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Offshore Wind: A Crucial Resource To Decarbonize The Western United States

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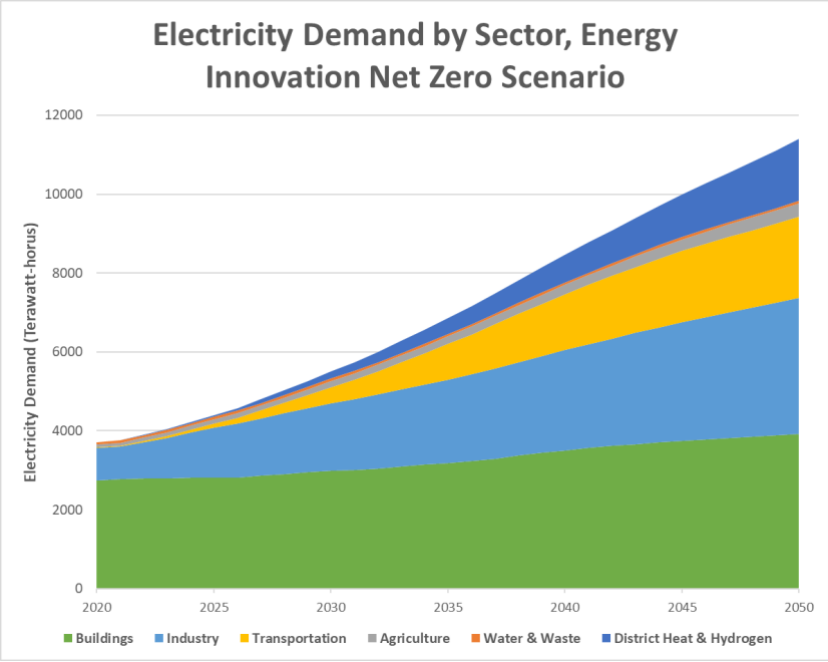
OFFSHORE WIND IN THE WEST

The West Coast has a vast, untapped resource to help decarbonize the United States' energy system—offshore wind. While decarbonizing the grid and electrifying many end-uses by 2035 is possible without significant offshore wind growth, scaling up offshore wind substantially increases our chances of success. Continued electrification of buildings, industry, and transportation, along with growing green hydrogen needs, may triple national electricity demand by midcentury in order to reach net-zero emissions. West Coast offshore wind can provide affordable, reliable, clean energy at scale to accomplish this feat.

Offshore wind would diversify generation resources while reducing land-use conflicts in the Western U.S., where 80 percent of customers are served by utilities with net-zero carbon emission mandates. Coastal states make up 57 percent of Western electricity demand and have some of the most ambitious electrification goals nationwide, but they are among the most land-constrained states in the U.S., especially California.



Source: Energy Innovation U.S. Energy Policy Simulator: NDC Pathway Scenario.

Transmission and greater regional coordination would enable coastal cities to access vast regional resources, if they can overcome significant land-use constraints and political barriers. The abundance of federal land across the West with different uses and jurisdictions creates barriers to efficiently site renewables and transmission, as do concerns from Interior Western states and private landowners about using their acreage to power economies in other states. The

development of offshore wind, as with any resource, brings with it potential environmental and conservation concerns in addition to those from the fishing industry. However, the wind resource on the West Coast is vast and has the greatest potential far from shore, creating significant opportunity for siting turbines in regions of least conflict.

Unfortunately, the U.S. lacks ambition on offshore wind, particularly on the West Coast, which has no established offshore wind deployment requirements. East Coast states, in contrast, are targeting more than 30,000 megawatts (MW) of capacity by 2035. President Biden has announced a U.S. target of 30,000 MW by 2030 but has not designated a specific target for West Coast wind. There has been some activity to promote offshore wind on the West Coast, including California's AB 525 which directs the state to set planning goals through 2045,[1] and Oregon's HB 3375 which directs the state to identify benefits and challenges of 3,000 MW of offshore wind by 2030. The U.S. Bureau of Offshore Energy Management (BOEM) has designated call areas off the coast of both California and Oregon and begun environmental assessment, with conditional approval by the California Coastal Commission. BOEM has also announced a proposed sale notice for two wind areas in California, with an estimated 4.5 GW of potential. This is a good start, but the U.S. should more explicitly support development of untapped West Coast wind potential to reach our carbon goals.

ECONOMIC BENEFITS OF WEST COAST OFFSHORE WIND

As in the East Coast, floating offshore wind would create jobs on the West Coast. The Schwarzenegger Institute estimates California would gain a total of 120,000 to 180,000 job-years of employment from developing 10,000 MW of offshore wind by 2040, including 4,000 permanent operations and maintenance jobs. The same report finds that up to 50,000 new jobs could be created, many locally, through 2040 if policy supports local component manufacturing while the national floating market continues to grow apace.

Floating turbines can also stimulate industrial deep-water port revival in coastal communities. The California Energy Commission (CEC) has approved a $10.5 million grant for Port of Humboldt Bay renovations to support offshore wind activities. This area is designated for offshore wind development, and the project is expected to revitalize the waterfront industry in Humboldt County and provide living wage jobs to nearby communities. An economic assessment found that the terminal could generate as many as 830 local jobs and more than $130 million in industry output over a five-year period.

California's support for the Humboldt project is a good start to meet near-term local needs, much larger public and private investment is needed region-wide to reach offshore wind's potential. West Coast ports are needed to secure the massive economic resources that can benefit consumers, stimulate jobs, and improve grid reliability. Port upgrades are even more crucial to the success of floating offshore wind compared to the fixed bottom turbines commonly used in the shallower waters off of the East Coast, as the floating platforms are assembled on shore and towed out to their designated location. Investment in even a few ports could enable installations across hundreds of miles of coastline. For instance, the Port of Humboldt could service turbines as far south as Morro Bay, as well as up to Oregon. The $10.5 million from the CEC is an important start to funding the necessary port upgrades, but additional public funding will be needed to ensure the project's success. A total of $130-$310 million will be required to complete the upgrades, plus an additional $50-$100 million to support floating platform fabrication. Federal infrastructure spending now can ensure port capacity is not a bottleneck for this crucial resource.

[1] As of the writing of this brief, the California Energy Commission is in the process of setting offshore wind "planning goals," for 2030 and 2045. These are not firm targets, but will inform state energy analysis and planning efforts.

BENEFITS OF OFFSHORE WIND TO THE WESTERN GRID

The U.S. must reach 70 to 80 percent carbon-free electricity by 2030 to stay on track for our national climate goal under the Paris Agreement and can do so using primarily wind, solar, and batteries. But beyond these resources, the grid must continue expanding despite growing land constraints and diversify to reach net-zero emissions. 2021 research from environmental groups and academics including Environmental Defense Fund and Princeton, as well as GridLab and Energy Innovation research, agree that California needs a diverse portfolio of high-capacity carbon-free resources to reach net-zero emissions.

A recent working paper from scientists at the University of California-Berkeley finds that West Coast offshore wind delivers power when the Western grid needs it most – in the early evening as the sun goes down. West Coast offshore wind also generates more reliable, consistent power because the wind is stronger and turbines can be built larger than onshore turbines. The largest offshore turbines being built today are 15 MW and can power about 20,000 households. The technology continues rapidly evolving, with 18 MW turbines expected in the near future.

According to the same research, building 50,000 MW of offshore wind off California's coast—only 25 percent of the technical potential—by 2045 could provide as much as 40 percent of California's total electricity in a highly electrified net-zero grid. It would also improve reliability on a climate-stressed grid while enabling an all-electric future. Offshore wind is not a silver bullet—we need wind, solar, offshore wind, geothermal, nuclear, long-duration storage, and other technologies to reach a reliable net-zero electricity system. But offshore wind must be a core strategy for the U.S. to achieve net-zero emissions by midcentury, which is not reflected in current policy.

THE VIABILITY OF FLOATING OFFSHORE WIND

Uncertainty exists as to when the technology will be ready for widespread commercial deployment in the U.S. We already lag other nations on more established "fixed bottom" offshore technology, which is affixed to the bottom of shallow water. 55,000 MW of fixed bottom offshore wind has been deployed worldwide, with the largest installations supplying power to China, Germany, and the United Kingdom. For comparison, the U.S. still only has two offshore wind farms, 30 MW in Rhode Island and 12 MW in Virginia—less than 0.1 percent of global installed capacity. Fixed bottom offshore wind is clearly viable globally even though the U.S. has fallen behind other major energy economies.

Floating offshore wind is essentially the same generation technology as fixed bottom, just with different assembly and installation characteristics. Floating offshore is needed off the West Coast because of much deeper waters. Rather than attaching a fixed platform to the seabed, a floating turbine is affixed to the seabed with long cables. Although the engineering challenges are different, researchers expect floating and fixed offshore wind costs to converge in the long-term, due to technological similarities.

Major investments have pushed floating offshore turbines to the verge of commercialization. Floating turbines have already been successfully deployed in demonstration projects, and major contracts have already been signed to deploy this technology, including 5,000 MW off the coast of Scotland. More than 25,000 MW of floating offshore wind projects are in the global pipeline, according to the U.S. Department of Energy's 2021 Offshore Wind Technologies Report, and 3,600 MW will be online in the next five years.

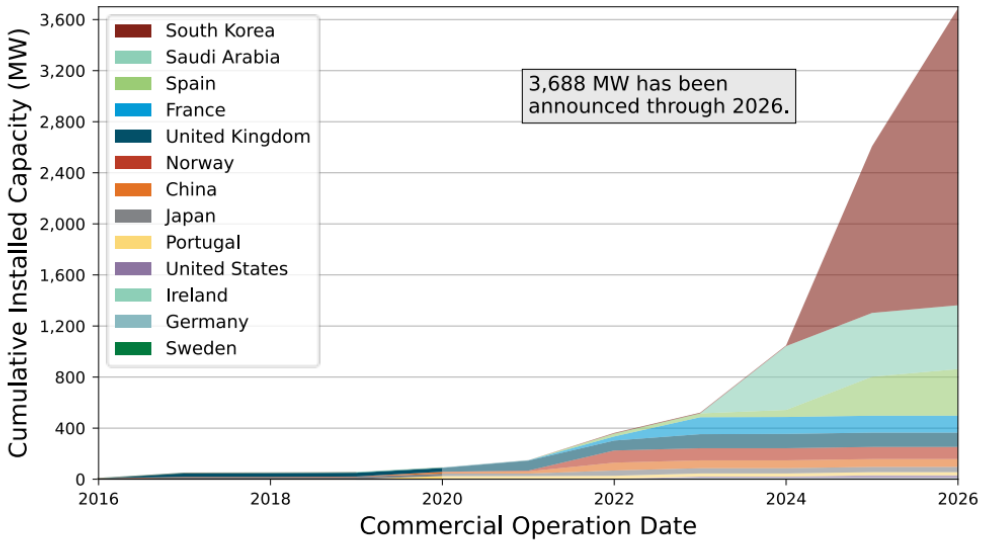


Figure 20. Cumulative floating offshore wind capacity by country based on announced COD through 2026

Source: U.S. Department of Energy 2021 Offshore Wind Technologies Report, at p. 53.

While the sheer volume of fixed bottom offshore turbines provides a robust cost picture, floating offshore wind costs require some speculation. The U.S. DOE predicts floating offshore wind costs in America will decline from approximately $160 per megawatt-hour (MWh) in 2020 to between $60 and $105/MWh in 2030, with California on the low-end of this estimate. These estimates suggest floating offshore cost will begin converging on fixed bottom costs this decade, with potential future cost declines predicted by the National Renewable Energy Laboratory's Annual Technology Baseline. Still, this convergence is not a given. The industry must achieve scale to achieve these cost reductions, which requires consistent policy support.

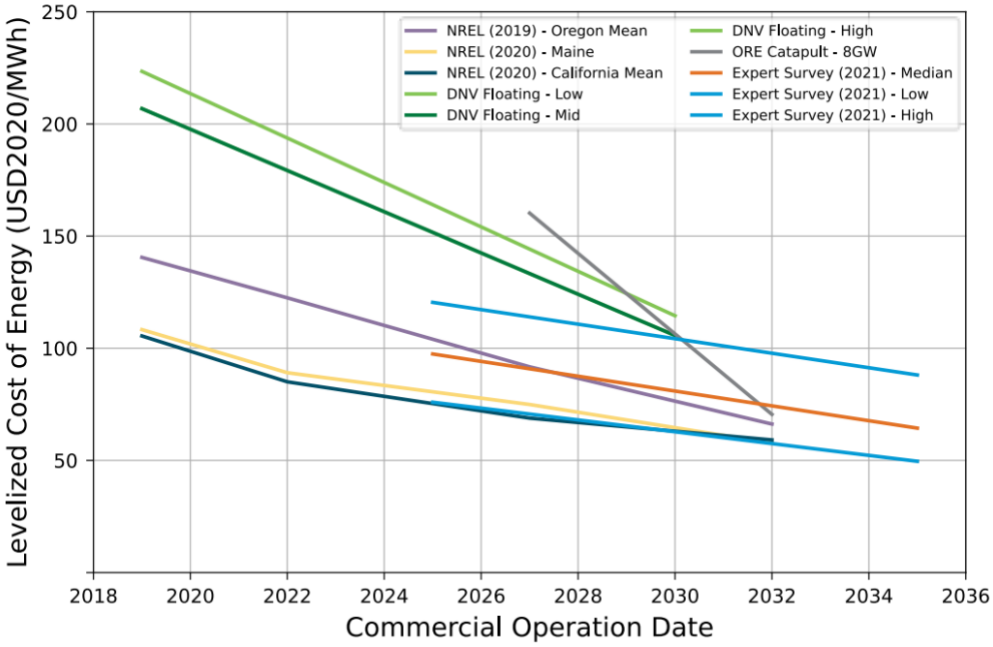


Figure 39. Global LCOE estimates for floating technology

Source: U.S. Department of Energy 2021 Offshore Wind Technologies Report, p. 81.

POLICY RECOMMENDATIONS

West Coast floating offshore wind can only reach its full potential through consistent federal and state policy support. Offshore wind will be an economic resource, but the projects are massive and complex. This emerging technology needs to achieve scale to see cost reductions similar to U.S. wind and solar projects. Workforces and supply chains must be ready. Port and transmission infrastructure must be built. Lands and seabeds must be assessed and permitted. At each stage, federal, state, and local government support will determine if offshore wind becomes a niche resource or a core economic strategy to decarbonize the West at least cost.

Congress has an important role to play providing funding needed to scale this vital resource. This starts with **extending the floating offshore wind production tax credit for 10 to 15 years at $25/MWh,** similar to the House-passed Build Back Better Act of 2021. Tax credit extensions are needed for all clean technologies to meet our climate goals, the House version is scaled back, long-term support for offshore wind should be considered separately. Because floating offshore comes at a significant cost premium in this early commercialization phase, long-term federal support sends a clear investment signal that the U.S. will be a viable floating offshore wind market. Federal support will also stimulate private investment in ports, ships, and transmission. Tax credits lessen sticker shock when early projects begin development, and should be refundable to improve this policy's effectiveness.

Second, Congress should **support West Coast port and manufacturing cluster development**, laying the groundwork to maximize job creation and economic benefits from floating offshore wind deployment. While offshore wind construction jobs will be significant, port communities deserve a permanent stake in the offshore wind industry. The Infrastructure Investment and Jobs Act funds port maintenance and upgrades, as well as certain clean energy manufacturing capabilities, but a more concerted offshore wind effort would speed the industry's scale by inviting much-needed private sector investment. This is also an important opportunity to advance equity through project labor and community benefits agreements that help ensure jobs stay in the local communities. As ports are upgraded and traffic through them increases, air pollution monitoring and mitigation should also be a priority. Federal Aviation Administration cooperation will help ensure Coos Bay, which sits near a regional airport, can become another important deep-water port to support Oregon's offshore wind development.

Third, Congress and the Federal Energy Regulatory Commission (FERC) should **support transmission infrastructure needed to connect Western offshore wind with the rest of the Western grid**. Transmission interconnection is a worsening national problem, with interconnection request waiting periods doubling over the last two decades. Proactive offshore wind substation and high-capacity transmission development can solve this problem. FERC should encourage proactive planning and transmission expansion to open offshore wind markets. Congress should provide federal grants and tax support to reduce upfront costs and stimulate development. The investment needed for these transmission projects is large, with estimates showing that transmission costs range from $0.75 to 2.5 billion per GW of installed wind capacity. Early planning and allocation of funds for these projects will be essential to support the development of this new industry. A least-cost, highest-benefit approach should include an offshore subsea cable linking offshore production along the entire West Coast would share the benefits of this resource across the region, and would increase resilience for states dealing with wildfires that threaten transmission access.

Fourth, the federal government must do what it can to **encourage responsible, timely siting of offshore wind**. The Biden administration has been leasing offshore wind areas at a record pace, but BOEM must accelerate offshore wind deployment beyond the Administration's 2030 target. The U.S. Departments of Defense (DoD) and Interior must also continue collaborating with Western states on leasing areas, emulating successful resolution of DoD's three-year opposition to leasing in the Morro Bay, California call area. Congress should further increase

funding for collecting and sharing data on the ecological impacts of offshore wind, including seabird, marine life, and ecosystem impacts of construction and operation of these facilities to build support for responsible conservation practices. Finally, Congress should hold agencies including FERC, DOE, and BOEM accountable on their ongoing efforts to support proactive offshore transmission infrastructure development, and encourage them to use the full extent of their legal authority to responsibly site these projects.