



PJM Interconnection's market rules and Open-Access Transmission Tariff encourage the reliable and efficient integration of variable energy resources like solar and wind into the grid. PJM has taken a number of other measures as well to reduce barriers and facilitate the ability of variable resources to integrate into the system while ensuring continued reliability.

The wide scope of PJM's operations and markets provides ample opportunities for variable energy resources to conduct business. The following PJM policies, protocols and programs are in place and provide needed support for the development of variable energy resources in the PJM region.

- In the Real-Time Energy Market, there are no penalties levied on generation for scheduling deviations. Instead, all generation can buy power at market prices to meet previously arranged schedules, as for example, if wind output drops. Wind generation also receives market-based revenues if wind project deliveries exceed scheduled amounts.
- Variable resources benefit from the short scheduling intervals of PJM's market. Generators of any type can self-schedule with 15-minutes notice; PJM typically approves a dispatch case and sends out new dispatch signals every four to five minutes. This helps reduce the need for regulation service to deal with changes in load within each hour.
- PJM established a centralized wind power forecasting service in 2009. Aggregated data from the service is made available to members and is used to help determine the next-day unit commitment to ensure there are sufficient reserves. The forecasting also was designed to encourage participation by wind resources in the Day-Ahead Energy Market.

Variable resources have the ability to earn revenues by participating as capacity resources in the PJM capacity market, the Reliability Pricing Model. Wind

and solar resources are not required to offer into the capacity market and may need to aggregate with other seasonal resources to provide the year-round capability required of all Capacity Performance resources. Because of the intermittent nature of these resources, PJM's capacity valuation procedure allows wind and solar to receive capacity credit on a rolling three-year average of actual performance over the previous three summers. If they have been in operation for less than three years, wind and solar projects receive a class-average value.

In the latest capacity auction for the 2020/2021 delivery year, about 504 megawatts of wind resources and about 119 MW of solar resources cleared in the auction.

PJM has been conducting a number of studies to examine the impact of renewable resources, including offshore wind, on the planning and operation of the transmission system.

PJM commissioned a study to assess the impact of large-scale renewable energy integration on operations, planning and markets, as well as the impact of state renewable portfolio standards on the planning of the high-voltage transmission system at the 345-kilovolt level and above.

PJM has taken a number of other steps to help support the effective integration of variable energy resources. These include:

- Forming the Intermittent Resources Subcommittee to examine the operational, reliability and market issues specific to variable resources. The subcommittee has been focusing its attention on



such areas as the operational impacts of large-scale renewable penetration and interconnection standards for intermittent resources.

- Implementing changes in software to enhance the management of wind resources.
- Participating in a variety of forums and studies by the federal Department of Energy, the North American Electric Reliability Corp. and others dealing with the integration of variable energy resources.

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