as specified in the award, the recipient does not intend to publish the results from the project. However, in an instance where a publication includes results of the project, the underlying research data will be made available according to the policies of the publishing media. Where no such policy exists, the recipient must indicate on the publication a means for requesting and digitally obtaining the underlying research data. This includes the research data necessary to validate any results, conclusions, charts, figures, images in the publications.

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Option 2: For any publication that includes results of the project, the underlying research data will be made available according to the policies of the publishing media. Where no such policy exists, the recipient must indicate on the publication a means for requesting and digitally obtaining the underlying research data. This includes the research data necessary to validate any results, conclusions, charts, figures, images in the publications.

Save the DMP in a single Microsoft Word file using the following convention for the title “ControlNumber_LeadOrganization_DMP”.

xv. Diversity, Equity and Inclusion Plan

As part of the application, applicants are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to submit a Diversity, Equity, and Inclusion Plan that describes the actions the applicant will take to foster a welcoming and inclusive environment, support people from groups underrepresented in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project; and the extent the project activities will be located in or benefit underserved communities (also see Section I.A.iii). The plan should include SMART milestones supported by metrics to measure the success of the proposed actions.

The following is a non-exhaustive list of actions that can serve as examples of ways the proposed project could incorporate diversity, equity, and inclusion elements. These examples should not be considered either comprehensive or prescriptive. Applicants may include appropriate actions not covered by these examples.

- a. Include persons from groups underrepresented in STEM as PI, co-PI, and/or other senior personnel;
- b. Include persons from groups underrepresented in STEM as student researchers or post-doctoral researchers;
- c. Include faculty or students from Minority Serving Institutions as PI/co-PI, senior personnel, and/or student researchers, as applicable;
- d. Enhance or collaborate with existing diversity programs at your home organization and/or nearby organizations;
- e. Collaborate with students, researchers, and staff in Minority Serving Institutions;
- f. Disseminate results of research and development in Minority Serving Institutions or other appropriate institutions serving underserved communities;
- g. Implement evidence-based, diversity-focused education programs (such as implicit bias training for staff) in your organization;
- h. Identify Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses and Veteran Owned Businesses to solicit as vendors and sub-contractors for bids on supplies, services and equipment.

Diversity, Equity, Inclusion (Address in the Diversity, Equity, and Inclusion Plan)	<p>The Diversity, Equity, and Inclusion Plan should contain the following information:</p> <ul style="list-style-type: none"> • Equity Impacts: the impacts of the proposed project on underserved communities, including social and environmental impacts. • Benefits: The overall benefits of the proposed project, if funded, to underserved communities; and • How diversity, equity, and inclusion objectives will be incorporated in the project. <p>See Section IV.D.xv. for more information on the contents of the Diversity, Equity, and Inclusion Plan.</p>
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Save the Diversity, Equity and Inclusion Plan in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_DEIP”.

E. Content and Form of Replies to Reviewer Comments

If replies to reviewer comments are applicable, EERE will provide applicants with reviewer comments following the evaluation of all eligible Full Applications. Applicants will have a brief opportunity to review the comments and to prepare a short Reply to Reviewer Comments responding to the comments however they desire or supplementing their Full Application. The Reply to Reviewer Comments is an optional submission; applicants are not required to submit a Reply to Reviewer Comments. EERE will post the Reviewer Comments in EERE Exchange. The expected submission deadline is on the cover page of the FOA; however, it is the applicant’s responsibility to monitor EERE Exchange in the event that the expected date changes. The deadline will not be extended for applicants who are unable to timely submit their reply due to failure to check EERE Exchange or relying on the expected date alone. Applicants should anticipate having approximately three (3) business days to submit Replies to Reviewer Comments.

EERE will not review or consider ineligible Replies to Reviewer Comments (see Section III of the FOA). EERE will review and consider each eligible Full Application, even if no Reply is submitted or if the Reply is found to be ineligible.

Replies to Reviewer Comments must conform to the following content and form requirements, including maximum page lengths, described below. If a Reply to Reviewer Comments is more than three (3) pages in length, EERE will review only the first three (3) pages and disregard any additional pages.

SECTION	PAGE LIMIT	DESCRIPTION
Text	2 pages max	Applicants may respond to one or more reviewer comments or supplement their Full Application.

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Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov Include FOA name and number in subject line.

Optional	1 page max	Applicants may use this page however they wish; text, graphs, charts, or other data to respond to reviewer comments or supplement their Full Application are acceptable.
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F. Post Selection Information Requests

If selected for award, EERE reserves the right to request additional or clarifying information regarding the following (non-exhaustive list):

- Indirect cost information;
- Other budget information;
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable;
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5);
- Representation of Limited Rights Data and Restricted Software, if applicable; and
- Environmental Questionnaire.

G. Dun and Bradstreet Universal Numbering System (DUNS) Number and System for Award Management (SAM)

Each applicant (unless the applicant is an individual or federal awarding agency that is excepted from those requirements under 2 CFR 25.110(b) or (c), or has an exception approved by the federal awarding agency under 2 CFR 25.110(d)) is required to: (1) Be registered in the SAM at <https://www.sam.gov> before submitting its application; (2) provide a valid DUNS number in its application; and (3) continue to maintain an active SAM registration with current information at all times during which it has an active federal award or an application or plan under consideration by a federal awarding agency. DOE may not make a federal award to an applicant until the applicant has complied with all applicable DUNS and SAM requirements and, if an applicant has not fully complied with the requirements by the time DOE is ready to make a federal award, the DOE will determine that the applicant is not qualified to receive a federal award and use that determination as a basis for making a federal award to another applicant.

H. Submission Dates and Times

All required submissions must be submitted in EERE Exchange no later than 5 p.m. Eastern Time on the dates provided on the cover page of this FOA.

I. Intergovernmental Review

This FOA is not subject to Executive Order 12372 – Intergovernmental Review of Federal Programs.

J. Funding Restrictions

i. Allowable Costs

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable federal cost principles.

Refer to the following applicable federal cost principles for more information:

- Federal Acquisition Regulation (FAR) Part 31 for For-Profit entities; and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

ii. Pre-Award Costs

Selectees must request prior written approval to charge pre-award costs. Pre-award costs are those incurred prior to the effective date of the federal award directly pursuant to the negotiation and in anticipation of the federal award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are allowable only to the extent that they would have been allowable if incurred after the date of the federal award and **only** with the written approval of the federal awarding agency, through the Contracting Officer assigned to the award.

Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis.

Pre-award expenditures are made at the selectee's risk. EERE is not obligated to reimburse costs: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the selectee anticipated.

1. National Environmental Policy Act (NEPA) Requirements Related to Pre-Award Costs

EERE's decision whether and how to distribute federal funds under this FOA is subject to NEPA. Applicants should carefully consider and should seek legal counsel or other expert advice before taking any action related to the proposed project that would have an adverse effect on the environment or limit the choice of reasonable alternatives prior to EERE completing the NEPA review process.

EERE does not guarantee or assume any obligation to reimburse pre-award costs incurred prior to receiving written authorization from the Contracting Officer. If the applicant elects to undertake activities that DOE determines may have an adverse effect on the environment or limit the choice of reasonable alternatives prior to receiving such written authorization from the Contracting Officer, the applicant is doing so at risk of not receiving federal funding for their project and such costs may not be recognized as allowable cost share. Nothing contained in the pre-award cost reimbursement regulations or any pre-award costs approval letter from the Contracting Officer override

these NEPA requirements to obtain the written authorization from the Contracting Officer prior to taking any action that may have an adverse effect on the environment or limit the choice of reasonable alternatives. Likewise, if an application is selected for negotiation of award, and the prime recipient elects to undertake activities that are not authorized for federal funding by the Contracting Officer in advance of EERE completing a NEPA review, the prime recipient is doing so at risk of not receiving federal funding and such costs may not be recognized as allowable cost share.

iii. Performance of Work in the United States (Foreign Work Waiver)

1. Requirement

All work performed under EERE awards must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment; however, the prime recipient should make every effort to purchase supplies and equipment within the United States. The prime recipient must flow down this requirement to its subrecipients.

2. Failure to Comply

If the prime recipient fails to comply with the Performance of Work in the United States requirement, EERE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable recipient cost share. The prime recipient is responsible should any work under this award be performed outside the United States, absent a waiver, regardless of whether the work is performed by the prime recipient, subrecipients, contractors or other project partners.

3. Waiver

There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a foreign work waiver, the applicant must submit a written waiver request to EERE. [Appendix B](#) lists the necessary information that must be included in a request for a foreign work waiver.

The applicant must demonstrate to the satisfaction of EERE that a waiver would further the purposes of the FOA and is in the economic interests of the United States. EERE may require additional information before considering a waiver request. Save the waiver request(s) in a single PDF file. The applicant does not have the right to appeal EERE's decision concerning a waiver request.

iv. Construction

Recipients are required to obtain written authorization from the Contracting Officer before incurring any major construction costs.

v. Foreign Travel

If international travel is proposed for your project, please note that your organization must comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 USC 40118), commonly referred to as the “Fly America Act,” and implementing regulations at 41 CFR 301-10.131 through 301-10.143. The law and regulations require air transport of people or property to, from, between, or within a country other than the United States, the cost of which is supported under this award, to be performed by or under a cost-sharing arrangement with a U.S. flag carrier, if service is available. Foreign travel costs are allowable only with the written prior approval of the Contracting Officer assigned to the award.

vi. Equipment and Supplies

To the greatest extent practicable, all equipment and products purchased with funds made available under this FOA should be American-made. This requirement does not apply to used or leased equipment.

Property disposition will be required at the end of a project if the current fair market value of property exceeds \$5,000. For-profit entity disposition requirements are set forth at 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316.

vii. Domestic Preference – Infrastructure Projects

As appropriate and to the extent consistent with law, Applicants shall ensure that, to the greatest extent practicable, iron and aluminum as well as steel, cement, and other manufactured products (items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber) used in the proposed project shall be produced in the United States. This requirement shall flow down to all sub-awards including all contracts, subcontracts and purchase orders for work performed under the proposed project.

viii. Lobbying

Recipients and subrecipients may not use any federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Recipients and subrecipients are required to complete and submit SF-LLL, “Disclosure of Lobbying Activities” (<https://www.grants.gov/web/grants/forms/sf-424-individual-family.html>) to ensure that non-federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with the application:

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subject line.*

- An officer or employee of any federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

ix. Risk Assessment

Prior to making a federal award, the DOE is required by 31 U.S.C. 3321 and 41 U.S.C. 2313 to review information available through any Office of Management and Budget (OMB)-designated repositories of government-wide eligibility qualification or financial integrity information, such as SAM Exclusions and “Do Not Pay.”

In addition, DOE evaluates the risk(s) posed by applicants before they receive federal awards. This evaluation may consider: results of the evaluation of the applicant's eligibility; the quality of the application; financial stability; quality of management systems and ability to meet the management standards prescribed in this part; history of performance; reports and findings from audits; and the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-federal entities.

In addition to this review, DOE must comply with the guidelines on government-wide suspension and debarment in 2 CFR 180, and must require non-federal entities to comply with these provisions. These provisions restrict federal awards, subawards and contracts with certain parties that are debarred, suspended or otherwise excluded from or ineligible for participation in federal programs or activities.

x. Invoice Review and Approval

DOE employs a risk-based approach to determine the level of supporting documentation required for approving invoice payments. Recipients may be required to provide some or all of the following items with their requests for reimbursement:

- Summary of costs by cost categories;
- Timesheets or personnel hours report;
- Invoices/receipts for all travel, equipment, supplies, contractual, and other costs;
- UCC filing proof for equipment acquired with project funds by for-profit recipients and subrecipients;
- Explanation of cost share for invoicing period;
- Analogous information for some subrecipients; and
- Other items as required by DOE.

xi. Additional Requirements

[Appendix F](#) outlines DOE Marine Energy data requirements

V. Application Review Information

A. Technical Review Criteria

i. Concept Papers

Concept Papers are evaluated based on consideration of the following factors. All sub-criteria are of equal weight.

Concept Paper Criterion: Overall FOA Responsiveness and Viability of the Project (Weight: 100%)

This criterion involves consideration of the following factors:

- The applicant clearly describes the proposed technology, describes how the technology is unique and innovative, and how the technology will advance the current state-of-the-art;
- The applicant has identified risks and challenges, including possible mitigation strategies, and has shown the impact that EERE funding and the proposed project would have on the relevant field and application;
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project; and
- The proposed work, if successfully accomplished, would clearly meet the objectives as stated in the FOA.

ii. Full Applications

Applications will be evaluated against the merit review criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Technical Merit, Innovation, and Impact (35%)

This criterion involves consideration of the following factors:

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state-of-the-art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including

relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work.

Impact of Technology Advancement

- How the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state-of-the-art.

Criterion 2: Project Plan, Testing Plan, and Likelihood of Project Success (35%)

This criterion involves consideration of the following factors:

Research Approach, Workplan and SOPO

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan and SOPO will succeed in meeting the project goals.

Identification of Technical Risks

- Discussion and demonstrated understanding of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and a mid-point deliverables defined in the application, such that meaningful interim progress will be made.

Market Transformation Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation plan including but not limited to product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, Data Management Plan, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources (20%)

This criterion involves consideration of the following factors:

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success. The qualifications, relevant expertise, and time commitment of the individuals on the team;

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- The sufficiency of the facilities to support the work;
 - The degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies;
 - The level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
 - The reasonableness of the budget and spend plan for the proposed project and objectives.

Criterion 4: Diversity, Equity, and Inclusion (10%)

This criterion involves consideration of the following factors:

- The quality and manner in which the measures incorporate diversity, equity and inclusion goals in the project; and
- Extent to which the project benefits underserved communities.

iii. Criteria for Replies to Reviewer Comments

EERE has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are attached to the original applications and evaluated as an extension of the Full Application.

B. Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this FOA, by the standards set forth in EERE's Notice of Objective Merit Review Procedure (76 Fed. Reg. 17846, March 31, 2011) and the guidance provided in the "DOE Merit Review Guide for Financial Assistance," effective September 2020, which is available at: <https://energy.gov/management/downloads/merit-review-guide-financial-assistance-and-unsolicited-proposals-current>.

i. Program Policy Factors

In addition to the above criteria, the Selection Official may consider the following program policy factors in determining which Full Applications to select for award negotiations:

- The degree to which the proposed project exhibits technological diversity when compared to the existing DOE project portfolio and other projects selected from the subject FOA;
- The degree to which the proposed project, including proposed cost share, optimizes the use of available EERE funding to achieve programmatic objectives;
- The level of industry involvement and demonstrated ability to accelerate commercialization and overcome key market barriers;

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-
- The degree to which the proposed project is likely to lead to increased employment and manufacturing in the United States;
 - The degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications);
 - The degree to which the proposed project incorporates diversity, equity, and inclusion elements, including but not limited to team members from Minority Serving Institutions (e.g. Historically Black Colleges and Universities (HBCUs)/Other Minority Institutions), Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, or members within underserved communities.

C. Evaluation and Selection Process

i. Overview

The evaluation process consists of multiple phases; each includes an initial eligibility review and a thorough technical review. Rigorous technical reviews of eligible submissions are conducted by reviewers that are experts in the subject matter of the FOA. Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as program policy factors, in determining which applications to select.

ii. Pre-Selection Interviews

As part of the evaluation and selection process, EERE may invite one or more applicants to participate in Pre-Selection Interviews. Pre-Selection Interviews are distinct from and more formal than pre-selection clarifications (See Section V.D.iii of the FOA). The invited applicant(s) will meet with EERE representatives to provide clarification on the contents of the Full Applications and to provide EERE an opportunity to ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

EERE will arrange to meet with the invited applicants in person at EERE's offices or a mutually agreed upon location. EERE may also arrange site visits at certain applicants' facilities. In the alternative, EERE may invite certain applicants to participate in a one-on-one conference with EERE via webinar, videoconference, or conference call.

EERE will not reimburse applicants for travel and other expenses relating to the Pre-Selection Interviews, nor will these costs be eligible for reimbursement as pre-award costs.

EERE may obtain additional information through Pre-Selection Interviews that will be used to make a final selection determination. EERE may select applications for funding and make awards without Pre-Selection Interviews. Participation in Pre-Selection Interviews with EERE does not signify that applicants have been selected for award negotiations.

iii. Pre-Selection Clarification

EERE may determine that pre-selection clarifications are necessary from one or more applicants. Pre-selection clarifications are distinct from and less formal than pre-selection interviews. These pre-selection clarifications will solely be for the purposes of clarifying the application, and will be limited to information already provided in the application documentation. The pre-selection clarifications may occur before, during or after the merit review evaluation process. Information provided by an applicant that is not necessary to address the pre-selection clarification question will not be reviewed or considered. Typically, a pre-selection clarification will be carried out through either written responses to EERE's written clarification questions or video or conference calls with EERE representatives.

The information provided by applicants to EERE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and EERE's selection decisions. If EERE contacts an applicant for pre-selection clarification purposes, it does not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

EERE will not reimburse applicants for expenses relating to the pre-selection clarifications, nor will these costs be eligible for reimbursement as pre-award costs.

iv. Recipient Integrity and Performance Matters

DOE, prior to making a federal award with a total amount of federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 U.S.C. 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.205.

v. Selection

The Selection Official may consider the technical merit, the Federal Consensus Board's recommendations, program policy factors, and the amount of funds available in arriving at selections for this FOA.

D. Anticipated Notice of Selection and Award Negotiation Dates

EERE anticipates notifying applicants selected for negotiation of award and negotiating awards by the dates provided on the cover page of this FOA.

VI. Award Administration Information

A. Award Notices

i. Ineligible Submissions

Ineligible Concept Papers and Full Applications will not be further reviewed or considered for award. The Contracting Officer will send a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE Exchange. The notification letter will state the basis upon which the Concept Paper or the Full Application is ineligible and not considered for further review.

ii. Concept Paper Notifications

EERE will notify applicants of its determination to encourage or discourage the submission of a Full Application. EERE will post these notifications to EERE Exchange.

Applicants may submit a Full Application even if they receive a notification discouraging them from doing so. By discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. The purpose of the Concept Paper phase is to save applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

A notification encouraging the submission of a Full Application does not authorize the applicant to commence performance of the project. Please refer to Section IV.J.ii. of the FOA for guidance on pre-award costs.

iii. Full Application Notifications

EERE will notify applicants of its determination via a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE Exchange. The notification letter will inform the applicant whether or not its Full Application was selected for award negotiations. Alternatively, EERE may notify one or more applicants that a final selection determination on particular Full Applications will be made at a later date, subject to the availability of funds or other factors.

iv. Successful Applicants

Receipt of a notification letter selecting a Full Application for award negotiations does not authorize the applicant to commence performance of the project. If an application is selected for award negotiations, it is not a commitment by EERE to issue an award. Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement, accessible by the prime recipient in FedConnect.

The award negotiation process will take approximately 60 days. Applicants must designate a primary and a backup point-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. The applicant must be responsive during award negotiations (i.e., provide requested documentation) and meet the negotiation deadlines. If the applicant fails to do so or if award negotiations are otherwise unsuccessful, EERE will cancel the award negotiations and rescind the Selection. EERE reserves the right to terminate award negotiations at any time for any reason.

Please refer to Section IV.I.ii. of the FOA for guidance on pre-award costs.

v. Alternate Selection Determinations

In some instances, an applicant may receive a notification that its application was not selected for award and EERE designated the application to be an alternate. As an alternate, EERE may consider the Full Application for federal funding in the future. A notification letter stating the Full Application is designated as an alternate does not authorize the applicant to commence performance of the project. EERE may ultimately determine to select or not select the Full Application for award negotiations.

vi. Unsuccessful Applicants

EERE shall promptly notify in writing each applicant whose application has not been selected for award or whose application cannot be funded because of the unavailability of appropriated funds.

B. Administrative and National Policy Requirements

i. Registration Requirements

There are several one-time actions before submitting an application in response to this FOA, and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected. These requirements are as follows:

1. EERE Exchange

Register and create an account on EERE Exchange at <https://eere-Exchange.energy.gov>. This account will then allow the user to register for any open EERE FOAs that are currently in EERE Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission. Applicants should also designate backup points of contact so they may be easily contacted if deemed necessary. **This step is required to apply to this FOA.** The EERE Exchange registration does not have a delay; however, **the remaining registration requirements below could take several weeks to process and are necessary for a potential applicant to receive an award under this FOA.**

2. DUNS Number

Obtain a DUNS number (including the plus 4 extension, if applicable) at <http://fedgov.dnb.com/webform>.

3. System for Award Management

Register with the SAM at <https://www.sam.gov>. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called a Marketing Partner ID Number (MPIN) are important steps in SAM registration. Please update your SAM registration annually.

4. FedConnect

Register in FedConnect at <https://www.fedconnect.net>. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf.

5. Grants.gov

Questions about this FOA? Email MarineEnergyFOA@ee.doe.gov.
Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov Include FOA name and number in subject line.

Register in Grants.gov (<http://www.grants.gov>) to receive automatic updates when Amendments to this FOA are posted. However, please note that Concept Papers, and Full Applications will not be accepted through Grants.gov.

6. Electronic Authorization of Applications and Award Documents

Submission of an application and supplemental information under this FOA through electronic systems used by the DOE, including EERE Exchange and FedConnect.net, constitutes the authorized representative's approval and electronic signature.

ii. Award Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR Part 200 as amended by 2 CFR Part 910.

iii. Foreign National Access

All applicants selected for an award under this FOA may be required to provide information to DOE in order to satisfy requirements for foreign nationals' access to DOE sites, information, technologies, equipment, programs or personnel. A foreign national is defined as any person who is not a U.S. citizen by birth or naturalization. If a selected applicant (including any of its subrecipients, contractors or vendors) anticipates involving foreign nationals in the performance of its award, the selected applicant may be required to provide DOE with specific information about each foreign national to ensure compliance with the requirements for access approval. National laboratory personnel already cleared for site access may be excluded.

iv. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR Part 170. Prime recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier subrecipients. Prime recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

v. National Policy Requirements

The National Policy Assurances that are incorporated as a term and condition of award are located at: <http://www.nsf.gov/awards/managing/rtc.jsp>.

vi. Environmental Review in Accordance with National Environmental Policy Act (NEPA)

EERE's decision whether and how to distribute federal funds under this FOA is subject to NEPA (42 U.S.C. 4321, *et seq.*). NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, at <https://www.energy.gov/nepa>.

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all recipients selected for an award will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project. If DOE determines certain records must be prepared to complete the NEPA review process (e.g., biological evaluations or environmental assessments), the recipient may be required to prepare the records and the costs to prepare the necessary records may be included as part of the project costs.

vii. Applicant Representations and Certifications

1. Lobbying Restrictions

By accepting funds under this award, the prime recipient agrees that none of the funds obligated on the award shall be expended, directly or indirectly, to influence Congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. § 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

2. Corporate Felony Conviction and Federal Tax Liability Representations

In submitting an application in response to this FOA, the applicant represents that:

- a.** It is **not** a corporation that has been convicted of a felony criminal violation under any federal law within the preceding 24 months; and
- b.** It is **not** a corporation that has any unpaid federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

3. Nondisclosure and Confidentiality Agreements Representations

In submitting an application in response to this FOA the applicant represents that:

- a. It **does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contractors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a federal department or agency authorized to receive such information.
- b. It **does not and will not** use any federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:
 - (1) *“These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling.”*
 - (2) The limitation above shall not contravene requirements applicable to Standard Form 312 Classified Information Nondisclosure Agreement (<https://fas.org/sgp/othergov/sf312.pdf>), Form 4414 Sensitive Compartmented Information Disclosure Agreement (<https://fas.org/sgp/othergov/intel/sf4414.pdf>), or any other form issued by a federal department or agency governing the nondisclosure of classified information.
 - (3) Notwithstanding the provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the United States government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

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viii. Statement of Federal Stewardship

EERE will exercise normal federal stewardship in overseeing the project activities performed under EERE awards. Stewardship Activities include, but are not limited to, conducting site visits; reviewing performance and financial reports; providing assistance and/or temporary intervention in unusual circumstances to correct deficiencies that develop during the project; assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

ix. Statement of Substantial Involvement

EERE has substantial involvement in work performed under awards made as a result of this FOA. EERE does not limit its involvement to the administrative requirements of the award. Instead, EERE has substantial involvement in the direction and redirection of the technical aspects of the project as a whole. Substantial involvement includes, but is not limited to, the following:

1. EERE shares responsibility with the recipient for the management, control, direction, and performance of the project.
2. EERE may intervene in the conduct or performance of work under this award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.
3. EERE may redirect or discontinue funding the project based on the outcome of EERE's evaluation of the project at the Go/No-Go decision point(s).
4. EERE participates in major project decision-making processes.

x. Subject Invention Utilization Reporting

In order to ensure that prime recipients and subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE may require that each prime recipient holding title to a subject invention submit annual reports for ten (10) years from the date the subject invention was disclosed to EERE on the utilization of the subject invention and efforts made by prime recipient or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the prime recipient, and such other data and information as EERE may specify.

xi. Intellectual Property Provisions

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at <http://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards>.

xii. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement. This helpful EERE checklist can be accessed at <https://www.energy.gov/eere/funding/eere-funding-application-and-management-forms>. See Attachment 2 Federal Assistance Reporting Checklist, after clicking on "Model Cooperative Agreement" under the Award Package section.

xiii. Go/No-Go Review

Each project selected under this FOA will be subject to a periodic project evaluation referred to as a Go/No-Go Review. At the Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the EERE program goals and objectives. Federal funding beyond the Go/No-Go decision point (continuation funding) is contingent upon (1) availability of federal funds appropriated by Congress for the purpose of this program; (2) the availability of future-year budget authority; (3) recipient's technical progress compared to the Milestone Summary Table stated in Attachment 1 of the award; (4) recipient's submittal of required reports; (5) recipient's compliance with the terms and conditions of the award; (6) EERE's Go/No-Go decision; (7) the recipient's submission of a continuation application; and (8) written approval of the continuation application by the Contracting Officer.

As a result of the Go/No-Go Review, DOE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

The Go/No-Go decision is distinct from a non-compliance determination. In the event a recipient fails to comply with the requirements of an award, EERE may take appropriate action, including but not limited to, redirecting, suspending or terminating the award.

xiv. Conference Spending

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States government would otherwise exceed \$20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such conference.

xv. Uniform Commercial Code (UCC) Financing Statements

Per 2 CFR 910.360 (Real Property and Equipment) when a piece of equipment is purchased by a for-profit recipient or subrecipient with federal funds, and when the federal share of the financial assistance agreement is more than \$1,000,000, the recipient or subrecipient must:

Properly record, and consent to the Department's ability to properly record if the recipient fails to do so, UCC financing statement(s) for all equipment in excess of \$5,000 purchased with project funds. These financing statement(s) must be approved in writing by the Contracting Officer prior to the recording, and they shall provide notice that the recipient's title to all equipment (not real property) purchased with federal funds under the financial assistance agreement is conditional pursuant to the terms of this section, and that the government retains an undivided reversionary interest in the equipment. The UCC financing statement(s) must be filed before the Contracting Officer may reimburse the recipient for the federal share of the equipment unless otherwise provided for in the relevant financial assistance agreement. The recipient shall further make any amendments to the financing statements or additional recordings, including appropriate continuation statements, as necessary or as the Contracting Officer may direct.

xvi. Implementation of Executive Order 13798, Promoting Free Speech and Religious Liberty

States, local governments, or other public entities may not condition sub-awards in a manner that would discriminate, or disadvantage sub-recipients based on their religious character.

xvii. Table of Personnel

If selected for award negotiations, the selected applicant must submit a list of personnel who are proposed to work on the project, both at the recipient and subrecipient level. The table should include the individuals' names, job titles, role in the project and their

organization. Recipients will have an ongoing responsibility to notify DOE of changes to the personnel and submit an updated list during the life of the award as there are changes to the personnel working on the project.

xviii. Pending and Current Sources of Support

Current and pending support is intended to allow the identification of potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. If selected for award negotiations, the principal investigator and each senior/key person at the recipient and subrecipient level must provide a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual's research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. All foreign government-sponsored talent recruitment programs must be identified in current and pending support. The information may be provided in the format approved by the National Science Foundation (NSF), which may be generated by the Science Experts Network Curriculum Vita (SciENCv), a cooperative venture maintained at <https://www.ncbi.nlm.nih.gov/sciencv/>, and is also available at <https://www.nsf.gov/bfa/dias/policy/nsfapprovedformats/cps.pdf>. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

For every activity, list the following items:

- The sponsor of the activity or the source of funding
- The award or other identifying number
- The title of the award or activity. If the title of the award or activity is not descriptive, add a brief description of the research being performed that would identify any overlaps or synergies with the proposed research.
- The total cost or value of the award or activity, including direct and indirect costs and cost share. For pending proposals, provide the total amount of requested funding.
- The award period (start date – end date).
- The person-months of effort per year being dedicated to the award or activity
- If required to identify overlap, duplication of effort, or synergistic efforts, append a description of the other award or activity to the current and pending support.
- Details of any obligations, contractual or otherwise, to any program, entity, or organization sponsored by a foreign government must be provided on request to either the applicant institution or DOE.

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VII. Questions/Agency Contacts

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted to: MarineEnergyFOA@ee.doe.gov. Questions must be submitted not later than 3 business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

All questions and answers related to this FOA will be posted on EERE Exchange at: <https://eere-exchange.energy.gov>. **Please note that you must first select this specific FOA Number in order to view the questions and answers specific to this FOA.** EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website.

Questions related to the registration process and use of the EERE Exchange website should be submitted to: EERE-ExchangeSupport@hq.doe.gov.

VIII. Other Information

A. FOA Modifications

Amendments to this FOA will be posted on the EERE Exchange website and the Grants.gov system. However, you will only receive an email when an amendment or a FOA is posted on these sites if you register for email notifications for this FOA in Grants.gov. EERE recommends that you register as soon after the release of the FOA as possible to ensure you receive timely notice of any amendments or other FOAs.

B. Government Right to Reject or Negotiate

EERE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. Commitment of Public Funds

The Contracting Officer is the only individual who can make awards or commit the government to the expenditure of public funds. A commitment by anyone other than the Contracting Officer, either express or implied, is invalid.

D. Treatment of Application Information

Applicants should not include trade secrets or commercial or financial information that is privileged or confidential in their application unless such information is necessary to

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convey an understanding of the proposed project or to comply with a requirement in the FOA. Applicants are advised to not include any critically sensitive proprietary detail.

If an application includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act. Without assuming any liability for inadvertent disclosure, EERE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for merit review of the application or as otherwise authorized by law. This restriction does not limit the Government's right to use the information if it is obtained from another source.

Full Applications, and other submissions containing confidential, proprietary, or privileged information must be 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. Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

The cover sheet of the Full Application, and other submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source. [End of Notice]

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

E. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Go/No-Go Reviews and Peer Reviews, the government may seek the advice of qualified non-federal personnel as reviewers. The government may also use non-federal personnel to conduct routine, nondiscretionary administrative activities, including EERE contractors. The applicant, by submitting its application, consents to the use of non-federal reviewers/administrators. Non-federal reviewers must sign conflict of interest (COI) and non-disclosure acknowledgements (NDA) prior to reviewing an application. Non-federal personnel conducting administrative activities must sign an NDA.

F. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this FOA include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

G. Notice of Right to Conduct a Review of Financial Capability

EERE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

H. Requirement for Full and Complete Disclosure

Applicants are required to make a full and complete disclosure of all information requested. Any failure to make a full and complete disclosure of the requested information may result in:

- The termination of award negotiations;
- The modification, suspension, and/or termination of a funding agreement;
- The initiation of debarment proceedings, debarment, and/or a declaration of ineligibility for receipt of federal contracts, subcontracts, and financial assistance and benefits; and
- Civil and/or criminal penalties.

I. Retention of Submissions

EERE expects to retain copies of all Full Applications and other submissions. No submissions will be returned. By applying to EERE for funding, applicants consent to EERE's retention of their submissions.

J. Title to Subject Inventions

Ownership of subject inventions is governed pursuant to the authorities listed below:

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- Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions;
- All other parties: The federal Non-Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the government obtains title to new inventions unless a waiver is granted (see below);
- Class Patent Waiver:

DOE has issued a class waiver that applies to this FOA. Under this class waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

- Advance and Identified Waivers: Applicants may request a patent waiver that will cover subject inventions that may be invented under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to EERE within the timeframes set forth in the award's intellectual property terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.
- DEC: Each applicant is required to submit a U.S. Manufacturing Plan as part of its application. If selected, the U.S. Manufacturing Plan shall be incorporated into the award terms and conditions for domestic small businesses and nonprofit organizations. DOE has determined that exceptional circumstances exist that warrants the modification of the standard patent rights clause for small businesses and non-profit awardees under Bayh-Dole to the extent necessary to implement and enforce the U.S. Manufacturing Plan. Any Bayh-Dole entity (domestic small business or nonprofit organization) affected by this DEC has the right to appeal it.

K. Government Rights in Subject Inventions

Where prime recipients and subrecipients retain title to subject inventions, the U.S. government retains certain rights.

i. Government Use License

The U.S. government retains a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world. This license extends to contractors doing work on behalf of the government.

ii. March-In Rights

The U.S. government retains march-in rights with respect to all subject inventions. Through “march-in rights,” the government may require a prime recipient or subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a license for use of the invention to a third party. In addition, the government may grant licenses for use of the subject invention when a prime recipient, subrecipient, or their assignees and exclusive licensees refuse to do so.

DOE may exercise its march-in rights only if it determines that such action is necessary under any of the four following conditions:

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;
- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
- The owner has not met public use requirements specified by federal statutes in a reasonably satisfied manner; or
- The U.S. manufacturing requirement has not been met.

Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision. To date, DOE has never exercised its march-in rights to any subject inventions.

iii. Rights in Technical Data

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

“Limited Rights Data”: The U.S. government will not normally require delivery of confidential or trade secret-type technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.

Government Rights in Technical Data Produced Under Awards: The U.S. government normally retains unlimited rights in technical data produced under government financial

assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated under EERE awards may be protected from public disclosure for up to five years after the data is generated (“Protected Data”). For awards permitting Protected Data, the protected data must be marked as set forth in the awards intellectual property terms and conditions and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause in the award. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

iv. Copyright

The prime recipient and subrecipients may assert copyright in copyrightable works, such as software, first produced under the award without EERE approval. When copyright is asserted, the government retains a paid-up nonexclusive, irrevocable worldwide license to reproduce, prepare derivative works, distribute copies to the public, and to perform publicly and display publicly the copyrighted work. This license extends to contractors and others doing work on behalf of the government.

L. Export Control

The U.S. government regulates the transfer of information, commodities, technology, and software considered to be strategically important to the U.S. to protect national security, foreign policy, and economic interests without imposing undue regulatory burdens on legitimate international trade. There is a network of federal agencies and regulations that govern exports that are collectively referred to as “Export Controls”. To ensure compliance with Export Controls, it is the prime recipient’s responsibility to determine when its project activities trigger Export Controls and to ensure compliance.

Export Controls may apply to individual projects, depending on the nature of the tasks. When Export Controls apply, the recipient must take the appropriate steps to obtain any required governmental licenses, monitor and control access to restricted information, and safeguard all controlled materials. Under no circumstances may foreign entities (organizations, companies or persons) receive access to export controlled information unless proper export procedures have been satisfied and such access is authorized pursuant to law or regulation.

M. Personally Identifiable Information (PII)

All information provided by the applicant must to the greatest extent possible exclude PII. The term “PII” refers to information which can be used to distinguish or trace an individual's identity, such as their name, social security number, biometric records, alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother’s maiden name. (See OMB Memorandum M-07-16 dated May 22, 2007, found at:

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<https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2007/m07-16.pdf>

By way of example, applicants must screen resumes to ensure that they do not contain PII such as personal addresses, personal landline/cell phone numbers, and personal emails. **Under no circumstances should Social Security Numbers (SSNs) be included in the application.** Federal agencies are prohibited from the collecting, using, and displaying unnecessary SSNs. (See, the Federal Information Security Modernization Act of 2014 (Pub. L. No. 113-283, Dec 18, 2014; 44 U.S.C. § 3551).

M. Annual Independent Audits

If a for-profit entity is a prime recipient and has expended \$750,000 or more of DOE awards during the entity's fiscal year, an annual compliance audit performed by an independent auditor is required. For additional information, please refer to 2 CFR 910.501 and Subpart F.

If an educational institution, non-profit organization, or state/local government is a prime recipient or subrecipient and has expended \$750,000 or more of federal awards during the non-federal entity's fiscal year, then a Single or Program-Specific Audit is required. For additional information, please refer to 2 CFR 200.501 and Subpart F.

Applicants and subrecipients (if applicable) should propose sufficient costs in the project budget to cover the costs associated with the audit. EERE will share in the cost of the audit at its applicable cost share ratio.

N. Informational Webinar

EERE will conduct one informational webinar during the FOA process. It will be held after the initial FOA release but before the due date for Concept Papers.

Attendance is not mandatory and will not positively or negatively impact the overall review of any applicant submissions. As the webinar will be open to all applicants who wish to participate, applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project. Specific dates for the webinar can be found on the cover page of the FOA.

APPENDIX A – COST SHARE INFORMATION

Cost Sharing or Cost Matching

The terms “cost sharing” and “cost matching” are often used synonymously. Even the DOE Financial Assistance Regulations, 2 CFR 200.306, use both of the terms in the titles specific to regulations applicable to cost sharing. EERE almost always uses the term “cost sharing,” as it conveys the concept that non-federal share is calculated as a percentage of the Total Project Cost. An exception is the State Energy Program Regulation, 10 CFR 420.12, State Matching Contribution. Here “cost matching” for the non-federal share is calculated as a percentage of the federal funds only, rather than the Total Project Cost.

How Cost Sharing Is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. FFRDC costs must be included in Total Project Costs. The following is an example of how to calculate cost sharing amounts for a project with \$1,000,000 in federal funds with a minimum 20% non-federal cost sharing requirement:

- Formula: Federal share (\$) divided by federal share (%) = Total Project Cost
Example: \$1,000,000 divided by 80% = \$1,250,000
- Formula: Total Project Cost (\$) minus federal share (\$) = Non-federal share (\$)
Example: \$1,250,000 minus \$1,000,000 = \$250,000
- Formula: Non-federal share (\$) divided by Total Project Cost (\$) = Non-federal share (%)
Example: \$250,000 divided by \$1,250,000 = 20%

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under an EERE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the federal government under another award unless authorized by federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

- FAR Part 31 for For-Profit entities, (48 CFR Part 31); and

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- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, EERE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, EERE generally does not allow pre-award costs prior to the signing of the Selection Statement by the EERE Selection Official.

General Cost Sharing Rules on a DOE Award

1. Cash Cost Share – encompasses all contributions to the project made by the recipient or subrecipient(s), for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project.
2. In-Kind Cost Share – encompasses all contributions to the project made by the recipient or subrecipient(s) that do not involve a payment or reimbursement and represent donated items or services. In-Kind cost share items include volunteer personnel hours, donated existing equipment, donated existing supplies. The cash value and calculations thereof for all In-Kind cost share items must be justified and explained in the Cost Share section of the project Budget Justification. All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out the In-Kind cost share section of the Budget Justification.
3. Funds from other federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC subrecipients. Non-federal sources include any source not originally derived from federal funds. Cost sharing commitment letters from subrecipients must be provided with the original application.
4. Fee or profit, including foregone fee or profit, are not allowable as project costs (including cost share) under any resulting award. The project may only incur those costs that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

DOE Financial Assistance Rules 2 CFR Part 200 as amended by 2 CFR Part 910

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As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

- Acceptable contributions. All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the prime recipient's cost sharing if such contributions meet all of the following criteria:
 - (1) They are verifiable from the recipient's records.
 - (2) They are not included as contributions for any other federally-assisted project or program.
 - (3) They are necessary and reasonable for the proper and efficient accomplishment of project or program objectives.
 - (4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:
 - a. For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A-122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the FAR, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations; and
 - b. Other types of organizations. For all other non-federal entities, allowability of costs is determined in accordance with 2 CFR Part 200 Subpart E.
 - (5) They are not paid by the federal government under another award unless authorized by federal statute to be used for cost sharing or matching.
 - (6) They are provided for in the approved budget.
- Valuing and documenting contributions
 - (1) Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of

the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

- a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
 - b. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.
- (2) Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.
- (3) Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.
- (4) Valuing property donated by third parties.
 - a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.
 - b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

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- i.** The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.
 - ii.** The value of loaned equipment must not exceed its fair rental value.

- (5)** Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:
 - a.** Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

 - b.** The basis for determining the valuation for personal services and property must be documented.

APPENDIX B – WAIVER REQUESTS AND APPROVAL PROCESSES: 1. FOREIGN ENTITY PARTICIPATION AS THE PRIME RECIPIENT; AND 2. PERFORMANCE OF WORK IN THE UNITED STATES (FOREIGN WORK WAIVER)

1. Waiver for Foreign Entity Participation as the Prime Recipient

As set forth in Section III.A.iii., all prime recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a state or territory of the United States and have a physical location for business operations in the United States. To request a waiver of this requirement, an applicant must submit an explicit waiver request in the Full Application.

Overall, the applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to have a foreign entity serve as the prime recipient. A request to waive the *Foreign Entity Participation as the prime recipient* requirement must include the following:

- Entity name;
- The rationale for proposing a foreign entity to serve as the prime recipient;
- Country of incorporation and the extent, if any, the entity is state owned or controlled;
- A description of the project’s anticipated contributions to the US economy;
- How the project will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
- How the project will promote domestic American manufacturing of products and/or services;
- A description of how the foreign entity’s participation as the prime recipient is essential to the project;
- A description of the likelihood of Intellectual Property (IP) being created from the work and the treatment of any such IP; and
- Countries where the work will be performed (Note: if any work is proposed to be conducted outside the U.S., the applicant must also complete a separate request for waiver of the Performance of Work in the United States requirement).

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

2. **Waiver for Performance of Work in the United States (Foreign Work Waiver)**

As set forth in Section IV.J.iii., all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the prime recipient should make every effort to purchase supplies and equipment within the United States. There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a waiver of the Performance of Work in the United States requirement, the applicant must submit an explicit waiver request in the Full Application. A separate waiver request must be submitted for each entity proposing performance of work outside of the United States.

Overall, a waiver request must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to perform work outside of the United States. A request to waive the *Performance of Work in the United States* requirement must include the following:

- The rationale for performing the work outside the U.S. ("foreign work");
- A description of the work proposed to be performed outside the U.S.;
- An explanation as to how the foreign work is essential to the project;
- A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the US economy;
- The associated benefits to be realized and the contribution to the project from the foreign work;
- How the foreign work will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
- How the foreign work will promote domestic American manufacturing of products and/or services;
- A description of the likelihood of Intellectual Property (IP) being created from the foreign work and the treatment of any such IP;
- The total estimated cost (DOE and recipient cost share) of the proposed foreign work;
- The countries in which the foreign work is proposed to be performed; and
- The name of the entity that would perform the foreign work.

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

APPENDIX C – GLOSSARY

Applicant – The lead organization submitting an application under the FOA.

Continuation application – A non-competitive application for an additional budget period within a previously approved project period. At least ninety (90) days before the end of each budget period, the Recipient must submit to EERE its continuation application, which includes the following information:

- i. A report on the Recipient’s progress towards meeting the objectives of the project, including any significant findings, conclusions, or developments, and an estimate of any unobligated balances remaining at the end of the budget period. If the remaining unobligated balance is estimated to exceed 20 percent of the funds available for the budget period, explain why the excess funds have not been obligated and how they will be used in the next budget period.
- ii. A detailed budget and supporting justification if there are changes to the negotiated budget, or a budget for the upcoming budget period was not approved at the time of award.
- iii. A description of any planned changes from the negotiated Statement of Project Objectives and/or Milestone Summary Table.

Cooperative Research and Development Agreement (CRADA) – a contractual agreement between a national laboratory contractor and a private company or university to work together on research and development. For more information, see <https://www.energy.gov/gc/downloads/doe-cooperative-research-and-development-agreements>

Federally Funded Research and Development Centers (FFRDC) - FFRDCs are public-private partnerships which conduct research for the United States government. A listing of FFRDCs can be found at <http://www.nsf.gov/statistics/ffrdclist/>.

Go/No-Go Decision Points: – A decision point at the end of a budget period that defines the overall objectives, milestones and deliverables to be achieved by the recipient in that budget period. As of a result of EERE’s review, EERE may take one of the following actions: 1) authorize federal funding for the next budget period; 2) recommend redirection of work; 3) discontinue providing federal funding beyond the current budget period; or 4) place a hold on federal funding pending further supporting data.

Project – The entire scope of the cooperative agreement which is contained in the recipient’s Statement of Project Objectives.

Recipient or “Prime Recipient” – A non-federal entity that receives a federal award directly from a federal awarding agency to carry out an activity under a federal program. The term recipient does not include subrecipients.

Subrecipient – A non-federal entity that receives a subaward from a pass-through entity to carry out part of a federal program; but does not include an individual that is a beneficiary of such program. A subrecipient may also be a recipient of other federal awards directly from a federal awarding agency. Also, a DOE/NNSA and non-DOE/NNSA FFRDC may be proposed as a subrecipient on another entity’s application. See section III.E.ii.

APPENDIX D – LIST OF ACRONYMS

COI	Conflict of Interest
DEC	Determination of Exceptional Circumstances
DMP	Data Management Plan
DOE	Department of Energy
DOI	Digital Object Identifier
EERE	Energy Efficiency and Renewable Energy
FAR	Federal Acquisition Regulation
FFATA	Federal Funding and Transparency Act of 2006
FOA	Funding Opportunity Announcement
FOIA	Freedom of Information Act
FFRDC	Federally Funded Research and Development Center
GAAP	Generally Accepted Accounting Principles
LCOE	Levelized Cost of Energy
M&O	Management and Operating
MPIN	Marketing Partner ID Number
MYPP	Multi-Year Program Plan
NDA	Non-Disclosure Acknowledgement
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Agency
NREL	National Renewable Energy Laboratory
OMB	Office of Management and Budget
OSTI	Office of Scientific and Technical Information
OSU	Oregon State University
PII	Personal Identifiable Information
PNNL	Pacific Northwest National Laboratories
R&D	Research and Development
RFI	Request for Information
RFP	Request for Proposal
SAM	System for Award Management
SNL	Sandia National Laboratories
SOPO	Statement of Project Objectives
SPOC	Single Point of Contact
TRL	Technology Readiness Level
UCC	Uniform Commercial Code
WBS	Work Breakdown Structure
WP	Work Proposal

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subject line.

APPENDIX E – DEFINITION OF TECHNOLOGY READINESS LEVELS

TRL indicates the stage of development/deployment that technologies, which are undergoing partial or full-scale device testing, are currently in.

TRL 1-3: Discovery / Concept Definition / Early Stage Development, Design, and Engineering

The purpose of this stage is to evaluate, to the largest extent possible, the scientific or technical merit and feasibility of ideas that appear to have commercial potential.

- **TRL 1/2:** Scientific research begins to be translated into applied research and development where basic principles are observed and reported. Technology concepts and applications are formulated and investigated through analytic studies and in-depth investigations of principal design considerations. This level is characterized by paper studies, concept exploration, and planning.
- **TRL 3:** At this level, active research is initiated, including engineering studies and laboratory studies to physically validate analytical predictions of separate elements of the technology.

TRL 4: Proof of Concept

The purpose of this stage is to evaluate, insofar as possible, the scientific or technical merit and feasibility of ideas that appear to have commercial potential.

- **TRL 4:** This TRL represents early stage proof-of-concept system or component development, testing, and concept validation. In this stage, critical technology elements are developed and tested in a laboratory environment. It is envisioned that scale models will be at a 1:10 scale or smaller. At this level, basic technological components of a subscale model are integrated to validate design predictions and system-level functionality. The models, or critical subsystems, are tested in a laboratory environment.

TRL 5/6: System Integration and Technology Laboratory Demonstration

At this TRL, device-, system-, and subsystem-level interfacing/integration testing represent a vital stage in technology development, and must be demonstrated. Models should be at a relevant scale (1:1–1:5) to reflect the challenges and realities of the full-scale (1:1) system. Model testing is to be performed at a test facility capable of producing simulated waves/currents and other operational conditions while monitoring device response and performance. Furthermore, the device's foundation concept shall be incorporated and demonstrated.

- **TRL 5:** At this level, basic technological components are fabricated at a scale relevant to full-scale and integrated to establish and verify subsystem and system-level functionality and preparation for testing in a simulated environment.
- **TRL 6:** At this level, a representative model or prototype system at a scale relevant to full-scale, which is beyond that of TRL 5, is tested in a relevant environment. This level represents a major step up in a technology's demonstrated readiness and risk mitigation leading to open water testing.

TRL 7/8: Open Water System Testing, Demonstration, and Operation

At this stage, the device model scale is expected to be at or near full scale (1:1–1:2). Initially, testing may be performed in water at a relatively benign location, with the expectation that testing will then be performed in a fully exposed, open water environment where representative operating environments can be experienced. The

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final foundation/mooring design shall be incorporated into model testing at this stage.

- **TRL 7:** At this level, the prototype scale components and subsystems are fabricated and integrated to establish and verify subsystem and system level functionality and preparation for testing in an open water operational environment to verify expected operation and fine tune the design prior to deployment in an operational demonstration project.
- **TRL 8:** At this level, the prototype in its final form (at or near full scale) is to be tested and qualified in an open water environment under all expected operating conditions to demonstrate readiness for commercial deployment in a demonstration project. Testing should include extreme conditions.

TRL 9: Commercial-Scale Production / Application

This stage represents an in-service application of the technology in its final form and under mission condition.

- **TRL 9:** At this level, the actual, commercial-scale system is proven through successful mission operations, whereby it is fielded and being used in commercial application.

APPENDIX F – DOE MARINE ENERGY DATA REPOSITORY PLAN

All data collected, as well as key deliverables, should be delivered in accordance with the Federal Assistance Reporting Checklist. Data will be uploaded either to the [EERE Project Management Center \(PMC\)](#), [DOE CODE](#), Interagency Edison ([iEdison](#)), USDOE Scientific and Technical Information management system ([OSTI elink](#)), to the relevant WPTO-funded [PRIMRE Knowledge Hubs](#) ([MHKDR](#), [Tethys](#), [Tethys Engineering](#), and [MRE Software](#)). Data should be uploaded as it is generated, but no later than the end of each reporting quarter in which the data is generated. The data will be made publicly available once it has been submitted, curated, and accepted into the appropriate system. Data submitted to MHKDR that have been identified as protected, or subject to a moratorium, will not be made publicly available until the period of protection is over or the moratorium has expired, and will be held in a secure section of the system. Protected Data will be treated according to the Intellectual Property Provisions of the Award.

Products resulting from WPTO financial assistance should be uploaded to the appropriate PRIMRE Knowledge Hub:

- MHKDR
 - Data; including any modeling outputs, visualizations, schematics, videos, code, software, raw data or other digital assets suitable for public release should be uploaded to DOE Marine and Hydrokinetic Data Repository (<https://mhkdr.openei.org>). For more information, see the MHK Data Repository Training Video online at <https://youtube.com/openei> or access tutorials and frequently asked questions (FAQs) under “Help” at <https://mhkdr.openei.org>.
- Tethys
 - Publications (such as journal articles, technical reports, conference papers, white papers, or as well as other public documents) focused on research, monitoring results, or technology development to assess and mitigate environmental effects of marine energy will be [contributed to Tethys](#). (<https://tethys.pnnl.gov/contributing-tethys>). All uploads are carried out by the Tethys team at PNNL.
- Tethys Engineering
 - Publications (such as journal articles, technical reports, conference papers, white papers, or as well as other public documents) focused on technical and engineering information about marine energy will be contributed to Tethys Engineering (<https://tethys-engineering.pnnl.gov/contribute-tethys-engineering>). All uploads are carried out by the Tethys Engineering team at PNNL.
- MRE Software
 - Software developed for marine energy applications should be hosted on the PRIMRE Code Catalog (https://openei.org/wiki/PRIMRE/Code_Catalog). Submit software through the MRE Code Submission Form. Open-source software hosted on a public

repository will automatically be forked into the GitHub MRE Code Hub (<https://github.com/MRE-Code-Hub>).

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APPENDIX G – EXAMPLE PERFORMANCE METRICS

Levelized cost of energy (LCOE) calculated using the NREL System Advisory Model (SAM) (<https://sam.nrel.gov/>).

Peak-to-average mechanical power as a function of significant wave height and peak period, where the peak absorbed power is the peak of mechanical power absorbed before conversion to electrical power.

$$\text{Peak to average power} = \frac{\text{peak absorbed power [kW]}}{\text{average absorbed power [kW]}}$$

Note that this can be the statistical measure of the peak power, fitted to a distribution rather than the absolute peak measured in testing. Average absorbed power is average mechanical power absorbed before conversion to electrical power.

Capture width ratio as a function of significant wave height and peak period. Capture width ratio should be calculated as the average width of wave front captured by the device as a given sea state divided by the characteristic dimension (e.g., diameter) of the device multiplied by the average wave energy flux at the given sea state.

$$\text{Capture width ratio} = \frac{\text{capture width [m]}}{\text{characteristic dimension of the device [m]}}$$

$$\text{Capture width} = \frac{\text{absorbed wave power [kW]}}{\text{wave resource } \left[\frac{\text{kW}}{\text{m}}\right]}$$

Other resources for industry accepted performance metrics can be found in the following links:

- **Ocean Energy Systems (OES) Task 12 Performance Metrics International Framework for Ocean Energy** is an international stage gate metrics framework to be used by technology developers, investors and funders:
 - <https://www.ocean-energy-systems.org/documents/47763-evaluation-guidance-ocean-energy-technologies2.pdf/>
- **Techno-Economic Performance Metrics by Sandia National Laboratory, which includes:**
 - <https://energy.sandia.gov/programs/renewable-energy/water-power/research-capabilities/techno-economic-performance-metrics/>
 - Existing Ocean Energy Performance Metrics: <https://energy.sandia.gov/download/56788/>
 - Lessons Learned Based on SNL Experience in Reviews of SPA Controls Awardees: <https://energy.sandia.gov/download/56799/>

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APPENDIX H – DESIGN STANDARDS

The following table provides information on the international standards that projects funded under this FOA should consider, as appropriate. This appendix does not provide a comprehensive list of relevant standards and applicants are responsible for identifying the standards appropriate to consider for their project. More information on International Electrotechnical Commission Standards (IEC) – Technical Committee (TC) 114 - Marine energy - Wave, tidal and other water current converters is available on the IEC TC 114 website¹⁹

¹⁹ https://www.iec.ch/dyn/www/f?p=103:7:916162839123:::::FSP_ORG_ID:1316

Document	Title	Reference	Scope
IEC TS 62600-2	Marine energy systems - Design requirements	https://webstore.iec.ch/publication/62399	Provides design requirements to ensure the engineering integrity of wave, ocean, tidal and river current energy converters, collectively referred to as marine energy converters. Its purpose is to provide an appropriate level of protection against damage from all hazards that may lead to catastrophic failure of the MEC structural, mechanical, electrical or control systems.
62600-3	Measurement of mechanical loads	https://webstore.iec.ch/publication/60359	Describes the measurement of mechanical loads on hydrodynamic marine energy converters such as wave, tidal and other water current converters (including river current converters) for the purpose of load simulation model validation and certification. This document contains the requirements and recommendations for the measurement of mechanical loads for such activities as site selection, measurand selection, data acquisition, calibration, data verification, measurement load cases, capture matrix, post-processing, uncertainty determination and reporting.
62600-4	Specification for establishing qualification of new technology	https://webstore.iec.ch/publication/63710	Specifies the requirements of the technology qualification process for marine renewable technologies. Technology Qualification is a process of providing evidence and arguments to support claims that the technology under assessment will function reliably in a target operating environment within specific limits and with an acceptable level of confidence.
62600-10	Assessment of mooring system for marine energy converters	https://webstore.iec.ch/publication/22012	Provides uniform methodologies for the design and assessment of mooring systems for floating MECs. It is intended to be applied at various stages, from mooring system assessment to design, installation and maintenance of floating MEC plants. Is applicable to mooring systems for floating MEC units of any size or type in any open water conditions. The intent of this technical specification is to highlight the different requirements of MECs.
62600-30	Electrical power quality requirements	https://webstore.iec.ch/publication/28781	Includes: definition and specification of the quantities to be determined for characterizing the power quality of a marine energy (wave, tidal and other water current) converter unit; measurement procedures for quantifying the characteristics of a marine energy (wave, tidal and other water current) converter. The measurement procedures are valid for a single marine energy converter (MEC) unit (or farm) with three-phase grid or an off-grid connection. The measurement procedures are valid for any size of MEC unit.

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62600-40	Acoustic characterization of marine energy converters	https://webstore.iec.ch/publication/31031	Provides uniform methodologies to consistently characterize the sound produced by the operation of marine energy converters that generate electricity, including wave, current, and ocean thermal energy conversion. This document does not include the characterization of sound associated with installation, maintenance, or decommissioning of these converters, nor does it establish thresholds for determining environmental impacts. Characterization refers to received levels of sound at particular ranges, depths, and orientations to a marine energy converter.
62600-100	Electricity producing wave energy converters - Power performance assessment	https://webstore.iec.ch/publication/60192	Provides a method for assessing the electrical power production performance of a Wave Energy Converter (WEC), based on the performance at a testing site. Provides a systematic method which includes: - measurement of WEC power output in a range of sea states; - WEC power matrix development; - an agreed framework for reporting the results of power and wave measurements. The contents of the corrigendum of April 2017 have been included in this copy.
62600-101	Wave energy resource assessment and characterization	https://webstore.iec.ch/publication/22593	Establishes a system for estimating, analyzing and reporting the wave energy resource at sites potentially suitable for the installation of Wave Energy Converters (WECs). This Technical Specification is to be applied at all stages of site assessment from initial investigations to detailed project design. In conjunction with IEC TS 62600-100 (WEC performance) it enables an estimate of the annual energy production of a WEC or WEC array to be calculated.
62600-102	Wave energy converter power performance assessment at a second location using measured assessment data	https://webstore.iec.ch/publication/25626	Describes the required methods and the required conditions to determine the power performance of the Wave Energy Converter 2 (WEC 2) in Location 2, possibly at a different scale and with configuration changes to accommodate the new site conditions, in all cases based on measured power performance of WEC 1 in Location 1. This technical specification allows for assessment at Location 1 or Location 2 based on limited/incomplete data material, as long as this is accompanied by a validated numerical model or physical model and assessment of the uncertainty involved. Another key element is transparency in the assessment.

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62600-103	Guidelines for the early stage development of wave energy converters - Best practices and recommended procedures for the testing of pre-prototype devices	https://webstore.iec.ch/publication/32966	Is concerned with the sub-prototype scale development of wave energy converters. It includes the wave tank test programmes, where wave conditions are controlled so they can be scheduled, and the first large-scale sea trials, where sea states occur naturally and the programmes are adjusted and flexible to accommodate the conditions. This document describes the minimum test programmes that form the basis of a structured technology development schedule. For each testing campaign, the prerequisites, goals and minimum test plans are specified.
62600-200	Electricity producing tidal energy converters - Power performance assessment	https://webstore.iec.ch/publication/7242	Provides the following items: - a systematic methodology for evaluating the power performance of tidal current energy converters (TECs) that produce electricity for utility scale and localized grids; - a definition of TEC rated power and rated water velocity; - a methodology for the production of the power curves for the TECs in consideration; - a framework for the reporting of results. City rural electrification marine power
IEEE 1547	IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces	https://standards.ieee.org/standard/1547-2018.html	The technical specifications for, and testing of, the interconnection and interoperability between utility electric power systems (EPSs) and distributed energy resources (DERs) are the focus of this standard. It provides requirements relevant to the performance, operation, testing, safety considerations, and maintenance of the interconnection. It also includes general requirements, response to abnormal conditions, power quality, islanding, and test specifications and requirements for design, production, installation evaluation, commissioning, and periodic tests. The stated requirements are universally needed for interconnection of DER, including synchronous machines, induction machines, or power inverters/converters and will be sufficient for most installations. The criteria and requirements are applicable to all DER technologies interconnected to EPSs at typical primary and/or secondary distribution voltages. Installation of DER on radial primary and secondary distribution systems is the main emphasis of this document, although installation of DERs on primary and secondary network distribution systems is considered. This standard is written considering that the DER is a 60 Hz source.

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APPENDIX I – GENERAL MEASUREMENT LIST FOR OPEN WATER DEPLOYMENT PROJECTS

This appendix presents data that may be required by WPTO to be submitted to MHK-DR as project deliverables. This list is not comprehensive, and WPTO may require data that is not listed in this Appendix to be submitted as deliverables.

Device Specifications

- Description of energy capture technology, including cut-off levels, depth below surface (or above the seabed) of the energy capture axis
- Description of power take-off system and its rating – power, voltage, type of generator, etc.
- Normal range of operating parameters
- Extreme event operating parameters
- Standard dimensions
- Device weight and displacement (ballasted and unballasted)
- Center of mass, center of balance
- Power production
 - Electrical - Rated power output,
 - Average power output (averaged over 1 year)
 - Hydraulic
 - Mechanical
- Capture efficiency
- Availability
- Structural Design
 - CAD drawings of the device
 - List of components and weights
 - Materials used
- Platform/Mooring Design
 - Surface structure geometry
 - Anchor type and weight
 - CAD drawing of anchors
 - Arrangement
 - Mooring line, type, arrangement (slack and taught), thickness and weight
- Power Conversion Chain
 - Power Conversion Chain (PCC) schematic with detailed layout/sizing
 - Breakdown of power conversion components and specs (pistons, generator, accumulators, etc.), including sizing, weight, efficiencies, power, voltage, as applicable
 - Description of control system (ex; latching, frequency of device parameter adjustment, wave by wave, etc.)
 - Control flow diagram including control algorithm(s)
 - Failure rate distribution of each component (by cycles or time)
 - Scheduled Maintenance requirements (i.e. Gearbox needs oil replacement every 2-years)

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- Electrical System
 - Electrical topology
 - Subsystems/components: size, weight
 - EMF output (device and cables)
- Biofouling Effects
 - On power output
 - On system loading

Device Measurements

- Motion
- Geodetic position (GPS)
- Heading
- Altitude above bottom
- Waterline
- 6 Degrees of Freedom - surge, sway, heave, roll, pitch, yaw and derivatives
- Power Conversion Chain
- Relative velocity (linear or rotational) that's driving the PTO (for a hydraulic system an equivalent would be piston displacement vs. time)
- Stroke length if applicable
- Generator input torque vs. time
- Power vs. time
- Available power
- Mechanical power
- Generated power
- Internal and generator temperatures
- Cycles
- Vibration/acceleration
- Shaft strain
- Primary structure
- Linear vibration/acceleration
- Loads (strain at primary components > 20 gauges)
- Wave pressure force
- Mooring
- Line tension
- Line angle
- Power (power quality, min sampling rate of 50 kHz (1 minute avg))
- Device voltage
- Device current
- Grid voltage - if applicable
- Grid current - if applicable

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- System Health
- Water intrusion
- Internal humidity
- Internal temperature
- Fault status
- Acoustic
- Internal sound levels
- Video
- Surface video
- Subsurface video

Manufacturing

- List components that are one-off constructions versus commercial off-the-shelf (COTS)
- Weights and dimensions associated with the following components:
 - Moorings
 - Float structure
 - Major PTO components such as the generator and hydraulic systems
 - Energy coupling system
 - Power transmission equipment
 - Subsea cable
 - Energy storage system
- List of components that must be assembled on site
- Number of devices planned for an array
 - Description of array configuration
- The supplier(s) of the materials and components
- The lot size ordered, the assemblers/fabricators
- Cost information for the parts
- Where the equipment and materials come from (are they imported?)
- Method and cost of transport

Installation and Operations and Maintenance

- Final assembly procedure at port (cranes, cost, etc.)
- Installation procedure, schedule and cost
- Required dedicated O&M Vessel(s)
- Required onshore O&M facilities
- O&M equipment purchases and cost

Grid Connection

- Overview map showing: (1) deployment location, (2) grid interconnection point, (3) distances
- Cable design details - dimensions, rated capacity, frequency, # of conductors, etc.
- Device or array connection to power transmission cable
- Packing density (Array layouts for: 1, 10, 100 devices)

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- Voltage frequency and the permitted tolerances
- Prevailing grid conditions that may have limited the power output during the test period
- Grid connection voltage, current, frequency including measures of voltage flicker and fluctuations, harmonic distortion (including existing grid harmonics and harmonic emission from device), power factor, and voltage unbalance.

Metocean Measurements

- Sea surface
 - Wave time histories (near device)
 - Joint probability distribution
 - Scatter diagram (Hs vs. Te)
 - Directional wave spectra
 - Water depth
- In-Flow
 - Current velocity profile
- Water Properties
 - Temperature (profile with depth if applicable)
 - Salinity
 - pH
 - Conductivity
 - Dissolved oxygen
 - Suspended sediment (concentration, particle size)
 - Turbidity
 - Dissolved nutrients (nitrate, phosphate, silicate, etc.)
- Meteorology
 - Wind speed and direction
 - Air temperature
 - Relative humidity
 - Barometric pressure
- Acoustic
 - Ambient noise/sound levels
- Electromagnetic Field (EMF)
 - Strength
 - Spectra

Bathymetry

- Bathymetry & topology of seabed (could have potential effect on performance of devices/mooring system, quality of tidal currents). Specify measurement method (i.e., multi-beam and/or single-beam, side scan, video, etc.)
- Sub-bottom/sediment core samples with soil characteristics (geotechnical data for designing foundations and anchoring systems)
 - Bulk Density with depth
 - Particle size distribution with depth
 - Total organic carbon (to help characterize benthic habitat)

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Biological Characteristics and Effects

- All baseline pre-installation biological survey data
- All biological monitoring for effects during construction, operation and decommissioning
- Baseline assessments of marine animals in area, particularly threatened or endangered species (i.e. marine mammals, seabirds, resident and migratory fish, commercially important invertebrates like crab)
- Monitoring data (post installation) of direct and indirect interactions of marine animals with devices
- Benthic substrate characteristics, before and after installation
- Measures of productivity of systems, such as chlorophyll
- Animals affected by acoustics (noise)
- Animals affected by EMF from devices or cables
- Near shore habitat that will be affected by cable crossings, grid connection
- Benthic habitat surveys before and after deployment
- Surveys of macrofauna before and after deployment
- ROV survey results
- Type of monitoring equipment & methodology

Siting and Acceptance

- Fishing - Commercial/recreational/subsistence
- Key recreational uses
- Navigation, commercial shipping, etc.
- Outreach activities
- Demographic studies
- Other marine industries
- Nearby port/landing facility
- Outline of required studies
- Study cost estimates
- Permitting process cost and timelines