BOEM
Bureau of Ocean Energy Management

Atlantic Science
Year in Review
2022

Bureau of Ocean Energy Management
Office of Renewable Energy Programs

Overview

The Bureau of Ocean Energy Management (BOEM) funds environmental studies to provide information needed to predict, assess, and manage impacts from offshore energy and marine mineral activities on human, marine, and coastal environments as mandated under Section 20 of the Outer Continental Shelf Lands Act. This year in review report presents the studies completed in 2022 that support BOEM's Offshore Renewable Energy Program along the Atlantic coast.

This year the studies focus on fisheries and concerns of commercial fishermen. BOEM also is funding a series of white papers that summarize existing information on a range of topics identified during the review of projects. Five of these white papers were published in 2022.

To learn more about other studies, please visit the BOEM website at www.boem.gov

Studies

supporting BOEM's Offshore Renewable Energy Program along the Atlantic coast

Fisheries

studies focused on concerns of commercial fishermen

White Papers

summarizing existing information on a range of topics

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Seafloor Disturbance and Recovery Monitoring at the Block Island Wind Farm, Rhode Island - *Summary Report (Year 6)*

Multi-beam surveys were conducted in 2021 at the Block Island Wind Farm to assess the recovery of the seafloor after completion of the construction of the wind farm in 2016. Some of the depressions from the liftboat legs used during the installation of the turbines could still be observed on the seafloor.

These depressions were not as large as in previous observations indicating that sediment is slowly filling them in. The depressions range from 10 to 50 centimeters deep. Scour, where sediment is removed by currents around the base of the turbine foundation, was also observed with depths of 5 to 20 centimeters.

Findings

- Depressions from the lift boat legs continue to recover with some no longer discernible
- Scour around the base was observed and appears to be dynamic, previously observed scour is gone and new scour locations are observed
- The recovery rates may be a function of the sediment type present around the WTGs

BOEM will use this information to

- Provide additional information necessary for BOEM's evaluation of environmental effects of future facilities
- Provide data to improve the accuracy of models and analysis criteria to establish mitigation and monitoring requirements

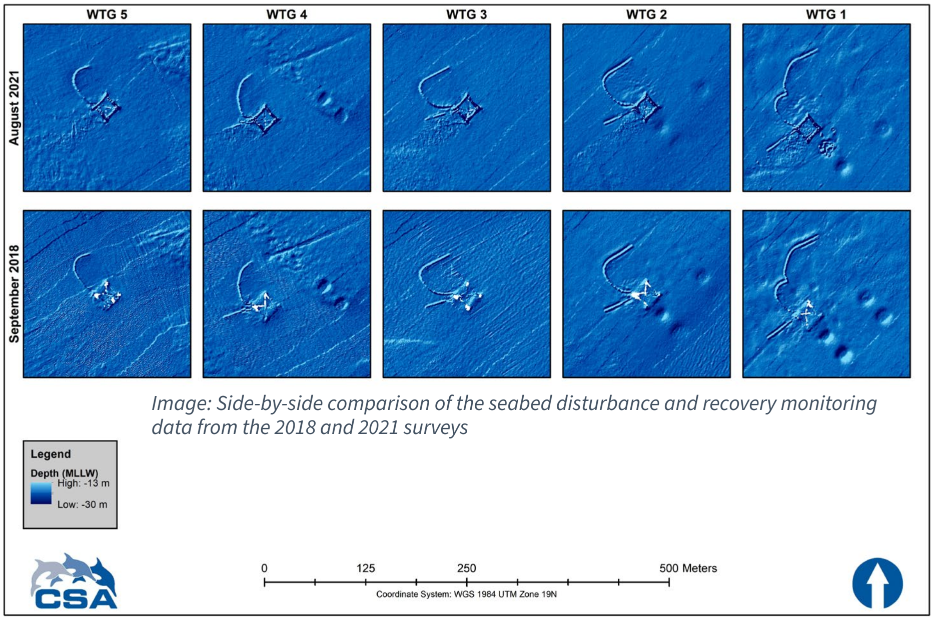


Image: Side-by-side comparison of the seabed disturbance and recovery monitoring data from the 2018 and 2021 surveys

Conducted by:
CSA Ocean Sciences Inc

Key Researchers:
Kim Olsen, Robert Erickson,
Edmund Hughes, Brian Diunizio, Scott Sharpe

Funded by:
BOEM

Additional information

Final report:
[Seafloor Disturbance and Recovery Monitoring at the Block Island Wind Farm, Rhode Island - Summary Report (Year 6)]

Passive Acoustic Telemetry as a Tool to Monitor the Baseline Presence and Persistence of Highly Migratory Fish Species

Passive acoustic telemetry is used to monitor the baseline location (presence) and persistence of highly migratory species (HMS) in popular recreational fishing areas within southern New England wind energy lease areas. The environmental conditions potentially associated with their presence in this region are also examined. The project uses charter sport fishing vessels to tag HMS, with particular focus on Atlantic bluefin tuna, shortfin mako, and blue shark, with acoustic transmitters. Commercial fishermen were also used to deploy and maintain an array of 15 acoustic receivers in the lease areas. The receiver detection data is used to establish baseline information on the presence, persistence, and habitat use of key species. The value of passive acoustic telemetry as a method for monitoring the presence of HMS, and other marine species, both prior to (i.e., baseline) and during the construction and operation phases of wind energy projects in southern New England is evaluated.

Conducted by:
INSPIRE Environmental and Anderson Cabot Center for Ocean Life at the New England Aquarium

Key Researchers:
Brian Gervelis and Jeff Kneebone

Funded by:
BOEM, Massachusetts Clean Energy Center, and Rhode Island Department of Environmental Management

Photo: Tagged Shortfin Mako Shark

Findings

- Demonstrates the capabilities of passive acoustic telemetry to effectively collect baseline data on the presence, persistence, movements, and habitat use of highly migratory species
- Presence of highly migratory species within the study site followed typical seasonal trends for the target species
- Variability in the location of occurrence, residency durations, and movement patterns between years and species indicates that two years of baseline monitoring is insufficient to fully characterize the baseline presence

BOEM will use this information to

- Inform future monitoring requirements for highly migratory species
- Evaluate potential impacts from offshore wind development on highly migratory species

Additional Information

Final report:
[Passive Acoustic Telemetry]

Understanding Economic Impacts to the Commercial Surfclam Fishing Industry from Offshore Wind Energy Development

Conducted by:
Rutgers the State University of New Jersey; University of Southern Mississippi; Gulf Coast Research Laboratory; Old Dominion University; Virginia Institute of Marine Science; University of Brest, Ifremer

Key Researchers:
Daphne M. Munroe , Eric N. Powell , John M. Klinck , Andrew M. Scheld , Sarah Borsetti, Jennifer Beckensteiner, and Eileen E. Hofmann

Funded by:
BOEM

The Atlantic surfclam fishery is vulnerable to potential impacts from offshore wind energy development due to port location, the overlap of fishing grounds and wind energy areas, and the nature of the gear and vessels used. Changes in these activities may have consequences to the behavior and economics of the fishery and downstream ecological or economic effects. Using a modeling tool that integrates spatial dynamics in surfclam stock biology, fishery captain and fleet behavior, federal management decisions, and fishery economics, the impact of excluding fishing and survey efforts from wind energy areas were examined.

The simulations include scenarios in which fishing displacement occurs cumulatively across all wind energy projects, as well as scenarios in which displacement is limited to wind projects in individual locations. The simulations include the New York Bight lease areas and designated transit corridors for vessels passing through the wind lease areas.

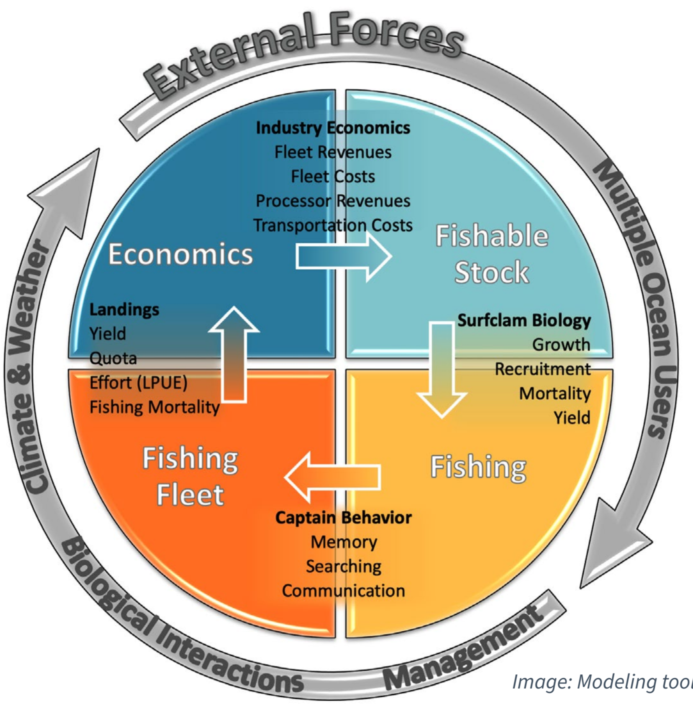


Image: Modeling tool infographic.

Findings

- Overall catch declines by 9%, regardless of the level of restrictions, due to the potentially reduced area for fishing
- Corridors tend to slightly reduce the degree to which transit restrictions impact the fishery

BOEM will use this information to

- Assess the impacts to the surfclam industry from the presence of offshore wind facilities
- Evaluate potential mitigation measures such as inclusion of transit lanes

Additional Information

Final report:
[Understanding Economic Impacts to the Commercial Surfclam Fishing Industry]

Wind Turbine Generator Impacts to Marine Vessel Radar

This report identifies and characterizes the impacts of wind turbine generators on marine vessel radar used on fishing vessels. Interference from the wind turbine structure decreases the effectiveness of marine vessel radar resulting in difficulties in navigating in and around facilities. Both the tower and the rotating blades cause interference with the radar signal. The report identifies actions that could be taken to reduce the impacts on marine vessel radar to preserve its use as a navigational aid for vessels both in and adjacent to wind turbine generator facilities.

Conducted by:
National Academies of Sciences, Engineering, and Medicine

Key Researchers:
William L. Melvin, Jennifer Bernhard, Benjamin Karlson, Andrew McGovern, Hao Ling, and John Stone

Funded by:
BOEM

Findings

- Offshore wind turbines affect marine vessel radar in a situation-dependent manner
- Interference from offshore wind turbines may be reduced through improved radar signal processing or signature-enhancing reflectors

BOEM will use this information to

- Evaluate impacts to radar from offshore wind facilities
- Encourage methods to reduce or mitigate the impacts

Additional information

Final report:
Wind Turbine Generator Impacts to Marine Vessel Radar

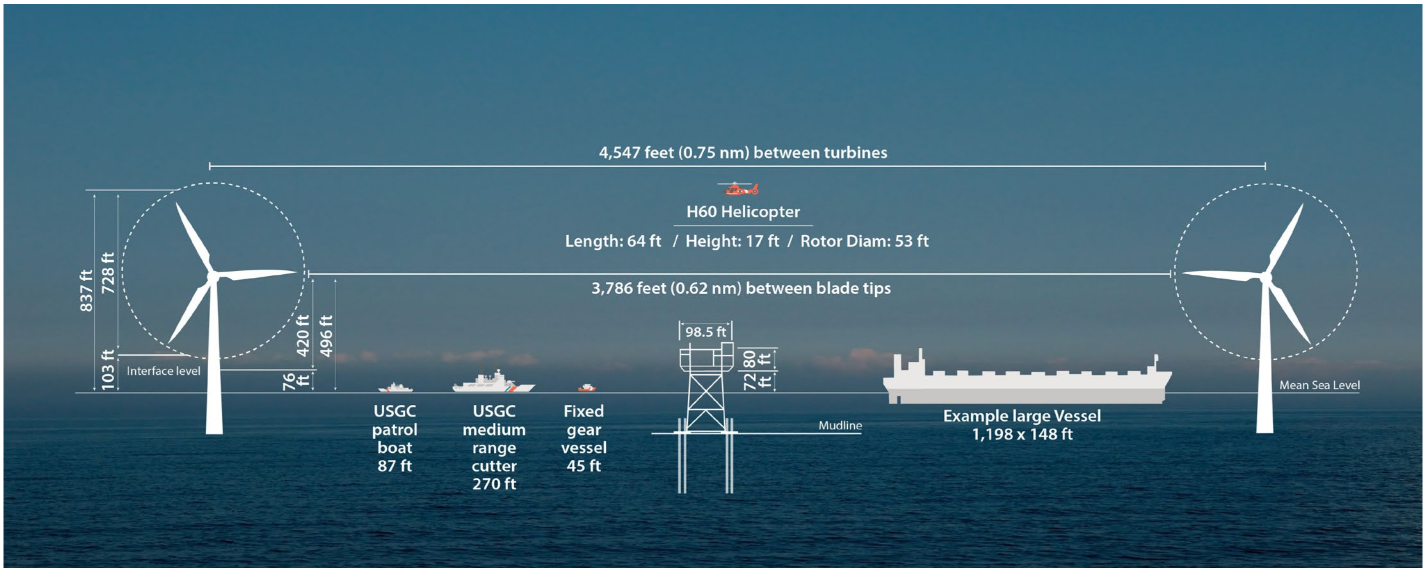


Image: A scaled representation of vessels using the Coastal Virginia Offshore Wind Project with 0.75 nautical mile spacing between turbines. Graphic inspired by Dominion Energy Services.

Assessment of BOEM's Role in Reviewing Hydrogen Production as a Complement to Offshore Wind

This report provides background, technical analysis, and recommendations to be used to update existing regulatory guidance for offshore wind development on the outer continental shelf. The report also identifies gaps in technical review expertise required for administer permitting and safety enforcement of collocation of hydrogen production and offshore wind. Hydrogen generation will require seawater intake for desalination/demineralization before the water is split into hydrogen and oxygen by electrolysis resulting in brine discharge as a byproduct. Power conditioning adapts electricity produced from the offshore wind turbines for stable and safe operation of electrolyzers. The report provides recommendations regarding BOEM's role, research avenues and partnering opportunities, stakeholder engagement, required subject matter expertise, and updates to existing regulatory guidance.

Conducted by:
AECOM Technical Services, Inc.

Key Researchers:
Jennifer Banks, Kevin Taylor, Graeme Cook, Andrew Balser, Amardeep Dhanju, and Bonnie Carr

Funded by:
BOEM

Findings

- Emerging projects in Europe offer some early lessons for potential hydrogen/offshore wind coexistence
- Research should focus on development of seawater electrolyzers, seawater desalination, and small-scale demonstration

BOEM will use this information to

- Identify next steps for research and technology assessment
- Development and implementation of an advancement strategy

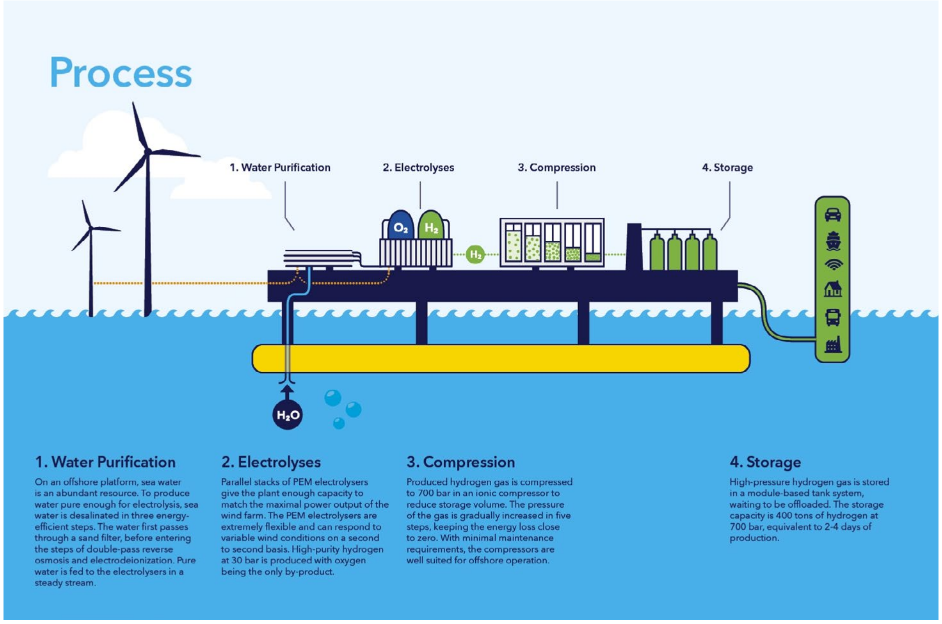


Image: Hydrogen production using offshore wind. Credit: DNV GL Jidai-Process.jpg

Additional Information

Final report:
Assessment of BOEM's Role in Reviewing Hydrogen Production as a Complement to Offshore Wind

NEPA

The National Environmental Policy Act

Supporting the National Environmental Policy Act Documentation for Offshore Wind Energy Development

Conducted by:
Booz Allen Hamilton

Key Researchers:
Bethany Barnhart,Gretchen Bruggeman, Keith Fernandez, Jr., Pamela Middleton, Jennifer Salerno

Funded by:
BOEM

During the review of offshore wind projects, BOEM identifies areas where concerns are raised by the public on various topics. In order to address these concerns, BOEM has prepared summary or white papers that summarize the topic, discuss in detail the issue, review the existing literature, and provides sources for additional information.

In 2022, the following five topics were identified for the preparation of white papers:

1. Offshore Wind Energy Development Related to Decommissioning Offshore Wind Facilities
2. Offshore Wind Energy Development Related to High Voltage Direct Current Cooling Systems
3. Atlantic Offshore Wind Energy Development Related to Microclimates
4. Offshore Wind Energy Development Related to Storm Events
5. Offshore Wind Energy Development Related to Munitions & Explosives of Concern and Unexploded Ordinances

BOEM will use this information to

- Provide the public with additional information about topics of concern
- Include in environmental analyses of offshore wind projects

Additional Information

White Papers:
NEPA and Offshore Renewable Energy

Offshore Wind Energy Development Related to Decommissioning Offshore Wind Facilities

1 Offshore wind facilities are approved for a 30 to 35 year term of operation. At the end of this term, the operator is required to remove the structures and cables, returning the area back to the original conditions. BOEM's implementing regulations at 30 CFR 585 provide specific financial security requirements for OCS projects and requires the lessee to provide a surety bond or other form of financial assurance.

BOEM's current decommissioning financial assurance regulations require the lessee or grantee to submit financial assurance covering the anticipated decommissioning costs and, upon termination of the lease, this sum is returned to the lessee or grantee to be used for decommissioning.

BOEM requires leaseholders to prepare conceptual decommissioning plans when their project is first proposed and requires more detailed plans for evaluation at the time decommissioning is requested. This report provides an overview of the processes, regulatory requirements, and financial assurances imposed by BOEM for decommissioning offshore wind facilities on the Outer Continental Shelf.

Photos: All 3 images depict the decommissioning phase of offshore wind turbines.

Findings

- Industry is required to provide a surety bond to cover expenses of decommissioning, at the time of project approval
- BOEM's stringent regulations assure that funds will be available to cover the cost of removing the offshore wind structures and cable

Additional Information

Final report:

[Decommissioning Offshore Wind Facilities]

Offshore Wind Energy Development Related to High Voltage Direct Current Cooling Systems

2 Offshore wind development on the Atlantic Outer Continental Shelf is moving further offshore, and with the distance, comes the challenge of effectively transporting the power to users onshore. Alternating current (AC) generated from wind turbines may be transported onshore when the wind farm is within about 30 miles (50 kilometers). When a wind farm is located further than 30 miles from shore, additional equipment is required to effectively move this energy onshore without encountering significant losses of power during transmission.

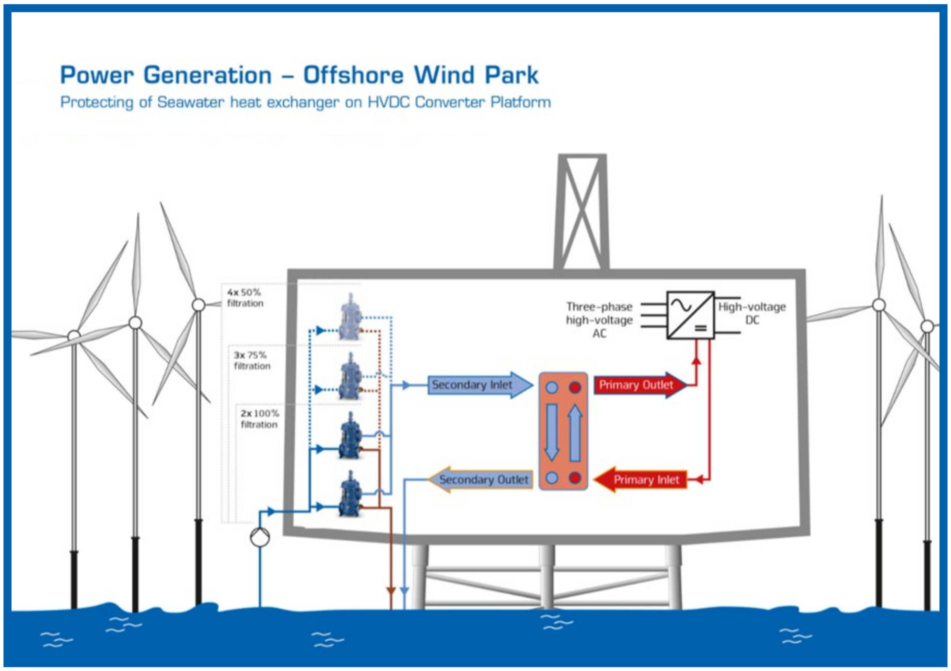


Image: Diagram of an Open Loop HVDC Filtration System (Bollfilter, 2022)
[Renewable Energy Offshore Windparks]

Findings

- Present technology uses an open loop system, more research is needed to develop a closed loop system
- Mitigation measures for the current system includes engineered screens and filters

A high voltage direct current (HVDC) system is used to convert AC power to direct current (DC), which is capable of being transported longer distances without significant power losses. The conversion process from AC to HVDC generates heat as a byproduct, and the systems require cooling to protect the equipment from damage and breakdown. Concerns have been raised to the Bureau of Ocean Energy Management (BOEM) about how HVDC systems are cooled and the impacts of the cooling systems to the environment.

Cooling these systems using current technology requires open loop seawater systems. Potential effects from using the cooling systems include the discharge of heated water, use of chemicals, and trapping of fish larvae. Mitigation techniques, such as engineered screens and filters may help protect small marine life from filtration systems. Ultimately, innovations for cooling HVDC systems to a form of closed loop technology shows the most promise in reducing or preventing the effects of current open loop systems.

Additional Information

Final report: [Offshore Wind Energy Development Related to High Voltage Direct Current Cooling Systems]

Atlantic Offshore Wind Energy Development Related to Microclimates

3

Wind turbines use the wind to rotate and, in the process, change the wind speed temporarily as the wind passes through the wind facility. These small changes can affect the microclimate, which includes the water vapor, with the wind facility as well as downwind. Questions have been raised regarding microclimates within offshore wind farms and how these phenomena may affect the local climate and the overall global climate.

Wind energy developers and scientists have studied microclimates generated by turbines and the associated downwind turbulence for decades to improve wind farm layout efficiency and energy production. More recently, research has been focused on the downwind effects of wind turbines on climate.

This white paper describes how microclimates are formed within offshore wind facilities and show that while microclimate effects are important for planning purposes, the effects are negligible onshore and to the overall climate.

Photo: Horns Rev 2 Visible Wakes (Hasager, et al., 2017). Wind Farm Wake

Findings

- Overall effects of wind farms do not result in a net increase in temperature, but rather can cause localized redistribution of air masses
- Observed local climate events within offshore wind facilities in Europe are short lived and are unlikely to occur along the Atlantic

Research and models applied to the subject of microclimates caused by offshore wind farms show some localized changes in surface temperature, humidity, and wind speed downwind of active turbines. Although some small-scale climatic shifts could occur offshore, sea breezes would not be disrupted by the presence of wind turbines offshore, and other climatic events are extremely unlikely offshore the East Coast.

Additional Information

Final report:

Atlantic Offshore Wind Energy Development Related to Microclimates

Offshore Wind Energy Development Related to Storm Events

4 Effects of climate change, such as increasing frequency and severity of storm events, are a concern of the public, especially pertaining to the safety of offshore wind facilities. Understanding the frequency of storm events and how climate change could affect future storm events informs how to design wind turbines to withstand severe weather conditions. While predicting long-term weather is challenging, looking at past and present storm frequency and applying possible scenarios for future conditions can provide some guidance for what the future may hold. Storm events that affect the North Atlantic Region, the Eastern North Pacific Region, and the Gulf of Mexico may have hurricane force winds, high wave action, lightning, freezing temperatures, and other conditions that may damage structures.

The design parameters for the wind turbines are based upon historical data, site-specific measurements, and engineering design practices. Design standards require structures to withstand forces based on site-specific conditions for a 50-year return interval, representing the higher end event that is reasonable to occur. Recent updates include a 500-year scenario as well. Post-storm inspections are required to identify damage and then repair structures to prevent more serious failures during subsequent storm events. The design standards, regulations, and safety inspections are built upon the foundation of BOEM's decades of offshore oil and gas experience and lessons learned.

Findings

- Projects will be designed in accordance with the International Electrotechnical Commission (IEC) 61400-1 and 61400-3 standards
- Design standards will be updated as projects are built and with monitoring of changing oceanographic conditions

Photo: Satellite view. Hurricane Florence over the U.S. Atlantic coast. Image elements furnished by NASA.

Additional Information

Final report:

[*Offshore Wind Energy Development Related to Storm Events*]

Offshore Wind Energy Development Related to Munitions and Explosives of Concern and Unexploded Ordinances

5 Munitions and explosives of concern (MEC) and unexploded ordnances (UXO) are a concern in offshore wind development. MEC and UXO are defined as specific categories of military munitions that may pose unique explosives safety risks. The risk can be greatly reduced or eliminated through procedures in place such as research, surveys, and risk analysis.

Findings

- Most UXO identified along the U.S. Atlantic coast are small, about a meter or less in size
- Applying the “As Low As Reasonably Practical (ALARP)” risk mitigation process is the method of investigation BOEM recommends to identify UXO

Additional Information

Final reports:

[Munitions and Explosives of Concern and Unexploded Ordinances]

[Munitions and Explosives of Concern Survey Methodology]

Mapped UXO disposal areas have already been excluded from potential offshore wind development, thereby reducing the likelihood of a leaseholder encountering UXO within their lease area. This white paper is to provide a brief overview of the typical steps to taken by a lessee in consideration of UXO when preparing a Construction and Operations Plan and potential mitigation measures for incorporation by reference in BOEM’s environmental impact statements for proposed offshore wind projects. Overall, UXO are not a major risk for an offshore wind developer, but still one to take seriously due to the number of military activities that have taken place in United States waters.

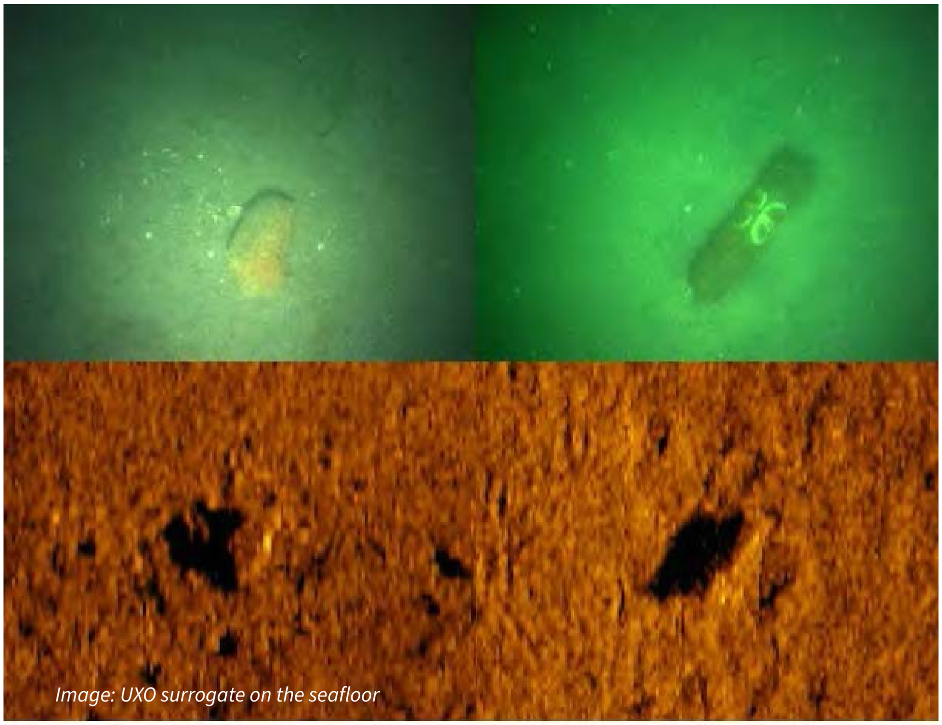
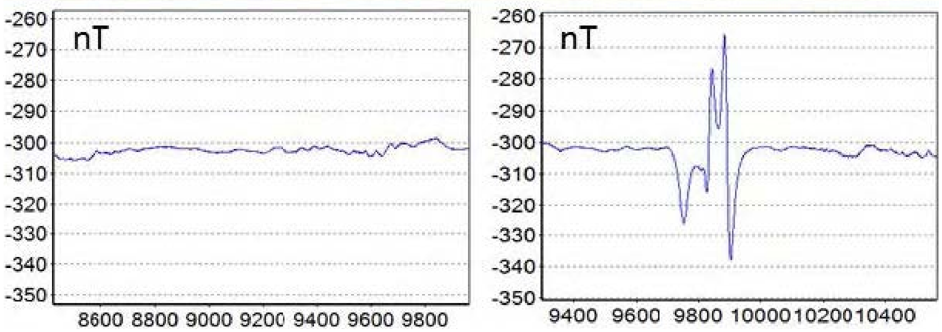


Image: UXO surrogate on the seafloor



What's Next

Here are a few of the new and continuing studies that are underway:

Disturbance from offshore wind construction may have effects on individuals as well as populations. Using a bioenergetic model, the population consequences of disturbance (PCoD) methodology will be applied to North Atlantic right whales to assess the impacts from the construction of multiple wind facilities along the Atlantic.

[Expected completion: 2023]

Impact of noise during construction of offshore wind projects on commercially important fish is a concern all along the Atlantic coast. This study examines behavioral effects of sound sources from offshore renewable energy construction on the black sea bass (Centropristis striata) and longfin inshore squid (Doryteuthis pealeii).

[Expected completion: 2023]

Construction of multiple offshore wind energy facilities in the Mid-Atlantic Bight may affect local and regional hydrodynamics (flow of water) under average seasonal conditions. Through modeling of these effects, the potential impact of the wind turbine structures on circulation and sediment, nutrient, and larval transport is being evaluated.

[Expected completion: 2024]

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