California State Assembly
UTILITIES AND ENERGY

COTTIE PETRIE-NORRIS
CHAIR

State Capitol, P.O. Box 942849
(916) 319-2083
FAX: (916) 319-2183

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1:30 p.m. – Capitol Room 437

INFORMATIONAL HEARING

Winds of Change: Realizing our Clean Energy Goals with Offshore Wind Development

In 2016, the federal Bureau of Ocean Energy Management (BOEM) established the BOEM-California Intergovernmental Renewable Energy Task Force as a partnership of members from federal agencies and state, local, and tribal governments to provide critical information for planning future offshore renewable energy development opportunities in federal waters off California's coast. While the first meeting of the Task Force acknowledged wave, tidal, and wind development potential in California, subsequent effort prioritized offshore wind (OSW).[1]

In 2019, the California Energy Commission's (CEC) Energy Research and Development Division began to assess opportunities to support cost-effective OSW development. Their report, released in August 2020, focused on identifying opportunities to remove or reduce technological, manufacturing, logistics, and supply chain barriers to deployment, identify opportunities for early pilot demonstration projects, and lower the development risk of full-scale projects.[2]

The Legislature, in 2021, passed AB 525 (Chiu, Chapter 231, Statutes of 2021), which required the CEC to produce a variety of reports regarding the development of OSW, including a look into feasible megawatt (MW) planning goals for OSW. In August 2022, the CEC set a goal of 2,000–5,000 MW by 2030 and 25,000 MW by 2045.[3] More recently in July 2024, per the requirements of AB 525, the CEC adopted a comprehensive strategic plan to guide the development of OSW and reach the planning goal for 2045 planning goal.[4]

[1] BOEM; "California Activities"; https://www.boem.gov/renewable-energy/state-activities/california
[2] CEC; *Research and Development Opportunities for Offshore Wind Energy in California*; August 2020.
[3] CEC; "Offshore Wind Energy Development off the California Coast Maximum Feasible Capacity and Megawatt Planning Goals for 2030 and 2045"; August 2020.
[4] CEC; "AB 525 Reports: Offshore Renewable Energy"; https://www.energy.ca.gov/data-reports/reports/ab-525-reports-offshore-renewable-energy

In December 2022, BOEM held an OSW energy auction for five leases off the coast of California. The leases sold for $757.1 million and covered 373,268 acres located approximately 20 miles offshore of central (San Luis Obispo County) and northern (Humboldt County) California.[5] These lease areas have the potential to generate up to 4.6 GW of OSW capacity,[6] enough to power more than 1.5 million homes. The lease sale also built upon the multifactor auction format BOEM utilized in other areas of the country, with bidding credits to incentivize local community and tribal engagement, and investment in job training and infrastructure. The sale represents a significant step for California in meeting the OSW planning goals that the CEC adopted. It also advances the Biden administration's goal of deploying 15 GW of floating OSW capacity by 2035.[7] Additional federal initiatives to advance OSW technologies – including the U.S. Department of Energy's (DOE) Floating Offshore Wind Shot[8] – will bolster OSW development in California.

Propelled by this activity in energizing OSW development, the California Public Utilities Commission (CPUC) and the California Independent System Operator (CAISO) have incorporated OSW into their resource[9] and transmission[10] planning, respectively. In the most recent Preferred System Plan adopted by the CPUC in February 2024, 1.6 GW of OSW mapped to the North Coast/Humboldt area and 2.9 GW of OSW mapped to the Central Coast/Morro Bay area was selected.[11] The subsequent transmission plan adopted by CAISO in May 2024 approved over $4.5 billion in transmission projects necessary to interconnect to OSW resources, with the vast majority of those costs arising from the Humboldt area.[12] Finally, last month on July 19, 2024, the CPUC issued a proposed decision which identified the need for centralized procurement of long lead-time resources, pursuant to AB 1373 (Garcia, Chapter 367, Statutes of 2023). The proposal determined a maximum need of 7.6 GW of OSW to be procured by the California Department of Water Resources (DWR), with online dates in 2035 to 2037.[13]

Given the recent actions federal and state agencies have taken to realize OSW, the purpose of this hearing is to serve as an introduction to the resource and to provide a broad overview of the building blocks that will be essential to successful deployment in California. These include transmission, permitting, procurement, ports, and community engagement. The committee will assess the progress made and forthcoming challenges anticipated in developing and deploying OSW off the California coast. The focus of the hearing is to highlight the operations needed to meet the state's ambitious OSW targets and identified

[5] BOEM; "California Activities"; https://www.boem.gov/renewable-energy/state-activities/california
[6] Utility Dive; "Biden administration opens up California coast for 4.6 GW of offshore wind development"; May 2021; https://www.utilitydive.com/news/biden-administration-opens-up-california-coast-for-46-gw-floating-offshore-wind/600820/
[7] The White House; "Fact Sheet: Biden-Harris Administration Announces New Actions to Expand U.S. Offshore Wind Energy"; September 2022; https://www.whitehouse.gov/briefing-room/statements-releases/2022/09/15/fact-sheet-biden-harris-administration-announces-new-actions-to-expand-u-s-offshore-wind-energy/
[8] DOE; "Floating Offshore Wind Shot"; https://www.energy.gov/eere/wind/floating-offshore-wind-shot
[9] The 2022-23 IRP adopts an aggregated portfolio calling for 86 GW of new resources, including 4.5 GW of OSW by 2035. Table 4, D. 24-02-047, R. 20-05-003, CPUC; *Decision Adopting 2023 Preferred System Plan and Related Matters, and Addressing Two Petitions for Modification*; February 2024.
[10] The 2023-24 TPP projects the addition of over 4.7 GW of OSW with 3.1 GW in Morro Bay and 1.6 GW in Humboldt. Pg. 3, CAISO; *2023-24 Transmission Plan*; May 2024.
[11] Pg. 74 and Conclusions of Law #13 pg. 134, D. 24-02-047, R. 20-05-003 CPUC; *Decision Adopting 2023 Preferred System Plan and Related Matters, and Addressing Two Petitions for Modification*; February 2024.
[12] Pg. 6, CAISO; *2023-24 Transmission Plan*; May 2024.
[13] R. 20-05-003, CPUC; *Decision Determining Need for Centralized Procurement of Long Lead-Time Resources*; July 2024.

procurement and transmission needs. As will be discussed, reaching our OSW goals will require a substantial effort from all members of state, local, tribal, and federal governments.

***Findings*:**

- *OSW can help diversify California's renewable and zero-carbon energy portfolio to complement the state's high solar capacity and to match well with the daily and seasonal fluctuations of electricity demand.*

- *As an emerging technology, OSW will be costly to deploy. Central procurement is a tool to employ economies of scale to bring down future costs, with OSW a primary resource under consideration. However, electric ratepayers in California already face rising bills. Financial guardrails against cost overruns should be prioritized to protect ratepayers.*

- *The timely deployment of OSW will require efficient timelines for the permitting and construction of OSW infrastructure, transmission, and port facilities, but is complicated by the large and complex web of federal, state, and local agencies that all have a stake in the process. Efforts to accelerate permitting should likewise balance the thorough review of environmental impacts from OSW and provide opportunities for public engagement.*

Offshore Wind's Role in Managing a Solar-Rich Grid. California is a leader in policies that support clean energy development and reduce carbon emissions. Chief among the suite of policies that frames California's speed and approach to decarbonize the energy sector is SB 100 (De León, Chapter 312, Statutes of 2018) which established the state policy that renewable and zero-carbon resources supply 100% of retail sales and electricity procured to serve all state agencies by 2045.[14] Within this goal, SB 100 also set an interim goal of achieving 60% renewable electricity by 2030. "Renewable" electricity in California is defined through the Renewables Portfolio Standard program, which was established in 2002 by SB 1078 (Sher, Chapter 516, Statutes of 2002).[15] Qualifying renewable energy resources include biomass, geothermal, solar, and wind, among others.[16] The state's clean energy targets parallel its goals to achieve net zero greenhouse gas (GHG) emissions and a reduction of statewide anthropogenic GHGs to at least 40% and 85% below 1990 levels by 2030 and 2045, respectively.[17]

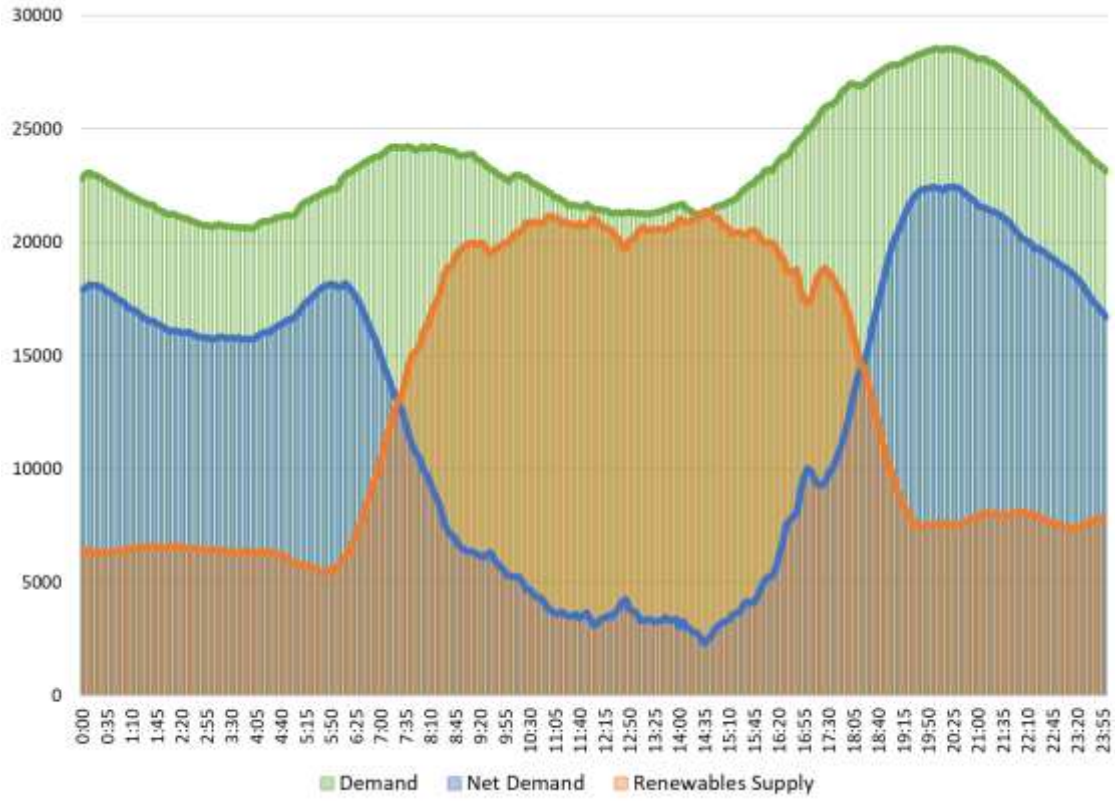
California has continually made progress in decarbonizing its energy sector, with recent data showing that zero-carbon and renewable resources supplied roughly 61% of the state's electricity in 2022.[18] Solar energy makes up the majority of California's renewable energy

[14] Public Utilities Code § 454.53
[15] Public Utilities Code §§ 399.11-399.22
[16] More comprehensively, RPS-eligible resources include biomass, biodiesel, biomethane, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation of 30 MW or less, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current. CEC; *RPS Eligibility Guidebook, Ninth Edition Revised*; April 2017
[17] Health and Safety Code §§ 38566 and 38562.2
[18] 61% = 39.4% from renewables (solar, wind, geothermal, biomass, small hydro) + 10.8% from large hydro + 10.7% from nuclear. CEC; "Clean Energy Serving California"; https://www.energy.ca.gov/programs-and-topics/topics/renewable-energy/clean-energy-serving-california

resources, supplying nearly 20%,[19] driven largely by the cheaper prices of solar photovoltaics in recent years and California's abundant solar capacity. However, the current timing imbalance between solar generation and electricity demand presents challenges to grid operations as the percentage of solar on the California electric system grows.

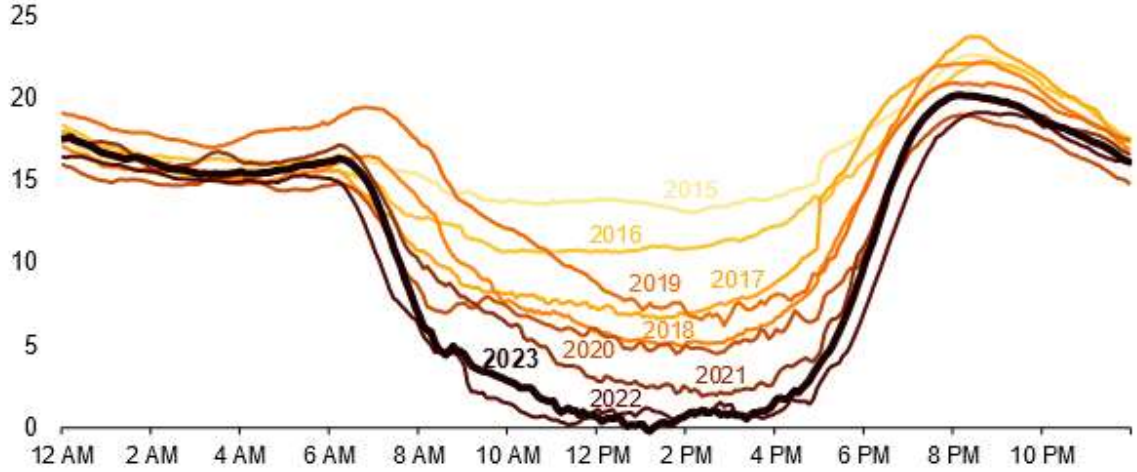
As shown in Figure 1, solar energy production peaks around midday when California electricity demand is on the lower end, which can lead system operators to curtail solar generation. As the sun sets, starting around 6 pm, solar production comes offline (decreasing orange line). However, this solar supply drop is often matched with increased demand (second green hump). Grid operators must then quickly call upon production from other generation sources within those few hours of supply and demand transition. This pattern of supply and demand behavior due to increased solar generation on our system is colloquially referred to as the "duck curve," due to the shape of the net demand curve (blue) resembling a duck's body. As shown in Figure 2, as solar adoption has increased over the years, the duck curve has deepened.

Figure 1. MW vs. hours curves for Demand (green) and Renewables supply (orange) in the CAISO Balancing Authority on a typical spring day (May 15, 2024). Net demand for nonrenewable sources (blue) illustrates the evening ramp from approximately 5-8 pm.[20]



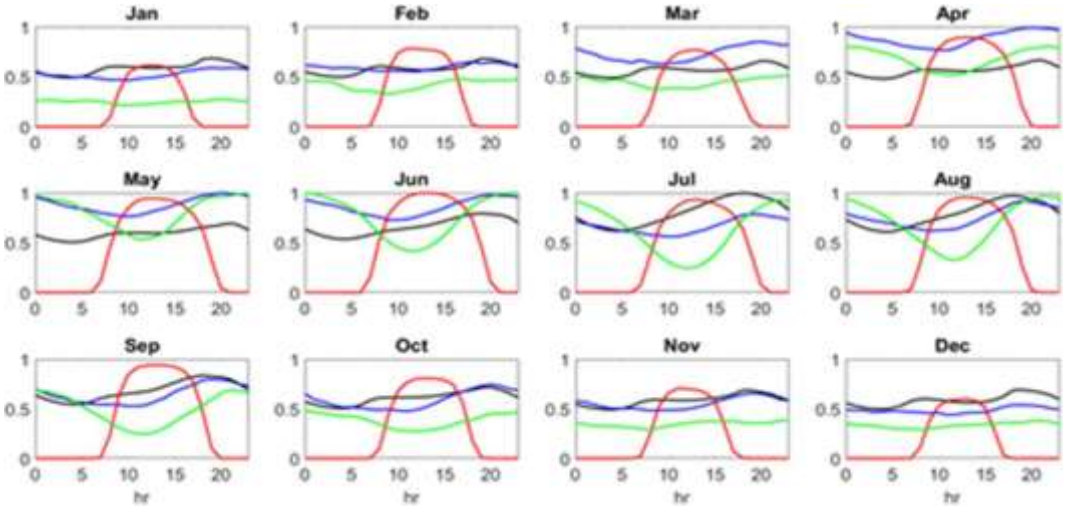
[19] Ibid.
[20] Data taken from CAISO. https://www.caiso.com/todays-outlook/supply

Figure 2. Annual Net Demand Curves (demand minus renewables supply) in GW vs. hours from 2015-2023 for an average spring day (March-May) in CAISO's balancing area, illustrating California's duck curve is getting deeper over time.[21]



To continue on California's path towards 100% clean energy and reduced GHGs, the CEC, CPUC, and California Air Resources Board (CARB) examined, in their 2021 SB 100 Joint Agency Report, various energy resource portfolios and strategies to manage the growing supply of solar power. Notably, the SB 100 Report determined that capacity additions across a more diverse portfolio of renewable resources will be critical, particularly those that can better match the daily pattern of energy demand, including OSW and energy storage.[22] Already, virtually all new utility-scale solar is being developed with battery storage. OSW – which can also be paired with battery storage – is expected to align well with hourly electricity demand, which could help to flatten the duck curve. As shown in the blue curves in Figure 3, for many months of the year, OSW production is expected to peak during the critical evening solar ramp from 5-8 pm, making it a desirable match to California's current grid conditions, particularly in the summer months when demand is higher.

Figure 3. Daily composite averages of hourly California electricity demand (black), solar production (red), onshore wind production (green), and offshore wind production (blue).[23]



[21] US Energy Information Administration; "As solar capacity grows, duck curves are getting deeper in California"; June 2023; https://www.eia.gov/todayinenergy/detail.php?id=56880
[22] Pg. 75, CEC, CPUC, CARB; *2021 SB 100 Joint Agency Report*; March 2021.
[23] Fig. 3, California Polytechnic State University, San Luis Obispo; "Spatial and temporal variation of offshore wind power and its value along the Central California Coast"; *Environ. Res. Commun.*; October 2019.

Currently, the evening ramp is largely met by natural gas generation and energy imported from outside the state. Diversifying our renewables supply, through the continued buildout of onshore wind (as shown in green in Figure 3), geothermal power plants, battery storage, and others – along with OSW – will help to complement solar and meet our clean energy goals. Indeed, as installation of battery storage has surged over the last few years to provide more than 10 GW of capacity, storage is helping to handle the solar ramp and displace natural gas.[24]

In contrast to other renewable generation sources, OSW might also serve as an important component to a diverse renewables portfolio as the state exhausts land allocable to land-based renewable energy projects – including for solar, battery storage, onshore wind, and geothermal power plants. A 2023 study conducted by researchers at the University of Wisconsin-Madison found that the low-hanging fruit of feasible land for onshore wind development has already been picked, and future developments will face greater contracting hurdles as suitable areas are more constrained in size – in many cases, wind developers would have to contract with over 40 landowners to lease an area large enough for a profitable wind farm.[25]

Offshore Wind Sites in California. Worldwide, OSW is developing into a dynamic and growing industry sector in renewable energy. By the end of 2023, the total global OSW capacity totaled to 75.2 GW.[26] OSW projects have primarily been developed in Asia and Europe. While the U.S. lags behind with a total online capacity of only 42 MW today,[27] efforts are underway to catch up with the rest of the world, spurred by the federal administration's goal to reach 30 GW of OSW energy capacity by 2030.[28] There is currently 56 GW of capacity under development – primarily on the East Coast – with approximately 14 GW of that expected to be online by 2035.[29]

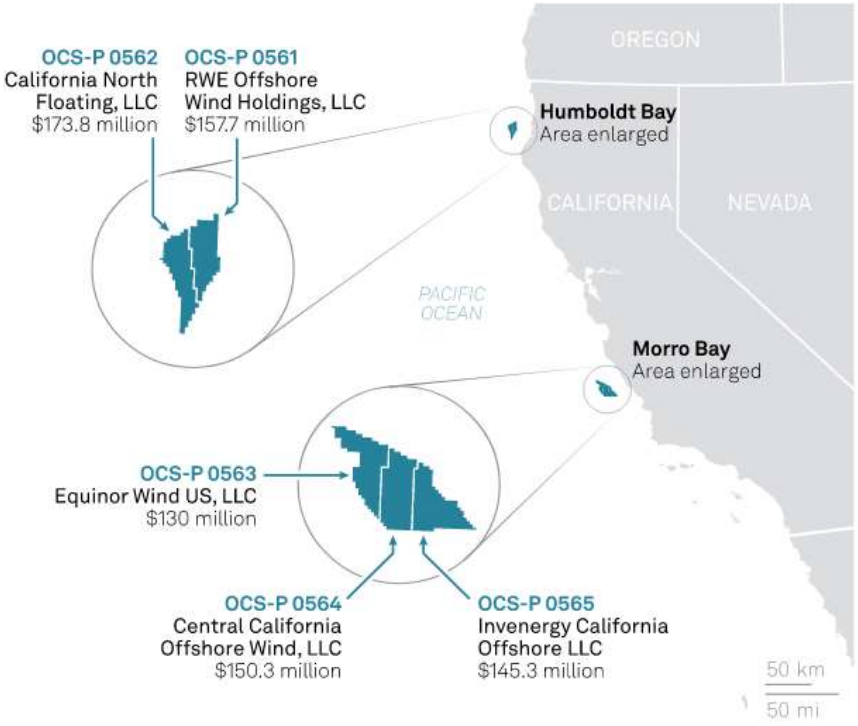
Off the coast of California where winds can exceed 7 meters per second, the National Renewable Energy Laboratory (NREL) has identified 200 GW of offshore wind technical potential.[30,31] This potential, however, is complicated by the fact that approximately 96% of it is located in water deeper than 60 meters, where the mature, fixed-bottom turbine technology that is used in most OSW projects globally and domestically is not technically feasible.[32] Instead, these OSW projects will need to rely on floating technology, wherein the towers are

[24] Webster, J.; "California's battery boom is a case study for the energy transition"; May 2024; https://www.atlanticcouncil.org/blogs/new-atlanticist/californias-battery-boom-is-a-case-study-for-the-energy-transition/
[25] University of Wisconsin-Madison; "Farm size, spatial externalities, and wind energy development"; *American Journal of Agricultural Economics*; November 2023; https://onlinelibrary.wiley.com/doi/full/10.1111/ajae.12438
[26] Global Wind Energy Council; *Global Offshore Wind Report 2024*; June 2024.
[27] Tham, N.; "The latest headwinds and tailwinds for U.S. offshore wind"; March 2024; https://bipartisanpolicy.org/blog/the-latest-headwinds-and-tailwinds-for-u-s-offshore-wind/
[28] The White House; "Fact Sheet: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs"; March 2021; https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/
[29] American Clean Power; "New report: Offshore wind momentum grows with sector to invest $65 billion and create 56,000 U.S. jobs by 2030"; July 2024; https://cleanpower.org/news/offshore-wind-to-invest-65-billion-and-create-56000jobs-by-2030/
[30] "Technical potential" is defined as the amount of offshore wind capacity that could be developed while taking into account exclusion factors related to water depth, mean wind speed, industry uses, and environmental conflicts (Musial et al. 2016a). It does not include areas where the wind speeds are lower than 7 meters per second or deeper than 1,300 meters.
[31] NREL; *2020 Offshore Wind Resource Assessment for the California Pacific Outer Continental Shelf*; October 2020.
[32] Pg. 7, CEC; *Research and Development Opportunities for Offshore Wind Energy in California;* August 2020.

anchored to the seafloor via long mooring cables and connected to the grid through floating substations and subsea electric cables. While floating OSW technology is still emerging, the CEC, as directed by the Legislature through AB 525, has found that it is *technically* feasible for California to get 2-5 GW of OSW online by 2030, and eventually 25 GW by 2045.[33]

In December 2022, BOEM held an auction for five leases near California's shores. This was the first federal OSW lease in the Pacific. The lease areas, as shown in Figure 4, are located approximately 20 miles off the coast, with 3 lease areas – leased (from west to east) by Equinor Wind, Golden State Wind, and Invenergy – located near Morro Bay in the Central Coast and 2 areas – leased (from west to east) by Vineyard Offshore and RWE – located off Humboldt County in Northern California. All five of the projects will be floating OSW farms, which will be the first of their kind considering their scale. Together, they have a nameplate capacity of 4.6 GW[34] – though this number is expected to be higher.[35] In contrast, the 14 operational floating wind projects – which span seven countries including Norway, the U.K., Portugal, and China – total just 227 MW.

Figure 4. California OSW lease areas.



How Will OSW Be Funded and Deployed? Installing OSW turbines, upgrading ports to serve the industry, and upgrading old or building out new, requisite transmission infrastructure to enable power delivery from the lease areas, will be expensive. In an effort to put wind in the sails, the state has injected a suite of funding into supporting OSW, including $10.5 million in the 2021-22 state budget to renovate the Port of Humboldt Bay; $25 million in the 2024-25 proposed state budget for the Ocean Protection Council, the California Coastal

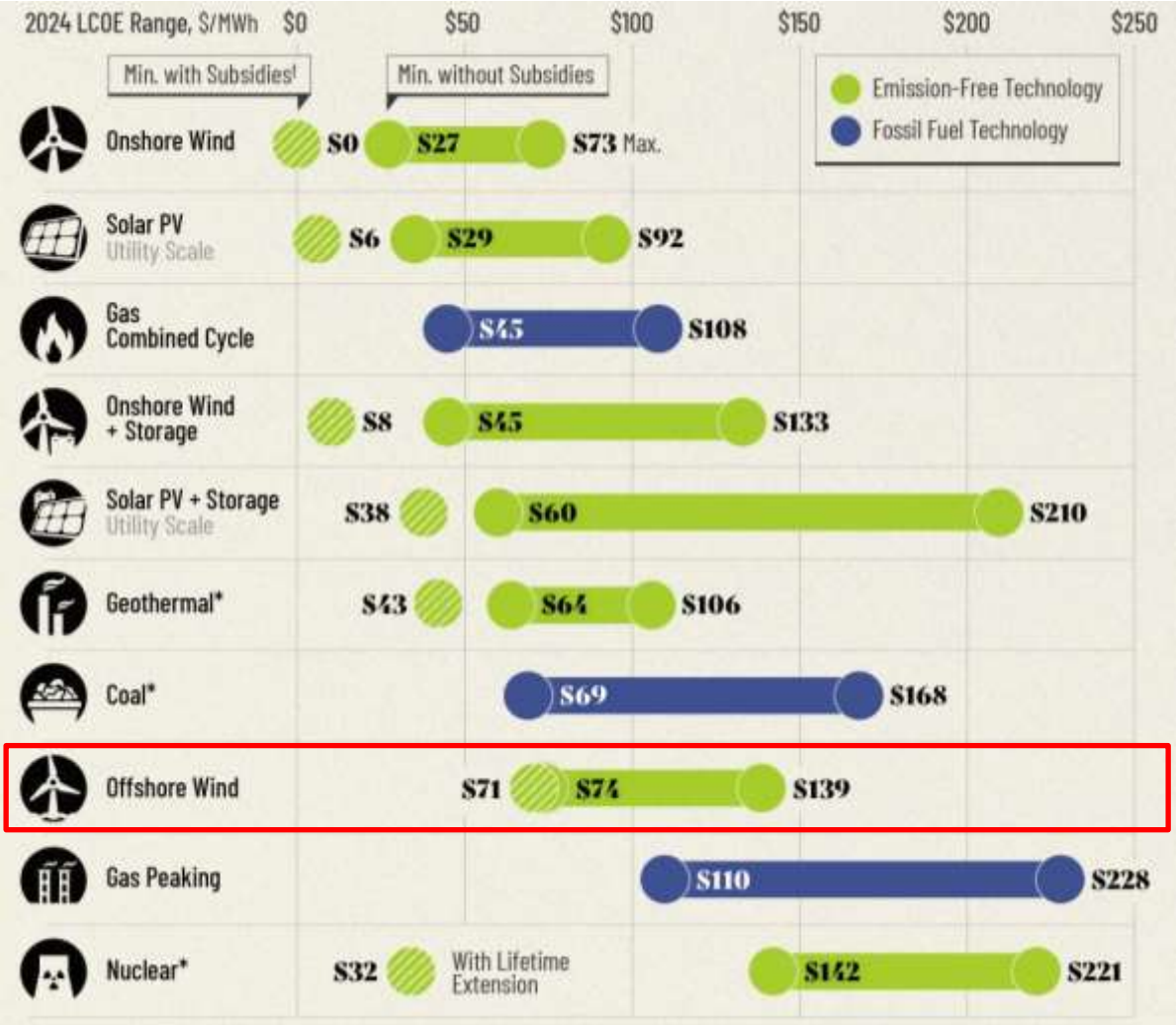
[33] CEC; *Offshore Wind Energy Development off the California Coast*; August 2022.
[34] CA State Lands Commission; "Offshore Wind Energy Development"; https://www.slc.ca.gov/renewable-energy/offshore-wind-energy-development/
[35] The original 4.6 GW prediction assumed a power density factor of 3 MW/km^2. Per data request by the committee to American Clean Power on Aug. 6th, 2024, BOEM and NREL are now assuming 5 MW/km^2 for these lease areas, while leaseholders are assuming 7 MW/km^2. The nameplate capacity would exceed 10 GW with leaseholder expectations.

Commission (CCC), the California State Lands Commission (CSLC), and the CEC to advance environmental research, planning, permitting, and continued port upgrades;[36] and $475 million in the 2024 Prop 4 climate bond to fund port infrastructure. Using some of the $10.5 million received from the state to attract federal dollars, Humboldt Bay Harbor District received $427 million in January 2024 from the federal Infrastructure for Rebuilding America grant program to build a new marine terminal at the Port of Humboldt Bay for turbine assembly and integration. This grant anticipates that the District will provide matching money from other sources, which could be fulfilled through additional funding from the state, private equity, partner developers, or other qualifying sources.[37] Beyond these injections, the funding source primarily responsible for covering the cost of developing OSW will be electric ratepayers, via the contract cost of electricity utilities agree to pay in order to receive the energy, capacity, and renewable credits for the OSW resource.

Ratepayers. The principle concern that might undercut OSW's success is not its technical feasibility – as small-scale demonstrations abroad have already fundamentally proven[38] – but rather the cost to ratepayers. Californians currently pay some of the highest utility rates in the country. Propelled in large part by Pacific Gas & Electric (PG&E), which hiked residential electricity rates by 20% in January 2024, the state's high electricity prices are second only to Hawaii's.[39] With individuals being hit hard by the increasing prices of essential goods including food and fuel, ratepayers have escalated alarm with each increasing utility bill. While the levelized cost of electricity (LCOE)[40] from OSW differs between analysts, all agree on two things: (1) that the levelized cost in 2023 has increased significantly from years before; and (2) that OSW costs significantly more than other renewable resources, as shown in Figure 5, including utility-scale solar, geothermal, and onshore wind.[41,42,43] While all clean energy technologies, including solar and onshore wind, have suffered from heavy delays in the supply chain and rising material costs, labor costs, and interest rates, OSW has felt the pain acutely. This is in part due to the lack of scale in the supply chain for OSW components such as turbines, subsea cables, and floating substations, and in part due to the near decade-long timeframes it takes to develop OSW projects.

[36] $45 million General Fund money was originally allocated in the 2022-23 budget for OSW Infrastructure, but this was cut down to $25 million and recast in the 2024-25 revised budget proposal.
[37] Pg. 1, Humboldt Bay Harbor District; *Solicitation of Interest: Humboldt Bay Offshore Wind Heavy Lift Marine Terminal*; August 2024.
[38] Though certainly more advancements will be needed to adapt technology to the far distances (more than 20 miles) from shore and the far depths (more than 700 meters) of water where the lease areas are located. See Chapter 8 of CEC's *Adopted Final Report AB 525 Strategic Plan Volume II* (July 2024) and Appendix A of CEC's *Adopted Final Report AB 525 Strategic Plan Volume III* (July 2024) for more information.
[39] San Francisco Chronicle; "California electricity prices now second-highest in United States"; May 2024; https://www.sfchronicle.com/california/article/electricity-price-rate-pge-19429422.php
[40] "Levelized cost of energy" refers to the estimates of the revenue required to build, operate, and maintain a power project over a specified cost recovery period, which provides a sense of the averaged-out cost of delivering electricity from a project.
[41] BloombergNEF; "Soaring costs stress US offshore wind companies, ruin margins"; August 2023; https://about.bnef.com/blog/soaring-costs-stress-us-offshore-wind-companies-ruin-margins/
[42] US Energy Information Administration (EIA); "Levelized costs of new generation resources in the Annual Energy Outlook 2023"; April 2023; https://www.eia.gov/outlooks/aeo/electricity_generation/pdf/AEO2023_LCOE_report.pdf
[43] Lazard; "LCOE"; April 2023; https://www.lazard.com/media/2ozoovyg/lazards-lcoeplus-april-2023.pdf

Figure 5. Estimated costs of electricity today, including from renewable sources (green) and fossil fuels (blue), with offshore wind highlighted in red.[44]



Consequently, developers on the East Coast are attempting to renegotiate their previously-agreed offtake deals, or even pulling out of these deals entirely. These deals, known as power purchase agreements (PPAs), are long-term contracts (typically 10-25 years) between an electricity generator and a utility which can help project developers to secure financing and/or reduce upfront capital investments, and help utilities to secure a fixed price and protect customers from rate fluctuations over time.

In Massachusetts, two developers, Avangrid and the team of Shell-Ocean Winds, initially appealed to reopen their 20-year PPAs and renegotiate higher prices for their 1.2 GW of capacity. Regulators rebuffed such efforts; so the companies terminated their PPAs, agreeing to pay fines totaling $108 million rather than keeping their contracts.[45] Both developers are expected to rebid their projects in the near future, presumably at higher prices. Similarly, state regulators in New York have rejected appeals by OSW developers for price adjustments to their original PPAs which total to 4.2 GW of capacity. Their requested adjustments would

[44] Graphic taken from National Public Utilities Commission; https://www.motive-power.com/ranked-americas-cheapest-sources-of-electricity-in-2024/. Data adapted from Lazard; "LCOE"; April 2023; https://www.lazard.com/media/2ozoovyg/lazards-lcoeplus-april-2023.pdf.

[45] CommonWealth Beacon; "New York rejects bid to renegotiate offshore wind contracts: Follows lead of Mass., starting the procurement process over"; October 2023; https://commonwealthbeacon.org/environment/new-york-rejects-bid-to-renegotiate-offshore-wind-contracts/

have brought the price of electricity from between $107.50 and $118 per megawatt-hour (MWh) to between $140 and $190 per MWh.[46] As a point of comparison, the average price of renewable contracts in California executed in 2023 greater than 3 MW was 5.8¢ per kWh, or $0.58 per MWh.[47] It is yet to be seen if these developers will next look towards canceling the existing PPAs and rebidding, but analysts predict it could be likely since the $49 million fine to Avangrid for terminating their contract in Massachusetts only amounts to less than 1% of the total project capital cost,[48] an example where the fine may not have been sufficient to deter behavior that risks ratepayers.

Central Procurement: If We Build It, PPAs Will Come? Despite ambitious state policies in Rhode Island mandating 100% clean energy by 2033, the state's main utility seemingly took lessons from the contract renegotiations in Massachusetts and New York, and rejected a bid by an OSW developer to provide power, citing rising costs that have made the deal too expensive for ratepayers and out of line with the state's 2014 Affordable Clean Energy Security Act.[49] California is taking notice too. On July 19, 2024, the CPUC, using its new central procurement mechanism as enacted by AB 1373, issued a proposed request for DWR to procure resources with long-lead times that were adopted in the most recent Integrated Resource Plan, including up to 7.6 GW of OSW, for deliveries starting June 1, 2035.[50] Per the decision, DWR would begin to conduct solicitations in 2027 and evaluate the quality of bids received, including costs and ratepayer risk provisions to facilitate cost containment. The CPUC argues that central procurement will be necessary to spur market transformation and develop economies of scale necessary to make OSW widely available and commercially competitive. Arguably, the state has taken similar, even heavier, strides with other clean energy technologies, including residential solar, through the California Solar Initiative which provided a $3.3 billion ratepayer-funded rebate program to incentivize installation,[51] and battery storage, via the Self-Generation Incentive Program which will provide a $664 million ratepayer-funded rebate program through 2024.[52]

The CPUC's central procurement framework acknowledges the delicate question the state faces: at what cost to ratepayers, who already face untenably high utility bills, is meeting our clean energy targets? Key to the CPUC's proposed decision, the selected OSW GW amount represents a maximum, but does not require DWR to procure any should it find the bids unreasonable. While several load-serving entities remarked, in the public comment period during the rulemaking, on providing off-ramps should projects become too expensive, the CPUC leaves this up to DWR to decide. However, the CPUC recommends DWR solicit open-book bids, where developers would be paid based on actual costs, rather than estimated costs, with an agreed-upon profit margin.[53]

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[46] Empire Center; "New wind energy costs blow the doors off projections"; September 2023; https://www.empirecenter.org/publications/new-wind-energy-blows-doors-off-projections/
[47] Pg. 22, CPUC; *2024 Padilla Report*; May 2024; https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/office-of-governmental-affairs-division/reports/2024/2024-padilla-reportvfinal.pdf
[48] BloombergNEF; "Soaring costs stress US offshore wind companies, ruin margins"; August 2023; https://about.bnef.com/blog/soaring-costs-stress-us-offshore-wind-companies-ruin-margins/
[49] DeAngelis, G.; "Rhode Island Energy rejects sole bid for offshore wind project"; July 2023; https://www.abc6.com/rhode-island-energy-rejects-sole-bid-for-offshore-wind-project/
[50] R.20-05-003, CPUC; *Decision Determining Need for Centralized Procurement of Long Lead-Time Resources*; July 2024.
[51] SB 1 (Murray, Chapter 132, Statutes of 2006)
[52] D.20-01-021, CPUC
[53] Pg. 57, R.20-05-003, CPUC; *Decision Determining Need for Centralized Procurement of Long Lead-Time Resources*; July 2024.

Transmission. PPAs with OSW developers only encompass the construction of OSW farms and the generation of electricity. Add onto those costs necessary upgrades and expansions for California's transmission system to connect OSW resources onto the grid – in California, the costs for transmission service include costs for construction, maintenance, operation, and the authorized return on investment – and the costs to ratepayers swell higher.

Humboldt Region Electricity Infrastructure. The Humboldt region's transmission system consists of 60-kilovolt (kV) and 115-kV transmission facilities as well as multiple generation sources that include natural gas, biomass, solar, and hydroelectric power plants. Together, this electrical system serves the regional load, typically ranging around 90 to 110 MW today.[54] Supplemental power is delivered from outside the region via the bulk PG&E transmission system. Transmission infrastructure into and out of the area is limited to four, 80 to 100 miles-long transmission circuits. The Humboldt region's transmission system is constrained, and has been plagued by reliability issues.[55] Additionally, the lines serving the area are not sized to accommodate a large import or export of power. Development of large-scale OSW that will generate many orders of magnitude more electricity than the transmission system currently handles will require upgrades and expansions to the interconnecting transmission lines to export power – as well as help to feed power to and increase reliability for the local region – to the state's major transmission system.

In their 2023-24 Transmission Planning Process (TPP), CAISO estimated that the transmission projects needed to interconnect and deliver OSW resources in the Humboldt call area would amount to more than $4.5 billion.[56] These projects are aimed to bring online 1.6 GW of capacity for OSW. Should OSW take off, more upgrades and expansion to the transmission system will be needed to accommodate greater capacity available from the 2 existing lease areas and more North Coast lease areas that might be scheduled for auction by early 2028.[57,58] CAISO indicates that they are anticipating an eventual 14.6 GW total of OSW from the area, which could cost between $25-36 billion in transmission costs.[59] As such, OSW supporters have emphasized the need to build the first transmission projects in expandable regions, so that developments do not become stranded. Like with the construction of OSW turbines, these transmission projects are expected to have long lead times of up to 8 to 10 years as a result of permitting timelines. Together with supply chain constraints, delays could drive final costs for these projects to be higher than anticipated.

Morro Bay Region Electricity Infrastructure. Unlike in the Humboldt call area, existing transmission on the Central Coast is much more robust and interconnects with the electricity system near large load centers, and therefore will require far fewer upgrades to accommodate OSW. CAISO has determined that there is approximately 2.3 GW of available capacity along

[54] Pg. 1, Schatz Energy Research Center, Cal Poly Humboldt; "Transmission Alternatives for California North Coast Offshore Wind Volume 1: Executive Summary"; March 2022.
[55] Pgs. 156-158, PG&E; *2022 Annual Electric Reliability Report*; July 2023.
[56] Table ES-2, CAISO; *2023-2024 Transmission Plan*; June 2024.
[57] BOEM; "Lease and Grant Information"; April 2024; https://www.boem.gov/renewable-energy/lease-and-grant-information
[58] BOEM has not released where the 2028 lease areas will be located, but NREL has identified Del Norte and Cape Mendocino as areas of interest. NREL; *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032*; November 2020.
[59] Pg. 70, CAISO; *2024 20-Year Transmission Outlook Update*; July 2024.

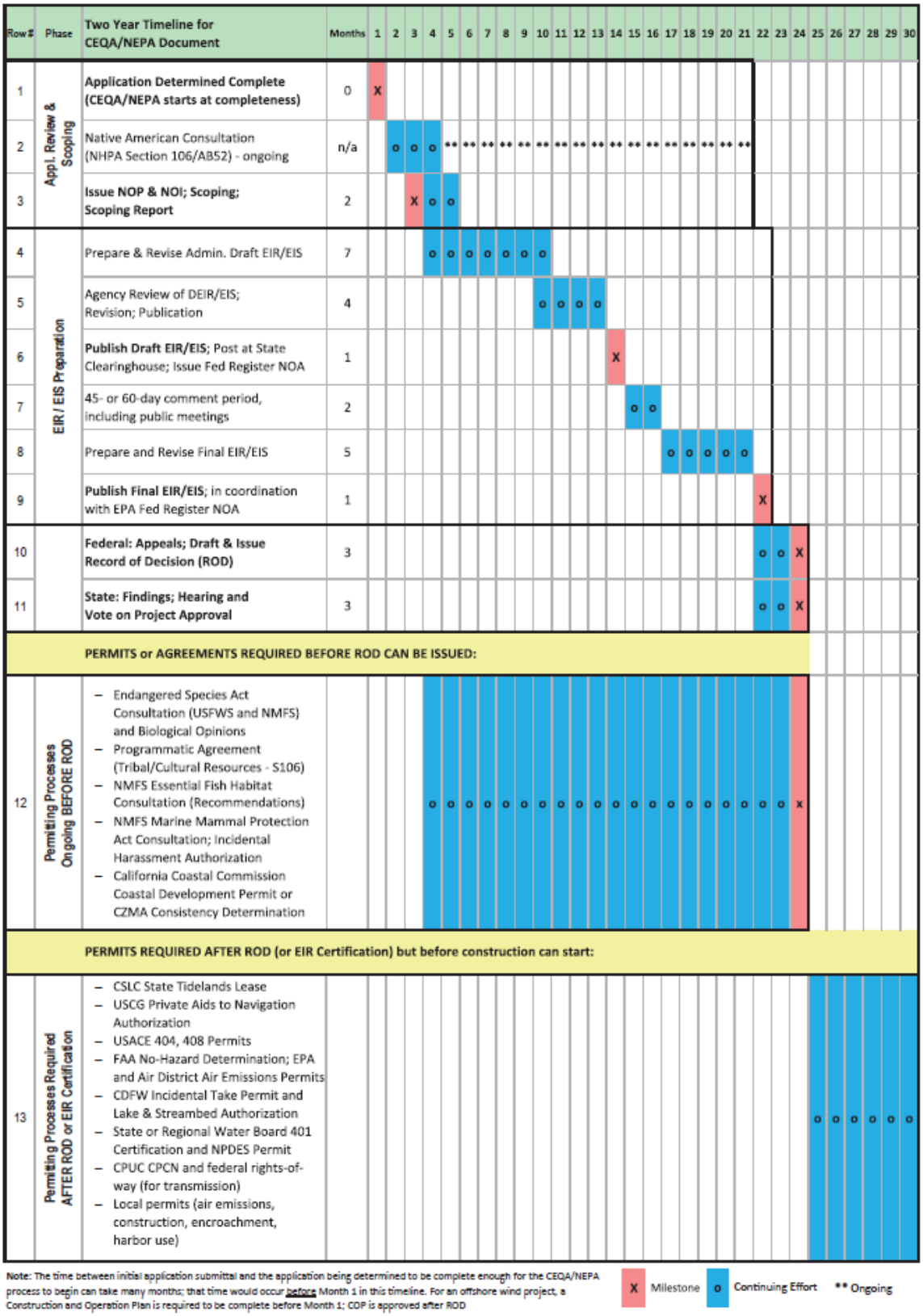
the existing Diablo Canyon 500-kV line due to the retirement of gas-fired power plants in the area.[60] The retirement of the Diablo Canyon power plant, which is currently set to be in 2030, would free up an additional 3 GW of capacity.[61] While their most recent TPP did not call for any OSW-related projects to update transmission in the area, CAISO anticipates the needed projects for eventually bringing 5.4 GW of OSW energy online to total between $150-360 million.[62]

Permitting. As part of the overall transmission plan to integrate OSW resources in the North Coast to the rest of the grid, CAISO is currently in the competitive solicitation process for two large projects identified in the 2023-24 TPP. Generally, in the competitive solicitation process, transmission developers – which may be publicly owned utilities, investor-owned utilities, or private, for-profit entities – apply for the project solicitation and those applications are evaluated on a number of qualifying criteria, including cost. Once a transmission developer's project proposal is selected in the competitive solicitation, it undergoes two application processes at the CPUC: a California Environmental Quality Act (CEQA) review and a Certificate of Public Convenience and Necessity (CPCN) review.[63] The CEQA review considers impacts on air, water, and noise quality, as well as impacts on biological, agricultural, and cultural resources. The CPCN review considers the need for the project based on economic, reliability, and/or renewable goals. Projects may also require permits from other state and local agencies, depending on where the project is being built. For example, a project could also require a permit from the California Department of Transportation to cross state highway rights-of-way. As alluded to above, years-long permitting processes across multiple agencies, community opposition, and high costs mean it can take a decade to build new transmission infrastructure. Although the long lead time to construct OSW resources provides some runway for the buildout of transmission infrastructure, delays in permitting and constructing transmission could significantly hurt the timely and cost-effective deployment of OSW.

The permitting of OSW infrastructure is an even more complex landscape, involving numerous state, federal, and local agencies, with differing data and information requirements, timelines, and processes. In short, amongst the several federal agencies that are involved in OSW development and permitting, BOEM has primary authority over the National Environmental Policy Act (NEPA) review process; the CSLC and the CCC will be the state's primary leads for CEQA and coastal zone permitting, but they will need to work in consultation with a bevy of other state agencies; and depending on the location, local air, water, land management, and seaport agencies could be involved in permitting some portion of an OSW development project. The successful development of a commercial-scale OSW industry depends on minimizing impacts on marine biodiversity and habitat, currents and upwelling, fishing, cultural resources, navigation, aesthetics and visual appeal, and military and other coastal users. Figure 6 illustrates the long list of permits and reviews that an OSW project is expected to undergo, although the specific timeline illustrated is an idealized coordinated agency approach rather than a reflection of today's timelines fragmented across the multiple agencies involved.

[60] Pg. 16, CAISO; *2023-2024 Transmission Plan*; June 2024.
[61] Ibid.
[62] Pg. 55, CAISO; *20-Year Transmission Outlook*; July 2024.
[63] Public Utilities Code § 1001

Figure 6. Illustrative timeline for 30-month coordinated NEPA, CEQA and permit reviews.[64]



Faced with mounting pressures to get clean energy resources online and expand the state's energy capacity, the Legislature has passed in recent years, and continues to contemplate, policies to reform permitting in the state – including possible approaches for coordinating

[64] Table 10-2, CEC; *Commission Adopted Final Report AB 525 Strategic Plan Volume II*; July 2024.

across agencies – and facilitate quicker development of projects that support California's energy and climate change goals, including OSW. These include AB 205 (Committee on Budget, Chapter 61, Statutes of 2022), SB 149 (Caballero, Chapter 60, Statutes of 2023), and SB 286 (McGuire, Chapter 386, Statutes of 2023) which, among other bills and provisions (see *Appendix A* for a more comprehensive list of OSW-related legislation), make the following changes:

- *Opt-in certification process*: Authorizes the CEC to establish a new consolidated permitting process (to replace all local and state permits, except for leases issued by the CSLC and permits issued by the CCC, San Francisco Bay Conservation and Development Commission, the State Water Resources Control Board, or regional water control boards, and local air boards or the Department of Toxic Substances Control for manufacturing facilities) for eligible renewable energy generation, nonfossil-fueled power plants, battery storage facilities, manufacturing and assembly, associated transmission lines, and related facilities to optionally seek certification from the CEC. Pursuant to statute,[65] only terrestrial wind – not OSW – is eligible to exercise this option.
- *Judicial streamlining*: Allows specified energy, transportation, water, and semiconductor projects – including OSW – to be eligible for expedited judicial review under CEQA.
- *Consolidated permitting*: Authorizes the CCC to process a consolidated coastal development permit for any new development that is associated with, appurtenant to, or necessary for the construction and operation of OSW projects, including necessary transmission facilities located in the coastal zone. Requires the CCC to forward an applicant's coastal development permit application to the local government agency for review and comment before giving final approval.

While these efforts by the Legislature go some way toward reducing duplication, inconsistency, and delay in obtaining approvals for OSW energy projects, developers should remain mindful of still engaging with and working alongside local communities, labor groups, and California Native American tribes to protect livelihoods, wildlife, and resources. At present, the five lessees are at variable stages of conducting outreach with local communities; applying for federal and state permits to commence site, seabed, and shore surveys – some have even acquired permits and begun surveying; and establishing agreements to access transmission lines and connect to the electrical grid (for projects in the Morro Bay area).

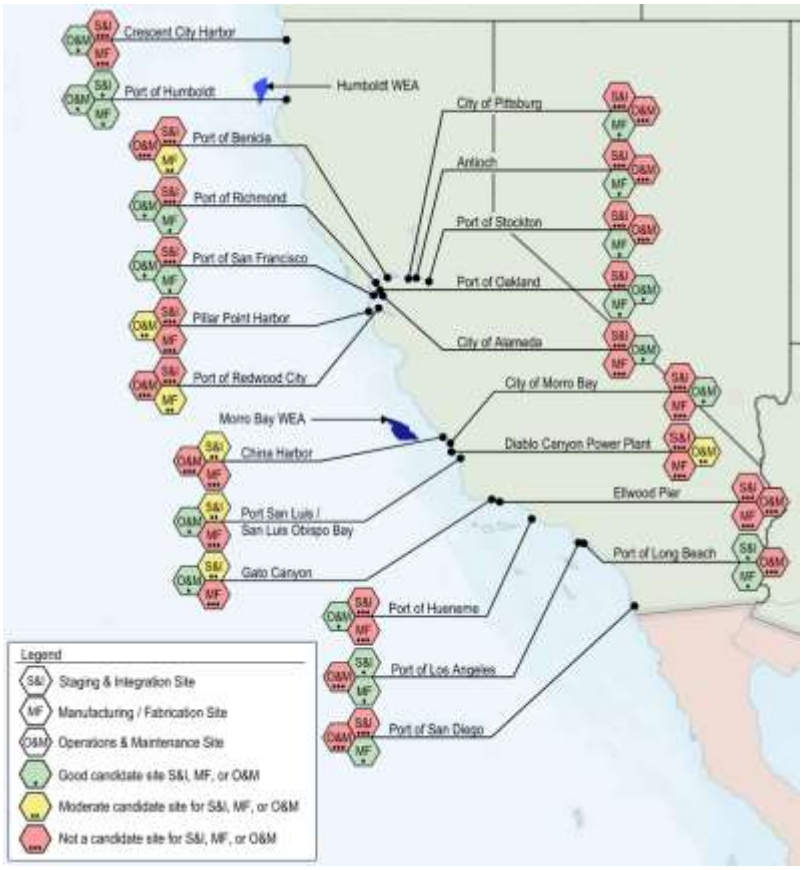
OSW will also require upgrades to ports and waterfront facilities, which will require their own permitting processes. In these cases, the lead agencies for permitting are relatively more straightforward, with the ports individually serving as their own CEQA lead and the U.S. Army Corps of Engineers serving as the NEPA lead. Still, permitting and environmental approvals will likely involve multiple agencies[66] and can take multiple years, so targeting the

[65] Public Resources Code § 25545(b)(1)
[66] See Table 9 in Port of Long Beach's "Pier Wind Project Concept Phase: Final Conceptual Report" (April 2023) as an example.

streamlining of those processes and timelines for port facilities will help to ensure that the ports are ready when needed.

Ports. The CEC and BOEM have found that no one port can meet all of the port needs for the OSW industry in California.[67] Instead, the state will need to strategically develop a port network that can efficiently, cost-effectively, and reliably support staging and integration (S&I), manufacturing/fabrication (MF), and operation and maintenance (O&M) activities along the California Coast (Figure 7).[68] Different factors affect the candidacy of each port for each activity. S&I sites require a large amount of space, deep navigation channels, and cannot have any air draft restrictions (e.g. bridges) since the fully assembled turbine systems, which are 1,100 feet above water, need to be towed out to the installation site. Therefore, the ports of Humboldt, Los Angeles, and Long Beach are most suitable as S&I sites. MF sites can occupy less space than S&I sites and be at locations with air draft restrictions since the individual components can be transported horizontally via vessel or barge. Ideally, O&M sites that transfer crew to and from the OSW farms should be close to the wind farm location to minimize travel time.

Figure 7. Potential port sites for OSW



As alluded to previously, the Port of Humboldt Bay has already drawn up plans, begun to drum up funding, and started the environmental review process for needed upgrades to serve the OSW industry. The Port of Long Beach has also starting preparing for a proposed $4.7 billion development plan that would create a facility to support the manufacturing and assembly of OSW turbines.[69] The CEC estimates that the total upgrades needed across all of the identified ports will cost approximately $11 to $12 billion to meet the 2045 goal for 25 GW of OSW in California.

Community Impacts. OSW could provide a reliable, high-capacity, renewable, and zero-emission power source to California. In addition to providing renewable energy, OSW is expected to open the door to significant job creation, primarily for local and regional supply

[67] Chap. 1, BOEM; *California Floating Offshore Wind Regional Ports Assessment*; January 2023.
[68] Fig. 6-5, CEC; *Commission Adopted Final Report AB 525 Strategic Plan Volume II*; July 2024.
[69] Port of Long Beach; "Pier Wind Project Concept Phase: Final Conceptual Report"; April 2023.

chain, manufacturing, project construction, and operations and maintenance.[70] The CEC anticipates that the OSW industry will create between 5,000 and 18,000 jobs over the next 20 years.[71] As mentioned previously, BOEM's multifactor lease auctions considered a combination of a base monetary bid and bidding credits, which could total up to 20% of the total monetary bid, towards programs or initiatives that support workforce training programs for the OSW industry and/or the development of an OSW-related domestic supply chain. However, the state and the federal government will need to take thoughtful steps to realize these benefits in and around the local OSW communities that have been historically disadvantaged.

Tribal nations. California Native American tribes and peoples have stewarded the lands, waters, ocean, and coast since time immemorial. As such, tribal expertise, traditional ecological knowledge, and tribal customs and practices will be critical components of the best available science for informing the environmental impact assessment of OSW. In consultations with the CEC and other state and federal agencies, California Native American tribes have highlighted the past historical wrongs still impacting tribal communities today. Specifically, tribes have noted that in the past, the lucrative incentives to quickly build out industries to support resource extraction led to state-supported forced removal of tribes from their ancestral territories and appropriation of those lands for private benefit. They understand federal and state motivations for developing clean and carbon-free energy resources, but several tribal nations, particularly up in the North Coast, have voiced formal opposition to OSW development until government agencies and developers create formal structures for tribal co-stewardship, compensated involvement in the surveying processes, and community benefit agreements that protect and uplift their sovereignty, cultural resources, and the historical and cultural connections that they have with the lands, ocean, and wildlife.

Port-adjacent communities. Industrial activity and development at ports can result in significant environmental burdens for communities of concern living near ports, including air, water, noise, and light pollution. Nearly 2 million pounds of toxic air contaminants pollute the skies in or near the Ports of Los Angeles and Long Beach, which contributes to high childhood asthma rates in those communities.[72] Although port and truck electrification have promise to achieving local emissions reductions, many emissions from port activities also come from the marine vessel traffic moving goods in and out, which may be increased as a result of OSW activity. The investment into port upgrades, however, could support an average of about 6,700 skilled workers annually over 10 years across the myriad of potential port sites.[73]

Local communities in the lease call areas. As mentioned previously, the buildout of transmission and generation sources in the North Coast will help to provide greater electrical reliability to communities that have faced a growing number and length of outages in recent years. However, OSW faces more pushback in the Central Coast region, where local residents are worried about how the industry will affect surrounding marine life, hinder tourism,

[70] Chap. 3, CEC; *Commission Adopted Final Report AB 525 Strategic Plan Volume II*; July 2024.
[71] Table 7-3, Ibid.
[72] CalMatters; "In the shadows of industry: LA County's port communities"; February 2022; https://calmatters.org/environment/2022/02/environmental-justice-photo-essay-la-county-port-communities/
[73] Pg. 169, CEC; *Commission Adopted Final Report AB 525 Strategic Plan Volume II*; July 2024.

industrialize the port, and raise the cost of living. Additionally, fishermen in both call areas have voiced concerns about the possible disruptions to marine ecosystems and increased vessel traffic that OSW projects pose, which risk displacing the commercial fishing sector. If the industry cannot quell these concerns and ensure a thorough environmental assessment process, OSW developers are likely to face legal pushback and delays, as evidenced by the city's initiative on the November 2024 ballot to block a proposed battery storage facility.[74]

Conclusion. OSW can help to diversify California's renewable energy portfolio, reduce carbon emissions in the sector, and provide greater reliability by more closely matching the patterns of energy supply and demand in the state. As the first projects of their kind, however, floating OSW development in California is poised to be a massive endeavor, with great risks to the developers, the state, and ratepayers, and possible encroachment to wildlife habitats and cultural resources. Although the CPUC has provided an anticipatory timeline that expects OSW to come online beginning in 2035, delays in connecting new generation sources and building new transmission across the state today raise concerns that we will not be on target to meet our goals. Ensuring efficient timelines for the permitting and construction of OSW infrastructure, transmission, and port facilities will be critical, but is complicated by the complex web of federal, state, and local agencies that all have a stake in the process. The successful deployment of OSW will require a confluence of strengthened cooperation – between developers, state and federal agencies, and impacted communities – continued investments and action, and earnest consideration of equity, affordability, and the environment.

# # # # #

[74] San Luis Obispo Tribune; "Should Morro Bay get massive battery storage plant? City will let voters decide"; September 2023; https://www.sanluisobispo.com/news/local/article279274739.html

Appendix A – Offshore Wind-Relevant Bills Passed or Being Considered by the California Legislature

AB 525 (Chiu, Chapter 231, Statutes of 2021) required the CEC to establish 2030 and 2045 planning goals, as specified, for electricity generated by OSW. Also required the CEC, in coordination with specified agencies, to develop a five-part strategic plan for OSW development and to submit the plan to the Natural Resources Agency and the Legislature by June 30, 2023.

AB 209 (Committee on Budget, Chapter 251, Statutes of 2022) required the CEC to establish and administer a program to support OSW infrastructure improvements to advance the capabilities of California's ports, harbors, and other waterfront facilities to support the build-out of OSW facilities. Also established the Voluntary Offshore Wind and Coastal Resources Program at the CEC to support state activities that complement or support federal laws related to the development of OSW facilities, among other provisions.

SB 704 (Min, Chapter 292, Statutes of 2023) authorized the CCC to seek scientific advice on offshore wind, among other things.

AB 3 (Zbur, Chapter 314, Statutes of 2023) established the California Offshore Wind Advancement Act to develop a strategy for seaport readiness for OSW developments, and to study the feasibility of achieving 70% and 85% in-state assembly and manufacturing of these projects.

AB 1373 (Garcia, Chapter 367, Statutes of 2023) authorized the DWR to act as a centralized procurement entity until January 1, 2035, to procure eligible energy resources, including OSW, in order to help the state meet its renewable and zero-carbon energy resources and reliability goals should the CPUC identify a specific procurement need and make a request of DWR. Also committed a future $6 million appropriation in the 2024-25 fiscal year to support environmental monitoring and research into OSW impacts around the regions the federal government has leased areas for wind development, among other things.

SB 286 (McGuire, Chapter 386, Statutes of 2023) established the California Offshore Wind Energy Fisheries Working Group to address OSW project impacts to certain fisheries and related interests, including the development of a statewide strategy to minimize impacts to ocean fisheries and providing for reasonable compensation to those affected. Additionally, required the CCC to process a consolidated coastal development permit for new development associated with OSW projects and related transmission facilities in the coastal zone, and required the CSLC to be the lead agency for purposes of environmental review for OSW projects, among other provisions.

AB 80 (Addis, 2023) would establish the West Coast Offshore Wind Science Entity, to be comprised of representatives from state agencies, federal agencies, California tribes, the OSW industry, and environmental protection or environmental justice nonprofit organizations, to assess the environmental impacts of OSW energy development. Status: *held*

in the Senate Committee on Appropriations, but folded into the 2024-25 state budget proposal.

AB 2537 (Addis, 2024) would establish the Offshore Wind Community Capacity Funding Grant Account to build capacity within local communities and tribal communities to support engagement of the process of OSW energy development in California, and continuously appropriates funding from the existing Voluntary Offshore Wind and Coastal Resources Protection Fund at the CEC. Status: *pending suspense file hearing* in the Senate Committee on Appropriations.

AB 3006 (Zbur, 2024) would amend the definition of "infrastructure" for purposes of the Governor's annual infrastructure plan to include port infrastructure for OSW, and would require the plan to include, beginning in the 2026-27 fiscal year, an assessment of funding needs for that port infrastructure. Status: *pending suspense file hearing* in the Senate Committee on Appropriations.

Appendix B – Acronyms Used

BOEM	Bureau of Ocean Energy Management
CAISO	California Independent System Operator
CARB	California Air Resources Board
CCC	California Coastal Commission
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPCN	Certificate of Public Convenience and Necessity [by CPUC]
CPUC	California Public Utilities Commission
CSLC	California State Lands Commission
DWR	Department of Water Resources
LCOE	Levelized Cost of Energy
NEPA	National Environmental Policy Act
NREL	National Renewable Energy Laboratory
OSW	Offshore Wind
PPA	Power Purchase Agreement
TPP	Transmission Planning Process [by CAISO]