Distributed wind energy

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The Distributed Wind Energy Futures Study, funded by the U.S. Department of Energy"s (DOE"s) Wind Energy Technologies Office, used highly detailed data and new modeling techniques to identify locations with the highest potential for distributed wind energy of all forms. The findings can help communities transition to a clean energy future.

The study focused on the impact of wind technology cost and performance, policy, and siting conditions on economic potential. NREL also modeled opportunities for distributed wind in disadvantaged communities.

The 2022 study builds on Assessing the Future of Distributed Wind: Opportunities for Behind-the-Meter Projects, NREL"s 2016 foundational wind futures study on the potential of distributed wind systems.

Distributed wind energy refers to wind technologies deployed as distributed energy resources. These technologies are place-based solutions that support individuals, communities, and businesses transitioning to carbon-free electricity.

For the Distributed Wind Energy Futures Study, NREL added new, higher-resolution data and modeling capabilities to its Distributed Wind (dWind) model. dWind is a module within the Distributed Generation Market Demand (dGen(TM)) model suite.

NREL added real-world dimensions for 150 million parcels of property in the United States to size turbines for those locations. NREL also improved the model to consider front-of-the-meter wind systems.

dWind also now considers more community-scale distributed wind applications that could participate in the wholesale electricity market and a broader swath of payment schemes. In addition, NREL modeled the potential of distributed wind and solar in parcels of property in communities with high risk to environmental hazards or high proportions of low-income households. dWind will be open-sourced as part of dGen in 2022.

NREL finds distributed wind has nearly 1,400 GW of economic potential today. This is the total resource potential that, if deployed, would have a positive return on investment. The economic potential could be multiple terawatts in 2035. However, the future potential depends heavily on low-cost wind financing and improved performance, relaxed siting constraints, and future policy support.

NREL finds the regions with the highest potential for distributed wind tend to have a combination of high-quality wind, relatively high electricity rates for behind-the-meter applications, higher wholesale power rates for front-of-the-meter applications, and siting availability.

The Midwest and Heartland regions have the overall highest potential for distributed wind. The Pacific and

Northeast regions have significant potential for expansion of behind-the-meter distributed wind deployments. States with the most near-term potential for behind-the-meter applications include Texas, Minnesota, Montana, Colorado, Indiana, and Oklahoma. States with the most near-term potential for front-of-the-meter applications include Oklahoma, Nebraska, Iowa, Illinois, Kansas, and South Dakota.

Disadvantaged communities represent 43% of all suitable U.S. parcels for front-of-the-meter distributed wind in the United States and 47% of all suitable U.S. parcels for behind-the-meter wind. There are significant opportunities to expand distributed wind in these communities through 2035, particularly for behind-the-meter deployments in Texas, Montana, Michigan, and New Mexico.

NREL consulted with an independent technical review group for the Distributed Wind Energy Futures Study. This body of industry, consulting, and national laboratory experts served as a source of empirical project data, analysis peer reviewers, and independent subject matter expertise.