



Offshore Wind Energy- Nonmarket Considerations

One of the biggest challenges of the anticipated rapid pace of offshore wind development is holistically assessing the cumulative impacts on environmental and social systems. This is a new area of development and operational activity, which is anticipated at a scale of deployment in the next two decades not seen before, to meet renewable energy ambitions and demands.

The Biden Administration’s “Advance Ambitious Wind Energy Projects to Create Good-Paying, Union Jobs” announced a new Wind Energy area in the New York Bight, an area of shallow waters between Long Island and the New Jersey coast. US Department of the Interior, Department of Energy and Department of Commerce announced a shared goal to deploy 30 gigawatts of offshore wind energy in the United States by 2030 while protecting biodiversity and promoting co-use. In addition to the thousands of jobs that will be created, this will generate enough power to meet the demand of more than 10 million American homes for a year and avoid 78 million metric tons of CO2 emissions.

These are very ambitious goals, and the economic arguments strongly support offshore wind projects as part of reliable and stable global energy markets. In addition, reduction in greenhouse gas emissions and decreasing dependence on fossil-fuel based electricity generation are compelling arguments. The counterargument to this is the unknown potential cumulative impacts on ecosystems and human social systems. Due to the complexity of the environmental review and authorization process for offshore wind development, the process can be greatly enhanced through a holistic integrated workflow, owned by a single Federal agency with comprehensive oversight. This would be an extension of the National Environmental Policy Act (NEPA) and Section 106 National Historic Preservation Act (NHPA) integrated process.

The scale and pace of offshore wind development in the current decade is expected to be at unprecedented levels. It is imperative that the required processes are in place, in a coordinated, structured, and integrated way, to manage and mitigate unintended environmental and social consequences resulting from this scale and pace of deployment and operational activity.

The strong message here is that nonmarket strategies must drive offshore wind energy projects and the process leading up to large scale deployment and operational activity is long and complex. Now that the ambitions have been set, there is no quick and easy solution to renewable energy and sustainable development- the hard but essential work is now beginning. This is not going to happen with the flick of an (electric) switch. You can read more about what is involved using the New York Bight project as a case study.

A recent article in The Economist discussed the “missing ingredients” in investments in renewable energy. These bottlenecks according to the article are in supply chains, site approvals and finance. The article spoke to the booms in renewable energy investment and electric vehicle manufacturing, all in support of governments’ aspirations to drastically

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reduce greenhouse gas emissions. Considering the economic scale, the article noted that capital remains poorly allocated, with the specific example of big companies rushing to secure offshore wind-leases in Britain earlier in 2021 and paying so much for access that future economic returns risk being non-existent. At the same time, investment in poorer countries is severely underrepresented, and these are the locations that need the increased investment to address greenhouse gas emissions while seeking sustainable development. In my opinion, it is near impossible to achieve global cost competitiveness in renewable energy projects, while this major global disparity exists.

Case Study- New York Bight Empire Wind Energy Project What's really involved?

In summarizing its Offshore Wind Initiatives in 2018, the US Department of Energy (DOE) stated that the winds off the shores of the Coastal and Great Lakes States have the technical resource potential two times as large as the entire US nation's current electricity use. With the decreasing development and operational costs, the DOE has noted that offshore wind has the potential to contribute significantly to a clean, affordable, and secure national energy mix.

In May 2021, the Biden administration announced a set of bold actions to catalyze offshore wind energy, strengthen the domestic supply chain, and create good-paying union jobs, through its coordinated support of rapid offshore wind deployment and job creation. The administration established a target of employing tens of thousands of workers to deploy 30 gigawatts of offshore wind energy by 2030. If this target is achieved, the pathway is set to unlock 110 gigawatts of wind energy by 2050 with significant implications of economic opportunities for the impacted communities, and energy independence for the US nation through access to clean and abundant renewable energy.

The Interior Department's Bureau of Ocean Energy Management (BOEM) facilitates the responsible development of renewable energy resources on the Outer Continental Shelf (OCS). The Energy Policy Act of 2005 (EPA) authorized the regulations that provided a framework for issuing leases, easements and rights-of-way for OCS activities that support production and transmission of energy from sources other than oil and gas. Lease Sale ATW-6 Offshore New York was proposed in June 2016 with the final sale notice issued in October 2016. There were 6 participants, with 33 rounds over two days, with a high bid of \$42,469,725 by Statoil Wind US LLC (now Equinor Offshore Wind US LLC) and is the highest grossing and longest auction to date. Commercial lease OCS-A-0512 (Figure 1) was awarded to Equinor in April 2017 and branded the Empire Wind energy project. In 2020, BP Wind Energy North America Inc. and Equinor Offshore Wind US LLC became 50/50 strategic partners in Empire Offshore Wind LLC.

Highlights of the project include:

- More than 2 gigawatts of clean, affordable, renewable energy to New Yorkers
- First power is expected in 2025 (pending BOEM action and project approvals) and supports New York's goal of 9 gigawatts of offshore renewable energy by 2035

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Figure 1- location of lease area for Empire Wind energy project. (Source: Equinor)

Economic Value Determination:

The Energy Information Administration (EIA) notes that New York’s Clean Energy Standard was revised in 2019 to require 100% carbon-free electricity by 2040. In 2019, 29% of New York’s in-state generation came from renewable sources. The primary source of electricity (April 2021) is from natural gas-fired plants, followed by nuclear energy, hydroelectric power and nonhydroelectric renewables, as shown in Figure 2. In New York, the average retail price of electricity to the residential sector is \$18.50/kWh (EIA, April 2021), and ranks 9th in price per kWh relative to other states.

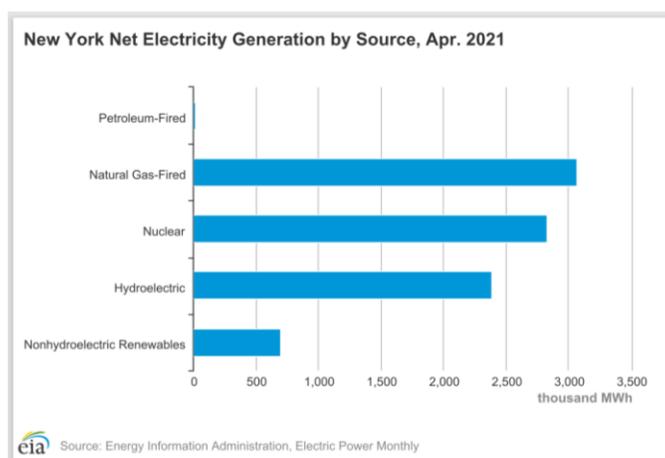


Figure 2: New York state monthly electric power (Source: Energy Information Administration, April 2021).



To achieve the state's 2040 ambition of zero carbon electricity, renewable sources of electricity generation must necessarily increase over the next two decades. New York's goal of 9 gigawatts of offshore renewable energy by 2035 is a major component of the 2040 zero carbon electricity ambition. The Empire Wind energy project is expected to deliver 2 gigawatts of energy, with first power expected in 2025.

Elements of Standards and Status Markets:

New York State Energy Research and Development Authority (NYSERDA) is advancing energy efficiency, economic development, cost competitiveness and use of renewable energy, and reduction on reliance on fossil fuels, while working to protect the environment. NYSERDA issues competitive solicitations for offshore wind energy and contracts with offshore wind developers to purchase offshore renewable energy certificates (ORECs). New York now has five offshore wind projects in active development- the largest offshore wind pipeline in the nation with a total of more than 4.3 gigawatts, which represents almost 50% of the state's 2035 goal. Two of these projects are Empire Wind 1 and Empire Wind 2, which will collectively contribute 2.7 gigawatts of energy and is the focus of this case study.

NYSERDA has stated that the offshore wind projects will bring tremendous economic benefit to New Yorkers. These projects are expected to power millions of homes, bring multi-billion-dollar economic impact to the area, and support thousands of jobs in project development, component manufacturing, installation, and operations and maintenance. Additionally, these projects are expected to bring significant economic benefits to disadvantaged communities while responsibly retiring aging fossil-fuel power plants. One example of this is Sunset Park, Brooklyn, and the potential for the offshore wind projects to revitalize the industrial sector in the area and bring much needed blue-collar employment. The Sunset Park location is a possible site for the assembly and transport of offshore wind turbines. Social justice organizations advocate reskilling and upskilling of workers to support the operational and maintenance aspects of the offshore wind projects. Environmental justice organizations advocate the responsible retirement of aging fossil-fuel power plants and replacing them with clean and renewable power sources, especially in communities that have suffered from poorer air quality and environmental disparities, and their resulting health inequities.

Market Imperfections:

Environmentalists who want complete elimination of the fossil fuel industry are in violent agreement with NYSERDA's strategy and fully support the offshore wind projects. The primary reasons are to combat climate change in defense of the planet and public health. Organizations such as 350Brooklyn have spoken out at public forums (such as the June/July 2021 Empire Wind public scoping meetings) in support of the Empire Wind energy project. 350Brooklyn works locally to address the climate crisis through education, legislation, and direct action. They are concerned about the opportunity costs for inaction

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and costs of health-related impacts. They are involved in local climate action and environmental justice and see the offshore wind projects as mechanisms for achieving both.

There are groups however that are strongly opposed to the Empire Wind energy project as currently proposed. Concerns have been raised by actors, including:

- National Audubon Society protects birds, and the places birds need now and into the future. Concerns have been raised whether the wind turbines proposed are properly and responsibly sited to accommodate marine birds and nocturnal migrants. This is an area that needs to be adequately addressed. They propose collision detection technology to further study the potential impacts on birds, including marine birds with high collision and displacement vulnerability and nocturnal migrants.
- Clean Ocean Action is a regional, broad-based coalition of conservation, environmental, fishing, boating, diving, student, surfing, women's, business, civic community groups with a mission to protect and enhance the degraded water quality of the marine waters off the New Jersey/New York coast. Concerns have been raised on the pace of the multiple large scale commercial offshore wind projects without the benefit of prior pilot or full-scale project in the environmentally sensitive highly utilized and widely treasured area of the Mid-Atlantic. Concerns have been raised about the lack of comprehensive baseline data for the diverse marine life that presently live or visit the area.
- Various Fisheries groups. Concerns raised on layout of array, spacing of turbines and the impact on safe navigation, and how the fisheries industry would be compensated for economic disruption. Concerns on the cumulative impacts of huge amounts of offshore wind development in the area and the commercial fishing industry becoming collateral damage from offshore wind development.

Existing laws and policies which have direct relevance to the Empire Wind energy project include:

- National Environmental Policy Act (NEPA)- enacted in 1969 requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their major proposed actions. Its primary goal is to foster better decision making that considers all the environmental impacts of an action and involves the public in that decision making. Actions covered by NEPA include:
 - Making decisions on permit applications.
 - Adopting federal land management actions.
 - Constructing highways and other publicly owned facilities.



- Section 106 of the National Historic Preservation Act (NHPA)- enacted in 1966, NHPA requires federal agencies to consider the effects of their undertakings on historic properties in the US, including the outer continental shelf and the exclusive economic zone. Section 106 requires federal agencies having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking to consider the effects of the undertaking on historic properties or resources that are either eligible for listing or are listed on the National Register of Historic Places.
- Coastal Zone Management Act (CZMA)- enacted in 1972, CZMA administered by NOAA provides for the management of the Nation's coastal resources including the Great Lakes. The goal is to preserve, protect, develop, and where possible to restore or enhance the resources of the nation's coastal zone. Federal actions, in or outside the coastal zone, that affect any land or water use or natural resource of a state's coastal zone must be consistent with the enforceable policies of the state Coastal Management programs. Of significance for Offshore Wind is Coastal Policy 29:
 - The development of offshore uses and resources, including renewable energy resources, shall accommodate New York's long-standing ocean and Great Lakes industries, such as commercial and recreational fishing and maritime commerce, and the ecological functions of habitats important to New York.

Special Management Areas:

- Local Waterfront Revitalization Programs
 - Significant Coastal Fish and Wildlife Habitats
 - Scenic Areas of Statewide Significance
 - Long Island Sound Coastal Management Program
- Endangered Species Act (ESA)- passed in 1973, NOAA Fisheries and the US Fish and Wildlife Service share responsibility for implementing the ESA. The federal government has the responsibility to protect:
 - Endangered species- species that are in danger of extinction throughout all or a significant portion of their range
 - Threatened species- species that are likely to become endangered in the foreseeable future
 - Critical habitat- specific areas are:
 - Within the geographical area occupied by the species at the time of listing if they contain physical or biological features essential to conservation and those features may require special management considerations or protection
 - Outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation



- Marine Mammal Protection Act (MMPA)- passed in 1972 in response to increasing concerns among scientists and the public that significant declines in some species of marine mammals were caused by human activities. This was the first legislation to mandate an ecosystem-based approach to marine resource management. Three federal entities share responsibility for implementing the MMPA:
 - NOAA Fisheries is responsible for the protection of whales, dolphins, porpoises, seals, and sea lions.
 - U.S. Fish and Wildlife Service is responsible for the protection of walrus, manatees, sea otters, and polar bears.
 - Marine Mammal Commission provides independent, science-based oversight of domestic and international policies and actions of federal agencies addressing human impacts on marine mammals and their ecosystems.
- Magnuson-Stevens Fishery Conservation and Management Act (MSA)- this is the primary law that governs marine fisheries management in US federal waters. The law was first passed in 1976 and fosters the long-term biological and economic sustainability of marine fisheries. Its objectives include:
 - Preventing overfishing
 - Rebuilding overfished stocks
 - Increasing long-term economic and social benefits
 - Ensuring a safe and sustainable supply of seafood

BOEM’s action is needed to further the United States policy to make Outer Continental Shelf energy resources available for expeditious and orderly development, subject to environmental safeguards including consideration of natural resources, safety of navigation, and existing ocean uses. A complete “Strengths, Weaknesses, Opportunities, Threats” (SWOT) analysis is shown in Table 1.

Renewable Energy and Sustainability Dimensions:

The five key indicators that are most useful in measuring sustainability of the Empire Wind energy project are:

- Generated renewable electricity is cost competitive and cost comparable to fossil fuel alternatives \$18.50/kWh (EIA, April 2021)- Economic indicator
- Minimal impact on marine life and biodiversity as measured by monitoring and surveys- Environmental indicator
- Minimal impact on commercial fisheries and related industries as measured by sustained economic development in the area- Economic indicator
- Greenhouse gas emissions showing a steady decrease from 2018 numbers (168 million metric tons of CO₂, EIA)- Environmental indicator

- Thousands of high paying union jobs and reskilling and upskilling of local workforce- Social indicator

<p>STRENGTHS</p> <ul style="list-style-type: none"> ➤ Support State and National renewable energy targets and environmental goals ➤ Support transition to a more sustainable energy mix not reliant on fossil fuels ➤ Cost effective post siting and construction ➤ Mitigates price uncertainty with more consistent supply ➤ Clean energy source, does not produce GHG emissions ➤ Direct conversion to electricity with no wastes ➤ Domestic source of energy- energy independence and energy security ➤ Sustainable- a form of solar energy ➤ Use of available and natural resources 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> ➤ Must still compete on a cost basis ➤ Impacts on local wildlife- birds, bats, marine life, impact on wildlife habitats ➤ Intermittency ➤ High cost of installation and maintenance ➤ High cost of decommissioning/removal ➤ Aesthetics impact ➤ Noise pollution/ vibration ➤ Only at wind-prone sites ➤ Impact on land integrity and visibility ➤ Vessel traffic
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> ➤ Cost efficiency ➤ Energy storage during inactive times ➤ Significant potential to produce large amounts of energy- high energy yield ➤ Backbone of a renewable energy system ➤ Holistic approach to risk mitigations and environmental concerns 	<p>THREATS</p> <ul style="list-style-type: none"> ➤ Change wind patterns due to global climate change ➤ Decreased wind ➤ Security concerns ➤ Navigational safety ➤ Impact on birds, flying animals and sea life ➤ Poor acceptance of population for wind turbines ➤ Intermittency issues

Table 1: SWOT Analysis for Offshore Wind Energy: Case Study- Empire Offshore Wind Energy Project

Three significant risks to sustainability of the Empire Wind energy project are:

- Impact on biodiversity due to destruction of marine and coastal habitats, displacement vulnerability for birds and nocturnal species, both short-term and long-term adverse effects
- Rapid pace of industrialization without the benefit of systematic learning and correction, resulting in cumulative harm to ecosystems and human health. This project sets precedence for future offshore wind renewable energy development and operational activity



- Not doing a complete life cycle assessment, resulting in unintended consequences on ecosystems and human health and environment that would be difficult to assess and mitigate. Not unlike what the fossil fuel industry is facing today as the world transitions to cleaner sources of energy

Projected environmental impacts:

Projected environmental impacts have been assessed and are summarized in Table 2.

	Local Impacts: both to individuals and small ecosystem services	Regional Impacts: the subnational area, often comprising entire ecosystems	Global Impacts: to very large systems
YEAR 1	Aesthetic impacts Marine life Migratory birds Nocturnal species Bat species Benthic habitats Fish habitats Sound pollution Site assessment traffic Surveying traffic Construction traffic Water Quality Air Quality Coastal infrastructure Historic properties Commercial fisheries Recreation and tourism Vessel navigation safety Wetlands and waterbodies Land use and zoning Impact on radar systems	Marine life Migratory birds Air Quality Water Quality Commercial Fisheries and national supply	Biodiversity GHG emissions
YEAR 2-5	Maintenance traffic Aesthetic impacts Collisions Air traffic Impacts to marine life Impact on Public Health & Safety	Marine life Migratory birds Air Quality Water Quality Commercial Fisheries and national supply Ocean use	Biodiversity GHG emissions
YEAR 5-10	Maintenance traffic Aesthetic impacts Collisions Air traffic Impacts to marine life Impacts to coastal and marine habitats	Marine life Migratory birds Air Quality Water Quality Commercial Fisheries and national supply Ocean use	Biodiversity GHG emissions



	Impact on Public Health & Safety	Manufacturing impacts	
YEAR 50	Sound pollution from decommissioning Decommissioning traffic Long term effects on marine life Cumulative effects of large-scale offshore development Impacts to marine and coastal habitats	Decommissioning/recycling	Biodiversity GHG emissions Change in wind patterns and ocean currents
YEAR 100	Sound pollution from decommissioning Decommissioning traffic Long term effects on marine life Cumulative effects of large-scale offshore development Impacts to marine and coastal habitats	Decommissioning/recycling New Development	Biodiversity GHG emissions Change in wind patterns and ocean currents

Table 2: Projected Environmental Impacts

Table 3 summarizes the primary actors and stakeholders and their specific areas of interest or concern.

Primary actors/stakeholders	Areas of interest
Bureau of Ocean Energy Management (BOEM)	Office within the US Department of the Interior with authority to respond to Empire Wind’s construction and operations plan (COP) and determine whether to approve, approve with modifications, or disapprove the COP.
National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS)	Office that evaluates Empire Wind’s request and considers impacts of activities on relevant resources through implementation of the Marine Mammal Protection Act and issues permit or authorization as appropriate.
US Army Corps of Engineers (USACE)	Authorized for permit action under Rivers and Harbors Act and the Clean Water Act for NEPA purposes.
New York State Energy Research and Development Authority (NYSERDA)	Responsible for advancing energy efficiency, economic development, cost competitiveness and use of renewable energy, and reduction on reliance on fossil fuels, while working to protect the environment.



New York Department of State Office of Planning and Development	New York Coastal Management Program in support of state development, energy, fish/wildlife and recreation.
Various other Federal, State, and local authorizations	Approval of the Empire Wind energy project
Equinor Offshore Wind US LLC	Empire Wind energy project Offshore Wind Developer and Operator
National Audubon Society	Protects birds, and the places birds need now and into the future. Interested in the study of potential impacts on birds, including marine birds with high collision and displacement vulnerability and nocturnal migrants.
Clean Ocean Action	Protect and enhance the degraded water quality of the marine waters off the New Jersey/New York coast. Concerned about the pace of the multiple large scale commercial offshore wind projects without the benefit of prior pilot or full-scale project in the environmentally sensitive highly utilized and widely treasured area of the Mid-Atlantic. Concerns about the lack of comprehensive baseline data for the diverse marine life that presently live or visit the area.
Commercial Fishing Associations	Various commercial fisheries, scallop industry. Navigation safety. Concerns on the cumulative impacts of huge amounts of offshore wind development in the area and the commercial fishing industry becoming collateral damage from offshore wind development. Compensated for economic disruption.
Fisheries Survival Fund	Represent interests of commercial and recreational fisheries
350Brooklyn	Eliminate fossil fuel industry, full support for renewable sources of energy
Social Justice Organizations	Equitable access, access to well-paying union jobs
Environmental Justice Organizations	Eliminate fossil fuel industry, full support for renewable sources of energy

Table 3: Primary actors and their areas of interest



Timeframe for implementation:

There are numerous significant benchmarks that need to be met to achieve the required approvals to move forward with the construction and operation plan of the Empire Wind energy project, a commercial-scale offshore wind energy project for renewable energy generation and distribution. The Environmental Review and Permitting process is ongoing, led by the Department of the Interior, Bureau of Ocean Energy Management as Lead Agency. The very complex process towards BOEM action is expected to take a minimum of 24 months, with potential outcomes including project approval, approval with conditions or non-approval.

The strong message here is that nonmarket strategies must drive offshore wind energy projects and the process leading up to large scale deployment and operational activity is long and complex. Now that the ambitions have been set, there is no quick and easy solution to renewable energy and sustainable development- the hard but essential work is now beginning.



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