NOWRDC reserves the right to extend and/or add funding to the Solicitation should other program funding sources become available

National Offshore Wind Research and Development Consortium
Innovation in Offshore Wind Solicitation 1.0
(Via NYSERDA PON 4476)
Proposal submissions accepted until:

Round 1 - Enabling Large Scale Turbines: Due Date September 21, 2020

Round 2 - Support Structure Innovation; Supply Chain Development: Due Date October 5, 2020

Round 3 - Electrical Systems and Innovation; Mitigation of Use Conflicts: Due Date October 19, 2020

3:00PM EST as designated by Round due date

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I. INTRODUCTION

In June 2018, the U.S. Department of Energy (DOE) announced the selection of the New York State Energy Research and Development Authority (NYSERDA), the Renewables Consulting Group (RCG), the Carbon Trust (CT), and the Advanced Energy Research and Technology Center (AERTC) at Stony Brook University to form a nationwide research and development organization for the offshore wind industry. The National Offshore Wind Research and Development Consortium (NOWRDC) is a nationally focused, independent, not-for-profit consortium of key offshore wind industry stakeholders and research institutions. NOWRDC is dedicated to managing industry-prioritized research and development of offshore wind to maximize economic benefits for the United States. The U.S. DOE award is for $20.5 million. This award was matched by NYSERDA, for a total of $41 million to support offshore wind research projects. In addition, three states (Massachusetts, Maryland and Virginia) offer cost share programs for applicants from those states. NOWRDC completed its first solicitation for offshore wind research and development technology projects earlier this year; twenty projects were selected for contract negotiation to receive funding from NOWRDC, bringing the total funding awarded to date to over $17.3 million.

NOWRDC seeks to fulfill, in part, a long-term vision for offshore wind energy in the United States that is supported by current policy for an all-inclusive energy strategy. To achieve this vision, NOWRDC supports identification of the technology innovations needed to address challenges and lower costs in each of the five U.S. offshore regions, allowing offshore wind to compete in all regional electricity markets without subsidies. The necessary cost reductions can be realized in part through targeted research and development (R&D) that removes or reduces technological and supply chain barriers to deployment and lowers development risk to investors. NOWRDC envisions this research being conducted through desktop

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studies, design development, and computer analysis, as well as hardware development with supporting demonstration and validation activities.

In November 2019, NOWRDC released its Research and Development Roadmap 2.0 (Roadmap) to advance offshore wind technology, drive wind technology innovation and combat climate change. Incorporating industry-led feedback, the Roadmap presents a long-term vision for innovative offshore wind technology development in the United States and identifies key priorities for establishing the industry as a leading national clean energy sector. Proposers are encouraged to review the Roadmap which is posted on NOWRDC's website at: https://nationaloffshorewind.org/.

Focusing on the research and development priorities identified in the Roadmap, available research funds will be distributed through a series of competitive solicitations over four years. These competitive solicitations reflect the three Research Pillars described in the original U.S. DOE funding opportunity announcement (DOE FOA 1767):

Pillar #1: Offshore Wind Plant Technology Advancement

Pillar #2: Offshore Wind Power Resource and Physical Site Characterization

Pillar #3: Installation, Operations and Maintenance, and Supply Chain

This Solicitation seeks proposals that fall within Pillar #1 and Pillar #3 to address the specific Technical Challenge Areas outlined in Section II of this document. Future solicitations or revisions of this Solicitation may add additional Challenge Areas, or update or remove existing ones. Proposals for research on topics other than those identified in Section II, in accordance with the current revision of the Solicitation at the time the proposal is submitted, are not within the scope of this Solicitation and will be considered non-responsive.

NOWRDC intends to support projects in partnership with the best research organizations to achieve maximum impact. Proposals are welcomed from all geographic locations. It should be noted that, as a condition of the award, a waiver from the U.S. DOE will be required for any funded work that will be undertaken outside of the United States.

All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind developer or a U.S. offshore wind materials or services supplier, or include an advisory group of industry experts to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should demonstrate knowledge of prior research, and/or identify partners who have been working on this challenge in order to demonstrate that the proposed research will further the overall state-of-the-art.

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Proposal Submission: Proposers may submit multiple proposals provided that each proposal concerns a separate and distinct topic. Each individual proposal must be submitted as a single file, inclusive of all supporting documents. Online submission is preferred. Proposers may submit Word, Excel, or PDF files (file formats include: csv, doc, docx, gif, jpeg, jpg, pdf, png, ppt, pptx, pps, ppsx, tif, txt, xls, xlsx, and zip). Individual files should be 100MB or less in file size. Proposal PDFs should be searchable and should be created by direct conversion from MS Word, or other conversion utility. Files should not be scanned. For ease of identification, all electronic files must be named using the proposer's entity name in the title of the document. NOWRDC will also accept proposals by mail or hand-delivery if online submission is not possible. For detailed instructions on how to submit a proposal (online or paper submission), click the link "Application Instructions and Portal Training Guide [PDF] " located in the "Current Opportunities" section of NYSERDA's website (https://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities.aspx).

No communication intended to influence this procurement is permitted. For technical questions about this proposal please email info@nationaloffshorewind.org. Emails will be reviewed daily, and responses provided as warranted.

Contractual questions or questions about NOWRDC's processes and policies regarding this Solicitation should be directed to Carrie Cullen Hitt at carrie.hitt@nationaloffshorewind.org. Contacting anyone other than the Designated Contacts (either directly by the proposer or indirectly through a lobbyist or other person acting on the proposer's behalf) in an attempt to influence the procurement: (1) may result in a proposer being deemed a non-responsible offerer, and (2) may result in the proposer not being awarded a contract.

Scoring Rounds:

Proposals will be accepted at any time up until the due dates noted for each of the three Scoring Rounds described in Section II. There will be one Scoring Committee per Round. NOWRDC reserves the right to change the interval of Scoring Rounds. Any, all, or none of the available program funds may be awarded in any Scoring Round. Proposals not selected for award can be updated based on feedback and can be resubmitted in later solicitations.

All Proposals must be received by 3 p.m. Eastern Time on the dates noted, via the means indicated above. **Late, faxed, or emailed proposals will not be accepted.** Incomplete proposals may be subject to disqualification. It is the proposer's responsibility to ensure that all pages have been completed/included in the application. Please note: for online submission, there are required questions that you will have to answer in addition to uploading attachments and you should allot at least 60 minutes to enter/submit applications. The online application system closes promptly at 3 p.m. Files in process or attempted edits or submission after 3 p.m. Eastern Time will not be accepted. If changes are made to this Solicitation, notification will be posted on the "Announcements" section of NOWRDC's website at https://nationaloffshorewind.org/ and NYSERDA's website https://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities.aspx.

Guidance for Federally Funded Research and Development Centers (FFRDCs):

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Federally Funded Research and Development Centers (FFRDCs), including but not limited to U.S. DOE national laboratories, are eligible to receive awards under this Solicitation as either a prime recipient or subrecipient. Except where noted below, all requirements for proposal submission and project execution apply equally to FFRDCs and to other applicants.

Proposals from or including FFRDCs will be evaluated and selected for award according to the procedures and criteria described in this Solicitation. No preference in evaluation and selection of awardees will be given to proposals from or including FFRDCs. FFRDC funding may not exceed 25% of the total of DOE's and NYSERDA funding for projects awarded in response to NOWRDC Solicitations. As of the date of this Solicitation, up to approximately $5,000,000 of project funding remains available for potential awards to FFRDCs as prime or sub-recipients, in response to this or future solicitations. There is, however, no obligation to award any of this amount beyond the established guidelines of the merit-based process by which all applications will be evaluated.

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II. SOLICITATION TOPICS AND REQUIREMENTS

The following Scoring Rounds (see Table 1 below) and Challenge Area descriptions include examples of projects that would address the challenge as a guide for prospective proposers. Guidelines for quantifying the benefits of proposed projects to the U.S. offshore wind industry are also provided.

Proposals for research on topics other than the Challenge Areas described are not in scope for this Solicitation and will be considered non-responsive. However, in future Solicitations, Challenge Areas may be added, deleted or modified. Similarly, the Roadmap, on which solicitation topics are based, will be periodically revised in response to progress in research and commercialization, as well as needs voiced by industry.

Construction of new research facilities or capital-intensive modification of existing facilities will not be funded under this Solicitation. However, this Solicitation may support research and equipment related to such facilities. For example, if testing and validation of an innovative technology are included in the scope of a proposed project, certain costs such as fabrication of test articles, procurement or upgrading of state-of-the-art instrumentation, data collection labor, and established facility usage fees may be funded. However, funds may not be used to, for instance, build or upgrade facility structures or infrastructure, or to erect instrumentation towers.

All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind developer, a U.S. offshore wind component supplier, or include an advisory group comprising developers and/or suppliers to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research that can be leveraged and/or partners who have been working on this challenge to demonstrate that the research will clearly further the overall state-of-the-art and will not duplicate or approximate other studies, products, or R&D projects.

The offshore wind industry is trending toward installing larger turbines (12MW - 15MW) in the next decade, with ultra-large (>15MW) turbines likely in the future. Therefore proposals under Round One are required to propose technical innovations consistent with the design specifications of the NREL/IEA 15MW reference turbine (information provided below), or with another set of 12MW – 15MW turbine specifications provided by a turbine manufacturer, in order to credibly establish the applicability and cost effectiveness of the proposed innovations to future turbines of that scale or larger.

Round 2 and Round 3 innovations may be applicable to any size of commercial offshore turbine planned for installation in U.S. waters. However, they should use the 15MW reference turbine, or another set of manufacturer-provided specifications, where needed to establish credibility of assumed design parameters and to justify cost/benefit analyses. Further, proposals should recognize and attempt to address trends toward ultra-large turbines.

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Table 1

Challenge Area	Round 1 Enabling Large Scale Wind Turbines Due Date September 21	Round 2 Support Structure Innovation; Supply Chain Development Due Date October 5	Round 3 Electrical Systems and Innovation; Conflicting Use Mitigation Due Date October 19
1	R1c1: Enabling Fabrication and Installation of Future Foundations	R2c1: Support Structure Solutions to Reduce Impact and Cost of Fixed and Floating Arrays (including anchor and mooring design)	R3c1: Cable Innovation to Reduce Cable Failure, Electrical Losses and Costs
2	R1c2: Port and Marine Systems Innovation to Support Offshore Logistics	R2c2: U.S. Supply Chain Development Through Innovation	R3c2: Innovation in Transmission Hardware or Transmission Options to Reduce Interconnection Costs
3	R1c3: Port Gaps Assessment and Strategies	R2c3: Solutions to O&M Challenges	R3c3: Innovation or Strategies to Mitigate Grid System Impacts
4	***Intentionally Left Blank***	R2c4: Safety Systems Innovation	R3c4: Technology Solutions to Mitigate Use Conflicts

Round 1: Enabling Large Scale Wind Turbines

Challenge Area 1: Enabling Fabrication and Installation of Future Foundations
Challenge Area 2: Port and Marine Systems Innovation to Support Offshore Logistics
Challenge Area 3: Port Gaps Assessment and Strategies

Proposal submissions in Round 1 should specifically use a 15MW reference turbine (large turbine) as the baseline for determining relevant design parameters and cost benefit analysis.

Background

As further cost competitiveness is pursued through increasingly larger offshore turbines, the physical size of each component has grown rapidly. In Fall 2019, General Electric announced development of a 12-MW Haliade-X turbine platform and, in May 2020, Siemens Gamesa announced a 14-MW turbine.

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Industry developers foresee installed turbine capacities in the range of 15 MW during the later 2020s. These large turbines, while a positive step for the industry, come with new technical challenges. Aside from the turbine upscaling itself, these challenges include understanding the impacts that larger turbines and their components will have on required vessel capacity, port infrastructure, test methods and facilities, construction and installation methodologies, and maintenance.

In March 2020, NREL in collaboration with the International Energy Agency and the Danish Technical University released a 15MW *reference* turbine. Round 1 of this Solicitation calls for proposals that address the challenges of installing and maintaining turbines of this scale or larger, using the open source specifications of this reference turbine for commonality reference. The specifications can be found here: *https://www.nrel.gov/docs/fy20osti/75698.pdf*. If a proposer has its own large turbine design, this may be used as an alternative reference baseline.

Challenge Area 1: Enabling Fabrication and Installation of Future Foundations (R1c1)

Challenge Statement

Offshore turbine size has increased significantly over the past decade and is predicted to continue increasing. Technology solutions are needed to adapt the design, testing, fabrication, and installation of existing foundation structure types in order to support the commercial trend toward larger turbines.

Objective

The main objective for this challenge is to optimize existing or develop new foundation and other support structure design options (including transition piece designs) for the coming generations of turbines, using the 15 MW *reference* turbine as a design baseline. If a proposer has its own similar scale turbine design this may be used as an alternative reference baseline. Design modifications will be proposed and evaluated, and new support structures designs will be identified to suit site conditions or enable support structure manufacturing and installation within the United States. Proposals may be for fixed or floating structures.

Background

As the offshore wind industry continues to develop, there is a great opportunity to innovate, modify, and optimize offshore substructures to enable installation and U.S. fabrication of these turbines. For example, a recent study by the Carbon Trust identifies substructure optimization, logistics, maintenance and repairs as technology challenges for large-scale floating wind turbines (Carbon Trust, Floating Wind Joint Industry Project, 2020).

Example Project Types

The following list provides example project types that could address this challenge, incorporating the specifications of the 15-MW reference turbine to ensure applicability to turbines of the coming decades. This list is meant as a reference and is not intended to be exhaustive. All project proposals will be considered, provided they contribute to the objectives of addressing this Challenge Area.

- Technical solutions to avoid the use of jack-up vessels;
- Innovative solutions to avoid the use of heavy lift vessels;
- New piling methods that allow installation of larger monopiles but lower loads, reduce fatigue loads from pile driving, better verticality to eliminate the transition piece, lower dependence on expensive heavy-duty pile driving vessels, and reduce noise during installation;
- Use of suction pile technology;
- Innovative materials that can be used as an alternative to steel, such as advances in composite concrete, that are lower cost, provide the necessary strength and lifetime, and/or are supplied by U.S. manufacturers; and
- An innovative or optimized approach to fabricating substructures (e.g., increasing the modularity of a substructure or innovations to improve welding of complicated foundation designs and alternatives to welded connections;) that will increase the efficiency of quayside fabrication and facilitate local production.

Challenge Area 2: Port and Marine Systems Innovation to Support Offshore Logistics (R1c2)

Challenge Statement

This Challenge Area seeks to explore alternative methods to provide marine logistics solutions that best utilize existing U.S. infrastructure and vessel capabilities and remain within the constraints of the existing U.S. maritime laws, while simultaneously meeting the cost requirements of the U.S. offshore wind industry (and assuming the 15MW reference turbine).

Objective

The main objective of this challenge is to develop alternative, innovative solutions that will lower costs associated with the fabrication, handling and transportation of offshore wind related materials, hardware, equipment, and componentry. These solutions may be applied to the fabrication facility, construction and installation port, and/or at the final offshore project site. Possible solutions may include novel systems or technologies that can be applied to new or existing U.S.-flagged vessels, or developed to support port infrastructure, or innovative fabrication processes. These may include, but are not limited to, new handling/transport solutions or hardware to ease handling and/or transportation of specific items, or storage solutions to optimize use of limited vessel/port real estate.

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Handling and transport solutions must be considered in conjunction with turbine/foundation system design, existing U.S. port capabilities and upgrade potential, and 15-MW turbine-scale specifications, in compliance with the Jones Act and other applicable port and vessel regulatory statutes. Solutions may be applicable to fixed-bottom and/or floating foundation installations.

Per the terms of the U.S. DOE cooperative agreement with NYSERDA, this Solicitation will not fund physical improvements to ports or vessels or the construction of new vessels or port infrastructure. Projects that develop innovative designs or alternative methodologies will be considered. Please refer to the Example Project Types for this Challenge Area for further guidance.

Background

Major offshore wind plant construction and maintenance activities, to support both turbine and balance of plant hardware, will require onshore-to-offshore, handling, storage, and transportation of large and heavy components often requiring very specific considerations. Recent turbine growth trends have introduced new challenges associated with port and lifting capacity, handling strategies, and space optimization solutions for the components and materials involved in an OSW plant. Traditional solutions to these issues have the potential to drive costs up rapidly as turbine sizes increase, and therefore, scaling traditional and current solutions and methodologies may not be the only, or the best, way to meet the marine logistics requirements associated with large wind turbines (using the 15MW reference).

The Merchant Marine Act of 1920, also known as the Jones Act, requires that delivery of any goods between two ports in the United States be conducted by a U.S.-flagged, U.S.-built vessel. This generally restricts European vessels from being brought to the U.S. to support construction operations. At present, there are no Jones Act-compliant vessels capable of carrying out the heavy lifts necessary to install current and future turbines, which require lifting heights greater than those previously encountered in the U.S. offshore oil and gas industry. The U.S. currently hosts a strong base of Jones Act-compliant vessels to support the domestic offshore oil and gas industries, many of which may be suitable for retrofit to support primary installation or support roles in offshore wind.

The perceived ability of a port to support the construction of large-scale offshore wind turbines currently rests on several key considerations, including port laydown storage capacity, quayside length and availability, heavy-lift equipment, laydown pad load limitations, port vessel traffic, and port overhead/underwater obstructions. While many of these port requirements are not inherently specific to offshore wind — and there may be existing partial solutions developed to support other industries like offshore oil and gas — there is an opportunity and need for continued innovation to lower the costs and barriers to entry associated with ports supporting large-scale offshore wind.

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Although this Challenge Area is specific to port, fabrication, and vessel innovations related to the handling and transportation of the large and heavy materials required to install and service the 15MW reference turbine, vessel solutions are not limited to heavy-lift installation vessels. Other supporting vessel types included under this Challenge Area may include tugs, barges, crew transfer vessels, and service operations vessels, all of which may be capable of assuming support roles in project installation or maintenance operations.

Example Project Types

The following list provides example project types that could address this challenge, incorporating the necessary specifications to ensure applicability to the anticipated larger turbines of the next decades. This list is meant as a reference and is not intended to be exhaustive. All project proposals will be considered provided they address the objectives of this Challenge Area. All prospective proposals for this Challenge Area are encouraged to seek input from — or partner with — an offshore wind developer, a U.S. port or vessel operator, and/or port/vessel experts to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research that can be leveraged and/or partners who have been working on this challenge to demonstrate that the research will further the overall state-of-the-art.

- Assessment of how traditional offshore activities and equipment can be repurposed to serve offshore wind;
- Technical assessment of existing Jones Act-compliant vessels, their suitability to serve the offshore wind industry, or potential modifications to support the reference turbine design,
    - Include design/redesign solutions, timelines for implementation, and detailed cost estimates;
- Development of new or modified tools and equipment that will facilitate improved fabrication, handling or transportation of offshore wind materials, equipment, hardware, and componentry (turbine component rigging, racking, or dunnage solutions, steel prefabrication and transportation solutions, concrete batching and transportation solutions, etc.);
- Alternative, innovative heavy lifting methodologies including consideration of corresponding health and safety consequences to the proposed solution;
- A new, innovative vessel design and/or installation approach to accommodate the reference turbine, and potentially larger turbine designs in the future; and
- Innovative service operation and crew transfer vessels.

It is the intent of this Challenge Area to fund technical analyses and innovative design and engineering activities. This Solicitation will not fund the actual construction or adaptation of vessel concepts or port infrastructure.

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Challenge Area 3: Port Gaps Assessments and Strategies (R1c3)

Challenge Statement

The current U.S. port system faces new requirements and challenges as it prepares to support large-scale offshore wind development in U.S. lease areas (NYSERDA, 2019, Port Infrastructure). While many ports have regional and geographic advantages that can be leveraged, further assessments and strategies are required to unlock regional efficiencies to improve port capabilities, coordination, and competitiveness.

Objective

The objective of this challenge is to assess the core capabilities of public and private ports in supporting the U.S. offshore wind development areas, and to develop systems or solutions that will improve port capabilities, coordination and competitiveness. Successful concepts may be tailored to specific geographies or specific regional port systems. Concepts will be partially evaluated based upon their achievable LCOE benefit. Further they should demonstrate knowledge of the requirements for these large turbines to enable full assembly, laydown, storage, and load-out with proximity to fabrication. Analysis and/or solutions proposed must reflect a current understanding of the U.S. port system, must objectively assess regional strengths and weaknesses (i.e. no regional bias), and must comply with all applicable federal and state laws and regulations.

Per the terms of the U.S. DOE cooperative agreement with NYSERDA, this Solicitation will not fund physical improvements to ports or the construction of port infrastructure. Projects that yield compelling insights or alternative methodologies and port design will be considered. Please refer to the Example Project Types for this Challenge Area for further guidance.

Background

The U.S. port system has developed to support various maritime activities including fishing, marine transport, and marine resource exploration, for which specific efficiencies and strategies have been developed regionally to improve efficiency and reduce costs.

The immediate need is reflected in port infrastructure improvement projects being undertaken in several U.S. States. For example, in June of 2020, New Jersey Governor Murphy announced plans to construct a 200+ acre hub-style marshalling and manufacturing port in Lower Alloways Creek Township which is intended to be the first purpose-built, “greenfield” port for offshore wind on the East Coast (New Jersey Office of the Governor, 2020, Governor Murphy Announces Plan to Develop the New Jersey Wind Port: First Purpose-Built Offshore Wind Port in the U.S.) In addition, in Fall 2019, New York announced a request for qualifications for entities interested in port infrastructure improvements with up to $200 million. While significant overhaul may be required at key offshore wind ports, and many of the port capabilities required to support offshore wind activities will be specific to that industry, there is a high likelihood that analogous methods and strategies have been developed in some capacity to support tasks associated with other, more traditional maritime industries.

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Due to the regional sectorization of port abilities that has naturally developed due to the location of natural resources or trade routes, there may be certain solutions, strategies, or "tribal knowledge" that are "locked into" certain geographies, and not others. To ensure the U.S. port system develops in such a way that it can competitively support offshore wind expansion across large areas of the U.S. perimeter coastline, support strategies and solutions must be shared, adapted, and implemented across the broader network of U.S. ports.

Another important aspect driving the success of U.S. port integration in the domestic offshore wind industry is the presence (or absence) of local characteristics, either natural or man-made, that may pose geographic advantages or disadvantages in the context of the offshore wind supply chain. The identification and impact assessment of factors including overhead obstructions, draft depth, vessel traffic, port lift and resting load capabilities, and port laydown real estate is critical to assist ports and developers in optimizing their collaborative operations.

Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and is not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area. All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind developer, a U.S. port or vessel operator and/or port/vessel experts to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research that can be leveraged and/or partners who have been working on this challenge to demonstrate that the research will further the overall state-of-the-art.

- Feasibility studies assessing strategies for regional collaboration among ports to address technical and logistics challenges;
- Feasibility studies for assessing onshore port access;
- Studies to assess competitive advantages and potential new approaches of U.S. port regions in addressing characteristics including, but not limited to fabrication, construction, assembly, and/or installation. New designs should include assessments of competing use and safety; laydown, lift, and loading capacities; and general access for 15MW reference scale turbines;
- Assessment of conflicting use and potential mitigation strategies at ports in coordination with various potentially impacted entities; and
- Innovative solutions or strategies to address existing fabrication, handling or transport constraints at U.S. ports.

It is the intent of this Challenge Area to fund technical analyses and innovative design and engineering activities. This Solicitation will not fund the actual construction or adaptation of vessel concepts or port infrastructure.

Round 2: Support Structure Innovation; Supply Chain Development

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Challenge Area 1: Support Structure Solutions to Reduce Impact and Cost of Fixed and Floating Arrays (including anchor and mooring design)
Challenge Area 2: U.S. Supply Chain Development Through Innovation
Challenge Area 3: Solutions to O&M Challenges
Challenge Area 4: Safety Systems Innovation

Innovations under Round 2 may be applicable to any size of commercial offshore turbine planned for installation in U.S. waters, particularly for projects currently under development. However proposals should also reflect awareness of industry trends towards large (~15MW) and ultra-large (>15MW) wind turbine installations Where needed to establish the credibility of assumptions used in establishing design parameters and carrying out cost benefit analyses, proposal submissions should use either established open source turbine specifications, such the 15MW reference turbine, or specifications provided directly by a turbine manufacturer.

Challenge Area 1: Support Structure Solutions to Reduce Impact and Cost of Fixed and Floating Arrays (R2c1)

Challenge Statement

Technology solutions are needed to optimize platforms, monopiles, jackets, gravity-bases, suction buckets, transition pieces and/or other types of foundation designs in order to lower overall cost and ensure suitability under the specific conditions of U.S. offshore wind regions for near term wind plant installations while taking into account applicability to future turbine designs.

Objective

The main objective for this challenge is to develop support structure design solutions (potentially including transition piece, anchor, and mooring designs) that are optimized for U.S. site conditions and transport and installation capabilities, and that facilitate the advancement of U.S. manufacturing capabilities.

Substructures and foundations account for 13.9% of the capital expenditure for a fixed-bottom offshore wind plant (Stehly et al., 2020), and this percentage can vary significantly with water depth, bottom conditions, and the capability of the local supply chain. Most offshore wind turbines installed to date are mounted on fixed-bottom substructures embedded into the seabed. This is largely due to the easy transferability of skills and knowledge of similar designs from the oil and gas industry, as well as the relatively shallow water depths available for siting projects. With more than 40% of the U.S. offshore wind resource located in water depths of 60 meters or less, the use of fixed-bottom substructures is feasible in many U.S. offshore locations (DOE, 2017).

Figures 1 and 2 show the present mix of offshore wind substructure types compared to the projected mix for new projects that are currently in the pipeline globally. Figure 1 shows the present industry status. For projects that have announced the type of substructure they plan to use, Figure 2 shows a trend toward jackets and other substructure types as the industry moves into other geographic markets, larger turbines, and more challenging site conditions. Note that most of the global pipeline has not decided on a specific technology yet. To date, monopiles make up the majority of installed offshore wind substructures in

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Europe. However, their dominance in the industry is decreasing as other substructures are better suited for some sites due to varying site conditions.

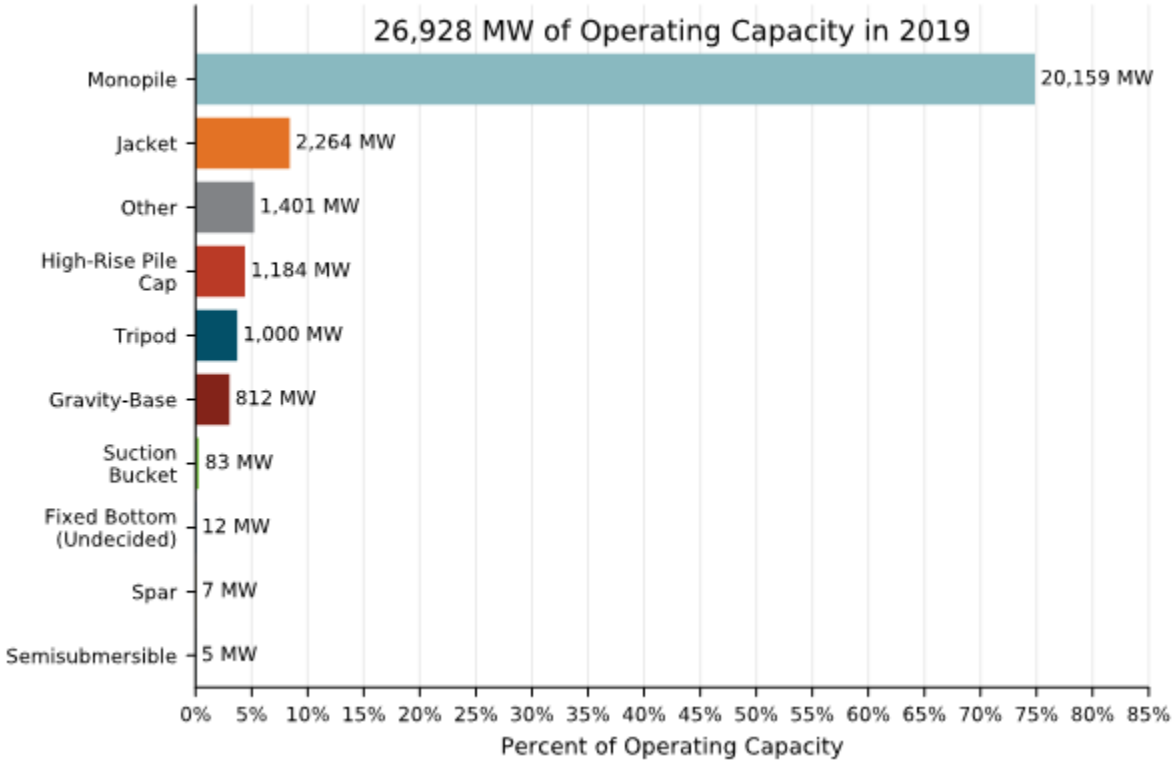

Figure 1. Current Mix of Substructure Types for Installed Offshore Wind Turbines Source: NREL

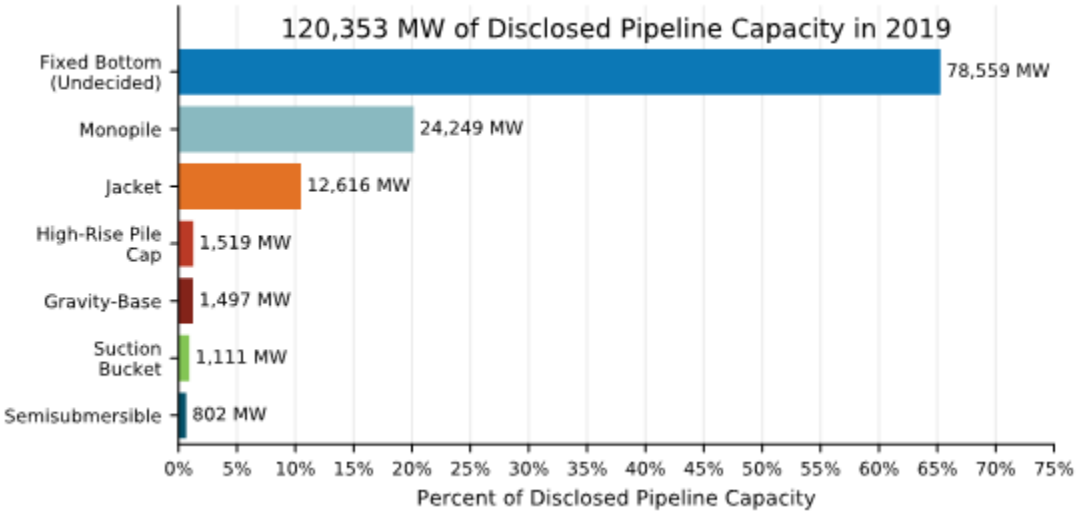

Figure 2. Future Projection of Substructure Types for Global Offshore Wind Fleet
Source: NREL

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Although there are several different substructure designs available, the market is characterized by three existing available designs: monopiles, jackets, and gravity-base, all designed and developed based on European offshore site conditions. Assessments of the suitability of existing available support structures targeted for U.S.-specific conditions are needed. These assessments are encouraged to quantify, but are not limited to, the following variables:

- Support structure mass and cost scaling;
- Suitability for ultra-large turbines;
- Domestic installation capabilities;
- The development of geotechnical calculation methods suitable for U.S. soils and seabed conditions;
- Domestic supply chain opportunities;
- Alternative installation methods to mitigate possible environmental impacts;
- Alternative installation methods to avoid negative cost impacts due to Jones Act restrictions;
- Innovative corrosion protection adapted for U.S. conditions (salinity, seabed, etc.)
- Extreme wind and wave resiliency; and
- Water depth.

In addition to assessing the suitability of existing designs for U.S. site conditions, there are a number of opportunities to develop *innovative* products or solutions that are more suited to U.S. conditions, supply chain and vessel availability, including:

- Innovative substructure designs that can be readily utilized;
- Innovative materials used as an alternative to conventional steel, such as advances in composite concrete, that are more cost effective, provide necessary strength, and can be readily supplied by U.S. manufacturers (Wind Power Engineering, 2018);
- Substructure solutions that reduce dependency on foreign flagged or expensive heavy lift vessels; and
- Options that extend the lifetime of the substructure, delaying the need to decommission and reducing the overall levelized cost of energy.

Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area.

- Comparative assessment of various foundation/support structure types (including fixed and floating) in near term U.S. applications (addressing site suitability, timeframe requirements, local supply);

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- Technical assessment and/or solutions to meet specific foundation/support structure/anchor/mooring requirements;
    - Innovative substructure designs or design modifications to existing substructures delivered by the U.S. supply chain that can be readily utilized;
    - Likely overall cost implications of any modifications;
    - Installation modifications;
    - Infrastructure modifications or innovations; or
    - Ability to mitigate a technology barrier (e.g., difficult soils types) to deployment in the United States.
- Options that extend the lifetime of the substructure, delaying the need to decommission and reducing the overall levelized cost of energy; and
- Substructure solutions that reduce the dependency on foreign flagged or expensive heavy lift vessels.

Challenge Area 2: U.S. Supply Chain Development Through Innovation (R2c2)

Challenge Statement

Many of the components for commercial offshore wind projects in the U.S. will be imported due to lack of qualified U.S. manufacturing and supply capabilities. Given current construction plans in the U.S., there will be manufacturing constraints. The primary U.S. challenge is to increase both capability and capacity.

Objective

The objective of this challenge is to develop new technologies and concepts to accelerate the U.S. supply chain towards the goal of promoting local content used in offshore wind plants. Successful concepts should result in increased utilization of existing U.S. manufacturing and new manufacturing (e.g. substructures that use the oil & gas supply chain, or ultra-large locally manufactured blades, etc.) that take advantage of or help create local or regional manufacturing and assembly capabilities. Proposed projects need not be limited to existing design configurations but may offer collaborative innovations that introduce combinations of new materials, new strategies for deployment, and new advanced manufacturing methods that leapfrog current supply constraints, including manufacturing capacity. All proposals should consider the long-term development of ultra-large turbines.

Background

As the U.S offshore wind market begins to take shape, one of the prevailing questions posed to the key manufacturers is, “When will offshore wind components be produced in the U.S.?” With a growing

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pipeline of projects projected to be built along the Atlantic coast within the next decade and a lack of qualified U.S. manufacturing and supply capabilities, many of the components, subcomponents, and infrastructure for the initial phase of commercial wind projects in the U.S. will be imported.

While the Block Island Wind Farm was assembled using European-built turbines and a foreign-flagged installation vessel, the project has also demonstrated the potential for U.S. produced and installed components, including steel jacket foundations having been supplied by fabricators from the Gulf of Mexico's oil and gas industry. This is a good starting point for the U.S. offshore industry, proving that certain wind plant requirements can already be met by using the existing supply chain companies in the U.S. The question to be addressed by U.S. manufacturers is whether they can match the demand of the U.S. offshore project pipeline and the increasing scale of individual projects and technology.

It is critical to determine how the U.S. supply chain can be accelerated to most effectively encourage investment in U.S. offshore wind component and vessel manufacturing investment. Studies have indicated that factors such as infrastructure development, logistics optimization, and project timelines can all affect the degree to which local content can be effectively incorporated into an offshore project.

Another vital part of U.S. supply chain development to enable U.S. offshore wind will be to accelerate the training and growth of the domestic workforce. This is an opportunity for researchers and developers to develop training centers and create new ways of training technicians (offshore, electrical, welders, etc.) and managers to master the execution and operation of an offshore wind turbine and do so in a safe and efficient manner. Innovative technology can lead to new methods of training the workforce for emerging workforce requirements.

Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area. All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind developer, a U.S. offshore wind component supplier, or include an advisory group comprising developers and/or sub-structure suppliers to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research that can be leveraged and/or partners who have been working on this challenge to demonstrate that the research will further the overall state-of-the-art. Analyses of the skill sets and/or tooling required to implement any proposed technology or method are welcome as part of the project in order to maximize the opportunity to increase the supply chain.

Projects under this Challenge Area might include:

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- Supply chain strategy solutions that utilize alternatives to traditional raw materials for offshore wind manufactured components;
- Design of an innovative U.S.-focused standardized training program, in compliance with federal regulations, for offshore wind technicians or fabricators to build experienced local workforces;
- Optimization of a major wind plant component to utilize U.S. expertise and manufacturing competencies, and reduce costs;
- Development of a modularized component design that can be manufactured and installed using unique U.S. supply chain capabilities; and
- Development of a lean manufacturing process for serial production of turbine and other wind plant components in order to reduce LCOE.

Challenge Area 3: Solutions to O&M Challenges (R2c3)

Challenge Statement

With the number of offshore wind turbines installed in U.S. waters set to increase, system reliability is likely to become a growing concern. In an offshore environment, the cost of component damage/failure or operations and maintenance (O&M) is complicated. Managing these issues on a reactive basis has proven to be expensive and inefficient, however, with current advances in analytics and technology there is the opportunity to optimize O&M strategies, reducing the need for technicians to go offshore, and ultimately reduce LCOE.

Objective

The objective of this challenge is to optimize the operation and maintenance of fixed and floating offshore wind plants to:

- Increase efficiencies in O&M (measured by possible metrics such as lower cost, decreased downtime, increased turbine availability, or increased energy capture);
- Achieve demonstrable reductions in component level damage and failures; and
- Reduce the labor hours spent offshore and the associated safety risk to personnel.

All proposals should consider the long-term development of ultra-large turbine deployment.

Background

Supervisory Control and Data Acquisition (SCADA) acts as a central ‘nerve center’ for the wind plant connecting individual turbines, the substation and meteorological stations to a central computer. SCADA systems are predominantly used to support analyses on the productivity of the wind plant and therefore focus primarily on collecting data to monitor the turbines’ operating status, health condition, real-time and long-term performance, as well as physical control inputs (e.g. orientation, yaw, etc.).

Comparatively little data is being collected to monitor the health of other components that make up the offshore wind plant, such as foundations and electrical cables etc., to assess damage or likelihood of

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failure. Issues on these components are usually identified during physical component inspections, (for which there is currently little guidance or industry standards) and may only be identified once the damage has progressed to a more serious (expensive) state.

One offshore wind industry trend has been to increase the number of remote sensors across the various offshore wind plant components to enhance the remote monitoring capabilities and to better identify, predict, and diagnose component damage and potential failures. The use of condition monitoring sensors on electrical cables is more common practice as is the use of sensors on steel foundations to monitor the extent of corrosion. This is particularly true for cable installation since a significant proportion of insurance claims on electric cables result from over bending or snagging during installation, causing damage to the internal conductors. Unfortunately, the development rate of new innovations in wind plant health prognostics, advanced analytical diagnostics, and new predictive maintenance strategies have not kept pace with the ever-increasing volumes of data being collected. Data is collected in a variety of formats and is difficult to synthesize.

There is the opportunity to not only considerably improve and increase the technology used to capture component status data, but also develop a holistic integrated system that can collect, analyze, and interpret all component level data and make O&M decisions remotely. This would allow for fault detection during construction as well as facilitating better O&M planning leading to a more efficient maintenance process, reduced O&M cost and a reduced need for technicians going offshore.

Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and is not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area.

Solutions are sought that can demonstrate increased analytical capability at component, system, turbine or plant level, and/or reduce at sea labor hours for O&M personnel on the U.S. fleet of offshore wind turbines. Favorable proposals will leverage known methods and “lessons learned” from the collective European offshore wind O&M experience. Proposals should demonstrate access or ability to access necessary OEM data.

All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind developer, a U.S. offshore wind component supplier, or include an advisory group comprising developers and/or suppliers to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research that can be leveraged and/or partners who have been working on this challenge to demonstrate that the research will clearly further the overall state-of-the-art and will not duplicate or approximate other products or R&D projects.

Innovations under this topic may include advances to current technologies and capabilities for:

- Remote repair capabilities featuring advanced sensors, artificial intelligence, and turbine-based robotics;
- Improvements in remote inspection accuracy using drones and autonomous vessels;
- Self-healing concepts to reduce manual repairs;

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- Development of machine learning / 'big data' processing methods to facilitate lower cost offshore O&M and increase reliability;
- Demonstration and development of guidance on industry best practice for U.S. offshore wind component inspections;
- Condition monitoring sensor development for cables and sub-structures during installation and operation;
- Improving the understanding of asset lifetime integrity through advanced sensors; and
- Integrated systems that can track the status of all major components and subsystems in the wind plant to inform O&M planning.

Challenge Area 4: Safety System Innovation (R2c4)

Challenge Statement

As the U.S. offshore wind industry grows in scale and size of workforce, numerous installation and maintenance activities will require that human operators perform duties in the potentially hazardous environmental conditions and spaces associated with an offshore wind plant. Technology solutions and strategies must be developed and implemented to mitigate worker exposure to the electrical, mechanical, height and marine-related hazards present in the offshore wind work environment to reduce the cost, both human and monetary, associated with workplace accidents.

Objective

The objective of this challenge is to assess the potential hazards present in an offshore wind farm and to develop systems or solutions that, accordingly, will apply controls in accordance with the U.S. Occupational Health and Safety Administration's (OSHA) hierarchy of Hazards and Controls, which are, in order of effectiveness, Elimination, Substitution, Engineering Controls, Administrative Controls, and Personal Protective Equipment (PPE). In accordance with this hierarchy, the most effective solutions within this Challenge Area will eliminate the hazard, which in the context of Offshore Wind may involve removing the worker entirely from the hazardous offshore environment. This type of solution will involve developing novel technologies or solutions that will enable tasks previously requiring local human operators to be performed remotely from a non-hazardous location.

While complete elimination of hazardous conditions is always the most effective safety solution, there are some tasks required in offshore wind construction and maintenance for which remote solutions do not yet exist. To address these types of tasks, successful proposals will develop novel engineering controls, administrative controls, or PPE solutions that will reduce the risk of personnel injury or death associated with that task in its anticipated environment.

Background

Currently, U.S. facilities within 3 nautical miles (nm) from shore must be permitted in accordance with state and local laws and regulations. Beyond this threshold are Federal waters, where the Energy Policy Act of 2005 assigned primary regulating authority to the Department of the Interior, and by proxy, the

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Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE). Health and Safety compliance for an offshore wind farm requires the developer to implement a safety management system (SMS) as part of their Construction and Operations (COP) plan in accordance with 30 CFR 585. The SMS is overseen by the BSEE, in cooperation with the Occupational Safety and Health Administration (OSHA) and the U.S. Coast Guard (USCG).

Currently the best practices for offshore wind health and safety in U.S. waters are in their nascent stage of development and are not explicitly stated in any federal regulatory code, but as the U.S. offshore wind industry grows, more rigorous and transparent industry-led health and safety protocols and standards must be established and refined to combat the inherent hazards associated with its challenging work environment.

Proposed solutions are encouraged to consider the current offshore wind regulations and requirements in the U.S., but should also consider the European offshore wind experience, where many more labor-hours have been committed to construction, operation, and maintenance activities. In addition, there are considerable health and safety "lessons learned" to be leveraged from the traditional U.S. offshore industries. including oil and gas exploration.

Successful proposals will address technology concepts and will be able to quantitatively demonstrate that the proposed concept can lower risk to personnel using metrics such as reduced labor at sea or comparisons to other related information on documented hazards that can be mitigated through the proposed innovation.

Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and is not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area.

Solutions are sought that can demonstrate increased personnel safety performance at the component, system, turbine or plant level, preferably by reducing at-sea labor hours for all personnel on the U.S. fleet of offshore wind turbines, but also by improving the safety systems, tools, PPE, training, and processes associated with all tasks currently requiring at-sea human labor, as well as offshore wind-related assembly, construction, installation, and loadout operations that may be conducted ashore.

Innovations under this topic may include:

- Novel or improved Personal Protective Equipment (PPE) specific to offshore wind environments or operations;
- Novel or improved safety procedures, protocol, or best-practices specific to offshore wind environments or operations;
- Technical innovations to reduce the occupational hazards associated with offshore wind-specific tasks. Such solutions may include:
    - Novel or improved fall arrest and restraint systems;
    - Lightning or extreme weather prediction and protection systems;
    - Technical solutions to reduce hazards associated with vessel-to-platform crew transfer;
    - Electrical protection systems to reduce risk of electrocution or shock; and

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- Evaluation and comparative risk assessment of offshore wind-related technologies or strategies (for construction through O&M phase) that quantitatively define relative risk profiles.

All project submissions will be assessed on projected Total Recordable Incident Rate Ratio (TRIR) improvement to infer LCOE impact, rather than a direct LCOE calculation. Projects submitted without a projected TRIR improvement calculation will not be considered. TRIR Improvement must be calculated using the OSHA standard calculation[1], as below

*TRIR = (# of total recordable injuries and illnesses) * 200,000 / Total Employee Hours Worked*

TRIR Improvement = $TRIR_{post\text{-}implemented\ solution}$ - $TRIR_{pre\text{-}implemented\ solution}$

It is the intent of this Challenge Area to fund technical analyses and innovative design and engineering activities. Per the terms of the U.S. DOE cooperative agreement with NYSERDA, this Solicitation will not fund the actual implementation or adaptation of safety systems.

Round 3: Electrical Systems and Innovation; Conflicting Use Mitigation

Challenge Area 1: Cable Innovation to Reduce Cable Failure, Electrical Losses and Costs
Challenge Area 2: Innovation in Transmission Hardware or Transmission Options to Reduce Interconnection Costs
Challenge Area 3: Innovation or Strategies to Reduce Grid System Impacts
Challenge Area 4: Technology Solutions to Mitigate Use Conflicts

Proposals under Round 3 may be applicable to any size of commercial offshore turbine planned for installation in U.S. waters, particularly for projects currently under development. However, proposals should also reflect awareness of industry trends towards large (~15MW) and ultra-large (>15MW) wind turbine installations Where needed to establish the credibility of assumptions used in establishing design parameters and carrying out cost benefit analyses, proposal submissions should use either established open source turbine specifications, such the 15MW reference turbine, or specifications provided directly by a turbine manufacturer.

Challenge Area 1: Submarine Cable Innovations to Reduce Failure, Electrical Losses and Cost (R3c1)

Challenge Statement
The Challenge is to reduce the capital costs of the submarine cable system while drastically lowering failure rates and building the U.S. supply chain to accommodate large GW scale U.S. development with turbine sizes increasing to 15 MW and beyond.

1 OSHA, *Clarification on how the formula is used by OSHA to calculate incident rates*

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Objective

The main objectives for this Challenge Area are to:

- Reduce costs and impacts of electrical cabling needed to connect offshore wind to the grid;
- Develop technical solutions to improve the reliability of subsea cables used in the array and for the export system; and
- To optimize offshore wind plant submarine cables and layouts for ultra-large wind turbines and minimize footprint on the seabed.

Background

The U.S. offshore wind industry is projected to grow to 29 GW by 2035 based on state-level policy commitments. This corresponds to U.S. demand by 2030 of hundreds of miles of electric cables; but currently major suppliers of submarine cables are overseas and most cable will need to be imported. Improvement in the reliability of submarine cables in the U.S. Waters is needed. In addition, according to Lloyd Warwick International Claims Database (2002—2019), 83% of the offshore wind insurance claims were related to cable failures (Musial et al 2020; Carbon Trust 2018). In addition, as projects move farther from shore for better wind resources, AC transmission systems may not be the most economic option due to higher cost, increased transmission losses, and other technical barriers. Systems such as High Voltage Direct Current (HVDC) and MVDC are possible alternatives; however, there are very few domestic or international suppliers of this equipment. Moreover, dynamic cables for floating offshore wind brings new challenges for long term reliability of submarine cable. As the industry moves into federal waters, the industry must achieve higher cable reliability while continuing to lower the cost of the electric infrastructure.

Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area. All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind or offshore transmission developer or include an advisory group comprising developers to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research and/or partners who have been working on this challenge to demonstrate that the research will further the overall state-of-the-art.

- Technology advances that lower cost in the U.S. of both turbine-to-turbine array cables and array-to-shore export cables, including dynamic cables;
- Technology advances that increase U.S. market availability of both turbine-to-turbine array cables and array-to-shore export cables;
- Evaluation of electromagnetic frequency (EMF) from HVAC and HVDC networks in likely development areas, and mitigation techniques;

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- Innovative technologies/designs/architectures that lower individual project cost, reduce risks, reduce losses, or enable longer distance transmission through the application of new power conversion systems, cable technology, or array cable topology; and
- Submarine cable monitoring systems - either integrated with the cable such as innovative distributed sensor system or improved conventional technology that conducts on site cable monitoring nearly full time and exports data via wet dock or by being retrieved and redeployed by project vessels;

Challenge Area 2: Innovation in Transmission Hardware and Transmission Options to Reduce Interconnection Costs (R3c2)

Challenge Statement

Technology advancement and innovation are needed to lower individual project costs, reduce transmission losses, enhance grid reliability, reduce environmental impacts, and enable aggregation strategies that address potential offshore wind grid interconnection challenges. New planning, procurement, and risk-management approaches are needed to minimize costs of grid infrastructure and upgrades, and to enhance competition. This Challenge Statement includes transmission and marine cabling configurations at/or greater than 66kV.

Objective

Identify innovative hardware and electrical system designs to resolve transmission challenges.

Background

Transmission infrastructure typically accounts for 25-40% of offshore wind capital expenditure, of which 8–12% typically accounts for the cost of cable supply and installation, but the cost of interconnection to the grid may vary widely depending on the availability of viable interconnection options. These options are expected to become increasingly scarce as the industry builds more offshore wind; innovations are needed to reduce the transmission expansion requirements and maximize the amount of offshore wind energy that can be integrated. Typically, the design of the offshore wind transmission infrastructure is influenced by several factors (NREL, 2014): Site characteristics; for example, distance to shore, existing seabed infrastructure, water depths, and seabed geology. The multi-layered permitting structure for offshore wind transmission and uncertainty related to onshore upgrade costs creates risks that can escalate the cost of an offshore wind project. In addition, export cable landfall has been an issue of contention for past U.S. offshore wind projects.

This Challenge seeks to reduce those risks while lowering system cost.

Example Project Types

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- Networked offshore transmission configurations that have the potential to enhance reliability, optimize interconnection with the terrestrial grid, and reduce impacts on marine ecosystems;
- Grid modeling and planning approaches that consider onshore upgrades, offshore infrastructure and combinations thereof to optimize grid integration to achieve established targets and potential longer-term needs;
- Identify state or federally endorsed cable landing sites that could be an alternative to shared transmission;
- Expandable shared radial HVDC systems;
- Feasibility studies on offshore HVAC network(s) that could be cost effectively built in stages as new projects come on-line and connected to HVDC links to shore; and
- Technology solutions to reduce LCOE related to offshore substation.

Challenge Area 3: Innovation or Strategies to Mitigate Grid System Impacts (R3c3)

Challenge Statement

Rapid deployment of offshore wind in the U.S. will create significant technical challenges for utilities, developers, regulators, and policymakers seeking to introduce a large amount of variable resource from offshore wind with minimal grid impact at the lowest possible cost. The integration of significant amounts of offshore wind is likely to impact resource adequacy, system-wide production costs, scheduling of existing units, curtailment and system flexibility. (See NREL, Lau et al, 2020).

Objective

The main objective for this challenge is to reduce the cost and minimize impacts of integrating offshore wind with the grid.

Background

The criticality of the transmission infrastructure in connecting the offshore wind plant to the grid is great motivation for continued improvement and optimization to limit risks, reduce the levelized cost of energy and increase reliability. Technology and planning advancements will help mitigate these risks but also may allow offshore wind to add additional value to the grid through ancillary services or other market products.

Projects in this Challenge Area may facilitate the development of analytical frameworks and tools to optimize grid integration. Projects will also provide a clear vision on where the industry is focusing its efforts, on best practices for offshore and onshore transmission, and therefore, what technical and regulatory trends the supply chain and regulators should focus on for future offshore wind electrical system advancement. De-risking and reducing the cost of integrating offshore wind with the grid will facilitate steady, predictable deployment of offshore wind and thus enhance the likelihood of attracting supply chain companies to the U.S.

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Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area. All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind or offshore transmission developer or include an advisory group comprising wind/and or transmission developers, transmission and grid system operators to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research and/or partners who have been working on this challenge to demonstrate that the research will further the overall state-of-the-art.

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- Approaches that enable OSW to provide ancillary grid services (for example an energy storage innovation that demonstrates value to the grid through increased dispatchability to meet peak demand, supply grid essential reliability services (such as voltage control and frequency response), increased system reliability, system restoration capability (i.e. black start), or otherwise demonstrating the value in helping to meet a state's renewable targets);
- Alternatives to battery storage, such as thermal storage;
- Technical assessment of the most critical power system infrastructure barriers or enablers to developing offshore wind;
- Assessment of existing onshore grid systems, future requirements, and the potential upgrades needed to ensure uptake of large amounts of offshore wind power;
- Planning models that reduce the risk associated with integrating multiple offshore wind farms to achieve offshore wind goals; and
- Studies to examine non-wires alternatives to transmission upgrades using offshore wind to relieve congestion.

Challenge Area 4: Technology Solutions to Mitigate Use Conflicts (R3c4)

Challenge Statement

Offshore wind development must work in balance with other marine users and wildlife, aiming for minimal disturbance. Improved techniques and innovative technologies are required to help reduce potential conflicts between offshore wind energy and wildlife at U.S. offshore wind installations. Technology solutions to assess or mitigate potential use conflicts are needed to safely and efficiently complete turbine installation, to operate wind plants effectively among the many existing ocean species and uses, and to promote the social acceptance of offshore wind.

Objective

The objective of this Challenge Area is to develop technical solutions to offshore wind environmental and conflicting use issues that benefit both stakeholders and offshore wind developers. Solutions will reduce the cost and time of construction and installation; better understand or mitigate environmental impacts; and effectively reduce impacts on other users of the sea.

Background

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The construction, installation, and operation of offshore wind farms will have a range of potential impacts that need to be assessed and addressed, as required. Offshore wind developers in the U.S. can learn from the existing offshore wind technology and experience in Europe, but while it is imperative to apply lessons learned from Europe in the U.S., it is also clear that U.S. waters host a different set of ocean users which present different challenges regarding avoiding or mitigating use conflicts. The growing pipeline of proposed offshore wind projects in the U.S. poses potential environmental impacts and, likewise, opportunities for future environmental research. For example, there are a number of ongoing efforts sponsored by DOE, Greentown Labs and Vineyard Wind that recognize the need to understand the impact of offshore wind energy development (EERE, 2020; Vineyard Wind, 2020).

Offshore wind arrays can have significant impacts on wildlife and other ocean users during the construction and operation phases if not properly addressed. Proactively evaluating and addressing siting conflicts can have long-term benefits by shortening development timelines (and hence cost), minimizing operations curtailments, and strengthening community relationships. This is especially important in areas where endangered species, such as North Atlantic right whales, are active. However, current techniques to protect wildlife through curtailment of operations may excessively restrict construction windows and significantly increase construction and installation costs.

Validated technology solutions that can be integrated into the wind system design at a turbine or farm level will be considered under this Challenge Area. Examples of potential conflicts during construction, installation, or operation include: collisions of surface vessels with marine mammals; avian species interactions; interference with commercial and recreational fishing, and the potential impact of noise on marine mammals from pile-driving.

Example Project Types

The following list provides example project types that could address this challenge. This list is meant as a reference and is not intended to be exhaustive. All project proposals will be considered provided they contribute to the objectives of addressing this Challenge Area. All prospective proposals for this challenge are encouraged to seek inputs from, or partner with, an offshore wind developer to ensure the direction of the project and outcomes can be commercially applied. Additionally, proposals should identify research that can be leveraged and/or partners who have been working on this challenge to demonstrate that the research will clearly further the overall state-of-the-art and will not duplicate or approximate other studies or technology advances.

Technology solutions under this topic may include:

- Noise solutions:
    - Advancements or demonstrations of novel installation practices, and/or foundation types that reduce noise output;
    - Advancements in and demonstration of noise quieting technologies for construction and siting activities;
- Radar solutions:

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  - Technical solutions for addressing turbine interference with coastal high frequency radar for wave and current monitoring and search and rescue activities; and
  - Solutions to mitigate the impact of wind turbines on marine navigation radars, such as those used by commercial fishers and other mariners.

- Monitoring solutions that allow for automating collection of pre- and post-construction of species composition, abundance patterns, behavior, and interactions with turbines in a way that allows for:
  - More continuous data collection efforts than boat-based or ship-based data collection efforts, that are less biased by limitations in data collection periods by sea state, good weather, and daytime conditions;
  - Lower costs;
  - Improved ability to monitor on autonomous platforms, including addressing challenges like motion compensation, power, data storage and transfer; and
  - Improved algorithms for automated data analysis, including organism detection, classification, and tracking.

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B. Funding Categories

Three (3) categories of research will be considered for funding:

A. **Technical Feasibility Studies**: Category A is for feasibility studies that conduct preliminary research into the concepts underlying new products, systems, strategies or services as a first stage of development. These studies are necessary precursors to ultimate product development and commercialization. Feasibility studies may include conceptual design, technology and market assessments, and similar early-stage studies. Funding for projects in this category will be limited to $300,000. It is expected that all proposals will include a budget that is commensurate with the proposed project plan and proposers will justify their proposed budget in terms of reasonable costs and scope.

B. **New Product, Systems, Service or Strategy Development:** Category B includes efforts that are crucial to the development of a marketable product, system, strategy or service and any testing or validation of an innovation that is not already commercially available. Funding for projects in this category will be limited to $800,000. It is expected that all proposals will include a budget that is commensurate with the proposed project plan and proposers will justify their proposed budget in terms of reasonable costs and scope.

C. **Demonstration of Technologies, Systems or Services:** Category C is aimed at demonstrating and testing innovative offshore wind technologies, systems, strategies or services that have undergone product development and require testing to reach commercialization or are already commercially available but have not yet been sufficiently demonstrated in the U.S. to gain industry acceptance. This includes hardware, software, and market development initiatives. for projects in this category will be limited to $1,500,000. It is recognized that some demonstration projects, particularly large-scale demonstrations, may require additional funding. As such, proposers are encouraged to seek additional funds, in-kind contributions or access to facilities from various offshore wind stakeholders. It is expected that all proposals will include a budget that is commensurate with the proposed project plan and proposers will justify their proposed budget in terms of reasonable costs and scope.

Proposers must select at least one (1) funding category per proposal, which must be indicated in the proposal. Proposals that do not identify a funding category may not be reviewed. If the funding category selected does not match the scope of the project, NOWRDC may at its discretion evaluate the project in terms of a category that in its determination better matches the proposed scope. If such a proposal is selected for award, it will be subject to the requirements of the funding category to which it has been assigned.

Multi-phase project proposals (i.e. a single project that spans more than one funding category) will be considered. For example, a proposed project may include Category B Product Development (Phase I)

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followed by a Category C Product Demonstration (Phase II). Each proposed project Phase must adhere to the requirements of the appropriate funding category for that Phase including required documentation and recommended maximum funding levels. NOWRDC may, at its discretion, select one or more phases for award without selecting other proposed phases. With respect to the proposal requirements (see Section III), multi-phase project proposals must submit all required attachments and fill out all required sections of the Proposal Forms for each phase per the instructions of Attachment B.

All multi-phase projects must include Go/No-Go decision points following each Phase. To proceed to the next phase the Contractor must demonstrate its progress in meeting the technical and commercial milestones of the prior Phase. The Contractor will not be permitted to proceed to the next Phase or submit invoices for work performed in that Phase without written approval, which may be granted or withheld at NOWRDC's sole discretion.

Similarly, Go/No-Go decision points will be required within each project Phase or at one or more points within a single-phase project, typically after each approximate $250,000 allotment of NOWRDC funding.

Project schedules must take into account a U.S. DOE Go/No-Go decision point at the conclusion of each Budget Period, as follows:

Budget Period 2: from January 1 2021 to December 31 2021
Budget Period 3: from January 1 2022 to December 31 2022
Budget Period 4: from January 1 2023 to December 31 2026

If a DOE no-go decision is reached at the conclusion of a Budget Period, milestones completed prior to the no-go decision may be invoiced. Work completed after the no-go decision may not be invoiced. Milestones partially completed may be partially invoiced, with an allowable amount determined at NOWRDC's sole discretion.

The proposed Statement of Work is subject to negotiation and NOWRDC may offer to fund any of the proposal's phases therein at a lower level than that requested, such as by offering to fund a feasibility study rather than a proposed prototype development effort.

C. Project Requirements

Project Scope. To qualify for funding, proposals must:

- Address issues essential for cost reduction, deployment, and industry expansion specific to offshore regions of the U.S. Proposals offering research topics already being addressed by other international projects must explain why further research is necessary.
- Adhere to the challenges identified in Section II of this Solicitation. Although the Technical Challenges and Roadmap will be updated in the future, it is expected the NOWRDC will continue to maintain an industry-focused, prioritized offshore wind R&D agenda that enables early U.S.

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offshore wind project development, LCOE reduction, and geographic industry expansion beyond the currently designated Wind Energy Areas.

- Provide benefits to multiple end users. R&D projects that benefit multiple end users are expected to have a greater impact toward achieving the NOWRDC's industry-wide cost reduction targets compared to R&D projects focused on a developer's specific commercial offshore wind project.

Project Schedule, Phasing and Teaming. The following guidelines should be considered when developing proposals:

- Projects are expected to begin as soon as is feasibly possible with a project schedule estimate of: 6 – 18 months for Category A; 18 - 30 months for Category B; and Category C will be negotiated based on the scope and goals of the project.
- Teaming Agreements which include an end user such as an offshore wind developer or a key member of the offshore wind supply chain are strongly encouraged, to enhance the likelihood of successful commercialization. Teams may include offshore wind developers, turbine manufacturers, supply chain members, research organizations, universities, national laboratories, end-users, or other stakeholders.
- Proposals must state the existing Technology Readiness Level (TRL) of any technology being proposed and what the expected TRL of that technology will be at the end of the proposed project, as a direct result of having undertaken the project. See Attachment B3, Technology and Commercialization Readiness Level Calculator.

Project Benefit Quantification. The following guidelines should be considered when developing proposals.

Establish Potential Benefits Clearly and Credibly

All proposals will be evaluated on their perceived benefits to offshore wind energy development in the United States. Therefore, it is incumbent upon each applicant to provide a clear and credible case for their proposed R&D project that substantiates its value. Regardless of the TRL level of a proposed innovation, or the focus area of a proposed study, its potential to become a viable commercial product or otherwise be adapted for uses benefiting the offshore wind community must be articulated in a manner that conveys a practical understanding of the industry's needs and a quantification of cost and/or risk reduction, to the extent possible. Representations of project benefits should include the timeframe within which those benefits are likely to be realized.

It is up to the applicant to decide how they can best make a credible case for the value of their proposed project. The paragraphs that follow provide information on potential approaches to consider. Regardless of the approach, validation of its methodology and conclusions through external references and/or supporting documents from potential users or development partners will be looked upon favorably in the proposal evaluation process.

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Assess Potential Impact on LCOE

One of the most common metrics for judging the benefit of a specific innovation or technical advancement is to calculate its impact on the levelized cost of energy (LCOE). Applicants may seek to establish the value of their proposed project through an explanation of how it could reduce the LCOE of offshore wind projects in the United States, including an estimation of when that impact would be achieved. Explanations focusing on component level innovations should consider the overall system-wide effect on cost of energy rather than limiting the focus to the given component.

It is expected that all LCOE calculations will be justified with evidence and analysis. Any unsupported claims may be discounted or disregarded. A methodology for calculating LCOE based on the *2018 Cost of Wind Energy Review* (see https://www.nrel.gov/docs/fy20osti/74598.pdf) published by the National Renewable Energy Laboratory is provided below. For consistency, it is recommended that all proposers use this approach. Also, proposers, where applicable, should use the reference turbine as described in each Challenge Area and found here: *https://www.nrel.gov/docs/fy20osti/75698.pdf*. If a proposer has its own large turbine design, this may be used as an alternative reference baseline.

Recommended methodology for calculating LCOE:

The term levelized cost of electricity (LCOE) refers to the net present value of the unit-cost of electricity over the lifetime of a generating asset. The following equation is used in estimating the LCOE impact of a proposed innovation:

$$LCOE = \frac{(FCR \times CapEx) + OpEx}{AEP_{net}}$$

where:

FCR	=	fixed charge rate (%)
CapEx	=	capital expenditures ($/kW)
OpEx	=	average annual operational expenditures ($/kW/year)
AEP_{net}	=	net average annual energy production (kWh/year).

The Fixed Charge Rate (FCR) represents the annual revenue per dollar of investment required to pay the carrying charges on that investment, which include finance charges, income taxes, inflation and depreciation. To ensure consistency of financial assumptions among project proposals, a real FCR of 6% should be assumed by applicants in their LCOE calculations.

Innovations that have the greatest impact could positively affect multiple elements of the LCOE equation. Certain innovations could lead to a higher cost of a given component that would be offset by greater cost reduction in another area. For example, an advanced control system may increase turbine cost but may enable higher capacity factors that decrease LCOE. As part of the LCOE analysis, proposers should

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specify which cost elements are affected, how they are affected and by what percentage they increase or decrease. Analyses should provide credible projections of when estimated cost reductions could reasonably be achieved, following a project award.

Reducing Offshore Wind Plant Risks

Where relevant, proposals may claim project benefits by providing an explanation of how their outcomes will reduce uncertainties and risks in wind plant development, installation, and/or operations and/or the costs associated with health and safety during the life cycle of a project.

Projects that claim to reduce uncertainties and risks related to project costs, revenue or installation timelines should substantiate and quantify those impacts to the extent possible. As applicable, LCOE calculations may be used.

Projects that seek to reduce health and safety risks should clearly describe, and wherever possible quantify, the direct and indirect positive effects of the project and provide or reference substantiating documentation.

Enabling Technologies

In certain cases, technology innovations may be seen as enabling a new business sector or type of commercial project. Any such claims should convey a thorough understanding of the sectors they would influence, indicate how they would be implemented, and be substantiated through credible cost benefit calculations.

Positive Impacts on the U.S. Supply Chain

All proposals shall provide an explanation of how the proposed project could have a positive impact on advancing the offshore wind supply chain to the benefit of U.S companies. Positive impacts (direct or indirect) on the supply chain may be demonstrated in many ways such as (but not limited to) the potential for increased participation from U.S. companies, reduced U.S. market entry barriers, adaptation of existing technologies or processes to offshore wind energy, and reduced uncertainty for investors.

Commercialization Strategy

All proposals shall include a summary and explanation of foreseeable follow-on efforts that will be required to enable the commercial use of the outcomes of that project in offshore wind plants in the U.S. All proposals for an innovative or modified technology/ methodology are required to provide a commercialization plan that details the expected path to commercialization or how the innovation will enable commercialization, and the necessary milestones in achieving it.

Thoroughness and credibility of the underlying commercialization analysis may be enhanced through:

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- itemization of the rough order of magnitude costs to implement the proposed commercialization pathway;
- indication of key product performance and cost metrics that would need to be achieved for successful commercialization; and
- a high-level breakdown of the time required to undertake follow-on tasks within the commercialization strategy.

Any proposal for innovative designs, methods, or advanced systems must ensure that the resulting outcomes are compliant with U.S. regulations and best practices. Proposals should be thorough and realistic in indicating whether further engineering efforts, testing, field validation, or component and system certification will be required prior to commercial deployment.

It is recognized that for some projects, considerable stakeholder engagement may be required to achieve the desired dissemination and utilization of results. Proposals will be encouraged to highlight where industry buy-in is needed, who the key stakeholders are, and provide a brief summary of how this industry integration would be achieved.

Although a project award may support specific stages of product development, there should not be an expectation that NOWRDC or NOWRDC funding will support all stages required to reach commercialization.

Letters of Commitment or Interest.

If relying on any other organization to provide data, conduct a portion of the work, provide services, equipment, or facilities, or contribute funds, a letter from that organization describing its planned participation and financial commitment must be included. In particular, if the project is dependent on data being provided by an offshore wind developer(s), a letter of commitment from the developers must be provided clearly describing the authority for use of the data, how the data will be used and for what purposes.

Also include letters of interest or commitment from businesses or other organizations critical to the future commercialization, demonstration, or implementation of the project. This is especially critical when partnering with an offshore wind developer or offshore wind supply chain members.

The first letter type is actual involvement in the project work (e.g. by providing a validation site or being an advisor). To the extent that the proposer is relying on an NOWRDC Member Company to do work in order to complete the proposer's contractual responsibilities, then, like any other subcontractor (compensated or otherwise), the Member Company should provide a 'letter of intent' confirming the Member/subcontractor's commitment to doing the work. Since the Member Company is participating in the proposal in such circumstances, NOWRDC's Conflict of Interest Policy (the "Policy") and the New York Not-for-Profit Corporation Law will require any employee of the participating Member serving on NOWRDC's Board of Directors or R&D Committee to make a disclosure regarding the Member's participation in the proposed work and to recuse from any vote to fund/not fund the specific proposal, as relevant. Please see the attached memo regarding Member Conflict Guidance for further discussion of the relevant rules.

The second type of support letter involves a request by a proposer for a letter indicating that a Member Company supports the project (a "letter of support"), which the proposer would submit in its response to a NOWRDC Solicitation as demonstration of industry support. Although letters of support from Member Companies are allowed and can provide some value to the Scoring Committee in its review process, caution should be observed with respect to such requests. Under applicable NYSERDA procurement rules (which apply to the current NYSERDA-managed Solicitation and NOWRDC solicitations that use funding received under the Funding Agreement between NYSERDA and the NOWRDC), such requests could be viewed as an "attempt to influence procurement by contacting anyone other than the Designated Contact," in violation of such rules. At this time, and to the extent of the limited facts described in this PON, NYSERDA has taken the position that such a letter of support, without more, would not be in violation of applicable rules. However, all Members should be aware of this concern and to interact with proposers accordingly. Further, NOWRDC policy prohibits proposers from lobbying individual Members or Directors outside of NOWRDC's formal review processes for purposes of securing votes for a proposal in Scoring Committee or R&D Committee decisions. This policy should also be kept in mind in

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interactions by proposers. In practice a letter of support would not be given much weight by the Scoring Committee and will never be a deciding factor in a decision whether to fund a proposal.

Given the considerations described above and NOWRDC's intent and obligations to maintain full transparency and integrity in the award review and approval process, if a proposer has communicated with a Member Company about a proposal, the proposer and the Member should disclose such communication[A2] and any relevant related circumstances in the Solicitation response and related communications, as applicable, to ensure the proper management of the same. If an employee of the Member Company is serving on the Board of Directors, any Member participation in a proposal should be disclosed to NOWRDC's Compliance Officer (currently, its Secretary) in accordance with NOWRDC's Conflict of Interest Policy.

Absence of letters of commitment or interest may be interpreted as meaning that the proposer does not have support from the subject parties. Project awards will be contingent on the proposer securing the relevant committed data, work, services, equipment, facilities, or funds as required by the project.

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III. PROPOSAL REQUIREMENTS

Incomplete proposals may be subject to disqualification. It is the proposer's responsibility to ensure that all pages have been included in the proposal and have been timely submitted in accordance with appropriate due dates and times.

The proposer must submit a proposal using the instructions and attachments listed below. The goal should be to concisely present the information needed to fully address the Proposal Evaluation Criteria (Section IV). Proposals that exceed the word limits or fail to follow the format guidelines will be rejected as non-responsive. If you believe proprietary or confidential information must be submitted to provide an adequate proposal, please clearly indicate in your proposal which information is proprietary and confidential and mark that information accordingly. Attachments beyond those requested will not be considered. Each page of the proposal should state the name of the proposer, the PON number, and the page number. All proposers are required to submit, at minimum, the following documents:

- Attachment A: Proposal Narrative (with required attachments)
- Attachment B1: Statement of Work
- Attachment C1: Milestone Payment Schedule
- Attachment C2: DOE Sub-Recipient Budget Justification

Instructions for all attachments are provided in the Attachment A Proposal Narrative file.

Required sections of the Proposal Narrative differ according to the Funding Category being proposed. Additional attachments may also be required based on the proposed Funding Category or Categories.

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	Funding Category A	Funding Category B	Funding Category C
Executive Summary	✓	✓	✓
Problem Statement and Proposed Solution	✓	✓	✓
Business Model Canvas (Attachment B2)		✓	✓
State of Research and Technology Targets	✓	✓	✓
TRL/CRL Calculator (Attachment B3)	✓	✓	✓
Commercialization Potential of Proposed Solution	✓	✓	✓
Feasibility Study Information	✓		
Three-Year Financial Projections Worksheet (Attachment B4)		✓	✓
Demonstration Site and Product (for projects that include pilot or validation testing ONLY)		✓	✓
Replication Potential of Proposed Demonstration (for projects that include pilot or validation testing ONLY)		✓	✓
Statement of Work (Attachment B1) and Schedule	✓	✓	✓
Project Benefits	✓	✓	✓
Budget	✓	✓	✓
Proposer Qualifications	✓	✓	✓
Letters of Commitment	✓	✓	✓

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Attachments	✓	✓	✓

Proposers must carefully review the Attachment A, Proposal Narrative to ensure that all required sections and attachments are submitted. Failure to do so may result in the proposal being rejected as non-responsive.

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A. Cost-Sharing

Proposers are not required to provide any form of cost-share. However, it is recognized that for projects such as demonstration projects, project team members may wish to provide additional funding or in-kind contribution to maximize the benefit of the project. Proposers are encouraged to provide an indication of any additional funding or in-kind contribution that will be used to support the delivery of a project.

B. Compliance with New York State Finance Law

In compliance with Sections 139-j and 139-k of the New York State Finance Law , proposers will be required to answer questions during proposal submission, which will include disclosing any Prior Findings of Non-Responsibility.

C. Annual Metrics Reports

If awarded, the proposer will be required to submit to NOWRDC on an annual basis, a prepared analysis and summary of metrics addressing the anticipated energy, environmental and economic benefits that are realized by the project. All estimates shall reference credible sources and estimating procedures, and all assumptions shall be documented. Reporting shall commence the first calendar year after the contract is executed. Reports shall be submitted by January 31st for the previous calendar year's activities (i.e. reporting period). The Contractor shall provide metrics in accordance with a web-based form, which will be distributed by NOWRDC. NOWRDC may decline to contract with awardees that are delinquent with respect to metrics reporting for any previous or active NOWRDC agreement.

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IV. PROPOSAL EVALUATION CRITERIA

Additional data or material to support applications/proposals may be requested. Proposers may also be requested to interview with all or part of the Scoring Committee to address any questions or provide clarification regarding information outlined in the proposals. Proposers will be notified if they are requested to participate in an interview.

A. Project Benefits and Value

All assumptions must be supported and justified using sources and evidence. Scoring will be based on the proposal team's ability to meet these criteria. For additional information see **Project Benefit Quantification**, Section IIC.

- The proposed solution addresses a core technical barrier that is not being addressed by others and has the potential for wide-scale replicability.
- The proposed solution will bring economic benefits to the U.S. offshore wind industry in the form of manufacturing capability, supply chain development or technical services. U.S. jobs are expected to be created and/or retained as a result of this project.
- The proposed solution quantifiably lowers development risk and/or represents an enabling technology likely to increase offshore wind deployment in the U.S.
- Timeframes for the offshore wind industry to realize the benefits of the proposed solution are realistic and appropriate.
- The implementation strategy is well-conceived, appropriate for the current stage of development, and there is a sound plan for measuring progress and success.
- The proposed project scope makes a clear case that it can deliver significant benefits. Where necessary and appropriate, the proposer has secured a commitment for additional cost share.
- The proposer exhibits strong market demand for this solution and has already identified one or more commercialization partners.
- The proposed solution has potential to significantly reduce LCOE. Components of LCOE include capital costs, operating costs and financing cost. Solutions that increase annual energy production without a commensurate increase in cost will also reduce LCOE.

B. Innovation, State of the Art and Technical Merit

- The proposal identifies a problem fully aligned and essential to the advancement, in the United States, of one of the identified Technical Challenge Areas.
- The proposer has demonstrated insightful understanding of the current state-of-the-art relative to the Challenge Area.
- The proposed project is technically sound, feasible, innovative, and superior to alternatives, and will make significant progress toward solving the identified problem.
- The proposed approach and scope of work are aimed at developing and commercializing a technology, as opposed to basic research and discovery.
- Technical assertions, such as assessments of performance relative to the state-of-the-art, are verified by rigorous analysis.

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- The proposal demonstrates industry buy-in and validation of the proposed technical concept.
- The proposal has demonstrated why the innovation is uniquely relevant to the U.S. offshore wind industry or the development of its supply chain.

C. Project Plan, Scope, Risks and Challenges

- The proposed project plan is clearly defined, with fully developed tasks, subtasks, milestones and deliverables that will enable effective project management.
- The scope of work is fully appropriate to the selected problem and will be highly valuable towards meeting the goals of the Technical Challenge Area and the Roadmap.
- Technical and programmatic risks are clearly understood and fully disclosed, with well-considered mitigation plans that have a high probability of ensuring project success.
- The cost of the project is strongly justified with respect to the expected benefits and the potential market or deployment opportunity.
- The proposal outlines a detailed plan for pursuing additional funding and development support, if necessary, to bring the proposed solution to full commercialization.
- The proposed work can be accomplished within the amount of time, effort, and resources proposed.
- The selected Funding Category is appropriate for the proposed solution.
- The proposal provides letters of commitment from all outside organizations the proposal team will need to provide data, equipment, support, facilities, etc.
- The implementation strategy is well-conceived and appropriate for the current stage of development, with a sound plan for measuring progress and success.
- The proposal offers a compelling explanation of how it will address barriers to market entry and commercialization.
- The proposed plan is as efficient as possible with regards to resources and time, including maintaining as limited of an administrative budget as positive relative to overall project budget.

D. Team Experience and Capabilities

- The proposed team has the necessary expertise and resources to carry out the proposed work.
- The project team includes members with industrial and business experience as well as technical skill.
- The project team has successfully commercialized applicable products, deployed similar services or has completed a similar project.
- The proposal team has secured strong commitments from all essential team members and partners, including letters and has demonstrated strong support from necessary market actors.

- The proposal clearly demonstrates the team structure and staff responsibilities.
- For demonstration projects relying on entities and jurisdictional authorities such as a maritime agency, leaseholder, equipment manufacturer, etc., the project team has secured or has a plan to secure all the commitments necessary to execute the proposed project scope.

Program Scoring

Each proposal will be scored on a scale of 100 with the following weighting applied to each of the evaluation criteria:

1) Project Benefits and Value – 40%
2) Innovation and State of the Art – 30%
3) Project Plan, Scope, Risks and Challenges – 15%
4) Team Experience and Capabilities – 15%

Additional data or material to support applications/proposals may be requested. Proposers may also be requested to interview with all or part of the Scoring Committee to address any questions or provide clarification regarding information outlined in the proposals. Proposers will be notified if they are requested to participate in an interview.

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Program Policy Evaluation Factors

NOWRDC reserves the right to accept or reject proposals based on the following factor(s):

1) Whether the proposed project will accelerate technology advances in areas that industry or the company, by itself, is not likely to undertake.
2) The degree to which the proposed project optimizes the use of available funding to achieve programmatic objectives.
3) The degree to which the proposal expands the geographic diversity of NOWRDC's R&D efforts.
4) The degree to which the proposal expands the technical portfolio of NOWRDC.
5) The degree to which the proposed project has leveraged award funds to expand their project scope and value attained with non-award resources.
6) The degree to which there are technical, market, organizational and/or environmental risks associated with the projects that outweigh the potential benefits.
7) Past performance of the proposer on other projects with NOWRDC, NYSERDA, the U.S. DOE, and NOWRDC Member companies.
8) The degree to which project expenses are in line with market rates.

Awardees are expected to be notified within approximately 12 weeks from proposal submission if their proposal has been selected to receive an award, contingent upon successful execution of an award.

V. General Conditions

A. Proprietary Information

Careful consideration should be given before confidential information is submitted to NOWRDC as part of your proposal. Your review of information to be submitted should include whether information, if confidential, is critical for evaluating a proposal, and whether general, non-confidential information, may be adequate for review purposes. You must submit a signed Applicant Assumption of Risk form with your application.

Funding awarded for projects hereunder is made available pursuant to a funding agreement between NOWRDC and the New York State Energy Research and Development Authority ("NYSERDA"), which agreement includes requirements for NOWRDC to provide information to NYSERDA which is included in your proposal. The NYS Freedom of Information Law, Public Officers law, Article 6, provides for public access to information NYSERDA possesses. Public Officers Law, Section 87(2)(d) provides for exceptions to disclosure for records or portions thereof that "are trade secrets or are submitted to an agency by a commercial enterprise or derived from information obtained from a commercial enterprise and which if disclosed would cause substantial injury to the competitive position of the subject enterprise." Information submitted to NYSERDA that the proposer wishes to have treated as proprietary, and confidential trade

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secret information, should be identified and labeled "Confidential" or "Proprietary" on each page at the time of disclosure. This information should include a written request to except it from disclosure, including a written statement of the reasons why the information should be excepted. See Public Officers Law, Section 89(5) and the procedures set forth in 21 NYCRR Part 501 https://www.nyserda.ny.gov/About/-/media/Files/About/Contact/NYSERDA-Regulations.ashx. However, NOWRDC and NYSERDA cannot guarantee the confidentiality of any information submitted.

B. Omnibus Procurement Act of 1992

This section and those that follow describe certain requirements applicable to awards using funding made available from NYSERDA. It is the policy of New York State to maximize opportunities for the participation of New York State business enterprises, including minority- and women-owned business enterprises, as bidders, subcontractors, and suppliers on its procurement Agreements.

Information on the availability of New York subcontractors and suppliers is available from:

Empire State Development
Division for Small Business
625 Broadway
Albany, NY 12207

A directory of certified minority- and women-owned business enterprises is available from:

Empire State Development
Minority and Women's Business Development Division
625 Broadway
Albany, NY 12207

C. State Finance Law sections 139-j and 139-k

NYSERDA is required to comply with State Finance Law sections 139-j and 139-k. These provisions contain procurement lobbying requirements which can be found at https://online.ogs.ny.gov/legal/lobbyinglawfaq/default.aspx. Proposers are required to answer questions during proposal submission, which will include making required certification under the State Finance Law and to disclose any Prior Findings of Non-Responsibility (this includes a disclosure statement regarding whether the proposer has been found non-responsible under section 139-j of the State Finance Law within the previous four [4] years).

D. Tax Law Section 5-a

NYSERDA is required to comply with the provisions of Tax Law Section 5-a, which requires a prospective contractor, prior to entering an agreement with NYSERDA having a value in excess of $100,000, to certify to the Department of Taxation and Finance (the "**Department**") whether the contractor, its affiliates, its subcontractors and the affiliates of its subcontractors have registered with the Department to collect New York State and local sales and compensating use taxes. The Department has created a form to allow a prospective contractor to readily make such certification. See, ST-220-TD (available at http://www.tax.ny.gov/pdf/currentforms/st/st220tdfillin.pdf). Prior to contracting with NOWRDC, the prospective contractor may also be required to certify to NYSERDA whether it has filed such certification with the Department.

The Department has created a second form that must be completed by a prospective contractor prior to contracting and filed with NYSERDA. See, ST-220-CA (available at http://www.tax.ny.gov/pdf/currentforms/st/st220cafillin.pdf). The Department has developed guidance for contractors which is available at http://www.tax.ny.gov/pdf/publications/sales/pub223.pdf.

E. Contract Award

NOWRDC anticipates making multiple awards under this solicitation. NOWRDC anticipates a contract duration of one to three (3) years, unless it determines a different structure is more efficient based upon proposals received. A contract may be awarded based on initial applications without discussion, or following limited discussion or negotiations pertaining to the Statement of Work. Each application should be submitted using the most favorable cost and technical terms. NOWRDC may request additional data or material to support applications. NOWRDC will use the Attachment D, Sample Agreement to contract successful proposals. NOWRDC may at its discretion elect to extend and/or add funds to any project funded through this solicitation. NOWRDC reserves the right to limit any negotiations to exceptions to standard terms and conditions in the Sample Agreement to those specifically identified in the checklist questions. Proposers should keep in mind that acceptance of all standard terms and conditions will generally result in a more expedited contracting process. NOWRDC expects to notify proposers in approximately eight to twelve (12) weeks from the receipt of a proposal whether your proposal has been selected to receive an award. NOWRDC may decline to contract with awardees that are delinquent with respect to any obligation under any previous or active NOWRDC agreement.

F. Accessibility Requirements

NYSERDA requires contractors producing content intended to be posted to the Web to adhere to New York State's Accessibility Policy. This includes, but is not limited to, deliverables such as the following

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that are intended for such purposes: documents (PDF, Microsoft Word, Microsoft Excel, etc.), audio (.mp3, .wav, etc.), video (.mp4, .mpg, .avi, etc.), graphics (.jpg, .png, etc.), web pages (.html, .aspx, etc.), and other multimedia and streaming media content. For more information, see NYSERDA's Accessibility Requirements.

G. Limitation

This solicitation does not commit NOWRDC to award a contract, pay any costs incurred in preparing a proposal, or to procure or contract for services or supplies. NOWRDC reserves the right to accept or reject any or all proposals received, to negotiate with all qualified sources, or to cancel in part or in its entirety the solicitation when it is in NOWRDC's best interest. NOWRDC reserves the right to reject proposals based on the nature and number of any exceptions taken to the standard terms and conditions of the Sample Agreement. NOWRDC reserves the right to disqualify proposers based upon the results of a background check into publicly available information and the presence of a material possibility of any reputational or legal risk in making of the award.

H. Disclosure Requirement

The proposer shall disclose any indictment for any alleged felony, or any conviction for a felony within the past five (5) years, under the laws of the United States or any state or territory of the United States and shall describe circumstances for each. When a proposer is an association, partnership, corporation, or other entity, this disclosure requirement includes the entity and its officers, partners, and directors or members of any similarly governing body. If an indictment or conviction should come to the attention of NOWRDC after the award of a contract, NOWRDC may exercise its stop-work right pending further investigation or terminate the agreement; the contractor may be subject to penalties for violation of any law which may apply in the particular circumstances. Proposers must also disclose if they have ever been debarred or suspended by any agency of the U.S. Government or the New York State Department of Labor.

I. Vendor Assurance of No Conflict of Interest or Detrimental Effect

The proposer shall disclose any existing or contemplated relationship or transaction of the proposer, or any known relationship or transaction of any person or entity that is a member, shareholder or other equity owner of five percent (5%) or more of the proposer, or of any parent, subsidiary, or other affiliate of the proposer, or any known relationship or transaction of any clients/customers of the proposer, to or with NOWRDC or NYSERDA, or with any current or former employee, officer, or director of NOWRDC or NYSERDA, which relationship or transaction could give rise to an actual, or the appearance of, a conflict of interest or impropriety in connection with the proposer's rendering of services as proposed. If any such actual or apparent conflict of interest or impropriety does or might exist, please describe how you would

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eliminate or prevent it. Indicate what procedures will be followed to detect, notify NOWRDC of, and resolve any such conflicts.

The proposer must disclose whether it, or any of its members, or, to the best of its knowledge, shareholders or other equity owners of five percent (5%) or more, parents, affiliates, or subsidiaries, have been the subject of any investigation or disciplinary action by the New York State Commission on Public Integrity or its predecessor State entities (collectively, "**Commission**"), and if so, a brief description must be included indicating how any matter before the Commission was resolved or whether it remains unresolved.

J. Public Officers Law

For any resulting awards, the Contractor and its subcontractors shall not engage any person who is, or has been at any time, in the employ of the State to perform services in violation of the provisions of the New York Public Officers Law, other laws applicable to the service of State employees, and the rules, regulations, opinions, guidelines or policies promulgated or issued by the New York State Joint Commission on Public Ethics, or its predecessors (collectively, the "**Ethics Requirements**"). Proposers are reminded of the following Public Officers Law provision: contractors, consultants, vendors, and subcontractors may hire former NYSERDA employees. However, as a general rule and in accordance with New York Public Officers Law, former employees of NYSERDA may neither appear nor practice before NYSERDA, nor receive compensation for services rendered on a matter before NYSERDA, for a period of two (2) years following their separation from NYSERDA service. In addition, former NYSERDA employees are subject to a "lifetime bar" from appearing before any state agency or authority or receiving compensation for services regarding any transaction in which they personally participated, or which was under their active consideration during their tenure with NYSERDA.

Any awardee will be required to certify that all of its employees, as well as employees of any subcontractor, whose subcontract is valued at $100,000 or more who are former employees of the State and who are assigned to perform services under the resulting contract, shall be assigned in accordance with all Ethics Requirements. During the term of any agreement, no person who is employed by the contractor or its subcontractors and who is disqualified from providing services under the contract pursuant to any Ethics Requirements may share in any net revenues of the contractor or its subcontractors derived from the contract. NYSERDA may request that contractors provide it with whatever information the State deems appropriate about each such person's engagement, work cooperatively with the State to solicit advice from the New York State Joint Commission on Public Ethics, and, if deemed appropriate by the State, instruct any such person to seek the opinion of the New York State Joint Commission on Public Ethics. NYSERDA shall have the right to withdraw or withhold approval of any subcontractor if using such subcontractor for any work performed would conflict with any of the Ethics Requirements. NYSERDA shall have the right to terminate any contract at any time if any work performed conflicts with any of the Ethics Requirements.

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VI. ATTACHMENTS

Attachment A – Form-Fillable Proposal Narrative
Attachment B1` – Business Model Canvas Template
Attachment B2 – Technology and Commercialization Readiness Level Calculator
Attachment B3 – Three-Year Financial Projections Worksheet
Attachment C1 – Milestone Payment Schedule
Attachment C2 – DOE Sub-Recipient Budget Justification
Attachment D – Sample Agreement (Includes SOW Template)

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