Offshore wind energy integration

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The Department of Energy"s (DOE"s) Wind Energy Technologies Office (WETO) works with electric grid operators, utilities, regulators, academia, and industry to create new strategies forincorporating increasing amounts of wind energyinto the power system while maintaining economic and reliable operation of the grid.

As the nation moves toward an energy system with higher penetrations of wind energy, it is increasingly important for grid operators to understand how theycan plan for and operate a system that reliably integrates large quantities of wind energy into system operations; additionally, it is important to develop capabilities that enable these new wind power plants to provide much-needed grid services (e.g. frequency and voltage support) that can improve the reliability and resilienceof the electric grid.

The office"s goal in renewable systems integration is to remove barriers to enable grid system operators, via innovation, to capture the economic and environmental benefits of the increasing availability of wind energy, while enhancing grid operations and assuring overall system reliability, resiliency, and security. This can be accomplished through integration studies, modeling, demonstrations, and assessments at both the transmission and distribution levels, coupled with working directly with utilities to help ensure adoption of best practices.

WETO and DOE National Laboratory researchers work with industry partners on projects aimed at better understanding integration issues and building confidence in the reliability of wind generation.WETO supports projects in the Grid Modernization Initiative through the Grid Modernization Laboratory Consortium (GMLC), which is a strategic partnership between DOE and its national laboratories to collaborate on grid modernization.

The long-lived nature of transmission infrastructure requires careful upfront analysis to evaluate where new transmission infrastructure is needed for both land-based and offshore wind, ensure that new or existing lines are best utilized, understand the benefits of new transmission development, and identify solutions to expediate wind interconnection to the nation"s electric grid.

The Gulf of Mexico Offshore Wind Transmission Planning- Literature Review and Gaps Analysis: Environmental, Community Readiness, and Infrastructure Report, co-funded by WETO and Grid Deployment Office (GDO) in collaboration with NREL, summarizes current research on available infrastructure, environmental factors, and community readiness as related to offshore wind transmission planning in the Gulf of Mexico.

The Atlantic Offshore Wind Transmission Study, led by National Renewable Energy Laboratory (NREL) and Pacific Northwest National Laboratory (PNNL), identifies and evaluates coordinated and shared transmission solutions to enable offshore wind deployment on the East Coast, through 2050, addressing gaps in existing analyses.

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The Atlantic Offshore Wind Transmission Action Plan, released by DOE and the Department of the Interior, outlines immediate actions needed to connect the first generation of Atlantic offshore wind projects onto the electric grid, and longer-term efforts to support needed transmission over the next several decades. Informed by the study and a series of stakeholder convenings, the action plan will help guide cost-effective transmission solutions, including network, approaches to connect multiple projects to shore.

Informed by the West Coast Offshore Wind Transmission Literature Review and Gap Analysis, the study investigates transmission options supporting offshore wind development along the nation"s West Coast through 2050. In the study, researchers are evaluating ways to achieve offshore wind energy goals that support grid reliability and resilience as well as ocean co-use. The study is led by PNNL and NREL.

This project, led by NREL, addresses regulatory and siting challenges that lead to delays in decision making and construction timelines for transmission projects. The goals of the project are to identify leading factors and best practices, and understand what factors contribute to construction delays and how to mitigate them.

Changes in the national electricity generation mix require that variable generation sources--such as wind and solar energy--improve their ability to provide the suite of grid services that has historically been provided by conventional generation sources. This section of WETO"s research portfolio focuses on advancing the capabilities of wind energy to provide the full suite of grid reliability and resilience services. Projects in this section also develop models and tools that support reliable and resilient system operation with increasing levels of wind.

Short circuit analysis is used to determine the force of short circuit currents--currents that introduce large amounts of destructive energy in the forms of heat and magnetic force into a power system. This project, led by Sandia National Laboratories in collaboration with Clemson University, is developing standardized comprehensive models of wind turbine generators to determine how well they respond to short circuits in a power system. The goal of the project is to expand wind turbine generator models for accurate modeling of hybrid wind systems.