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CalWave comments on IEPR wave and tidal energy report

Additional submitted attachment is included below.

CALWAVE

July 29, 2024
Chair David Hochschild
Vice Chair Siva Gunda
California Energy Commission
Docket Unit, MS-4
Docket No. 24-IEPR-04
715 P Street Sacramento, CA 95814-5512

Subject: Comments on the 2024 IEPR Update – Wave and Tidal Energy

Dear Chair Hochschild and Vice Chair Gunda:

In April 2024, CalWave and the National Hydropower Association (NHA) worked together to submit a response (referred to as the "previous docket submission" throughout the rest of this document) to the California Energy Commission (CEC) Docket No. 24-IEPR-01 regarding the inclusion of wave and tidal energy (referred to as "marine energy" throughout the rest of this document) in the 2024 Integrated Energy Policy Report (IEPR).

The submission from CalWave is linked here:
https://efiling.energy.ca.gov/GetDocument.aspx?tn=255544&DocumentContentId=91313

The submission from NHA is linked here:
https://efiling.energy.ca.gov/GetDocument.aspx?tn=255547&DocumentContentId=91316

In summary, the previous docket submission makes the case that CEC should prioritize the inclusion of marine energy as part of California's future mix to help the state reach 100 percent renewables by 2045, lower costs for ratepayers, and create jobs in California instead of out-of-state or overseas. The submission also contends that the addition of "marine energy" to activities currently specific to offshore wind would have a significant impact on the growth of the marine energy sector in California while benefiting the offshore wind sector. The submission concludes with several recommendations to ensure California benefits from a robust local marine energy sector.

In this new submission to Docket No. 24-IEPR-04, we expand upon the previous docket submission from April 2024.

Part I includes eight recommendations to the CEC. Most of these recommendations were included in the previous docket submission, but in this version, they are organized in order of priority. The recommendations are summarized here:

1) Quantify potential savings for California ratepayers resulting from the integration of marine energy technologies into the California grid.
2) Encourage further legislation to create the same pathway for marine energy as offshore wind.

3) Implement statewide marine energy deployment targets of 100 MW by 2030, 500 MW by 2035, and 2,500 MW by 2040.
4) Work with the California Public Utilities Commission (CPUC) to determine the steps required for marine energy to receive an explicit price per MWh as part of the Renewable Market Adjusting Tariff (ReMAT).
5) Provide matching funds for U.S. Department of Energy (DOE) and other federal awards and investments in technology Research, Development, Demonstration, and Deployment (RDD&D) relevant to marine energy.
6) Clarify state regulatory processes for deployment of marine energy projects, and encourage the appropriate federal agencies to clarify federal regulatory processes for deployment of marine energy projects.
7) Partner with the U.S. Bureau of Ocean Energy Management (BOEM) to begin planning efforts related to deployment of marine energy in both federal and state waters off the coast of California, including the potential of expanding offshore wind lease areas for multi-use opportunities to include marine energy.
8) Encourage the Humboldt Bay Harbor, Recreation, and Conservation District to ensure that their $426.7 million investment from the U.S. Department of Transportation (DOT) can also support the marine energy sector.

Part II discusses key points from the SB 605 draft report, which was released on July 23, 2024.

Part III discusses several key points from the AB 525 Offshore Wind Strategic Plan adopted on July 10, 2024.

Part IV discusses state-level incentives and programs in California and other states that the CEC can draw inspiration from to start building a robust marine energy sector in California.

Ultimately, the aim of this docket submission is to put a variety of resources into one document that may assist CEC in its implementation of SB 605. Many points focus on new developments in California since the last docket submission in April (like the adoption of the Offshore Wind Strategic Plan and the passage of SB 867), while many others focus on policies in states around the country which California may use as models to continue improving upon its already revolutionary clean energy incentive programs. Hopefully this document can help serve as a guide to what would be helpful for California's promising marine energy sector to grow into a booming marine energy industry. We look forward to the ongoing dialogue with CEC as California continues to implement this important initiative.

I. ELABORATION ON RECOMMENDATIONS FROM PREVIOUS DOCKET SUBMISSION

The 2024 IEPR Scoping Order requires the CEC (and other state agencies) to "identify near-term actions related to investments and workforce for wave and tidal projects." Here are eight recommendations so the CEC and other stakeholders involved can ensure that the output(s) of SB 605 lead to a swift and responsible scale-up of the local marine energy sector. The recommendations are ordered by priority, with the first recommendation being the highest priority.

Recommendation 1: Quantify potential savings for California ratepayers resulting from the integration of marine energy technologies into the California grid.

The Pacific Northwest National Laboratory (PNNL) published a study in 2021 about the grid value of marine energy. This study was discussed in the previous docket submission from April 2024 and during the meeting between CEC, AltaSea, and members of the marine energy sector held on June 6, 2024. The study highlights how much battery storage capacity is required to meet electricity demands at specified levels of renewable energy penetration. The study concludes that the lowest-cost option for building storage occurs when 50 to 60 percent of the renewable energy portfolio comes from marine energy, no matter how much of the electricity mix comes from renewable energy. The local marine energy sector could more effectively seek financing for building projects if a resource were published for California that answered the following questions:

A) How much money could California ratepayers save from the integration of marine energy?
B) What is the timeframe over which ratepayers would save this money?
C) How much marine energy capacity would be deployed to achieve these savings?

While not directly considering marine energy, a sensitivity analysis by CPUC finds that increasing offshore wind nameplate capacity from 4,707 MW to 13,400 MW in a 2035 base case allows for 14,195 MW of other renewable energy generation capacity to be avoided (across solar, geothermal, and shed demand response) and 5,828 MW of storage capacity to be avoided. Given the consistency and predictability of marine energy, along with its proximity to demand centers along the coast, doing a similar sensitivity analysis for marine energy should yield similar encouraging results.

Recommendation 2: Encourage further legislation to create the same pathway for marine energy as offshore wind.

Legislation intended to accelerate the scale-up of marine energy technologies in California beyond SB 605 should be swiftly introduced. AB 525, signed in 2021, has resulted in the

adoption of an Offshore Wind Strategic Plan, state deployment targets, requests from CPUC for offshore wind centralized procurement, and massive investments in the state's port infrastructure, among other things. By enacting similar legislation for marine energy, which should include mechanisms to cover cost share for contracts with federal agencies like DOE, we can ensure that California sets the course for the scale-up of another crucial renewable energy sector.

Recommendation 3: Implement statewide marine energy deployment targets of 100 MW by 2030, 500 MW by 2035, and 2,500 MW by 2040.

While utility-scale wave energy converters (WECs) are scheduled to be connected to the U.S. mainland grid over the next couple of years, California should pursue integrating full-scale marine energy projects into its electricity mix starting in the late-2020s to avoid overbuilding energy storage and transmission infrastructure at an unnecessarily high cost. With 100 MW of marine energy capacity by 2030 and a growth rate thereafter similar to that of California solar in the 2010s, the state should have multiple GW of marine energy capacity by 2040.

Recommendation 4: Work with the California Public Utilities Commission (CPUC) to determine the steps required for marine energy to receive an explicit price per MWh as part of the Renewable Market Adjusting Tariff (ReMAT).

Marine energy currently qualifies for the ReMAT in California, but only wind, solar, hydro, geothermal, and bioenergy receive an explicit price per MWh (recalculated annually). To facilitate market-pull for marine energy technologies, we recommend that the CEC work with CPUC to determine the steps required for marine energy to receive an explicit price per MWh and fully benefit from this market-pull mechanism while lowering costs for California ratepayers. This is discussed further in Part IV.

Recommendation 5: Provide matching funds for U.S. Department of Energy (DOE) and other federal awards and investments in technology Research, Development, Demonstration, and Deployment (RDD&D) relevant to marine energy.

Federal agencies, including DOE, often include cost share requirements for technology developers as part of their contracts, even when it is not economically feasible for those technology developers. These companies must then rely upon raising private capital to fill the gap. However, with a relative lack of demonstrations to date, private capital providers often claim that these technologies do not quite fit into their risk profiles. We recommend that California consider creating a program to help cover the required cost share for federal awards if a project can be proven to benefit the state. Given the consistent, predictable, and low-carbon characteristics of marine energy, and the massive marine energy resource available off California's coastline, we recommend that the state of California cover the cost share requirements for marine energy projects that benefit the state through emissions reductions, energy cost reductions, job creation, or otherwise. With this cost share support, technology

developers will be better equipped to run successful RDD&D projects that catalyze more private investment in California than would have otherwise been possible.

Recommendation 6: Clarify state regulatory processes for deployment of marine energy projects, and encourage the appropriate federal agencies to clarify federal regulatory processes for deployment of marine energy projects.

The Marine Energy toolkit developed by Kearns and West (with funding from DOE) outlines permits required for wave energy projects at the federal and state levels: https://marineenergy.app/index.html

The California state permits listed with this resource are as follows:

- Coastal Zone Management Act (CZMA) Consistency Review
- Water Quality Review
- Coastal Development Permit
- California Environmental Quality Act Determination
- State Lands Lease
- California Endangered Species Consultation

In addition, the AB 525 Offshore Wind Strategic Plan recommends developing and implementing "coordinated permitting for offshore wind and related projects based on the previously successful Desert Renewable Energy Action Team." This is discussed further in Part III.

Recommendation 7: Partner with the U.S. Bureau of Ocean Energy Management (BOEM) to begin planning efforts related to deployment of marine energy in both federal and state waters off the coast of California, including the potential of expanding offshore wind lease areas for multi-use opportunities to include marine energy.

The NHA has requested that BOEM identify "challenges and potential solutions to streamline the permitting and leasing processes for co-located marine energy deployments with offshore wind." Co-locating offshore wind with wave energy systems off the coast of California is expected to significantly reduce variability in power generation. Since these projects may share infrastructure like offshore substations and power export cables, balance-of-plant costs may decrease and ultimately lower costs for ratepayers. By partnering with BOEM, the state of California can help shape marine energy leasing processes from a relatively early stage and can ideally advocate for a combined offshore wind and marine energy leasing process.

Recommendation 8: Encourage the Humboldt Bay Harbor, Recreation, and Conservation District to ensure that their $426.7 million investment from the U.S. Department of Transportation (DOT) can also support the marine energy sector.

SB 867 (officially titled the “Safe Drinking Water, Wildfire Prevention, Drought Preparedness, and Clean Air Bond Act of 2024”) was signed into law on July 3, 2024 and will place a climate bond on the November ballot. The $10 billion bond includes $475 million for the following activities related to offshore wind port infrastructure:

1) “Construction of publicly owned port facilities for manufacturing, assembly, staging, and integration of entitlements and components for offshore wind generation.”

2) “Expansion and improvement of public port infrastructure to accommodate vessels involved in the installation, maintenance, and operation of offshore wind generation.”

3) “Upgrades to port facilities.”

We urge the CEC to work with the State Energy Resources Conservation and Development Commission to ensure that this investment in offshore wind port infrastructure can also enable the commercialization of marine energy technologies. Point 3 under Part III further addresses this topic.

II. KEY POINTS FROM THE SB 605 DRAFT REPORT

The following comments respond to the SB 605 draft report released on July 23, 2024. For each chapter in the draft report, we encourage stakeholders involved with the outputs of SB 605 to consider the following.

Chapter 1: Technology and Economic Feasibility of Wave and Tidal Energy

Section 1.5 on pages 28 through 30 of the draft report considers “Challenges to Developing Marine Energy.” Here are some additional points to keep in mind when considering the six challenges included:

1) Technology Development

   SB 605 largely exists to set in motion the scale-up from immature technologies to large commercial projects offshore California. The lack of long-term demonstrations should be seen not as a challenge, but as simply the current stage of technology commercialization. Since CalWave and other technology developers are lined up to deploy systems offshore Oregon at the PacWave test site for upcoming long-term demonstrations once the facility becomes operational in early 2025, the sector will soon move past this stage of technology maturation.

2) Resource Variability

   Marine energy resources are generally more consistent and predictable than solar and wind energy resources, and deploying marine energy technologies may lower total energy system costs given this consistency and predictability. Climate change may slightly increase the available marine energy resource, but focusing on any potential increase in variability is counterproductive to building up the marine energy sector in California.

3) Grid Integration

   Marine energy can be quite applicable to distributed energy. Considering the high emissions, high costs, and energy dependence associated with importing diesel fuel to run generators, we contend that marine energy projects are well worth considering for remote coastal communities to decarbonize, reduce costs, and create energy independence. Starting with smaller deployments in markets with higher energy costs should help the industry fall down the cost curve and ensure that larger utility-scale projects are de-risked, bankable, and cost-saving for ratepayers.

4) Environmental Impact

The draft report contends that “marine mammal entanglement is likely to be less of an issue for a device with a single mooring versus one with multiple moorings.” This may be true, but it is important to note which type of mooring configuration is being considered. Taut mooring lines are much less likely to be an issue than catenary mooring lines, and this should be communicated in the report. In addition, we agree that the OES-Environmental 2024 State of the Science Report should be consulted, and risks that are deemed very low or retired in this report should not slow the process of scaling the marine energy sector in California.

5) Cost Competitiveness

It has been well established that the LCOE for wave energy is significantly higher than the LCOE for other forms of renewable energy like solar (around 1,600 GW deployed globally) and wind (over 1,000 GW deployed globally). Given the current cumulative installed capacities of these industries, this cost differential is to be expected when compared to a still nascent sector such as marine energy. As the marine energy sector scales, LCOE is expected to drop precipitously. These future LCOE figures are difficult to predict with any accuracy given that supply chains have not yet been built out. From a cost perspective, the metrics to focus on regarding marine energy should involve total system costs, not just LCOE. Solar and wind may currently have low LCOEs, but their intermittency implies overbuilding storage and transmission to meet decarbonization targets. The consistency, predictability, and proximity of marine energy resources can significantly reduce the amount of energy storage and transmission necessary to decarbonize our electricity mix and ensure low costs for ratepayers.

6) Socioeconomic Factors

The potential for sea space conflicts is one reason to pursue a partnership with BOEM, as outlined in Recommendation 3 in Part I, so that offshore lease areas can be labeled as multi-use opportunities that include offshore wind, marine energy, and other offshore infrastructure. While “potential changes to fish and fisheries and other marine organisms or their marine habitats” should be considered, a 2022 PNNL report called “Use of a 360-Degree Underwater Camera to Characterize Artificial Reef and Fish Aggregating Effects around Marine Energy Devices” provides promising insights:

“Many demersal and pelagic fish species are particularly attracted to artificial structures at sea, due to a common phenomenon called a thigmotactic response, in which fish tend to ‘move toward structured rather than bare, featureless habitat’ … These new artificial structures may enhance the regional production of fish and invertebrates by providing shelter and food.”

Chapter 2: Factors Contributing to Increased Use of Wave and Tidal Energy in California

As discussed under Recommendation 1 in Part I, the PNNL publication "Grid Value Proposition of Marine Energy: A Preliminary Analysis" provides valuable insight into the factors that may contribute to the increased use of wave and tidal energy along the West Coast, including in California. The report splits benefits of marine energy into three categories: Location, timing, and special applications. The summary at the beginning of the report highlights 2-3 points for each of the three categories:

1) Location

    a) Deployment of marine energy resources to deliver energy to coastal loads can fulfill local energy needs and reduce transmission utilization elsewhere on the system, freeing up capacity to provide additional renewable resources.
    b) The deployment of marine energy resources on distribution grids can help deliver renewable energy to local loads while alleviating distribution system voltage issues.

2) Timing

    a) Marine energy resources, when included in the generation portfolio, can be shown to reduce balancing energy requirements leading to an overall reduced reliance on dispatchable fossil generation or reduced energy storage buildout.
    b) Deploying marine energy can reduce balancing requirements associated with high levels of renewable integration across both distribution and bulk power systems, which may be of near-term value to island power systems.

3) Special Applications

    a) Marine energy can be shown to reduce capital and fuel costs associated with dispatchable generation and energy storage costs in microgrid and small grid environments while maintaining delivery of supply and supporting system resiliency.
    b) Marine energy resources, when collocated with other offshore or near-shore renewable resources in hybrid systems, can bring down overall plant output volatility and generation ramp rates.
    c) Marine energy resources can help to relieve land-use pressures associated with renewable energy development in both populated and remote regions.

Other factors that may contribute to the increased use of wave and tidal energy in California include, but are not limited to, the following:

- Opening of PacWave off the coast of Oregon in 2024-2025, where wave energy technology developers will soon start deploying their devices

- Satisfying SB 100 and reaching 100 percent renewables by 2045 without overbuilding generation and storage capacity, which is mentioned in the CPUC sensitivity analysis discussion in Part I
- Increasing curtailment of intermittent renewable energy resources in California and the resulting "Duck Curve" now turning into a "Canyon Curve"
- Increasing energy demand from the artificial intelligence boom
- Alignment of supply chains and port infrastructure with offshore wind
- Availability of new transmission infrastructure, both onshore and offshore, once offshore wind is built out
- Potential to increase capacity factors of offshore renewable energy projects by co-locating wave and offshore wind projects

Chapter 3: Transmission Needs and Transmission Permitting Requirements

Section 3.2.2 on page 44 says that "Offshore wave and tidal configurations are used at greater than 25 meters (82 feet) of water depth and can be beyond 100 km (62 miles) from shore." This statement is extremely misleading. Most wave energy converters (WECs) meant for integration with onshore grids will be deployed much closer to shore than this, as costs increase significantly with distance to shore; that WECs can be deployed much closer to shore than offshore wind is one of its major advantages. We strongly encourage CEC and any stakeholders working on the output(s) of SB 605 to instead emphasize that offshore configurations will be concentrated in an area several km from shore to minimize costs for transmission and other balance-of-plant infrastructure.

Overall, the evaluation of potential transmission needs and permitting requirements for marine energy may be largely adapted from the California Offshore Wind Strategic Plan; this is discussed in Part III.

Chapter 4: Permitting Requirements for Wave and Tidal Energy Projects

As mentioned in Part I, the Marine Energy toolkit developed by Kearns and West outlines permits required for wave energy projects at the federal and state levels.

Chapter 5: Economic and Workforce Development Needs

Communicating the significant workforce and economic development impacts of constructing, installing, and operating marine energy projects is an important aspect of SB 605, and this section should be highlighted in the final output(s). However, while the report considers the impacts made by projects of 10 MW and 100 MW, it does not consider any sort of roadmap to get to projects of those sizes. We cannot assume the sector will get there on its own, and we certainly cannot assume the sector will get there on its own by 2027, the benchmark year the report uses to model these scenarios. More than just about anything else, technology developers, project developers, investors, and stakeholders across the board are interested in figuring out how we are going to go from systems rated at hundreds of kW to projects rated at

tens to hundreds of MW. Only then can we start to build an industry that will create the sort of workforce and economic development impacts the report predicts.

Chapter 6: Monitoring Strategies to Gather Data for Evaluation of Environmental Impacts

The OES-Environmental 2024 State of the Science Report summarizes findings of the environmental effects of marine renewable energy developments around the world. This report should be considered and its contributors consulted when identifying a monitoring strategy to ensure that work is not unnecessarily duplicated.

In addition to the PNNL report titled "Use of a 360-Degree Underwater Camera to Characterize Artificial Reef and Fish Aggregating Effects around Marine Energy Devices" referenced in the discussion of Chapter 1 above, PNNL published another report in 2022 about the long-term environmental monitoring of CalWave's deployment offshore San Diego: https://tethys.pnnl.gov/project-sites/calwave-xwave-demonstration

Chapter 7: The Future of Marine Energy in California

There were six requirements for the outputs of SB 605 included in the scoping order for the 2024 IEPR:

1) Evaluate factors that may contribute to the increased use of wave and tidal energy in California.
2) Provide findings on latest research about the technological and economic feasibility of deploying offshore wave and tidal energy off the coast of California in state and federal waters.
3) Evaluate wave and tidal energy project potential transmission needs and permitting requirements.
4) Evaluate wave and tidal energy project economic and workforce development needs.
5) Identify near-term actions related to investments and workforce for wave and tidal projects, to maximize job creation and economic development, while considering affordable electric rates and bills.
6) Identify a monitoring strategy to gather sufficient data to evaluate impacts to marine and tidal ecosystems and inform adaptive management.

Requirements 1, 2, 3, 4, and 6 are each covered by at least one chapter in the SB 605 draft report. Requirement 5, which may hold significant influence over the future of the marine energy sector in California, is not explicitly covered. It makes sense that "near-term actions" should be covered in Chapter 7, which focuses on the future of marine energy in California.

There are critical and urgent actions the state of California should take in the near-term to establish itself as the center of the marine energy sector's scale-up. As the marine energy sector matures from pre-commercial demonstrations to full commercialization, the most impactful lever the CEC can pull is to match-fund federal investments into the sector, specifically

funding opportunities by the DOE Water Power Technologies Office (WPTO). The WPTO has positioned the U.S. at the forefront of the global marine energy sector, especially through its commitment to building out the new 20 MW PacWave wave energy test site off the coast of Oregon. With the facility near completion and soon transitioning to full operations, the WPTO should naturally soon focus on funding open-ocean devices and farms of devices via funding opportunities that usually require 10 to 20 percent cost share. Therefore, by funding technology developers aiming to build projects offshore California and hire California workers, the CEC has the potential to get a 4-9x multiplier on its investment using federal funds.

In addition to match-funding federal investments, California should build workforce development programs in tandem with the floating offshore wind industry, ensuring as much cross-industry collaboration as possible. Ocean Energy Systems (OES) has forecasted that reaching 300 GW of marine energy capacity across the world by 2050 could create 680,000 jobs and contribute $340 billion in gross value added. Highlighting the potential for job creation and increased economic output, especially as the state begins to establish itself as a global center for floating offshore wind, may encourage significant additional investment in the state. While some are slightly outdated, there are existing regional and global strategic roadmaps that CEC can draw from to set strategies for economic and workforce development, among other areas. These roadmaps include the following:

- NHA Marine Energy Council: Commercialization Strategy for Marine Energy
- IRENA: Scaling up investments in ocean energy technologies
- OES: Ocean Energy and Net Zero
- Ocean Energy Europe: 2030 Ocean Energy Vision

As the conclusion of the report, Chapter 7 should include recommendations and concrete next steps that the state of California can take to support the responsible scale-up of the marine energy sector. While we recognize that SB 605 cannot act on the recommendations included in Part I of this document, we believe that the inclusion of those recommendations in the final chapter of the SB 605 report would help scale the marine energy sector in a way that benefits ratepayers and builds resiliency for the California energy system.

III. KEY POINTS FROM AB 525 OFFSHORE WIND STRATEGIC PLAN

The CEC officially adopted the Offshore Wind Strategic Plan (an output of AB 525) on July 10, 2024. The following points from the strategic plan extend beyond offshore wind, and are directly applicable and transferable to building a robust marine energy industry with projects offshore California.

1. **"On August 10, 2022, the CEC adopted ambitious offshore wind planning goals of 2 to 5 gigawatts (GW) by 2030 and 25 GW by 2045." (page 4)**

California's stated offshore wind goals have helped drive significant interest in scaling up the industry in California. This is clear from the $757.1 million lease sale across five different lease areas in December 2022 and the $426.7 million investment to the Humboldt Bay Harbor, Recreation, and Conservation District by U.S. DOT in January 2024, among other major commitments and private sector investments.

By setting marine energy deployment targets of 100 MW by 2030, 500 MW by 2035, and 2,500 MW by 2040, the state has the opportunity to spark significant private and federal investment into marine energy as well, catalyzing the growth of an industry that will be crucial to helping California meet its decarbonization goals, including those required by SB 100.

2. **"The AB 525 suitable sea space identified in this report is intended to be a starting point for future BOEM activities related to offshore wind development off California's coast." (page 124)**

The Offshore Wind Strategic Plan identifies six initial sea space areas of interest by narrowing down space that satisfies four quantitative criteria:

A) Annual average wind speed greater than 7 meters per second
B) Average water depth of 2,600 meters or less
C) Ocean bottom slope of 10 percent or less
D) Minimum distance of 20 miles from shore

For marine energy deployment, it is important to identify areas of interest based on available energy resource (A), water depth (B), and bathymetry (C). The wave and tidal sectors have not yet converged on dominant system designs, so marine energy technologies may have a wider range of potential deployment locations than offshore wind farms, so setting these parameters is especially helpful as the sector prioritizes some locations over others.

Where marine energy differs significantly from offshore wind is distance to shore (D). While offshore wind deployment is preferable far from shore to reduce visual impacts, marine energy

deployment is preferable closer to shore to reduce transmission costs. Due to the relatively high balance-of-plant costs relative to deployed capacity for early projects, setting a minimum distance to shore for marine energy projects may prohibit the industry from scaling at all. Therefore, while we encourage the hybridization of offshore wind and marine energy projects offshore California where feasible, we recommend that potential wave energy sites should not be limited to specific locations adjacent to or within offshore wind lease areas.

3. **"The Port Plan identifies numerous potential port sites, and as noted above, concludes that no one port can meet all of the port needs for the offshore wind industry in California. Instead, the state will need to strategically develop a port network that can efficiently, cost effectively, and reliably support staging and integration, manufacturing and fabrication, and operation and maintenance activities along the California Coast." (page 150)**

The Offshore Wind Strategic Plan includes conceptual site layouts for 1) staging and integration, 2) nacelle assembly, and 3) operations and maintenance for floating offshore wind turbines and platforms, which would require a combined 130 acres per port. Marine energy technologies require far less space in port than offshore wind turbines and platforms because of their modularity and smaller system sizes. Thus, we recommend that a fraction of the area in California's offshore wind port(s) be set aside for marine energy staging, assembly, and O&M. Once marine energy technologies are more de-risked and bankable, offshore wind developers and other stakeholders interested in expanding their offshore renewable energy portfolios would likely streamline supply chains and construction processes. Ensuring there is sufficient capacity to stage both offshore wind and marine energy technologies will be crucial to this end.

4. **"The Inflation Reduction Act (IRA) provides renewable energy tax credits to projects that meet the prevailing wage and apprenticeship requirements. Projects may qualify for the "increased" rate, five times the base rate, if all laborers employed are paid prevailing wages during construction and the entire tax credit period." (page 179)**

Like the Offshore Wind Strategic Plan, the output(s) of SB 605 should highlight the significant tax credit opportunities presented by the Inflation Reduction Act (IRA). Through the revised Section 48E, clean energy projects can receive an investment tax credit (ITC) of 30 percent by meeting prevailing wage and apprenticeship requirements. Additional bonuses, like the energy community bonus and domestic content bonus, can push this ITC up to 70 percent. The IRA, and 48E in particular, has significant potential benefits for the marine energy sector. Clearly communicating these potential benefits is more likely to ensure the domestic marine energy industry lays its roots in California.

5. **"As offshore wind developments expand globally, grid operators have explored concepts for interconnecting multiple wind projects or farms offshore with the onshore energy system." (page 191)**

The Offshore Wind Strategic Plan considers four different offshore wind farm interconnection concepts with a variety of substation and export cable configurations. The output(s) of SB 605 should include a similar analysis for marine energy projects offshore California to ensure the lowest cost and highest reliability as the sector scales. In addition, if this analysis can be integrated with the analysis done in the Offshore Wind Strategic Plan, then co-location of technologies (and therefore lower average balance-of-plant costs) may be more likely to occur.

6. **"There are several potential elements of the proposed structure for a coordinated REAT permitting approach applied to the ocean and coastal environment for offshore wind and related development, referred to as the Ocean REAT approach." (page 261)**

As mentioned under Recommendation 4 in Part I, the AB 525 Offshore Wind Strategic Plan recommends developing and implementing "coordinated permitting for offshore wind and related projects based on the previously successful Desert Renewable Energy Action Team." It then recommends an "Ocean REAT" structure could be used for permitting offshore wind projects. This structure would have two entities:

- Ocean Renewable Energy Policy Group (REPG): The Ocean REPG would be composed of executives and principals from state, federal, tribal, and local entities with a role in the planning, environmental review, and permitting aspects of offshore wind off the coast of California. They would meet to provide policy guidance and resolve potential issues, disputes, or conflicts that emerge.
- Ocean Renewable Energy Action Team (REAT): The Ocean REAT would be composed of staff from state, federal, tribal, and local entities with a role in the planning, environmental review, and permitting aspects of offshore wind infrastructure. This interagency working group would coordinate with lessees from pre-filing through permitting.

Given the likelihood of similar permitting processes between offshore wind and marine energy projects, we recommend that the Ocean REAT structure be expanded to include marine energy projects over 10 MW. Marine projects under 10 MW should follow a further expedited permitting process to ensure California can swiftly deploy early capacity and begin to build out relevant supply chains.

IV. EXISTING STATE-LEVEL INCENTIVE PROGRAMS

This document has thus far discussed a few general incentive structures, like deployment targets, feed-in tariffs, and contracts-for-difference. Included in this section are seven specific state incentive programs that CEC can use as models for incentivizing the scale-up of wave and tidal energy capacity in California.

1. Deployment targets and centralized procurement (California)

As discussed in Part III, the CEC "adopted ambitious offshore wind planning goals of 2 to 5 gigawatts (GW) by 2030 and 25 GW by 2045" in August 2022. These goals helped lead to the successful BOEM lease sale in December 2022 and the subsequent DOT investment in expanding the port infrastructure at Humboldt Bay. Under the provisions of AB 1373, the California Public Utilities Commission (CPUC) may request that the Department of Water Resources procure electricity from diverse long lead-time (LLT) resources on behalf of customers of all load-serving entities. CPUC determined a need for 10.6 GW of centralized state procurement to be brought online between 2031 and 2037. Because of these overall system benefits and savings to ratepayers, CPUC has requested that offshore wind satisfy 7.6 GW of the proposed 10.6 GW of nameplate capacity. As discussed in Part I, CPUC has released a study that says an extra 8,693 MW of offshore wind allows for 14,195 MW of other renewable energy generation capacity to be avoided (across solar, geothermal, and shed demand response) and 5,828 MW of storage capacity to be avoided.

Some foreign countries have set marine energy deployment targets worth considering, too:

- Portugal: 70 MW of wave energy capacity by 2030
- Spain: 40-60 MW of wave or tidal energy capacity by 2030

2. Feed-in tariff (California)

The Renewable Market Adjusting Tariff (ReMAT) allows eligible customer-generators to enter 10, 15, or 20-year standard contracts with their utilities to sell the electricity produced by small renewable energy systems (up to 3 MW). While the ReMAT includes 13 different eligible renewable energy sources (geothermal electric, solar thermal electric, solar photovoltaics, wind, biomass, municipal solid waste, landfill gas, tidal, wave, ocean thermal, small hydroelectric, anaerobic digestion, fuel cells using renewable fuels), the portion of the program with set prices (recalculated annually) only includes five different renewable energy sources:

- As-available non-peaking resources (wind and hydro): $55.13 per MWh
- Baseload resources (bioenergy and geothermal): $74.59 per MWh
- As-available peaking resources (solar): $67.69 per MWh

We contend that to build demand for renewable energy capacity that is more consistent and more predictable than solar and wind, marine energy (wave and tidal) should be included in this pricing scheme. We request that the CEC work with CPUC to determine the steps required for marine energy to be included.

While not technically a FiT, the U.K. has implemented a contracts for difference (CfD) scheme for tidal energy that shows the promise of market-pull mechanisms for marine energy, and over 50 MW of tidal capacity secured financing through this mechanism in 2023 alone. California should take the lead within the U.S. in implementing successful market-pull mechanisms.

3. **Renewable portfolio standard carve-outs (Maryland)**

On top of year-by-year carve-outs for renewable energy (including "ocean" energy) in general, the RPS in Maryland's Clean Energy Jobs Act of 2019 includes year-by-year carve-outs for solar energy specifically. It required at least 7.5 percent of Maryland's energy to come from solar by 2021, with this requirement increasing by one percentage point per year until it hits 14.5 percent by 2028, after which it remains flat. California has its own RPS, but the RPS does not include any carve-outs for specific technologies.

4. **Clean transition tariff (Nevada)**

While no state yet uses granular renewable energy certificates (granular RECs), or time-based energy attribute certificates (T-EACs), Google and NV Energy have "asked Nevada regulators for permission to enter into a power supply agreement based on a proposed 'Clean Transition Tariff' that would allow large energy users to pay a premium for 24/7 clean energy from new resources." These companies contend that since consistent clean energy is more valuable than intermittent clean energy, it should draw a higher price from buyers. While Nevada's focus is on geothermal energy, California's significant marine energy resource should receive consideration for such a program as well, as it is more consistent and predictable than solar and wind.

5. **Production tax credits (New Mexico)**

For projects that started operations before 2018, the Renewable Energy Production Tax Credit (REPTC) in New Mexico offers one cent per kWh for wind and biomass projects and 2.7 cents per kWh for solar projects. The program has now sunset (qualifying facilities still receive the tax credit), and it appears to have worked. Residential, commercial, and industrial electricity prices are 15 percent, 18 percent, and 26 percent lower than the national average, respectively, while the state generated 47 percent of its electricity from renewables in 2023.

6. **Investment tax credits (Massachusetts)**

An "Act driving clean energy and offshore wind" passed in Massachusetts in 2022 and created the Offshore Wind Tax Incentive Program. This program includes both a Wind Power Incentive

Jobs Credit and Wind Power Incentive Investment Credit. According to the Massachusetts Governor's Budget:

- "The Wind Power Incentive Jobs Credit is available to certified offshore wind companies that commit to the creation of a minimum of 50 net new permanent full-time employees in Massachusetts. Where the credit exceeds the taxpayer's liability for the taxable year 90 percent of such excess credit may be refunded to the taxpayer."
- "The Wind Power Incentive Investment Credit is available for certified offshore wind companies that make a capital investment in an offshore wind facility that they either own or lease in an amount up to 50 percent of such investment… Eligibility requirements vary depending on whether the certified offshore wind company owns or leases the offshore wind facility but in general the certified offshore wind company must demonstrate to the Center that (i) it has a total capital investment in an offshore wind facility that equals not less than $35,000,000; and (ii) the offshore wind facility must employ not less than 200 new full-time employees by the fifth year of the offshore wind company's certification."

A company cannot claim both of these tax credits in the same taxable year.

7. Innovation fund (Alaska)

While the Electric Program Investment Charge (EPIC) Program in California funds a variety of clean energy projects (including R&D projects), it has not funded marine energy technologies or projects. Alaska's Emerging Energy Technology Fund (EETF) started in 2010 and made grants for over a decade, focusing on "emerging technologies that had the potential to be commercialized in Alaska within five years." This fund led to the successful installation of ORPC's RivGen technology in the remote community of Igiugig on the Kvichak River, which has served as a key milestone as the company scales to additional larger tidal projects elsewhere in the state. By supporting technologies that are pre-commercial but have the potential to be commercialized in the coming years, CEC can ensure all communities in California can access clean energy that is both reliable and affordable.