INSIGHT

A Deeper Look at Offshore Wind Farm Air Emissions

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Offshore installation. *A self-elevating jack-up vessel is a type of mobile platform used to construct offshore wind turbines. The vessel stabilizes itself by planting its long support legs into the ocean floor.*

When people think of wind farms, they picture a clean source of power with no impact on air quality. After all, unlike traditional power plants, there is no burning of fossil fuel or air pollutant emissions from the generation of wind power.

Despite the recognized long-term benefits of this

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wind farms—especially those operated offshore—can generate significant levels of air emissions.

In fact, emissions associated with the larger, commercial-scale offshore wind projects can trigger restrictive regulatory permitting requirements and, in turn, costly mitigation measures.

Air Emissions Permitting for Offshore Wind Farms

The Bureau of Ocean Energy Management (BOEM) is the government agency that regulates development in federally established wind energy lease areas on the Outer Continental Shelf (OCS). The U.S. Environmental Protection Agency (EPA) works in cooperation with the BOEM to evaluate air pollutant emissions from offshore wind farm projects.

Prior to construction, an offshore wind farm—also called an OCS source—must obtain an OCS permit from the EPA. The OCS permit regulates air pollutant emissions associated with both the construction and operational phases of OCS sources. (This is unique to OCS permits, as New Source Review and Prevention of Significant Deterioration permits regulate only operational emissions.)

An OCS source also is subject to air quality regulations for the state it abuts, also known as the corresponding onshore area.

Emissions during OCS source/wind farm

Operational emissions from wind farms come from engines on wind turbine generators, electrical service platforms and marine vessels servicing the wind farm when operating within 25 miles of the wind farm.

In addition, BOEM must also determine if the General Conformity rule is applicable. This rule considers project-associated air emissions occurring outside the 25-mile radius from the OCS source but within designated maintenance or nonattainment area(s).

If emissions are large enough to classify the offshore wind farm as a major source, and/or the General Conformity rule applies, more restrictive emission controls and costly mitigation measures may be required (including "offsetting" project emissions by acquiring emission reduction credits).

Wind Power in the U.S.

The amount of electricity generated by wind power has grown substantially over the past 30 years. According to the U.S. Energy Information Administration, in 2020, wind turbines generated approximately 8.4% of the total U.S. utility-scale electricity.

As evidence of the increasing contribution of wind power to this country's overall power generation, on March 29, 2022—for the first time ever—wind-based power was the second largest source of electricity (after natural gas-fired power plants) over a 24-hour period.

The U.S. Geological Survey's *U.S. Wind Turbine Database* reports that, as of January 2022, the U.S. has installed more than 70,800 wind turbines as part of 1,500 wind power projects across at least 44 states and two U.S. territories. Moving forward, offshore wind farms will likely play a bigger role in U.S. wind power generation.

Case Study: Vineyard Wind 1 Project

To demonstrate the magnitude of air emissions associated with a commercial-scale offshore project, consider a wind farm recently approved for construction: the 800-megawatt (MW), 62-wind turbine Vineyard Wind 1. Located 35 miles southeast from mainland Massachusetts, the Vineyard Wind 1 Project is the nation's first commercial-scale offshore wind power project.

Based on the estimated maximum potential emissions from annual operation and maintenance, Vineyard Wind 1 is categorized by EPA as a major source of air pollutants under the OCS permit. The Final Environmental Impact Statement (FEIS) for Vineyard Wind 1 projects the annual average emissions of oxides of nitrogen (NO_x) during the wind farm's 30-year operational period as about 70 tons per year. This is equivalent to the annual NO_x emissions from a modern natural gas-fired 300 MW power plant.

According to the FEIS, the total NO_x emissions within the U.S.* during the two-year construction phase of Vineyard Wind 1 are estimated to be about 5,000 tons. This is equivalent to the emissions from a fleet of about 11,500 bulldozers operating 10 hours a day for two years. The total carbon dioxide (CO_2) emissions during the two-year construction phase are estimated to be about 319,000 tons, which is equivalent to the emissions from a fleet of approximately 1,100 of those same bulldozers.

Offshore Wind Farm Development

Currently, there are two offshore wind farms in operation: the Block Island Wind Farm, with five wind turbines off the coast of Rhode Island, and the Coastal Virginia Offshore Wind pilot project, with two wind turbines. Along with Vineyard Wind 1,

least 15 projects—all located off the Eastern Seaboard—under review by the BOEM.

President Biden has established a national goal of 30 gigawatts (GW) of offshore wind energy by 2030. This goal accounts for the potential generating capacity from wind turbines at any single point in time, once all the wind farms are built and operating.

Additionally, individual states continue to adopt their own offshore wind power procurement mandates, with a goal to procure about 39 GW of total offshore wind capacity by 2040.

The Biden administration projects that the U.S. could be generating 110 GW of offshore wind energy at any one time by 2050—generating from wind farm projects on the Eastern Seaboard, off the coasts of California and Hawaii and in the Gulf of Mexico.

Looking Ahead

Although construction-phase emissions for any wind farm project are temporary in nature, they are certainly not inconsequential—especially for large, commercial-scale projects like Vineyard Wind 1. With the approval of numerous projects in the coming years both similar in size and larger than Vineyard Wind 1, associated construction emissions, although geographically dispersed, will be ongoing.

Greenhouse gas reductions and net air quality benefits from wind farms are substantial when compared with fossil fuel-fired facilities that generate similar power levels. However, air pollutant emissions from offshore wind farm projects—from the construction through decommissioning—remain an important consideration.

It is essential to carefully and thoroughly quantify wind farm emissions, as they can trigger restrictive (and potentially costly) federal and state air

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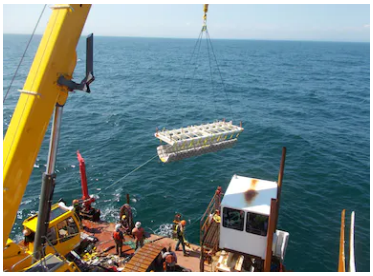

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