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Response to Call for Information (Docket No: 19-ERDD-01)

Draft Research Concept on Advance to Next-Generation Offshore Wind Technology

Submitted to:

California Energy Commission
1516 Ninth Street
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CA 95814

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1. ABOUT CIERCO PROJECTS CORPORATION

Cierco Projects Corporation is headquartered in Palm Springs, California. Through its work in Europe, Cierco has developed two core competencies – the development of consented and financed marine energy sites and the commercialization of offshore wind technology (supply and maintenance operations).

Cierco is the developer behind the CADEMO Offshore Wind Demonstration Project, located off Vandenberg AFB in Santa Barbara County (www.cademo.net). CADEMO is a technology demonstration project aimed at piloting the development, construction, installation, and operation of the first offshore wind project in California. The project aims to support the development of the local supply chain and skills to meet the opportunities of the newly emergent floating offshore wind industry.

Cierco has applied for a lease and permit for the CADEMO project to the California State Lands Commission (SLC), and its application was determined as complete on July 21, 2020. As a result, the SLC has commenced the lease and permit determination process through the initiation of a stakeholder outreach program (https://www.slc.ca.gov/renewable-energy/offshore-wind-applications/) in preparation of the publication of a Notice of Preparation and commencement of the formal assessment stage. It is Cierco's ambition to have the CADEMO project permitted, installed, and operating in California waters by 2025.

As a demonstration project, CADEMO is intended to facilitate precisely the sort of research as proposed in the CEC's Draft Research Concept. For example, we have already identified some significant innovative anchor and mooring modular products for inclusion within the CADEMO project that are applicable to deep water floating offshore wind deployments.

Cierco is working with a number of public/academic institutions and not-for-profit NGOs in the development of a number of innovative environmental monitoring initiatives that can be utilized, field

tested and ground truthed on the CADEMO project a number of years prior to the first installation of commercial offshore wind in the deeper waters of the proposed BOEM lease areas.

2. COMMENTS ON THE CEC DRAFT RESEARCH CONCEPT

Cierco believes the CEC's Draft Research Concept is an important and well-considered proposal that should be advanced without major modifications. In particular, our comments are the following:

- In general, the ideal research grant period is three to five years, so the CEC's proposed three-year period for funded research should be sufficient to enable a pilot/demonstration project to produce significant findings during the funded time period. While the CEC exploratory proposal does not cite a start date, a logical assumption would be for the Request for Applications to be issued in 2021 or 2022, meaning a funding term of roughly 2023-26. Cierco believes this timeline is realistic and appropriate.

- The CEC's proposed project budget of $4-5 million, based on the requirement of 25% match funding, should be sufficient to effectively support advancement in two or three selected key initiatives in areas such as modular technology demonstration, environmental monitoring technology, design studies and port and infrastructure research. This will be crucial to small-scale pilot demonstration projects and, over the long term, will support the development of commercial scale roll outs. It does, however, need to be acknowledged that the total amount of funding will be insufficient to address all areas identified in the Docket, so additional sources of state and federal funding support need to be identified and secured to support the future commercial-scale development of the California offshore wind industry. In the UK and European Union, grant funding programs for offshore wind technology projects and developments (https://windeurope.org/policy/eu-funded-projects/#) tend to be between €10 to 20 million per 6-12 MW wind turbine demonstration projects (i.e. €25 million grant under Horizon 2020 to develop first 1X demonstrator).

- From Cierco's experience across many jurisdictions in Europe, we recognize the need for technology pilot/demonstration projects. No country has established a mature and competitive offshore wind industry without first having demonstration/pilot projects, whether fixed or floating. While California can and should learn lessons from other jurisdictions, it still needs small-scale pilot/demonstration projects – not just to develop the supply chain, workforce and infrastructure requirements, but also to gain experience in permitting, socialize offshore wind well ahead of the commercial projects, and conduct its own research relevant for the specific California conditions.

- Offshore wind development opportunities within California are dictated by the seabed lease and permit processes. Outside of state waters, the process is governed by BOEM and does not distinguish between pilot, pre-commercial or commercial projects, meaning any development under the BOEM process will follow the same timelines. This makes it very challenging to identify meaningful opportunities that do not clash with pre-commercial or commercial deployment timelines. This means that any meaningful offshore wind research can only be addressed by demonstration projects located within California state jurisdiction, governed by the State Lands Commission which is a separate and distinct process and timeline to the BOEM process.

3. SPECIFIC RESPONSE TO THE CEC QUESTIONS

Which key research areas were not (fully) addressed in the draft research concept, but should be taken into consideration?

Cierco believes that the research areas identified within the draft concept are fully appropriate. If we were to widen the scope, we would suggest specific research on:

- To distinguish between the different kind of projects and what purpose and function each project step will have in the specific California environment, aiming for a fast and effective pathway to commercial deployments:

    a) Pilot or early demonstration with up to 30 MW per technology (2-3 units) where such project is early stage with individual units that break new grounds for industry and workforce development and will come at higher cost, most likely best supported by grants or specific PPA top-offs.

    b) Pre-commercial projects (100 – 300MW), also being first deployment of medium project size, still coming at sightly higher cost than the target LCOE, best supported by slight top off or tendering for guaranteed 15-year PPA.

- The development/investment needs of the local supply chain and local infrastructure, including ports, to meet commercial-scale floating offshore wind in California.

However, as stated earlier, Cierco believes that only a selected few of these areas can be addressed within the scope of budget proposed by the Docket. Other State and Federal funding/stimulus initiatives are needed to address additional areas.

What type of innovation is needed in design and material science that support the improvement of substructure and foundation components?

We believe grants funding is needed for research in the following two areas:

A) Multi turbine anchoring designs and strategies.

B) Fabrication processes and strategies to accommodate for modular fabrication within the local supply chain for both steel and concrete. This is an important differentiation to fixed-bottom because a single fabrication pathway may work for one supplier but not the other. Given that there are over 35 companies with individual platform designs with their own funding and IP, the question is how such preparations can be done ahead of the market without any real projects and engagement for the local industries to build on.

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?

Cierco considers the following aspects need to be considered to address the question:

- **Floating Wind Technology spread** – while the more boosterish sectors of the offshore wind industry claim that floating technology is fully established, the evidence is that only three platform designs have demonstrated at the appropriate scale (one of which is unsuitable for construction in the Californian environment). If offshore wind is to become a significant low-cost renewable energy source for California, additional platform technologies will be needed to provide sufficient

innovation and cost reduction. Support to emergent floating structure technology demonstration in the Californian environment is needed, otherwise the market will be dictated by a first-to-market philosophy rather than identifying and using the most appropriate technology for the environment (based on cost, impact, and local benefit). Demonstrating and increasing the spread of available floating substructure technologies at a more manageable scale ultimately reduces uncertainty, risk, and cost of future, commercial-scale deployments.

Currently there are no test sites in the world to demonstrate the next generation of wind turbines up to 15 MW with floating foundations. The steps required to commercialize any new technology differ greatly, but the complexity, technical risks and scale of financial investment required for floating offshore wind means there is a need for prudent stepwise increases in capacity from laboratory to pilot plant to demonstration scale. The complexity of power generation systems leads to a particularly expensive process of commercialization. Again, we wish to note that the CADEMO project will provide exactly this stepwise approach to demonstrating next-generation scale and technology.

- **Californian port and harbor infrastructure** - The fabrication and serial production methods of each floating platform need to be established and optimized. California's supply chain and port infrastructure is underdeveloped when compared to facilities in East Asia, the U.S. Gulf Coast, and Europe. This underdevelopment creates the significant risk that California offshore wind projects will use supply chains comprising mostly imported inputs and services, and thus the state will lose economic benefits. Local ports need to assess and create readiness for lower cost serial production of floating devices.

- **Development of modular technology solutions to reduce LCOE** - In a similar vein, the demonstration of new modular technology solutions applicable to floating wind technologies requires a path to commercialization through the proving of concepts in an operational environment. While in theory there are opportunities to prove modular designs in existing commercial offshore wind development projects, in practice there has been a general reluctance for commercial developments to include new technologies due to the technical risks and potential commercial impact should the technologies fail.

- **Validating the LCOE of floating offshore wind in California** - Costs are still high for offshore floating wind foundations. The technologies need to mature, be optimized, and drive the cost down through demonstration in real environments where they will eventually be deployed commercially.

What type of innovation is needed in design and material science that supports the improvement of inter-array and export cables?

Cierco has worked on alternative array grid layouts and there are opportunities to explore in this area. Some of the floating foundation designs do have sufficient physical space where deployment of inter-array and even transmission voltage transformation can take place. Using this principle, there could be a decentralization of the otherwise large substations to more modest group transformer strategies, connecting smaller 5-9-unit clusters in a radial "spoke" cabling layout. This could have large cost reduction impact on floating intermediary transformer platforms and the overall grid design. In addition, there could be environmental and technical/cost benefits to support the exploration of cabling management system allowing cable to follow anchor line, wire or chain system to the seabed. Would require measures on floater platform level as well as on the anchor design level.

What environmental studies are needed to complement current studies and support the deployment of FOSW in California? Please provide details.

As mentioned earlier, Cierco has been working with a number of public/academic institutions and NGOs in the development of innovative environmental monitoring initiatives that can be utilized, field tested and ground truthed. Some of the areas identified for deployment on the CADEMO project include:

- In field verification of a state-of-the-art remote sensing technology, ThermalTracker-3D, for avian monitoring. ThermalTracker-3D automatically extracts bird and bat flight data from thermal video, generating quantified information that includes flight direction and flight height of individual animals. It operates effectively both day and night, providing a more comprehensive characterization of activity than can be achieved by traditional ship-based and aerial surveys.
- Incorporating passive acoustic monitoring during all phases of development to record the ambient noise and detect vocalizations from high-frequency marine mammals. Sound propagation monitoring can also be conducted to estimate the sound field generated by various types of noise generated during construction and operations. The passive acoustic equipment deployed at the site, combined with the sound propagation modelling, can work together to generate a comprehensive assessment of the potential impacts of offshore wind construction and operation on marine mammals.
- Testing and evaluation of various benthic sampling approaches and techniques, including: (1) sediment profile imaging, to produce a plan view photograph of the substrate surface and a side profile within the substrate and (2) sediment grab samples, to collect a physical sample of the surface sediment and provide a subsample of the benthic species diversity and abundance within the biotic zone of the sediment. Both methods allow the collection of information related to the sediment nature (mean grain size), but each also provide different information related to the biological component of benthic habitats. Depending on what regulatory concerns are surrounding a proposed development site, one method may be more appropriate and cost-efficient than the other. Both methods of benthic sampling can be proposed for pre-construction and post-construction benthic habitat characterization to understand baseline conditions and to monitor any changes in benthic habitat after installation.
- Novel habitat modelling approaches and techniques which will increase our understanding of habitat suitability and larval dispersal patterns of valuable benthic species with pelagic larval stage. A coupled modeling framework will be utilized including: (1) a downscaled ocean modeling system framework to characterize hydrodynamic processes in the vicinity of the pilot project; (2) a habitat suitability model to predict the probable distribution of benthic species of interest based on a selection of environmental variables; and (3) a biophysical model combining the outputs of the hydrodynamic model and the predicted adult habitats, to track larval dispersal from spawning grounds and assess the connectivity patterns of the population. The combination of these three models is an innovative approach that will allow the consideration of all environmental conditions that affect population dynamics and a better understanding of the potential effects of offshore energy development on benthic species and larval dispersal patterns.

The research identified above will need grant support to implement, however it can provide relevant and useful information a number of years prior to the wider commercial deployment of FOSW in California.

What would be the appropriate level of project funding that would leverage private investments associated with the research proposed in this draft concept.

As expressed earlier, while Cierco believes that the research areas identified within the draft concept are appropriate, the difference between developing, testing and validating on-site manufacture/assembly is orders of magnitude different to developing a monitoring system in terms of financial requirements. Cierco believes a requirement of 25% match funding is appropriate irrespective of the scale of financial investment. However, if the desire is to address all the 4 objectives stated in the docket then the scale and scope of the funding made available needs to be re-considered.

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?

Green hydrogen and technologies are moving quickly in Europe. Larger industrial programs in Denmark and Netherlands are shifting this segment into focus. There are multiple opportunities where island-operated windfarms could generate and store hydrogen or liquid ammonia for use of existing pipelines with O&G platforms - possibly functioning as hubs and generation platform of the hydrogen or ammonia. An alternative option is use in shipping transport, including the development of hydrogen/ammonia fuel, or refueling stations for transitional shipping fleets.

Another area is to undertake more detailed power pocket analysis of the California coastline and identify the pockets, then define site areas within proximity to such connection and deploy project sized from 100 MW to 500 MW+, but distributed along the coastline. There could be opportunities in the electrical network if we can implement smart grid system approach and utilize solar PV grid capacity outside of the solar generation. Combination of hydrogen or battery storage could bridge certain amount of generation to be added under such a scheme.

Indirectly, reforming grid connectivity conditions and have clear rewards and conditions for both generation under Peak hours as well as providing Firm capacity. Given consumer pricing of off-peak kWh cost of $0.16 where on-peak reaches up to $0.48, there should be room to device mechanisms for new wind or renewable generation to benefit substantially. With the right conditions, on peak generation and firm capacity measures could come on its own by the industry.

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?

As stated previously, California ports' overall readiness and infrastructure for next generation floating fabrication is very low, while the fabrication and serial production methods of each floating platform will require unique and varied ports infrastructure. We believe California ports must be engaged via real projects to understand and respond to these needs. This will enable state authorities, the offshore wind industry, and the ports themselves to assess and create readiness for lower-cost serial production of floating devices. We are convinced that it will take a few iterations to identify the needs and ideal infrastructure improvements.

4. CONCLUSION

Amid the current stagnation in BOEM-related California offshore wind, Cierco has taken a proactive strategy of moving forward with its CADEMO demonstration project in state waters. We expect this

project to be operational in 2025. Clearly, the grant program proposed under this Draft Research Concept will be of little relevance to those developers who are focused exclusively on projects in federal waters that will become operational toward the end of the decade. However, for a multi-technology project in state waters, the proposed grants could provide considerable enhancements and added values to enable results within the state's desired timeframe. Cierco is already engaged with a wide range of stakeholders – the environmental community, local business groups, labor unions, educational bodies and workforce development boards. We would welcome the opportunity to work with CEC to provide solutions to its research needs within the envisioned 2023-26 timeframe. We both encourage the CEC to continue to develop its research proposal without delay.

As ever, Cierco remains open to discuss this topic further in more detail.