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Offshore Wind: A Primer on Trends and Opportunities

January 2021

Contents

Section 1

Introduction to Offshore Wind

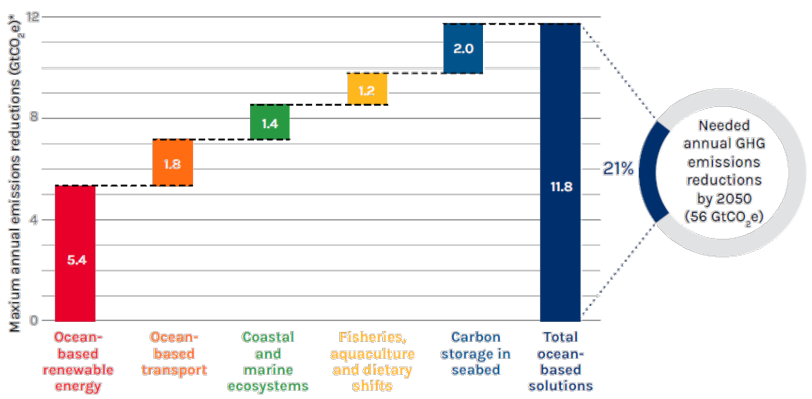
Ocean-based renewable energy provides the largest opportunity to mitigate carbon at sea.

Ocean-based renewables represent 10% of the global emissions reductions needed by 2050 to stay under a 1.5°C warming scenario. It represents the largest opportunity to reduce carbon emissions through marine activities. Of the existing technologies that generate electricity from the ocean, offshore wind is the most commercially advanced. The sector has grown ~30% per year since 2010 and contributed 1% to global electricity generation in 2019, but its future is far from certain. Project development can take a decade, costs billions of dollars, and can be derailed by multiple stakeholders including fishers, local communities, shifting political regimes, regulatory uncertainty, and conservation concerns. To date, there has been surprisingly little investment by the philanthropic community despite the need.

We believe that philanthropy can have an outsized impact in this key climate-wedge through targeted grantmaking.

Offshore wind and other marine renewables represent 45% of emissions reduction potential in the ocean according to the High-Level Panel

Figure ES-4. Contribution of Five Ocean-based Climate Action Areas to Mitigating Climate Change in 2050 (Maximum $GtCO_2e$)



*Notes: * To stay under a 1.5°C change relative to pre-industrial levels*

Source: Authors

Source: https://oceanpanel.org/sites/default/files/2019-10/HLP_Report_Ocean_Solution_Climate_Change_final.pdf

Offshore wind is by far the most developed marine renewable technology.

	Offshore Wind	Other Marine Renewables
Technology	Turbines are installed offshore and are affixed directly to the seafloor or float on a platform that is anchored.	Wave, current, tidal, and ocean thermal energy conversion (OTEC) are all early-stage technologies that seek to harness ocean energy to turn various turbine generators.
2018 energy generation (market share of global renewable electricity generated)	68 TWh of electricity generated (1%) 23 GW of installed capacity (1%)	1 TWh of electricity generated (0.02% of global total) 0.5 GW of installed capacity (0.02% of global total)
2019 installed capacity by country (renewable-specific market share)	1) UK 9.8 GW (35%) 2) Germany 7.5 GW (27%) 3) China 5.9 GW (21%) 4) Demark 1.7 GW (6%) 5) Belgium 1.6 GW (6%) 6) Holland 1.0 GW (3%) 7) Sweden 0.2 GW (1%) … 14) USA 0.03 GW (0.1%)	Korea (48%), France (41%), UK (4%), Canada (4%)

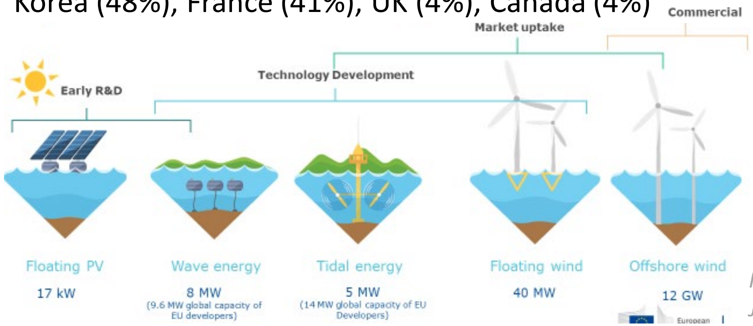


Image credit: JLC 2019

Offshore wind technology improvements will increase turbine size, move farms farther from shore, and add energy storage.

Illustration by Josh Bauer, National Renewable Energy Laboratory (NREL) *Image credit: NREL*

The first fixed-bottom offshore wind project was installed in Denmark in 1991; the first floating project was installed in 2017. Floating technologies represent less than 1% of global installations today, but will be increasingly important as they allow for siting in deeper waters and largely avoid view-shed issues.

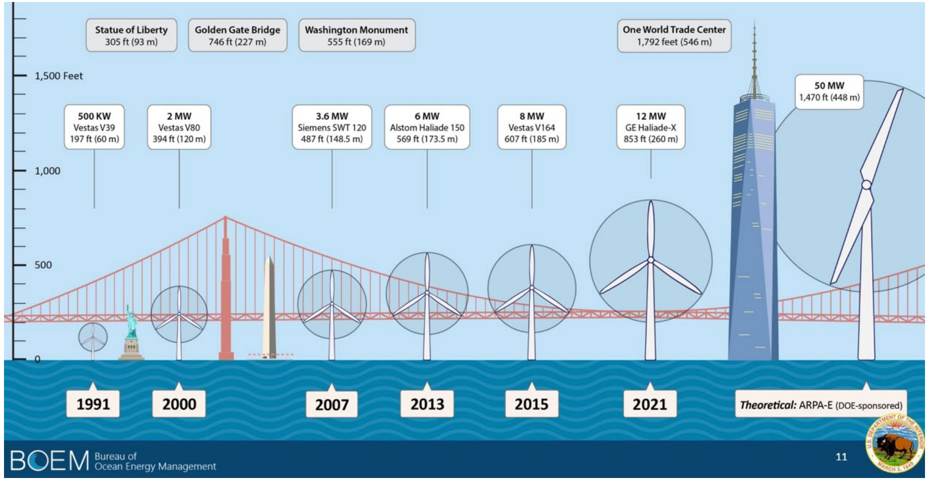
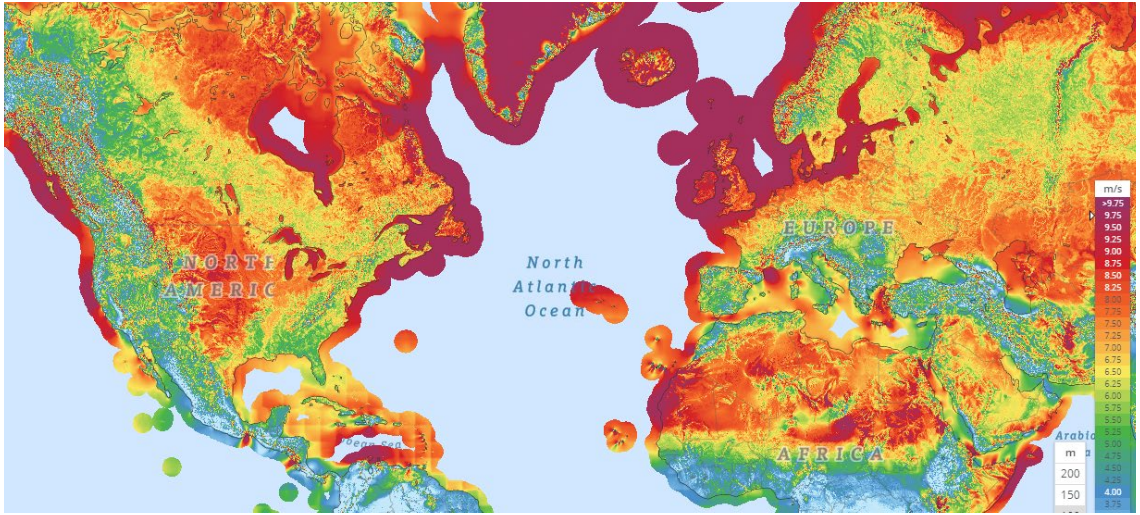


Image credit: BOEM

Turbine size has increased to 12 MW; a Siemens Gamesa 14-MW turbine may be available in 2024 and turbines could grow even larger.

Wind resources offshore are often stronger and more consistent, translating into more reliable electricity production.

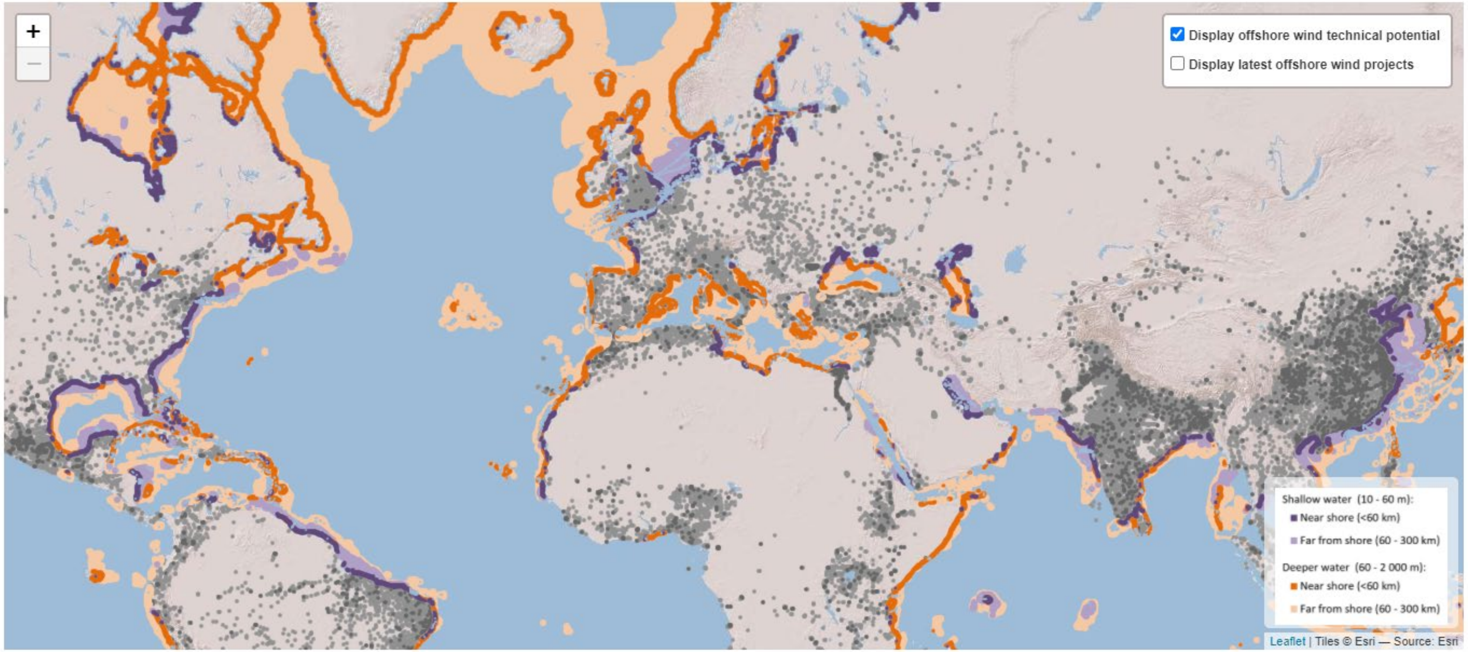
Winds typically blow more strongly offshore where the sea surface is two orders of magnitude smoother than where turbines are sited on land. Wind strength, measured in meters per second, is an important factor because **watt generation is a cubic function of wind speed: if wind speeds double, power generation increases eight-fold**.



"Offshore wind is in a category of its own, as the only variable baseload power generation technology. New offshore wind projects have capacity factors of 40%-50%, as larger turbines and other technology improvements are helping to make the most of available wind resources. **At these levels, offshore wind matches the capacity factors of efficient gas-fired power plants, coal-fired power plants in some regions, exceeds those of onshore wind and is about double those of solar PV**." ~ IEA Offshore Wind Outlook 2019

Offshore wind technical resource capacity is enormous; siting renewables in the ocean will be attractive in many regions.

- The best close-to-shore offshore wind sites could provide almost 36,000 TWh globally per year, which is nearly equal to global electricity demand in 2040.
- For nations with substantial coastline and coastal load centers coupled with limitations to siting large quantities of other renewables or new transmission on land, offshore wind may become increasingly important to achieving aggressive clean energy goals.



Grey dots represent coastal load centers; Shallow (purple) and deeper (orange) offshore wind areas are close to many load centers around the globe.

Offshore wind generation profile is well matched to daily and seasonal demand in key regions.

New York

Figure 5. 110 m MSL Mean Diurnal Profile (Eastern Standard Time) – Location D

Source: AWST (2017)

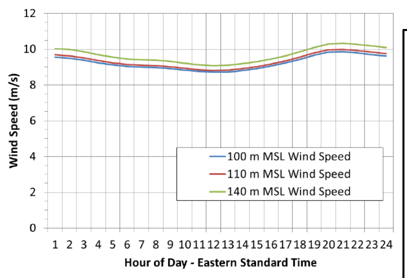
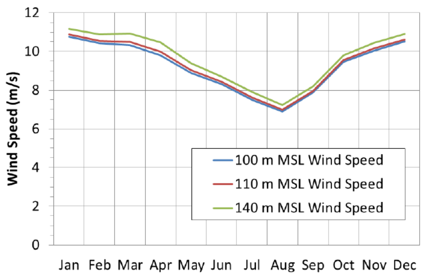


Figure 4. Monthly Mean Wind Speeds – Location D

Source: AWST (2017)



Source: NYSERDA, https://www.nyserda.ny.gov/-/media/Files/Publications/Research/Biomass-Solar-Wind/Master-Plan/17-25o-OSW-Preliminary-Offshore-Wind-Resource-Assessment.pdf

- In New York, wind patterns are strongest at the end of the day and in winter months, complementing solar's profile

China

- In China, offshore wind exhibits low seasonal variability compared to onshore wind, which is concentrated in the winter months

California

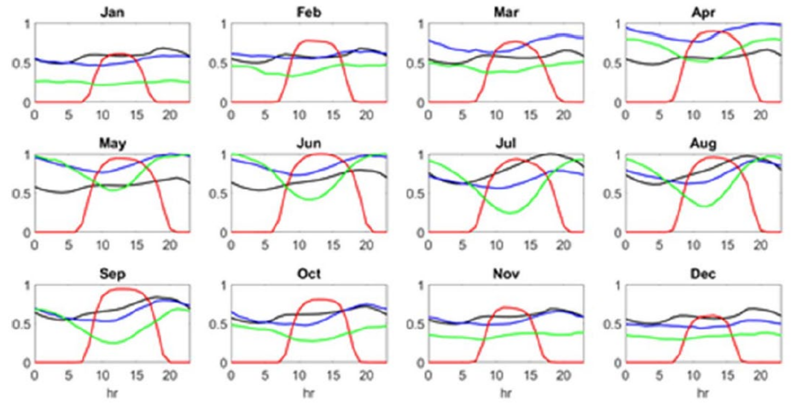


Figure 3. Daily composite averages of hourly California electricity demand (black), solar production (red), onshore wind production (green), and offshore wind production near 46028 (blue) in each month (see text for details). Composite averages are normalized by the maximum over all months and hours of each respective curve. Data from CAISO (http://www.caiso.com/market/Pages/ReportsBulletins/RenewablesReporting.aspx).

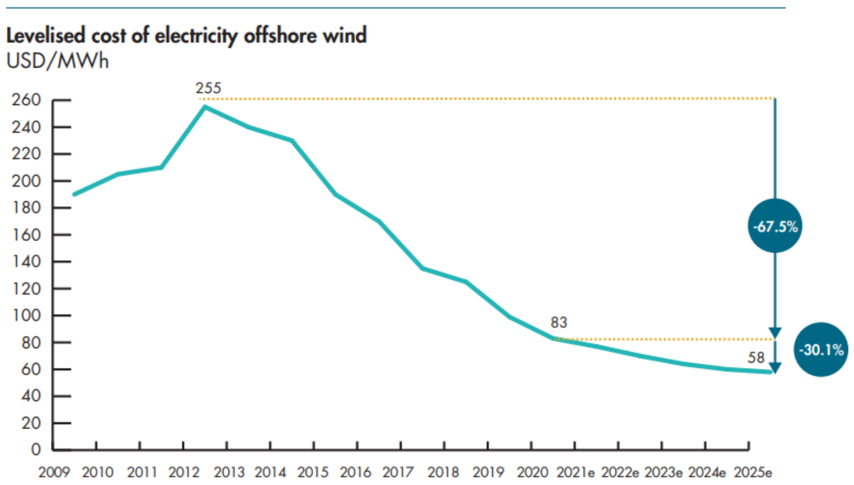
Source: Yang, https://doi.org/10.1088/2515-7620/ab4ee1

- In California, offshore wind (blue line) shows up in the evening and summer months consistently, precisely when California needs it most

Levelized cost of energy (LCOE) of offshore wind production is projected to fall by 46%–77% by 2050 (IRENA 2019).

Offshore wind costs are expected to be competitive this decade. Floating offshore wind costs are expected to be competitive in the early 2030s.

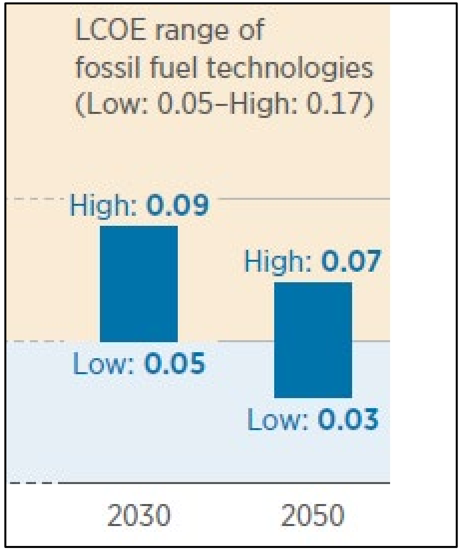
BNEF Projections to 2025



Methodology: BNEF LCOE scope for offshore wind farms includes all transmission costs up to the project's onshore substation, which is also included. The outlook from 2020-2025 is a fitted curve best reflecting future levelized auctions bids (it mixes auctions including and excluding the cost of transmission to shore).

Source: BNEF LCOE Database Jan 2020, GWEC Market Intelligence

IRENA Projections, 2030 & 2050



Source: IRENA, Future of Wind, 2019

Comparative LCOE ($/MWh) Today
Utility-scale solar: $32-44
Land-based wind: $28-54
Combined cycle gas: $44-68
Coal: $66-152

Source: Lazard 3.0

Offshore wind can also be used to produce hydrogen, which may provide a valuable energy storage solution and a renewable fuel.

Offshore wind's high capacity factor (percentage of time producing energy) could make it a good match for hydrogen production.

- Hydrogen-production via electrolysis requires electricity to convert water into liquid fuel.
- Some view hydrogen fuel as a key resource to replace the final ~10% of fossil generation or to decarbonize the building, industrial, or heavy-duty transportation sectors, and can be an alternative to new transmission infrastructure and investment.
- BP and Ørsted plan a 50 MW project producing 9,000 tones H_2 per year.
- Skeptics view the fossil fuel industry's support of long-term renewable hydrogen as means to lock in a generation of LNG infrastructure today.

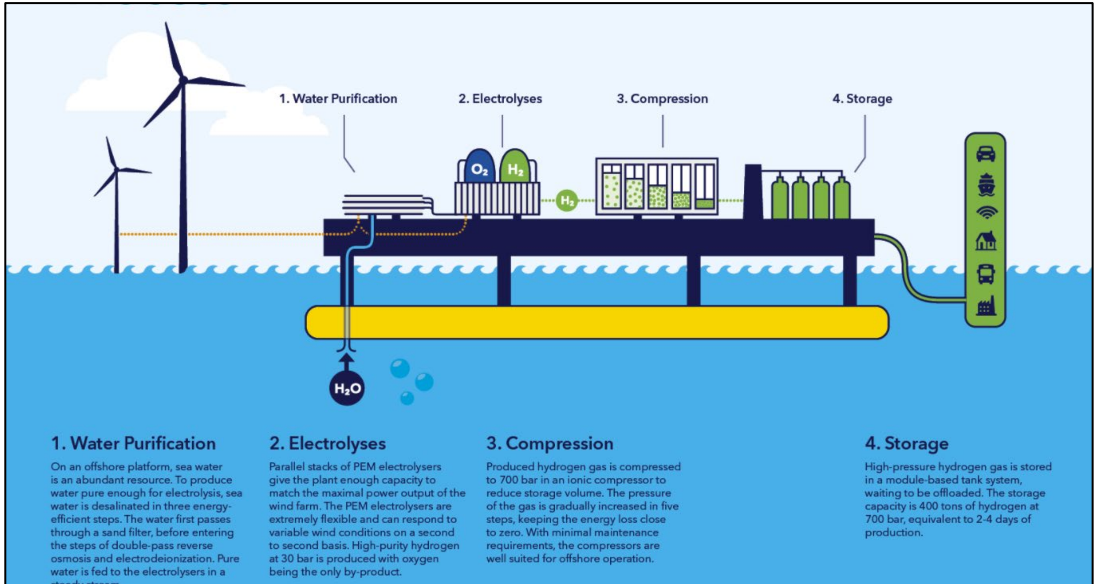


Image credit: DNV GL

Wildlife Concerns

Uncertainty about offshore wind interactions with wildlife has led some groups to emphasize caution in siting and permitting offshore wind.

- Impacts can be a result of bird strikes from the turbines, construction (e.g., noise, benthic habitat disturbance), operation (e.g., electro magnetic fields), or cumulative impacts with other industries (e.g., secondary entanglement in derelict fishing gear). Impacts may be direct (e.g., collisions) or behavioral (e.g., displacement of habitat due to avoidance).
- Species of particular interest or concern vary by region and site (e.g., locations closer to shore may encounter greater biodiversity).
    - On the U.S. east coast, the endangered North Atlantic right whale is the species of greatest concern.
    - On the U.S. west coast, potential interactions are less well known, though effects on marine mammals.
- There are also benefits to wildlife. In particular, wind farms can create de factor marine protected areas, by limiting the use of bottom-tending gear such as trawls and dredges.

Collaboration to Protect Whales
NGOs and the developers of Vineyard Wind agreed to specific measures outside the permitting process to limit impacts to the North Atlantic right whale, including avoiding construction during migration periods, "bubble curtains" and other noise mitigations, and funding for on-going research

Photo credit: NOAA

Photo credit: BOEM

Fishing Concerns

The fishing industry has expressed substantial concern about the effects of offshore wind on their livelihoods. There are considerable unknowns about how fisheries and fishing activities will be impacted.

- Potential benefits and impacts will vary by region, site and fish species and require further study, including baseline data collection.
- Commercial fishermen are concerned about being excluded from large areas they have traditionally operated. At the same time, recreational fisherman have seen benefits from the creation of artificial reefs at turbine piles.
- Fishermen who are concerned about overall loss of fishing grounds, due to the combination of restrictions from MPAs, gear restrictions, offshore wind, shipping traffic, etc., may find more political traction in engagement on decisions about offshore wind siting and permitting.

Lobster fishery unharmed in UK
One of the first long-term studies of an operational offshore wind farm – an assessment of impacts to a local lobster fishery in the U.K.– found no detectable impact from construction or operations of offshore wind.

Disputes over fishing mitigations at Vineyard Wind
A proposed 800 MW project off the coast of Massachusetts has faced multiple permitting delays, in part driven by concerns about cumulative impacts from multiple OSW projects to the fishing industry and disagreement about the length of fishing lanes (1 vs. 4 miles). The Trump administration threatened additional delays at the end of 2020.

Photo credit: AWEA

Photo credit: Orsted

Assessment and Mitigation of Impacts

Wildlife Impacts

- Public and industry commitment to research and data collection, beginning with baseline assessments of where species are
- NGO-industry collaborations to identify research priorities (e.g., POWER work group in California)
- Early ocean spatial planning to avoid most sensitive areas while accounting for multiple ocean uses and identifying sufficient space for offshore wind development
- Government commitment of staff time and research to assess impacts and process permits
- Development of best practices for mitigation and adaptive management, such as modified wind energy areas, construction schedules, operating plans, etc.
- Reconciling risks with alternatives: climate change and building different renewables in other, albeit equally sensitive ecosystems.

Fishing Industry

- Public and industry commitment to research and data collection (e.g., ROSA), beginning with baseline assessments of where fish populations and fisheries intersect with wind development areas
- Industry-Industry working groups to facilitate constructive dialogue and agreements (Note, however, that consolidating individual local fishing interests into a single representative voice, like RODA, may hinder collaboration)
- Early ocean spatial planning that accounts for benefits (e.g., creation of de facto MPAs) and risks (reduced fishing ground) from offshore wind holistically
- Mitigations and compensation including those required by permit (modified plant design) and voluntary agreements (upgrades to harbors that benefit fishing industry, monetary compensation)
- Reconciling risks with alternatives (i.e., depletion of fisheries from climate change) and proper attribution of impacts (OSW conflicts vs. overfishing)

Offshore wind remains in its infancy in many geographies; philanthropy and civil society can address several critical challenges.

Issues Ill-suited for Philanthropy

Cost	Projects cost billions to construct and power is often more expensive than other renewables (but falling rapidly).
Technology	While shallow-water fixed turbine farms are commonplace, novel floating technology is needed in many places.
Transmission	New transmission infrastructure is needed to onshore electricity generated at sea.
Supply Chain Development	New supporting industries and supply chains are needed to support the development of large-scale offshore wind.

Issues Well-suited for Philanthropy

Stakeholder Engagement	Commercial fishers, local residents, conservation advocates, and others have opposed offshore wind development.
Spatial Planning	Siting wind farms near population centers requires balancing the needs and safety of others (transportation, shipping, defense, fishing).
Wildlife Interactions	Birds, bats, cetaceans, fish, and other fauna are potentially affected by turbines & installation; Need policy commitment to ongoing research and responsible siting and operation.
Political Support	Countries often support offshore wind development through targets, subsidies, infrastructure investments, and economic development planning that maximizes local benefits from the industry.

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Section 2

Global Trends

"Offshore wind currently provides just 0.3% of global power generation, but its potential is vast. Much work remains to be done by governments and industry for it to become a mainstay of clean energy transitions."

Dr Fatih Birol, IEA Executive Director

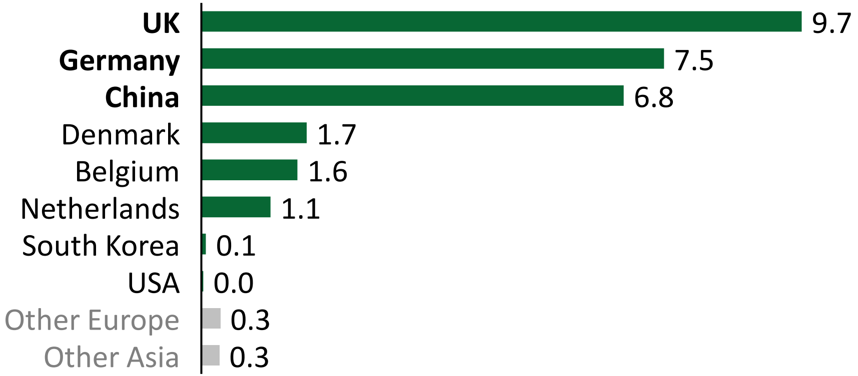
Only three countries have more than 2 GW of installed offshore wind generation capacity; the US has less offshore wind than Belgium.

29 GW

The world's offshore wind generation capacity in 2019

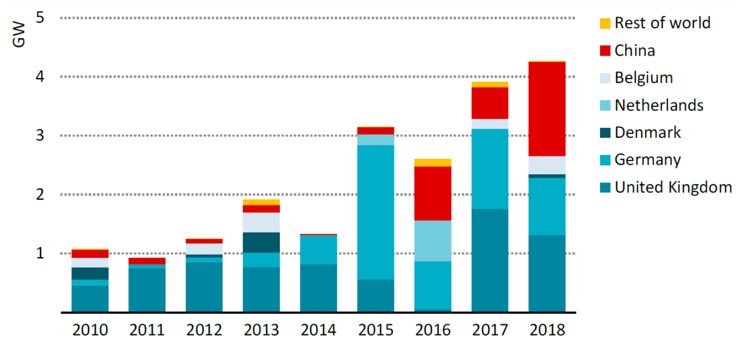
Global coal-fired generation capacity was 2,047 GW

Global renewables generation capacity was 2,533 GW



Cumulative offshore wind generation capacity in 2019 (GW)

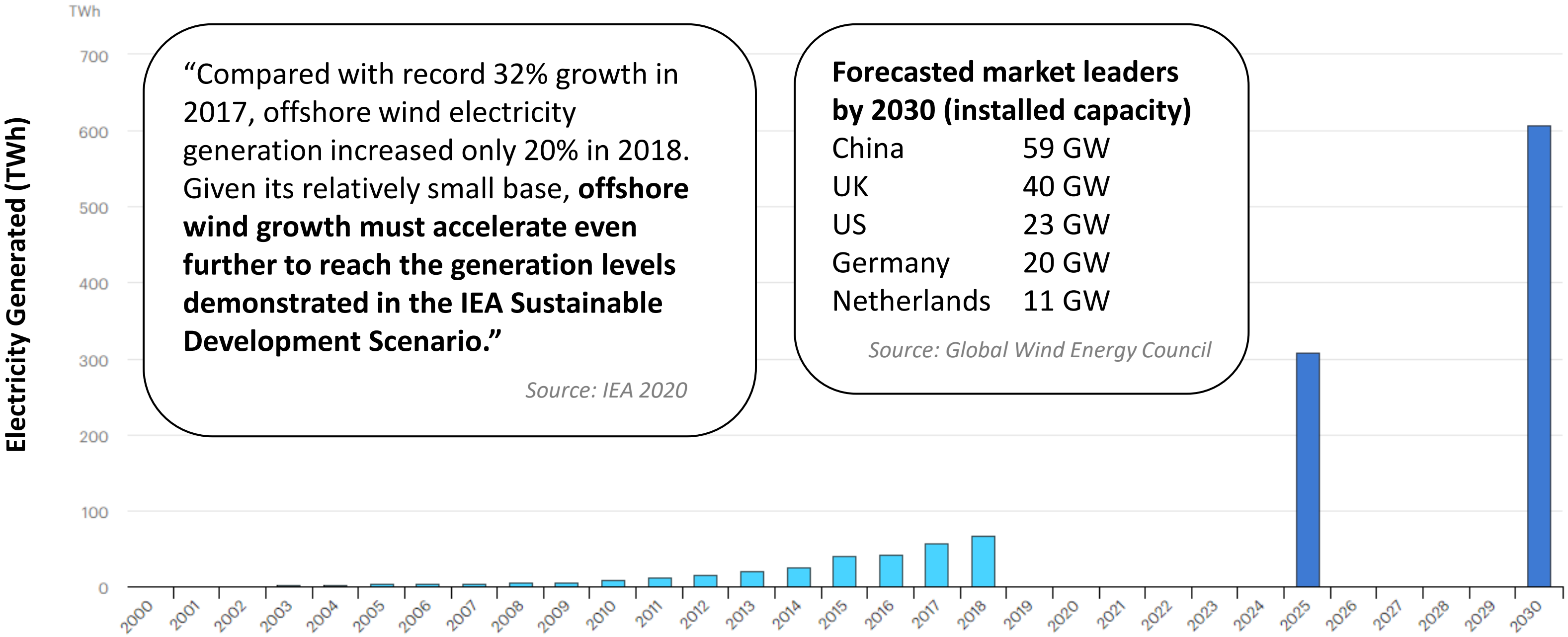
Figure 1 ▹ Annual offshore wind capacity additions by region, 2010-2018



Deployment of offshore wind has increased by nearly 30% per year since 2010, second only to solar PV, as the technology and industry have matured

Since 2014, **only China, Germany, and the UK have added meaningful amounts of offshore wind** to their national grids.

Despite recent double-digit growth in installed capacity, a large gap remains to achieve target levels of offshore wind generation.



"Compared with record 32% growth in 2017, offshore wind electricity generation increased only 20% in 2018. Given its relatively small base, **offshore wind growth must accelerate even further to reach the generation levels demonstrated in the IEA Sustainable Development Scenario."**

Source: IEA 2020

Forecasted market leaders by 2030 (installed capacity)

China	59 GW
UK	40 GW
US	23 GW
Germany	20 GW
Netherlands	11 GW

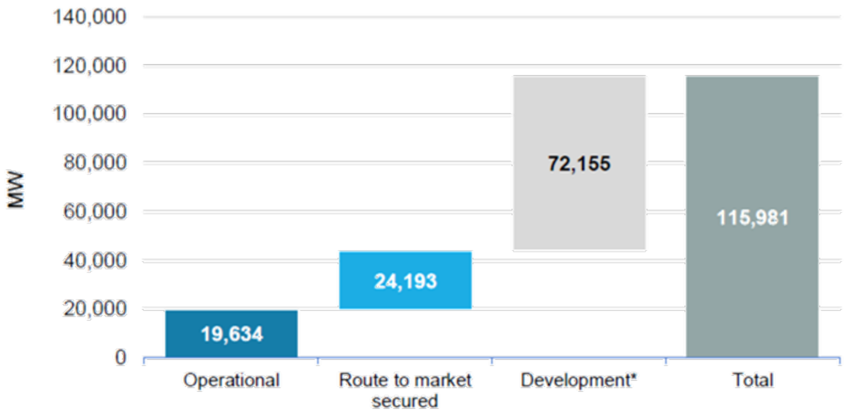
Source: Global Wind Energy Council

Offshore wind power generation in the IEA Sustainable Development Scenario 2000-2030

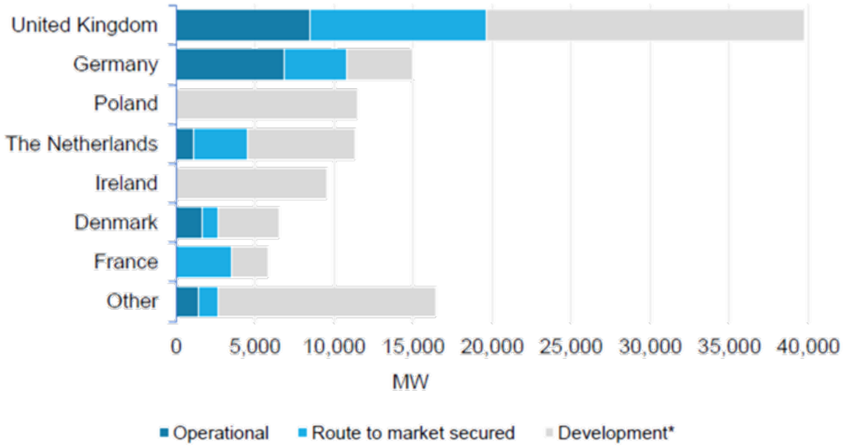
Europe leads in offshore wind development but has a long way to go to achieve targets, including breaking ground in Poland and Ireland.

European Commission Strategy targets 300 GW offshore wind by 2050

European Offshore Wind Capacity by Development Stage (2019)



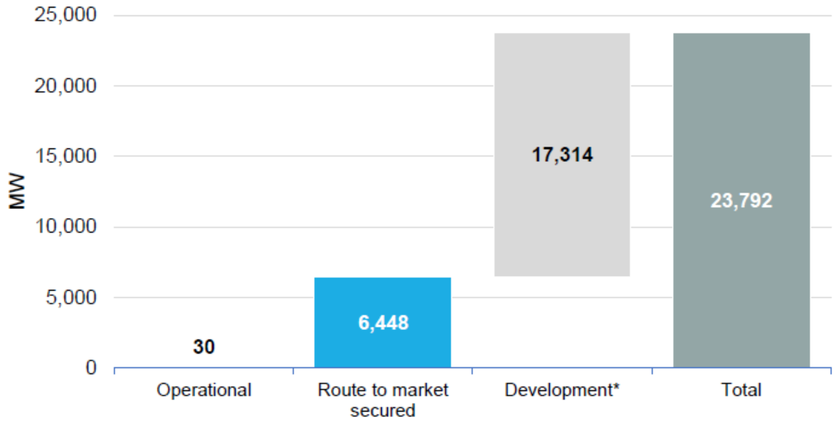
European Countries Offshore Wind Capacity by Development Stage (2019)



Source: Renewable Consulting Group

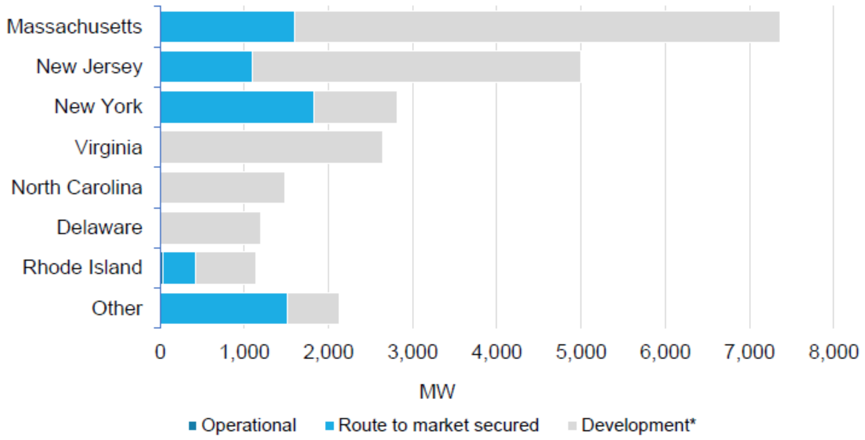
The United States offshore wind power sector is just now getting off the ground with states setting its own targets and supporting project development despite a lack of federal support.

US Offshore Wind Capacity by Development Stage (2019)



*does not include lease areas without owners (i.e. call areas that have yet to be leased

State Offshore Wind Capacity by Development Stage (2019)



*does not include lease areas without owners (i.e. call areas that have yet to be leased

Source: Renewable Consulting Group

Global offshore wind targets exceed 275 GW by 2030

Country/Region	Current Deployment (2020)	2030 Goal	2050 Goal
EU [European Commission Strategy](1)	21 GW	60 GW	300 GW
Germany	7.5 GW	20 GW	40 GW
France		8.75 GW (2028)	-
Netherlands		11.5 GW	-
UK	10.4 GW	40 GW	-
China	6.8 GW	66.5 GW (individual provinces)	-
South Korea	0.124 GW	12 GW	-
Japan	0.065 GW	-	-
India	0	30 GW	-
U.S.	0.044 GW	29 GW by 2035 (individual states)	-

Source: Various News Media

IEA's Energy Technology Perspectives 2 degrees scenario, designed to limit global warming to 2 degrees Celsius, calls for 125 GW of offshore wind globally by 2030 and 410 GW by 2050

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Section 3

Offshore Wind in the US

"What happens in the next five years is going to make all of the difference between today's 42 megawatts of capacity [in the US] and getting to our 29 gigawatts of commitments."

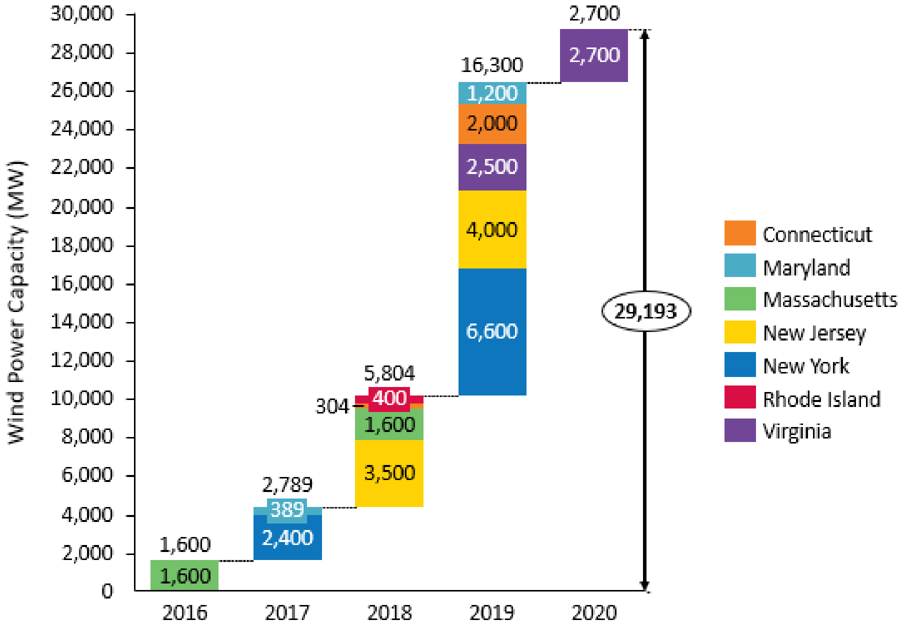
Key Informant, US eNGO

Individual states in the U.S. have committed to a combined 29 GW of offshore wind by 2035; today the US has 7 operational offshore turbines generating <1% of the 2030 target.

The US is projected to be among the 2030 leaders in installed offshore wind capacity as states have committed to constructing 29 GW of capacity by 2035. Key informants agree **this outcome is highly uncertain** due to various factors including political uncertainty at the state and federal level influencing procurement commitments and subsidies, potential stakeholder acrimony, permitting delays, and project finance considerations.

Currently, **only two small projects are generating offshore wind power in the United State**: Block Island Wind in Rhode Island (5 turbines, 30 MW) and Dominion Energy in Virginia (2 turbines, 12 MW).

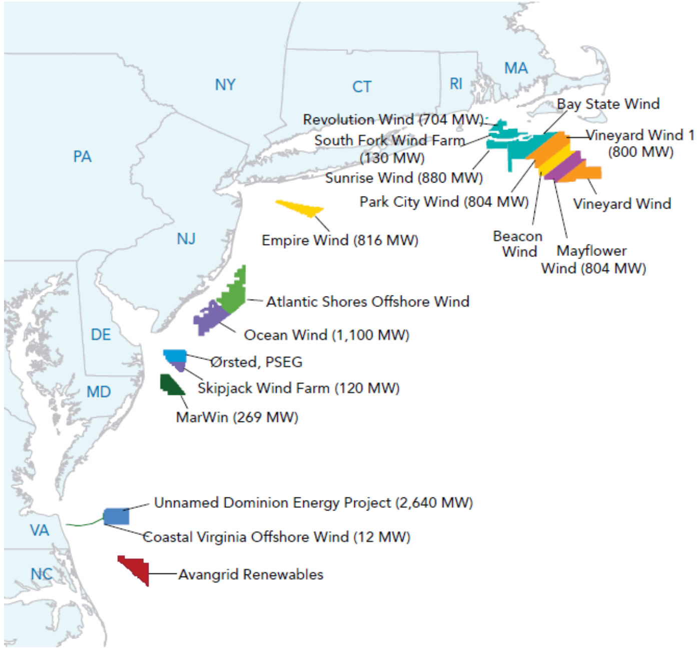
Multiple proposed projects have failed or been delayed at the permitting stage, including the US's first offshore project—Cape Wind in Massachusetts—which shuttered in 2017 after 16 years in development.



Source: American Wind Energy Association, 2020

10 projects are currently slated to be completed along the East Coast in the next seven years; 3 more are in development.

Offshore wind projects and lease areas for the US East Coast



Source: American Wind Energy Association, 2020

Year	Project (Developer)	Customer	Capacity
2023	Vineyard Wind 1 (Vineyard Wind)	Massachusetts	800 MW
2023	South Fork Wind Farm (Orsted)	New York	132 MW
2024	Ocean Wind (Orsted)	New Jersey	1100 MW
2024	Sunrise Wind (Orsted)	New York	880 MW
2023	MarWin (US Wind)	Maryland	248 MW
2023	Revolution Wind (Orsted)	CT/RI	704 MW
2023	Skipjack Windfarm (Orsted)	Maryland	120 MW
Mid-2020s	Empire Wind (Equinor)	New York	816 MW
2025	Park City Wind (Vineyard Wind)	Connecticut	804 MW
Mid-2020s	Mayflower Wind (EDPR-Shell)	Massachusetts	804 MW

A tale of two coasts: while the East Coast is committing to offshore wind this decade, the West Coast lags behind for multiple reasons.

There are a suite of factors for why the East Coast is better suited than the West Coast for offshore wind.

	East Coast	West Coast
OSW commitments	29 GW in various state policies	No commitments
Ocean depth	Relatively shallow, allowing fixed bottom turbines that are less expensive and widely used	Relatively deep, requiring floating platform turbines that are more novel and expensive
Proximity to load centers	50+ million people live between Boston and DC (<500m) with more substantial coastal transmission infrastructure near offshore farms	Major load centers are more distributed with limited transmission infrastructure to deliver power from offshore wind farms
Alternative sources of renewables	Relatively difficult to access major domestic renewable sources raises priority of OSW	Easy access to major solar and onshore wind provides cheap alternatives
Biggest stakeholder challenge	Commercial fisherman are widely seen as most outspoken opponent of East Coast OSW	Department of Defense operations prohibit offshore wind in Southern California and significantly limits offshore wind development potential in the Central Coast

Currently there are three areas where offshore wind has been proposed on the West Coast, all in California.

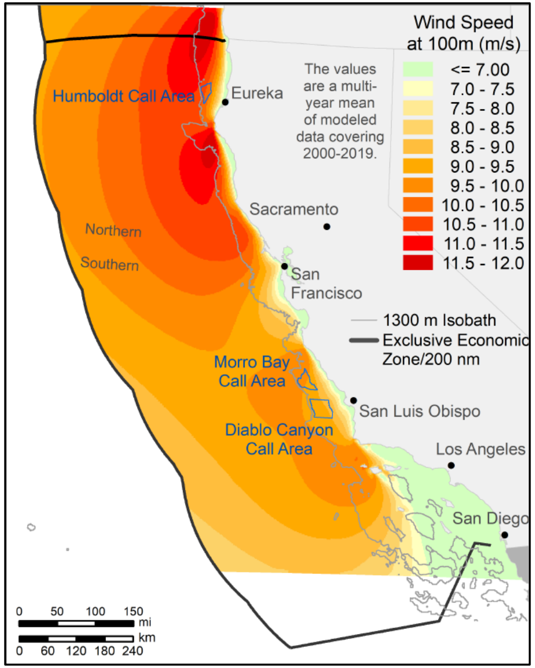


Image: NREL, 2020

California is conspicuously absent among the states leading in commitments to offshore wind despite the state's commitment to 100% renewables energy by 2045. There are three call areas for which project developers could propose project in California, but without a state commitment to plan and create procurement pathways for offshore wind, they will likely remain undeveloped. California's deep coastline, abundant renewable alternatives, large marine protected areas, Defense Department restrictions, and lack of transmission infrastructure all contribute to the slow market adoption of offshore wind without further intervention.

CA call area	Key Strengths	Key Weaknesses
Humboldt	Best wind resource in CA Minimal interaction with shipping lanes or protected areas Most well studied to date	Far from load centers Major transmission infrastructure needed through difficult terrain
Morro Bay & Diablo Canyon	Substantial existing transmission infrastructure, including from nuclear plant retiring in 2025 Can replace retiring nuclear power and coastal gas plants	Department of Defense objections Adjacent to marine sanctuaries Significant vessel traffic Active fishing interests

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Section 4

US Philanthropic Landscape

"There is only a few million a year in total committed to supporting offshore wind in the US, within the [US] landscape of roughly $400m in climate funding annually."

Foundation program officer

Offshore wind is widely viewed as underfunded relative to the emissions reduction potential.

Offshore wind has not been an area of concentration from the environmental funding community. There are several rationales:

(1) energy and climate funders are awash with nearer term opportunities (e.g., solar, onshore wind, transmission);

(2) marine conservation funders are ambivalent about industrial development in the marine environment;

(3) project costs are massive (e.g., >$1b), and there is often a sense that the wind industry can take care of itself; and

(4) offshore wind development unfolds on a decadal scale.

All told, **we would estimate that there is $4–6 million of grantmaking to support offshore wind by foundations in the US**. The Barr Foundation is the largest grantmaker with a grantmaking budget for offshore wind around ~$2–3 million annually. We do not know the full funder landscape supporting offshore wind via labor organizations, but it is likely modest and probably totals ≤ $1 million annually.

Funders supporting offshore wind

Barr Foundation

The John Merck Fund

Rockefeller Brothers Fund

Energy Foundation

Bloomberg Philanthropies

Z. Smith Reynolds Foundation

The New York Community Trust

The Scherman Foundation

Marine funders that have made exploratory grants on offshore wind

The David & Lucile Packard Foundation

Gordon and Betty Moore Foundation

Funders that participated in a recent roundtable hosted by Climate Jobs New York

- The Scherman Foundation
- Northlight Foundation
- The McArthur Foundation
- David Rockefeller Fund

Coalitions are forming at state and local levels around offshore wind; there is a lack of coordination nationally among NGOs.

National eNGOs

National Wildlife Federation

NRDC

Ocean Conservancy

Sierra Club

Audubon

clf Conservation Law Foundation

Center for American Progress

TNC

Labor Partnerships

BlueGreen Alliance

Climate Jobs NY

Climate Jobs National Resource Center

NY Offshore Wind Alliance

Research and Science Organizations

University of Delaware College of Earth, Ocean, & Environment Special Initiative on Offshore Wind

poet Pacific Ocean Energy Trust

REGIONAL WILDLIFE SCIENCE ENTITY FOR ATLANTIC OFFSHORE WIND

American Wind Wildlife Institute

ROSA

Engagement at every level of government can help translate early commitments to contracts, siting, building, and operation.

Federal

- **Presidential administration matters** and Biden is supportive of offshore wind. Appointed staff at the **Dept of the Interior and Department of Defense/U.S. Navy** can prohibit or substantially slow down permitting processes. That can cause developers to miss contractual obligations with offtakers and project financers and kill projects.
- **Federal tax credits** create "tax-equity" that often compose 30% of an OSW farm's project financing.

State

- **State commitments to buy offshore wind power are currently the most powerful incentive driving industry investment**. This can take many forms (gubernatorial orders, state legislation), but explicit commitments to buy power long-term give developers the security to invest in 30+ year OSW projects.
- **Infrastructure development investment** is needed to retrofit ports to support a new maritime industry; grid infrastructure is needed to onshore power. NY committed $200m for OSW upgrades.

Local

- **Combating NIMBYism at the municipal level** is critical to support offshore wind. Local opposition killed Cape Wind and hinders each of the existing projects.
- **Transmission siting** will be a critical issue for many offshore farms as municipalities need to approve industrial power cables coming onshore through their beaches and under their roads to integrate with the existing grid.

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Section 5

EU Foundations & CSOs

"...Already, offshore renewable energy is a true European success story. We aim to turn it into an even greater opportunity for clean energy, high quality jobs, sustainable growth, and international competitiveness."

Frans Timmermans, Executive Vice President for the European Green New Deal

European philanthropic funding for offshore wind is modest.

Offshore wind has not been an area of concentration from the environmental funding community in Europe. We have not found major sources of philanthropic funding for offshore wind in Europe. The only known source of philanthropic funding for offshore wind strategy in Europe is via the European Climate Foundation as a strategy supported by its core funding. We believe that the Velux Foundations may have provided aligned funding.

Funders supporting offshore wind

European Climate Foundation

Aligned funding to key ECF Partners

THE VELUX FOUNDATIONS
VILLUM FONDEN VELUX FONDEN

The EU's Offshore Renewable Energy Strategy will build off the leadership off its Member States.

EU Offshore Renewable Energy Strategy

Passed in November 2020, EU's Offshore Renewable Energy Strategy proposes to increase offshore wind capacity from 12 GW to at least 60 GW by 2030 and 300 GW by 2050.

The Commission will encourage cross-border cooperation between Member States and help generate investment. The strategy will:

- Set ambitious targets for growth
- Encourage public and private investment in infrastructure and research
- Make it easier for different regions to work together
- Provide a clear and stable legal framework

Leaders among EU Member States

Netherlands plans to build the largest OSW farm at 1.5 GW, expected to be online in 2023. It set a national target of 11.5 GW by 2030.

Germany has been actively promoted the offshore wind agenda: central to the German push was the adoption of the EU Offshore Renewable Energy Strategy in November 2020.

Poland's Council of Ministers has adopted a draft Offshore Wind Act that sets Poland on the way to auction almost 6 GW of OSW capacity by the end of June next year.

No longer part of the EU, **the UK is the leader in offshore wind, both in Europe and globally**. Recently, PM Boris Johnson pledged to increase the UK's total offshore wind capacity from 30GW to 40GW by 2030 with £160 million invested in ports and infrastructure.

European industry and civil society lead discussions on market design and environmental impacts.

Industry Organizations

SIEMENS Gamesa RENEWABLE ENERGY

VATTENFALL

Ørsted

Wind EUROPE

Civil Society

EPG ENERGY POLICY GROUP

CAN CLIMATE ACTION NETWORK Europe

CSD CENTER FOR THE STUDY OF DEMOCRACY

WWF

Research and Science Organizations

CEPS

Guidehouse

E3G

Section 6

East Asian Context

"Asia would take the lead in the coming decades with more than 60% of global installations [of offshore wind] by 2050"

IRENA Future of Wind

East Asian context

At 6.8 GW of deployed offshore wind resources in 2020, China leads the pack in East Asia with small and emerging contributions from South Korea and Japan.

According to the GWEC, by 2024, the majority of growth in Asia is projected to come from China and Taiwan with China maintaining 70% of the market share. From 2025–2030 Japan, South Korea, and Vietnam will overtake some of the market share as projects are connected.

The top five markets in this region in the coming decade are expected to be:

- China (52 GW)
- Taiwan (10.5 GW)
- South Korea (7.9 GW)
- Japan (7.4 GW)
- Vietnam (5.2 GW)

IRENA's Future of Wind scenario similarly expects Asia will dominate the offshore wind market globally in the future, with a third of capacity installed in China

IRENA, Future of Wind Scenario, Installed Capacity (GW) Projections for Asia, October 2019

Industry associations and research institutes are major players in China with additional involvement from foreign NGOs.

Industry and Trade Associations

CREIA

中国风能协会
CWEA

OREAC
OCEAN RENEWABLE ENERGY
ACTION COALITION

中华新能源
China New Energy

广东省环境保护产业协会
GDAEPI

Foreign NGOs

ENERGY FOUNDATION
能源基金会

iCET
INNOVATION CENTER FOR ENERGY AND TRANSPORTATION

Industry associations and research institutes drive policy and research in East Asia.

Japan

GEC Global Environment Centre Foundation

IEE JAPAN

RENEWABLE ENERGY INSTITUTE

JWPA Japan Wind Power Association
General Incorporated Association
Japan Wind Power Association

Vietnam

VIET
Vietnam Initiative for Energy Transition

CARBON TRUST

Korea

ECO NETWORK
FOR SUSTAINABLE FUTURE

KIER 한국에너지기술연구원
KOREA INSTITUTE OF ENERGY RESEARCH

KWEIA 한국풍력산업협회
KOREA WIND ENERGY INDUSTRY ASSOCIATION

Taiwan

TwnWEA
TAIWAN WIND ENERGY ASSOCIATION

ITRI
Industrial Technology Research Institute

GWEC
GLOBAL WIND ENERGY COUNCIL

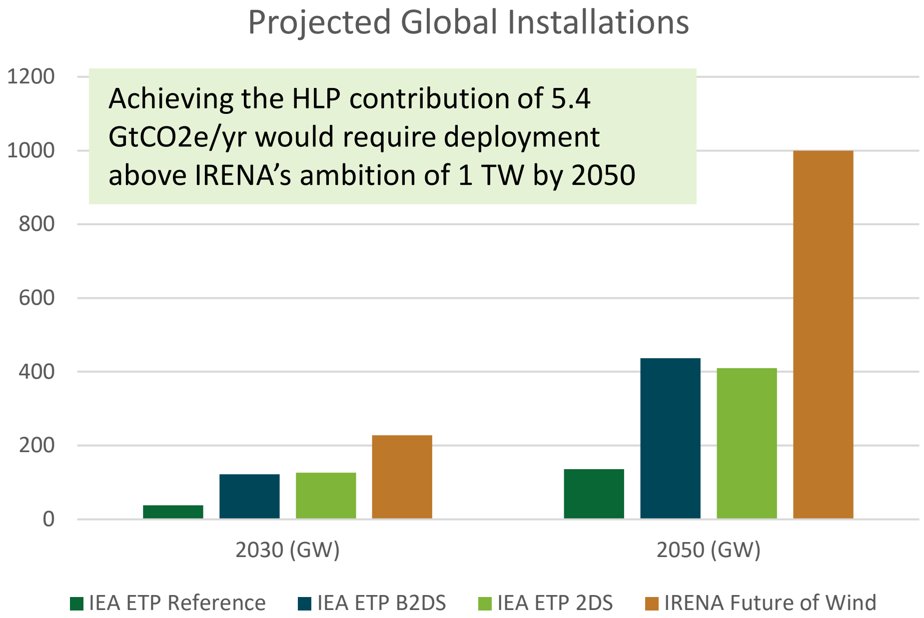
Section 7

Conclusion

> **“The ocean covers nearly three-quarters of the world, and ocean based renewable energy is a major opportunity to combat climate change and develop a greener, healthier and wealthier world.”**

OREAC, The Power of Our Ocean Report

National and local policy will determine whether OSW meets or exceeds its global potential.



Sources: IEA, Energy Technology Perspectives, 2017
IRENA, Future of Wind, 2019

In all regions, policy frameworks should:

- Create a market pipeline, through lease auctions and state or national targets
- Establish clear, certain, efficient permitting processes
- Support procurement mechanisms and contract structures that de-risk offshore wind up-front investments (e.g., long-term purchase agreements, tax credits, offshore wind "credits)
- Involve stakeholders early and regularly