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Document Title:	Draft Research Concept on Advance to Next-Generation Offshore Wind Energy Technology
Description:	The California Energy Commission (CEC) Research and Development Division is seeking public comment on this draft research concept for potential applied research, development, and deployment projects that facilitate the deployment of floating offshore wind energy (FOSW) and results in increased cost competitiveness, performance, and reliability, while increasing the knowledge of the environmental and wildlife impacts of FOSW in California.
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DRAFT RESEARCH CONCEPT

ADVANCE TO NEXT-GENERATION OFFSHORE WIND ENERGY TECHNOLOGY

For Public Comment

(Scoping Workshop on October 22, 2020)

Energy Research and Development Division

California Energy Commission

October/2020

Introduction

The California Energy Commission (CEC) Research and Development Division is seeking public comment on this draft research concept for potential applied research, development, and deployment projects that facilitate the deployment of floating offshore wind energy (FOSW) and results in increased cost competitiveness, performance, and reliability, while increasing the knowledge of the environmental and wildlife impacts of FOSW in California.

The CEC-administered Electric Program Investment Charge (EPIC Program) invests in scientific and technological research to accelerate the transformation of the electricity sector to meet the state's energy and climate goals.

To help meet the state's climate goals, new clean energy solutions are developed and commercialized to decarbonize the electricity sector. EPIC-funded research is helping to:

- Expand the use of renewable energy.
- Build a safe and resilient electricity system.
- Advance electric technologies for buildings, businesses, and transportation.
- Enable a more decentralized electric grid.
- Improve the affordability, health, and comfort of California's communities.
- Support California's local economies and businesses.

The California Energy Commission (CEC), will host a remote-access workshop on October 22, 2020 to seek input from stakeholders on this draft research concept.

Written comments must be submitted to the Docket Unit by **5:00 p.m**. on **November 13, 2020**.

Written and oral comments, attachments, and associated contact information (including address, phone number, and email address) will become part of the public record of this proceeding with access available via any Internet search engine.

The CEC encourages use of its electronic commenting system. Visit the CEC e-commenting system at https://www.energy.ca.gov/proceedings/e-filing-and-e-commenting, which links to the comment page for this docket.

Background

California's passage of Senate Bill (SB) 100 continues to change the landscape for clean energy development in the state by increasing demand for new clean energy generation sources, such as offshore wind energy (OSW). The state has an estimated 112 GW of accessible offshore wind resources, with the vast majority of offshore wind resource potential (96 percent) located in water deeper than 60 meters, where traditional offshore wind technologies are not suitable. California faces multiple technical challenges in the implementation of offshore wind projects, including limited information from the handful of floating offshore wind (FOSW) demonstrations around the globe, the depth of the ocean offshore California, the cost of floating technology, and potential impacts on species, habitats, and other ocean uses.

A recent study funded by the CEC identified that R&D opportunities to overcome the FOSW challenges are focused on advancing floating technologies, such as substructure, anchor, mooring lines, and cabling webs; developing advanced remote monitoring systems for proactive operation and maintenance (O&M); developing manufacturing and assembly solutions; and advancing technologies to reduce wildlife impacts, including smart curtailment and deterrents.

A CEC-funded research roadmap on utility-scale renewable energy technologies also identified R&D opportunities to facilitate the development of cost-competitive FOSW projects in California. Prioritized FOSW R&D opportunities include: the development and demonstration of floating offshore platform manufacturing approaches; and the development of innovative solutions for port infrastructure readiness for FOSW deployment.

Innovation on floating substructure and foundation design, installation, and inspection and monitoring are identified as key in reducing FOSW's levelized cost of energy (LCOE). Literature estimates that manufacturing of the floating substructure, turbine and anchor make up the main portion of the life cycle cost of a FOSW project, followed by O&M and installation costs. Average capital expenditure (CAPEX) per project breaks down as follows: the substructure and foundation contribute 27 percent; the turbine approximately 25 percent, electrical installation 19 percent; assembly and installation 9 percent; and the remining expenditure totals 20 percent.

Draft Proposed Research

The objective of the project under this draft research concept is the development and pilot demonstration of innovative FOSW component(s), tool(s), and installation processes that advance the readiness and cost-competitiveness of FOSW in California, while increasing the understanding of how FOSW installation and deployments may affect sensitive species and habitats. The expected research project is a technology

pilot demonstration; with a technology readiness TRL5 at the beginning of the project. TRL5 represents the bridge from scientific research to engineering, where a high-fidelity lab-scale system is tested in a relevant environment.[2]

The specific objectives of the proposed project are the following:

1. Innovate manufacturing/assembly processes and materials for FOSW component(s) (e.g. substructure, foundation and support substructure) and demonstrate at a pilot scale to validate the expected benefits, such as LCOE reduction and increase the understanding of potential environmental and wildlife impacts of FOSW projects.
2. Test and validate a monitoring system for FOSW applications that support reduction of installation and O&M costs and increase commercial readiness.
3. Develop tools or methods for assessing and monitoring the environmental impacts (e.g. on marine biodiversity or habitat, currents and upwelling) related to manufacturing/assembly processes and operation of FOSW component(s).
4. Build a consortium that works on the development of parallel solutions for technical and environmental challenges that facilitate the deployment of cost-effective and environmental-friendly FOSW projects in California.

Envisioned requirements for the proposed research include:

- Meeting the specific objectives mentioned above.
- For field testing and validation, securing a site and associated permissions, with permitting and site assessments underway or complete, and all construction engineering and hardware selection underway.
- For test facilities, demonstrating commitment of the testing site manager to collaborate with the project.
- Identifying solutions for the end-of-life of the FOSW component(s) developed, tested, and installed under the proposed project.

Envisioned metrics include:

- Demonstrating how the innovative technology and tools will contribute to a LCOE for offshore wind energy lower or equal to $75/MWh.
- Advancing the FOSW and monitoring technology to TRL7-8.

Examples of potential projects are listed below, but are not limited to:

1. Develop, test, and validate an onsite manufacturing or assembly approach for a floating substructure or foundation components designed to reduce FOSW LCOE and avoid or minimize marine species and ecosystem risks when the components are in operation. The project includes the test and validation of inspection and

monitoring systems of substructure or foundation components that support O&M activities and help increase the understanding associated with distribution of invasive species, sea surface and seafloor disturbances, turbidity and other related interaction risks due to the operation of floating substructure or foundation components.

2. Develop, test, and validate installation processes of floating substructure or foundation components designed to increase installation efficiency, reduce FOSW LCOE, and avoid or minimize marine species and ecosystem risks during construction and installation. The project includes the test and validation of inspection and monitoring systems that support construction and installation activities and help understand and reduce impacts related to distribution of invasive species, sea surface and seafloor disturbances, turbidity, and other related interaction risks due to the installation of those components.
3. Develop, test, and validate innovative design of anchoring and mooring systems that reduce FOSW LCOE and the acoustic impacts and risk of marine mammal entanglement during the construction, installing, and operation of these systems. The underwater acoustic impacts can be analyzed either by measuring sound levels during installation and construction or modeling the sound levels and comparing them to the hearing capacity of marine mammals and perhaps other species groups. The project includes the test and validation of inspection and monitoring systems that support installation, operation, maintenance activities of anchoring and mooring systems, and help increase the understanding of underwater acoustic impacts.
4. Develop, test, and validate innovative design of inter-array and exporting cables systems that reduce FOSW LCOE and disturbance to marine species and ecosystems. The project includes the test and validation of inspection and monitoring systems that support installation, operation, maintenance activities of inter-array and exporting cables, and increase the understanding of the impact of electromagnetic fields, marine mammal entanglement with derelict fishing gear and cables, seafloor disturbance, turbidity, and other marine life and ecosystem impacts.

Potential Project Budget: $4 – 5 Million

Potential Project term: 3 years

Match Funds: 25%

Questions for stakeholders and FOSW sector

CEC staff are seeking input from stakeholders, industry and the research community. Specifically, staff seeks responses and comments on the following questions to shape the direction and scope of this draft research concept:

1. Which key research areas were not (fully) addressed in the draft research concept, but should be taken into consideration?
2. What type of innovation is needed in design and material science that support the improvement of substructure and foundation components?
3. Floating substructures have been demonstrated outside California's environment and context; what are the R&D opportunities to reduce costs of floating substructures for potential projects in California?
4. What type of innovation is needed in design and material science that supports the improvement of inter-array and export cables?
5. What environmental studies are needed to complement current studies and support the deployment of FOSW in California? Please provide details.
6. What would be the appropriate level of project funding that would leverage private investments associated with the research proposed in this draft concept.
7. CEC-funded studies have recommended research projects on alternative transmission paths, such as green hydrogen production and energy storage, that avoid costly transmission upgrades in the short time. What type of research project you identify as a critical to facilitate the deployment of alternative transmission paths in California?
8. CEC-funded studies have also identified port infrastructure as a market barrier to deploy FOSW projects in California. Which research projects do you identify as critical to advance port readiness to support FOSW?

Sources

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Schwartz, Harrison, Sabine Brueske. 2020. Utility-Scale Renewable Energy Generation Technology Roadmap. California Energy Commission. Publication Number: CEC-500-2020-062. https://ww2.energy.ca.gov/2020publications/CEC-500-2020-062/CEC-500-2020-062.pdf

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