



Distributed energy resources represent a small but growing part of the electric energy resource mix. PJM is working to reliably and efficiently integrate them into its operations, markets and planning activities.

Electric systems have traditionally featured large centralized power plants feeding transmission lines that serve communities far and wide.

In recent years, however, with technological and cost improvements in distributed resources combining with shifting customer preference and choice, the deployment of smaller, more dispersed resources has grown. These are called distributed energy resources (DER).

PJM considers DER to be any generators or electric energy storage resources connected to lower-voltage local distribution lines and/or on the customer's side of the utility meter. DER can be powered by a variety of fuel sources. They also can range in capacity from a few-kilowatt residential unit, to a few-hundred-kilowatt commercial unit, to a generator as large as 20 megawatts.

### Forecasting To Ensure Efficient Dispatch and Planning

Most DER in PJM are not wholesale resources. They operate on the customer's side of the utility meter, and PJM does not have real-time information about them. Because solar power is the fastest-growing category of DER, PJM has developed two tools to help understand the impact of these solar resources: a short-term forecast and a long-term forecast.

The short-term solar forecast predicts how much output non-wholesale solar DER will generate from five minutes to one week in advance. The long-term solar forecast looks at trends in solar power pricing and policies to forecast how many solar power systems will be installed each year, extending out 15 years. These forecasts ensure that PJM can efficiently dispatch generators to meet customers' immediate needs and help PJM plan for sufficient electric supply and transmission resources in the future.

### Gaining Greater Situational Awareness

Knowing the location of non-wholesale DER can help system operators better understand system conditions if they need to respond quickly to emergencies.

PJM's Dispatch Interactive Map Application shows system operators if these resources are near a substation. In emergency situations, this information can help operators and transmission owners determine whether DER would be a help or a hindrance.

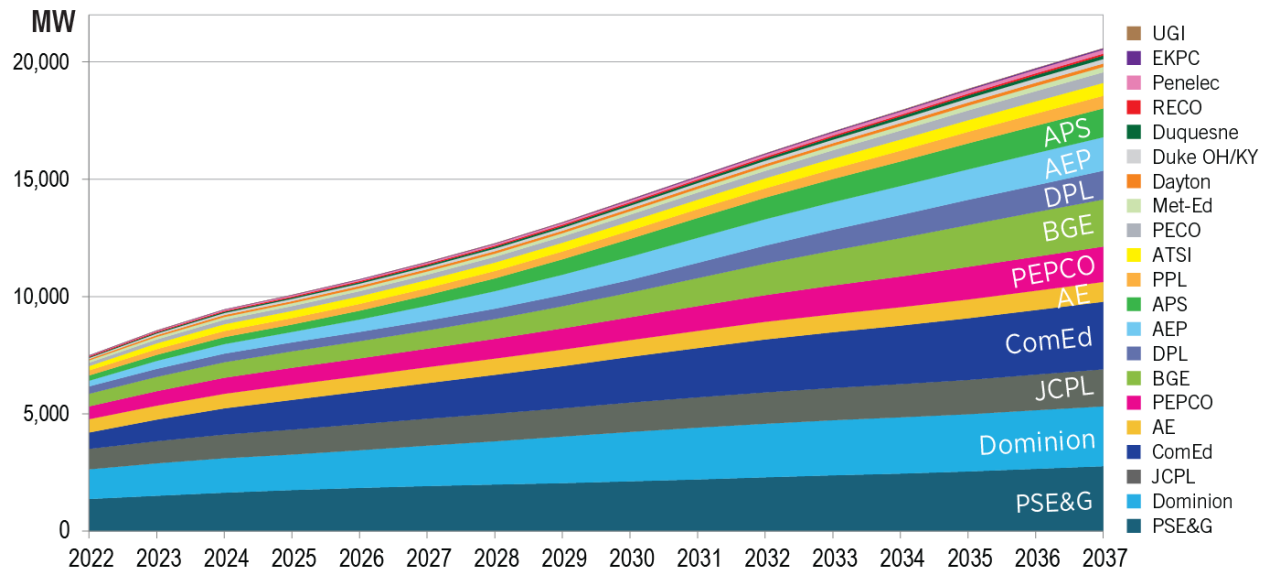
#### Key Points

- DER are small electric generation or storage units connected to the local electric distribution system.
- Most DER are installed on the customer's side of the electric meter and are not visible to PJM.
- Some DER participate in wholesale electric power markets.
- The more DER in an area, the greater potential impact on the high-voltage transmission system.
- PJM filed a comprehensive proposal on Feb. 1 outlining how it will comply with Order 2222, FERC's directive for power system operators to create market rules enabling the participation of DER aggregations in the wholesale markets.





## Long-Term Non-Wholesale Solar Growth Forecast in PJM



### Providing Open Access to Wholesale Markets

PJM works to ensure that its rules allow DER to participate in its wholesale markets fairly and without undue burden. Market access offers additional benefits, because when DER provide wholesale electricity services to the PJM marketplace, PJM gains greater visibility and coordination in their operation.

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Wholesale DER are connected to the distribution system and offer their output and services to PJM markets. PJM knows the status of these units. They provide more than 1,000 MW. In addition, about 1,000 MW of generation on the customer’s side of the meter participate in PJM markets as demand resources, which can reduce the amount of electricity drawn from the grid when regional generation capacity is tight.

Most DER are considered non-wholesale. They include as wide an array of technology types as wholesale DER but don’t participate directly in the market. There are about 7,000 MW of non-wholesale DER in the region served by PJM.

### When Distribution Affects Transmission

PJM oversees the regional transmission system and has a significant interest in understanding the impact that DER have on the amount of electricity that must be carried by the transmission lines. Understanding the impact of DER also helps PJM control voltage on the transmission system and protects the system from failure and damage. The more DER at the lower-voltage distribution level, the more they can affect high-voltage operations.

PJM continues to work with stakeholders, regulators and the electricity industry to understand the impacts of DER on the grid as well as develop interconnection standards to address system reliability as the amount of DER grows.

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