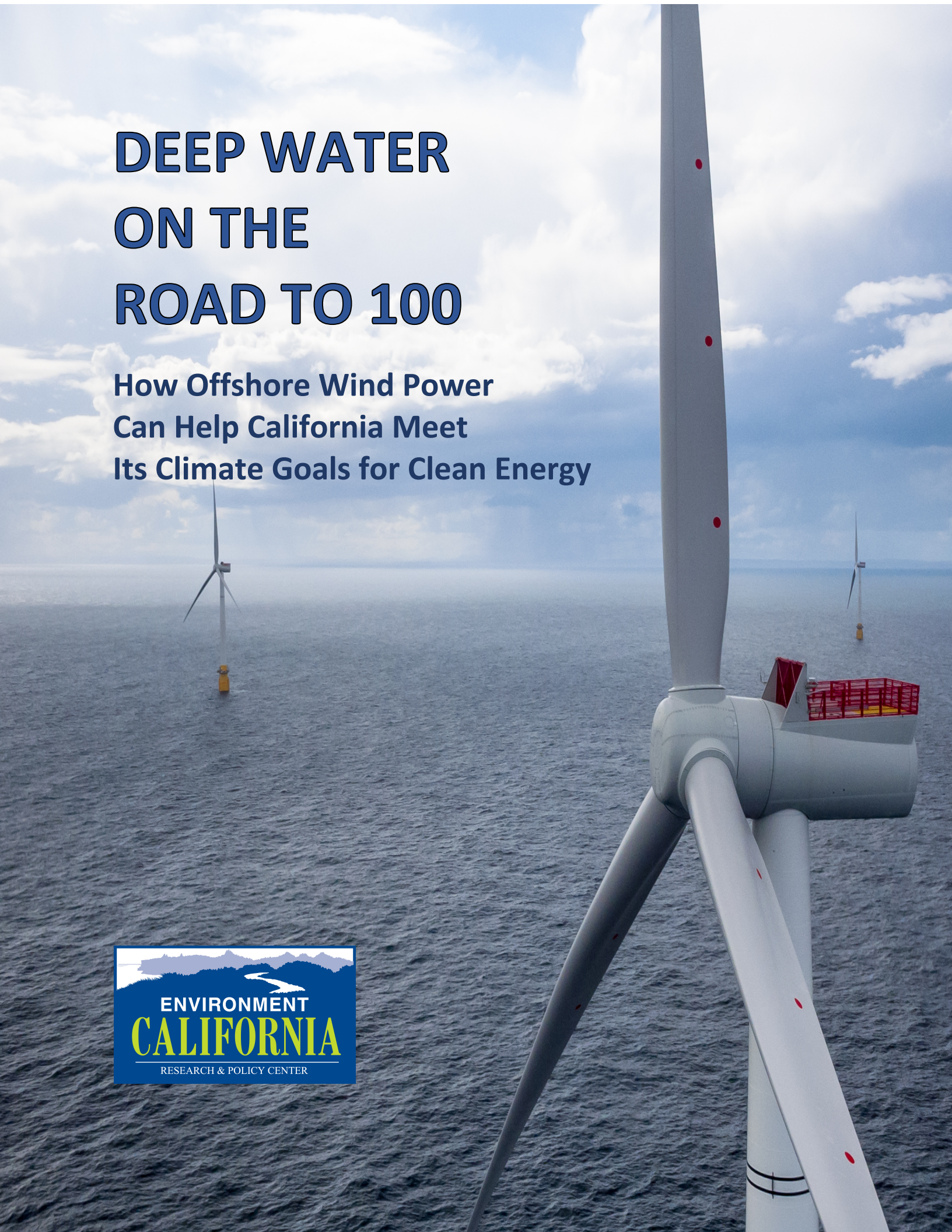

DEEP WATER ON THE ROAD TO 100

How Offshore Wind Power Can Help California Meet Its Climate Goals for Clean Energy

ENVIRONMENT CALIFORNIA
RESEARCH & POLICY CENTER

DEEP WATER
ON THE ROAD TO 100

How Offshore Wind Power Can Help California Meet Its Climate Goals for Clean Energy

Written by
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Cover photo credit: Equinor, Hywind Scotland floating wind farm

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EXECUTIVE SUMMARY

California has made significant progress during recent years in its fight against global warming, especially through its efforts to switch its electricity supply to renewable and zero-carbon sources. But its final target of 100 percent clean electric power by 2045 remains daunting. As the state pushes forward, it would do well to look to an energy source it has not yet tried: offshore wind. The same Pacific Ocean winds that blow incessantly off many sections of the state's coastline could serve as a key element of a diverse energy mix in the decades to come.

A growing body of research shows that California offshore wind could generate as much as 21 gigawatts (GW) of power - roughly equivalent to about 85 percent of the state's projected growth in overall renewables capacity by 2030 and 12 percent of its cumulative, projected renewables growth by 2045. What's more, offshore wind would not compete with variable energy sources such as solar photovoltaic but would complement them, helping balance their daily swings in generation to provide reliable power for the grid.

Research has found that the total system-wide cost of a diverse mix of renewable power resources including offshore wind would be fully competitive in comparison with a more narrowly based resource mix. Just as important, research has also showed that offshore wind could help balance the concerns of environmental justice and labor groups and thus help strengthen public support for climate action. For example, a power mix with a large amount of offshore wind would enable the retirement of a greater number of fossil fuel power plants, thereby addressing concerns of low-income communities that face air pollution and associated health impacts from those plants. At the same time, however, offshore wind power could help preserve and create union jobs, addressing the concerns of power plant workers who fear they will become collateral damage in the transition to green energy.

Significant research into the environmental impacts of floating offshore wind platforms has been carried out, although more is needed to fill the remaining information gaps. Studies to date have shown potential impacts on fish populations, marine mammals, and birds. Further research is needed on several key topics and potential mitigation strategies, including habitat loss, entanglement with loose fishing gear, the impact of underwater electrical cables and their magnetic fields on marine life, and the impact of anchors and cables on seafloor habitat.

The most immediate barriers to California offshore wind are from the Trump administration and the U.S. Navy. In particular, the Navy's attempt to place an outright veto on offshore wind farms along most of California's Central Coast is a challenge that needs concerted, high-level attention from Sacramento – and the next administration in Washington.

Other challenges to be resolved are transmission capacity and port infrastructure, both of which appear to be prime opportunities for inclusion in any federal stimulus package that might emerge from Congress in response to the current economic crisis.

But rather than simply wait for decisions from the federal government, state policymakers need to take their own proactive series of steps on offshore wind, including the following:

- **Short-term goals:** Support the development of offshore wind pilot projects on the Central and/or North coasts to break the current deadlock on offshore wind and demonstrate forward movement for the sector.
- **Long-term goals:** Accelerate planning by the California Public Utilities Commission (CPUC) and the California Independent System Operator (CAISO) to integrate offshore wind into the state's 2030 and 2045 power procurement and transmission targets.
- **Environmental impact**: Accelerate the funding and completion of needed research to examine the potential impacts of offshore wind development on fish, marine mammals and seabirds, and to design mitigation strategies for these.
- **Federal government:** Prepare a strategy to persuade the next presidential administration that offshore wind farms can and should coexist with military activities off the California Central Coast and that the Navy should lift its restrictions on development of the sector. Similarly, a state strategy is needed to persuade the new administration that the federal Bureau of Ocean Energy Management (BOEM) should work proactively to help resolve the bureaucratic difficulties around cumulative environmental impacts review.
- **Infrastructure:** For transmission, prioritize upgrades to local systems on the North Coast and Central Coast for inclusion in any proposals for potential federal economic stimulus funding. For seaports, begin long-term planning for modernization and upgrading of facilities for offshore wind manufacturing, assembly, operations and maintenance. As an initial step, this ports planning should include a ground-truthed survey of space availability and governance in ports statewide.

INTRODUCTION

California is counting on the electric power sector for a large portion of its cutbacks of greenhouse gas emissions over the coming decades.[1] The large-scale development of solar and land-based wind power, and the incipient progress of battery storage technology, have put the state's 2030 reduction goals within reach.[2] Yet the post-2030 phase will be markedly more difficult. If the state is to achieve its goal of 100 percent clean electricity sources by 2045, it will need to create a huge and increasingly diverse portfolio of new resources.

Until now, offshore wind power has been odd man out in California's energy planning. Offshore wind is a major source of renewable power in Europe and East Asia and seems on the verge of becoming the same on the U.S. East Coast. In California, it has not yet attained the same status as other renewable energy resources, and until recently was barely an afterthought for regulators and policymakers.

But an increasing body of evidence shows that in California, as in other locations worldwide, offshore wind is needed to complement other renewable power sources such as solar PV, solar thermal, land-based wind, geothermal, battery storage, and others. Offshore wind would help balance this mix to provide grid reliability as the state moves toward 100 percent clean energy. The efficacy of offshore wind as linchpin of a diverse energy supply is shown by the sector's growth globally to over 27 gigawatts (GW), a tenfold increase over the past decade, with about 20 percent of that amount installed in 2019 alone.[3] This total is projected to soar to almost 200 GW by 2030, with at least half expected to be in Europe and much of the rest in China.[4] On the U.S. East Coast, many states have made offshore wind the centerpiece of their clean energy strategies, with a total of 29 GW of new capacity mandated by 2035.[5]

This report's analysis and recommendations coincide with and reinforce the recommendation by the California Ocean Protection Council, adopted in February 2020, for the state to ensure development of a commercial-scale offshore wind project by 2026.[6] That recommendation was the first formal policy goal set by a California state government planning entity for offshore wind.

Locations and scope

California differs from the East Coast, much of Europe and East Asia in that its continental shelf is narrow and the ocean bottom drops off quickly, thus requiring offshore wind turbines to be on floating platforms rather than on fixed-bottom structures drilled into the seafloor. This floating technology is very similar to deep-water oil rigs and has been successfully demonstrated in multiple locations worldwide.[7] While the cost of floating offshore wind today is higher than fixed-bottom offshore wind, its cost is expected to decline rapidly in coming years.[8]

As shown in Exhibit 1, six offshore wind zones have been proposed in federal waters: the Humboldt, Morro Bay and Diablo Canyon Call Areas as formally outlined by BOEM, the Del Norte and Cape Mendocino areas as discussed by the California Energy Commission and analyzed by E3 in UC Berkeley's 2019 study,[9] and the Navy proposal in February 2020. One has been proposed in state waters: the Vandenberg pilot project.

Exhibit 1: California's proposed offshore wind areas

Wind resource area	Area (sq. mi.)	Potential output (MW)
Del Norte	850	6,604
Humboldt Bay Call Area	207	1,607
Cape Mendocino	800	6,216
Navy proposal Feb 2020	192	unknown
Morro Bay Call Area	311	2,419
Diablo Canyon Call Area	556	4,324
Vandenberg pilot	5	60

X COASTAL GRID CONNECTIONS

Sources: California Offshore Wind Energy Gateway, Collier et al 2019[10]

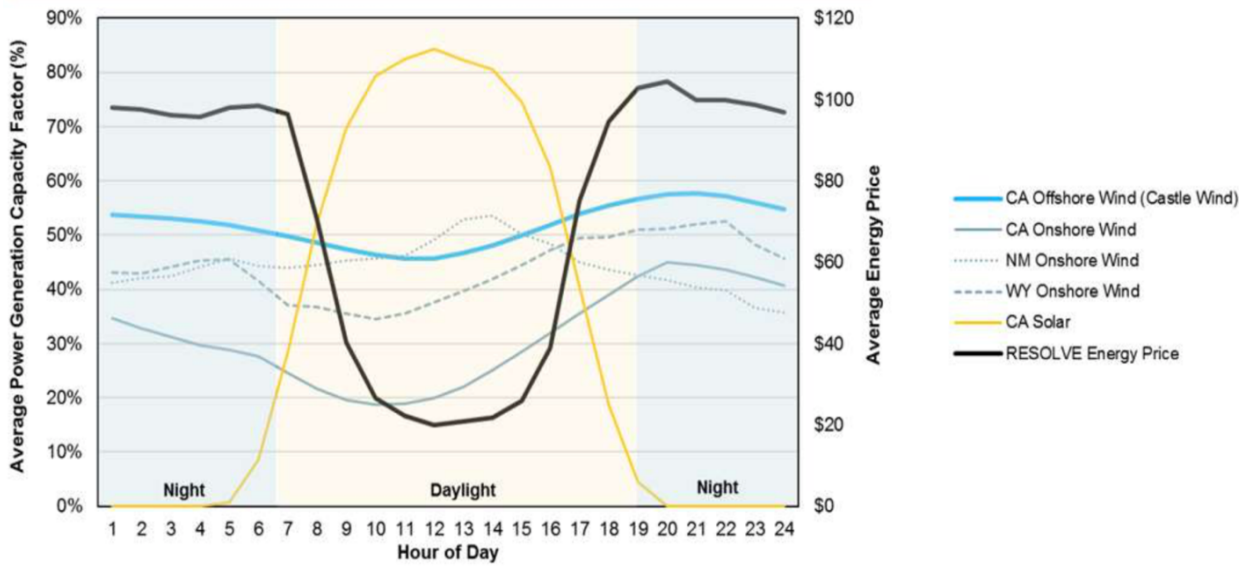
California's North Coast has some of the nation's most optimal wind resources, with steady offshore winds averaging over 23 mph.[11] Wind speeds on the Central Coast are only somewhat less strong, and that area's closer proximity to the state grid and to major population centers, as described later in this report, is a major advantage.

GETTING TO 100 PERCENT CLEAN ENERGY

Without offshore wind power, California could have a harder time achieving its climate goals, which require a clean electricity supply that is diverse and reliable. Recent studies by the California Energy Commission (CEC) and CPUC show that while retail electricity consumption has remained more or less flat for the past decade, the electrification of buildings and transportation is projected to cause a sharp, six-fold increase in electricity needs – and therefore in renewable power generation requirements – by 2045.[12] Because solar generation disappears at sunset, at the same time as peak demand occurs, a diverse portfolio of other clean energy sources will be needed to fill this daily gap. Battery and other storage technologies are expected to fill a large part of this portfolio, but offshore wind could be another key component. Pacific Ocean winds along the California coastline are relatively stable throughout the day but are strongest in evenings – just when power is needed. This was demonstrated in a 2019 report by Energy and Environmental Economics (E3), one of the state's primary sources of technical analysis of the power sector.[13] The E3 report evaluated the daily generation profile in a project area proposed by Castle Wind off Morro Bay, and found that offshore wind power would help fill the gap caused by the fluctuations of solar power, as shown in Exhibit 2.

Offshore wind power can help fill California's daily gap in electricity generation after sunset, when solar generation ends and peak consumption occurs.

Exhibit 2: Offshore wind generation profile: a reliable complement to solar power

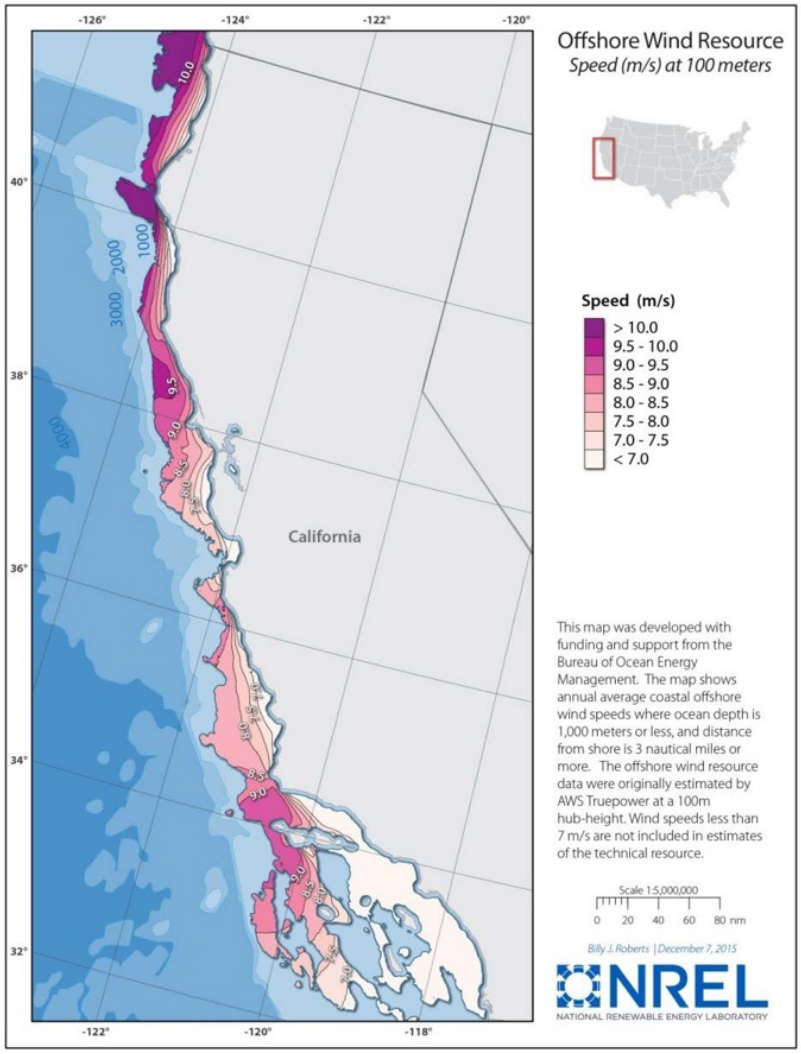


Source: Copyright E3, by permission[14]

Other studies have also come to similar conclusions. Technical analysis by E3 in the UC Berkeley 2019 report found that while offshore wind is nominally more expensive than solar in cost per megawatt hour (MWh), it would be fully competitive when calculated as one component of a diverse mix of renewable energy sources because it would reduce the need to build redundant capacity in solar and storage.[15] The report found that development of as much as 21 GW of offshore wind – equivalent to 85 percent of statewide projected growth in renewables capacity by 2030 and roughly 12 percent of projected renewables growth by 2045 - as part of a diverse resource mix would provide comparatively greater economic value to the grid than alternative development scenarios that lacked offshore wind.[16]

The CPUC's overall planning process for the power sector, the biennial Integrated Resource Plan (IRP), has not yet included offshore wind in its principal analyses because sufficient data was not available. The IRP's most recent iteration, the 2019-20 Reference System Portfolio, envisioned a relatively narrow resource mix focused on utility-scale solar and battery storage to meet the state's renewables needs.[17] Offshore wind was not included in the primary IRP analysis, although it was included in a supplemental analysis, as described below. The CPUC designated offshore wind for inclusion and additional analysis in a proceeding that began in May 2020, and future IRP cycles are expected to include offshore wind in their portfolios.[18]

Exhibit 3: Offshore wind speeds



Source: Musial et al 2016

The state's grid authority, the CAISO, has warned that the IRP process needs to examine a broad mix of clean energy resources, including offshore wind, to ensure grid reliability. In a series of regulatory comments, the CAISO warned that from the mid 2020s onward, as power consumption grows, the state grid will have increased difficulty maintaining reliability during

multiple-day periods of cloud coverage with limited solar generation, especially in wintertime, and during evenings after solar generation stops.[19]

"It is critical for policy makers to act now to diversify the fleet based on energy and reliability needs, rather than wait for technologies to be cost effective," the CAISO warned. "Start with limited testing of a variety of new(er) technologies rather than significant investment in a limited portfolio that reduces diversity."[20] The CAISO – which relies on the IRPs to set policy directions for its own long-distance transmission planning process - recommended that the CPUC start its offshore wind analysis sooner than later because permitting can delay major transmission projects by a decade or more.[21]

Exhibit 4: CPUC's modeling of alternative scenarios for 2045

	Option 1: Base case: solar & storage	Option 2: Out-of-state wind + solar & storage	Option 3: Offshore wind + solar & storage
Projected output in MW			
Solar	127,517	88,616	107,808
Customer solar	34,858	34,858	34,858
Battery storage	64,171	46,784	58,719
Land wind	12,735	11,793	12,701
Out of state land wind	3,000	23,211	3,000
Offshore wind	--	--	6,844
Geothermal	4,159	1,986	4,127
Biomass	2,048	901	2,048
Large hydro	7,070	7,070	7,070
Small hydro	974	974	974
Nuclear	635	635	635
Gas	20,594	24,110	19,874
CAISO total load	425 TWh	425 TWh	425 TWh
Marginal GHG abatement cost per tons of CO_2	$587	$408	$539
Gas plant capacity retirement	4.5 GW	1GW	5.2 GW
Levelized Total Resource Cost	$55 billion/year	$54.8 billion/year	$55.3 billion/year

Source: CPUC 2019[22]

The CPUC's supplemental modeling of offshore wind power for the 2019-20 IRP did not analyze the sector's estimated full potential capacity of 21 GW, and instead modeled a more modest 6.8 megawatts (MW) by 2045.[23] As mentioned previously, future modeling analyses are expected to include more robust offshore wind scenarios with updated data inputs. Nevertheless, the existing results are useful in demonstrating how the introduction of offshore

wind could trigger changes in the statewide power resource mix. The IRP "sensitivity analysis" shown in Exhibit 4 compared three resource options - a Base Case scenario dominated by PV solar and battery storage; a scenario with out-of-state wind; and a scenario with 6.8 GW of offshore wind as well as solar and storage – and it found the offshore wind option would provide significant system-wide benefits. Similarly, in September 2020, a joint SB 100 planning study by the California Energy Commission and CPUC projected 10 GW of offshore wind by 2045.[24]

Balancing the coalition for climate action

The CPUC analysis in Exhibit 4 shows that the Levelized Total Resource Cost – in other words, the overall economic competitiveness – of each of the three options would be roughly similar. But it also shows the offshore wind option has a distinct advantage for California environmental justice communities because of its ability to support the retirement of natural gas power plants. Option 3 would make it possible to shut down 5.2 GW of gas-fired power plants, an amount that is one-eighth of the state's current gas generating capacity and roughly equivalent to a half-dozen large power plants. This is greater than the 4.5 GW gas retirement under the solar-plus-storage Option 1 and the 1 GW gas retirement under the out-of-state wind Option 2. The difference between the three is important for public health because the emissions of conventional air pollutants from these gas-fired plants directly impact nearby communities, many of which are low-income. Public demands for the plants' shutdown and removal have been a key priority of environmental justice groups.[25]

State policymakers will need to ensure that the workers at existing power plants, as well as the residents of marginalized communities beset by pollution from those plants, benefit from the new offshore wind jobs and the clean energy transition overall.

However, policymakers will need to recognize the delicate balance of interests in this matter. Gas plant workers and their unions are rightly concerned that their livelihoods could become collateral damage in the switch to clean energy. Without a "Just Transition" to equivalent jobs or incomes, many gas plant workers will continue defending their existing jobs and may oppose the shift to clean energy.[26] Fortunately, research has shown that offshore wind, more so than other renewable technologies, offers the potential to break the zero-sum, winners-vs.-losers dynamic of economic change by creating high-skilled, well-paying jobs. Innovative workforce policies – such as California's High Road Training Partnership program – can be leveraged in a high-wage, high-value-added, unionized supply chain that eventually includes the manufacturing and assembly of wind turbines and their floating platforms, as well as their installation, operations, and maintenance.[27] Ensuring that power plant workers, in addition to marginalized communities, benefit from the new offshore wind jobs and the clean energy transition overall will be an important responsibility for state policymakers.

If the state were to adopt proactive policies to ensure a balance of public benefits in an offshore wind industry, environmental justice groups and labor unions could have reason to join with environmental advocacy organizations and the offshore wind industry in supporting these decisions. As a result, California could get the best of several worlds: lower pollution, lower cost, and a strengthened alliance between environmentalists, labor, marginalized communities, and the clean energy industry to help the state advance toward its climate goals.[28]

CHALLENGES AND SOLUTIONS

For various reasons, offshore wind will require unusually proactive leadership. A more hands-off, laissez-faire strategy could result in policy paralysis, institutional stalemate, and inaction by the offshore wind industry. Offshore wind in California has several particular barriers to development that need to be addressed strategically, with immediate leadership by the Legislature and Governor.

Minimizing environmental impact

Significant research into the impacts of offshore wind turbines and subsea structures to marine and avian life has been conducted in recent years with funding from BOEM and the California Ocean Protection Council, and more is underway.[29]

The scientific research conducted to date on the impacts of offshore wind farms on marine and avian life has been useful, but significant information gaps remain that need to be filled.

Environmental impact research has been limited by two related factors: globally, no floating offshore wind projects larger than 30 MW have yet been built, and the smaller projects that have been developed are located closer to shore, in shallower waters, and in substantially different ecosystems than California ocean waters. Nevertheless, studies to date have suggested that floating wind farms could have potentially significant impacts on several species of seabirds, marine mammals, and small pelagic (open sea) fish such as the Pacific sardine.[30] In a January 2019 letter to BOEM, environmental organizations Audubon, Sierra Club, Surfrider, California Coastal Protection Network, Environmental Defense Center, and NRDC wrote that while they support offshore wind development in California, further research needed to be done on potential impacts including the following: [31]

- Reef effects and habitat loss – the impacts that the wind farms' floating platforms will have on schools of fish such as rockfish, albacore tuna and salmon, either attracting them and potentially subjecting them to higher rates of predation by pinnipeds and seabirds or repelling them. Some research has found that oil platforms in the Santa Barbara Channel serve as highly productive reefs, supporting large concentrations of fish, and has suggested that floating wind platforms might have a similar effect – but with the benefit that wind energy, unlike oil extraction, has no danger of catastrophic spills.[32] However, the gaps in environmental research for floating wind farms leave open the possibility that the wind farms could also cause some species to avoid the areas, thus reducing their habitat.
- Entanglement - the possibility that cables stretching between turbine platforms would serve to catch the nets and gear that escape from fishing boats, and that fish or marine mammals would get caught in these entanglements. Unlike fixed-bottom offshore wind turbines, floating offshore wind developments have an extensive underwater network of mooring cables and inter-array cables that connect each turbine to another.
- Electromagnetism - the impact of underwater electrical cables (AC lines between turbines and high-voltage DC transmission to shore) and their magnetic fields on sharks and rays, salmon, sturgeon, and crustaceans.
- Seafloor – the impact of anchors and cables on benthic (seafloor) structural habitat including sponges and corals, and the resulting impacts on groundfish, crab, lobster, and others.

These potential impacts could affect California's fishing industry, whose statewide catch in 2018 was valued at $183 million, with a much smaller but unknown portion of that amount deriving from the proposed offshore wind farm areas.[33] The fishing industry's political clout has been enhanced by events on the East Coast, where fishing groups supported the Trump administration's 2019 decision to conduct a broad "cumulative impacts" review of

Sardines – normally among California's most abundant fish populations
Photo: Adam Fagen, Creative Commons

current and future projects along the Atlantic Seaboard, thus temporarily freezing offshore wind development.[34]

Commercial fishing boats in California use a diverse mix of gear types; while some of these may be operable within floating wind farms, most are likely to be incompatible with them, thus removing those areas from fisheries production.[35] Fishing industry groups have said that research to date has insufficiently examined the potential impacts of wind farms on commercial fish harvests.[36] However, the task of researching these impacts has been hindered by the lack of data: Commercial fishing groups have claimed they are unable to provide detailed locations of their own fishing grounds or quantitative catch data for areas near the potential wind farm sites, and the state government does not compile this information.[37]

One environmental impact that is not expected to be a significant problem in most cases is the issue of viewsheds. Because most of the offshore wind farms proposed to date are expected to be at least 20 miles offshore – except in the Navy-backed Morro Bay proposal and the Vandenberg projects mentioned below - they will be virtually invisible from the coast and thus are likely to escape the sort of opposition from local property owners and environmental groups that often befall land-based wind farms, utility-scale solar plants, and pumped storage projects.

While research work into some of the abovementioned issues is ongoing, the state budget cuts in 2020 prompted by the COVID-19 crisis could hinder future funding for this work. High-level attention from state decisionmakers may be required to ensure adequate funding for research to identify and resolve any environmental problems within an accelerated timeline.

Transmission

Getting the generated electricity from California's offshore wind farms to shore will require undersea cables, and once at shore the power will need to connect to the state grid. That's a significant problem on the North Coast, which has the state's strongest winds and about 14 GW in estimated potential offshore wind capacity.[38] Any large-scale build-out of the North Coast's wind potential would require construction of major, high-voltage transmission lines to connect to the state grid. Several routes have been discussed – east or southeast over the mountains, or underwater southward to the Bay Area.[39] The latter routes would cross into the Greater Farallones National Marine Sanctuary, in what could be a dangerous, national precedent for industrial encroachment on federally protected areas. Each of these routes is expected to cost well over $1 billion and would require complex environmental permitting.

The Central Coast, in contrast, is a "plug and play" scenario because large-scale wind farms in this area could easily connect with existing coastal infrastructure and connections to the state grid: the 3 GW transmission nexus at Diablo Canyon nuclear power plant, which is planned for closure in 2024-25, and the 668 MW interconnection at Morro Bay Power Plant, which closed in 2014.[40]

Port infrastructure

The manufacture, assembly, operations and maintenance of offshore wind turbines will require specialized port facilities in several locations, using considerable acreage because of the large size of the turbine components.[41] The Port of Humboldt Bay near Eureka has unique advantages for this purpose. Abandoned by the area's once-dominant pulp and lumber industry, the port has vast expanses of vacant land alongside a little-used, deep-water harbor. But it could require as much as $100 million in upgrades – thus requiring direct support from the state and/or federal governments, perhaps as part of a public/private partnership to develop the port.[42] One promising initiative is being carried out by the Humboldt Bay Harbor District, in cooperation with the Schatz Energy Research Center at Humboldt State University, to develop a proposal for a multi-purpose marine terminal that would support offshore wind operations as well as commercial fishing, aquaculture, and other uses.[43]

Another port ideally located to support Central Coast wind farm development is Port Hueneme in Ventura County, although its availability to provide sufficient space for large-scale manufacturing and assembly operations is unclear. However, no comprehensive, ground-truthed survey of California ports has been done to determine how much acreage is potentially available near deep-water docks, rail lines, and other useful infrastructure. Previous interviews with ports directors have indicated that many ports are already fully booked with long-term leases dedicated solely to the business of import/export throughput – i.e. moving goods on and off ships.[44] California ports are largely self-governing, and the state has limited regulatory power over them through the State Lands Commission and the Air Resources Board. For these reasons, each offshore wind-related port project would need to be pitched to the individual port commission in question, which would evaluate the proposal based on its perception of the port's own economic interests and planning priorities, not the state's.

Potential offshore wind seaports such as the Port of Humboldt Bay, along with local electricity transmission networks on the North and Central coasts, deserve close consideration for federal economic stimulus funding.

This decentralized governance structure will create a series of challenging tasks for state officials. These challenges will include: identifying the port locations and resources necessary to create single-site hubs or multi-site networks to host and service the new industry; helping project developers navigate among and negotiate with the local port decision-making entities; selecting and marshaling appropriate policy tools to channel resources to ensure adequate facilities at those ports; and helping ensure the availability of well-trained local workforces.

The Trump administration and U.S. Navy

During the Obama administration and the early years of the Trump administration, the federal government took a relatively balanced approach to offshore wind, and the sector enjoyed bipartisan support. BOEM worked cooperatively with state governments on the East Coast and in California to advance the complex process of auctioning offshore lease areas. In the past year, however, the federal stance has changed dramatically.

As mentioned above, BOEM's "cumulative review" of environmental impacts of offshore wind projects along the entire Atlantic seaboard has markedly slowed work on billions of dollars in investment in the sector, and it has cast uncertainty on BOEM's stance toward offshore wind in California as well. Given President Trump's record of opposition to environmental regulation of fossil-fuel projects and his harsh criticism of wind power, his administration's sudden insistence on meticulous environmental review for offshore wind farms has raised questions about political intent, and has been viewed by some industry leaders as a double standard.[45] The implications of BOEM's Atlantic review for California's offshore wind industry remain unclear.

The U.S. Navy has attempted to impose a unilateral ban on offshore wind farms along most of the Central Coast, thus casting in doubt the industry's future. The state will need an effective strategy to overcome this opposition.

A more powerful opponent is the U.S. Navy, which has attempted to veto BOEM's proposed Morro Bay and Diablo Canyon call areas along California's Central Coast on the grounds that they would interfere with military training and testing activities.[46] Extensive negotiations have taken place between the Navy and California state officials, facilitated by U.S. Rep. Salud Carbajal, who represents the Central Coast. In February 2020, a compromise proposal was green-lighted by the Navy, stipulating that wind farm development in federal waters off the Central Coast would be allowed only in two relatively small zones overlapping and outside of the Morro Bay call area.[47] But the deal was criticized by wind industry representatives, who said it would be too small to bring the offshore wind industry to scale and would effectively ratify and make permanent the Navy's ban on wind farms outside the two new zones.[48] Others noted that by bringing turbines as close as 15 miles to the central part of the iconic Big Sur coast – closer than the 20 mile minimum setback farther south, as envisioned in the Morro Bay call area – the proposal could run afoul of the Big Sur Land Use Plan, which strictly regulates viewshed impacts, and thus could weaken chances of Coastal Commission approval of the project(s).[49]

Carbajal's February 2020 deal was soon undermined by the Trump administration, which Carbajal accused of an "abrupt and unilateral decision to walk away from productive negotiations, after months of good-faith efforts by other stakeholders and public engagement."[50] Seeking to rescue the agreement, Carbajal added an amendment to the fiscal 2021 Defense Department authorization bill to obligate the Defense Department to consult

with Congress before unilaterally blocking the slimmed-down lease areas described in the deal. However, Carbajal's amendment would not necessarily prevent the Navy from sticking to its hard line once the Pentagon had duly informed Capitol Hill, nor would it expand the deal's much-criticized parameters.[51]

Whatever the final Congressional outcome of Carbajal's amendment, many state and industry officials are hoping for a different kind of fix: a new U.S. president in 2021. Whether and how quickly a Biden administration might persuade the Navy to alter its stance, and how California should prepare to advocate its case to the military's new civilian leadership, are open questions that have received little public discussion. These dilemmas must be resolved as soon as possible to prevent a Catch-22 in the state's power planning process, as follows: Until the uncertainties with BOEM and the military have been resolved, the CPUC will have difficulty setting long-term procurement commitments for offshore wind for 2030 and 2045; without these procurement targets, the CAISO will face similar difficulties with long-term transmission planning for offshore wind; and without both procurement and transmission targets, state policymakers and wind developers alike will be hesitant to make the necessary, large-scale economic commitments to develop the industry in California.

Pilot projects

Some offshore wind industry advocates say that floating platforms and turbine technologies have been field-tested in other nations, [52] so California could jump the test stage and go straight to full-scale deployment of multi-megawatt projects. But because of the unique environmental conditions of California's coastal waters, as well as the federal bureaucratic resistance to the Central Coast call areas, two proposed pilot projects are worth examining as alternative first steps.

Much public attention has been focused on Humboldt County, where Redwood Coast Energy Authority, the local community choice power agency, and a consortium of wind developers has proposed a 100 MW wind farm off Eureka.[53] This project has a major difficulty, however: transmission. The Humboldt area's connection to the state grid is currently weak, with two PG&E transmission lines totaling 70 MW that import power from the grid. The project would require major construction and upgrading of local electricity substations as well as new transmission to the rest of the state. Research on the details and cost of this work is currently underway by the Schatz Energy Research Center.[54] Depending on the economic and political feasibility of the final cost estimates, the project might be an appropriate target for new federal stimulus legislation, much in the same way as the grid modernization projects nationwide that were funded by the American Recovery and Reinvestment Act of 2009.[55]

Another competing pilot option, which has received less public attention but potentially has a much shorter timeline, would be located in state waters less than three miles off Vandenberg Air Force base in Santa Barbara County. A four-turbine project has been proposed by Cierco

Projects Corp.,[56] while a competing, three-turbine project nearby has been proposed by the French firm Ideol.[57] A pilot at Vandenberg appears to offer several advantages:

- The Vandenberg offshore proposals are advancing under project-specific Defense Department "Clearinghouse" applications that are separate from the military's Clearinghouse review of offshore wind development in federal waters, and they do not appear to face the same degree of military opposition as the BOEM call areas farther offshore.[58] The electricity output from a Vandenberg wind farm could partly serve the military base, which has long suffered periodic power outages and has sought to diversify its power supply. For this reason, the project would increase energy security and reliability for Air Force, NASA, and commercial spaceport operations at the base.[59]
- Unlike the Humboldt project, a Vandenberg wind farm would not need major transmission upgrades because it would tie into the existing, local PG&E grid. Its needed network upgrading would likely be much smaller in scope and thus lower in cost than the upgrading required by the projects in Humboldt,[60] and it might also be an appropriate target for federal stimulus funding.
- By dint of being in state rather than federal waters, a Vandenberg project would avoid the BOEM regulatory and auction processes. Instead, the proposals are being evaluated by the State Lands Commission under a process that would shave years off the federal regulatory timeline and would potentially enable the project to be operational as early as the end of 2024. This would enable the early development of best practices in environmental and workforce policies that could serve as models for the offshore wind industry as a whole.
- A Vandenberg project would avoid coastal viewshed concerns because the only nearby landowner is the Air Force, and civilian access to the base is strictly limited.

Whether the California offshore wind sector will start with pilot projects off the North or Central coasts or will wait for larger-scale development in either region is unclear. But the logic of starting small seems strong. Putting turbines in the water sooner than later would demonstrate the sector's fundamental viability – economically, environmentally, and above all politically. It would demonstrate to stakeholders, regulators, state and federal policymakers, and the general public that the deadlock has been broken and forward movement is underway.

CONCLUSION: NEXT STEPS

Despite the many strong reasons to push forward on offshore wind, the necessary regulatory approvals and industry investments will not happen without decisive state leadership. On the U.S. East Coast, state governments are competing energetically with their neighbors to provide strategic vision for the industry, iron out regulatory processes, provide needed infrastructure

investments in ports and transmission, and set long-term power procurement targets, all in the hopes of attracting large-scale offshore wind operations.[61] In Europe and East Asia, national governments are taking similar steps. As California waits for a change in federal priorities, the Governor's Office, Legislature, and regulatory agencies need to use the time wisely and consider a package of steps to move forward on offshore wind, including the following:

- **Short-term goals:** Support the development of offshore wind pilot projects on the Central and/or North coasts as a first step to break the current deadlock on offshore wind and demonstrate forward movement for the sector statewide.
- **Long-term goals:** Accelerate planning by the CPUC and CAISO for the integration of offshore wind into the state's 2030 and 2045 power procurement and transmission plans.
- **Environmental impact**: Accelerate the funding and completion of needed research to examine the potential impacts of offshore wind development on fish, marine mammals and seabirds, and to design mitigation strategies.
- **Federal government:** Well in advance of January 2021, prepare a strategy to persuade the next presidential administration that offshore wind farms can and should coexist with military activities off the California Central Coast and that the Navy should lift its restrictions on development of the sector. Similarly, the new administration should be persuaded that BOEM should work proactively to help resolve the regulatory difficulties around cumulative environmental impacts review.
- **Infrastructure:** For transmission, prioritize upgrades to local systems in Humboldt County and/or Santa Barbara County for federal economic stimulus funding. For seaports, begin long-term planning for modernization and upgrading of facilities for offshore wind manufacturing, assembly, operations and maintenance. As an initial step, this ports planning should include a ground-truthed survey of space availability and governance in ports statewide. Informed by the results of this survey, consideration should be given to the Port of Humboldt Bay for potential economic stimulus funding from the federal government.

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