

CASE STUDY

Grid Balancing with Distributed Energy Resources: Largest ISO in the U.S Picks Enbala Platform

The Challenge

Demand just keeps going up for PJM Interconnection, the largest regional transmission operator (RTO) in the United States. Frigid weather in November 2014 forced the grid operator to meet record demand of 121,987 megawatts (MW) to serve the 61 million souls who rely on PJM to keep power flowing. That's some 7,000 MW more than the previous autumn peak of 114,699 MW from November 2013. Recent summer and winter peaks have been record-setters, too.

Meanwhile, the RTO has seen dramatic increases in renewable resources, particularly wind power. Between 2010 and 2011, renewable generation resources, called variable energy resources because of their intermittent capacity, increased 139 percent. With the increase in VERs, the grid operator has seen a rising need for fast response mechanisms to address frequency deviation. Peak loads and VER generation add complexity to the task of maintaining a steady 60 Hertz frequency on the massive PJM grid.

The Solution: Enbala Frequency Regulation Service

PJM Interconnection has implemented the Enbala regulation service application, a combination of software and operational technology – an IT/OT solution – that leverages loads from a network of electricity customers that function as distributed energy resources. PJM sends Enbala a continuous signal indicating how much response is needed from the demand side to maintain a balanced grid. Enbala fulfills that request by identifying which of its participating facilities are available, then sends out a signal to adjust power usage.

Enbala manages its connected customer load resources in PJM's Regulation Service market through the Enbala enSITE communications device, which is deployed at each participating customer's premises. Through enSITE, the energy usage of connected devices that control HVAC equipment, chillers pumps and other flexible loads can be shifted in real-time based on the grid's

Demand-side resources offer another means of cost-effectively enhancing overall grid reliability. – Andrew L. Ott, PJM, Sr. Vice President – Markets

What's more, the RTO's capacity mix is 40 percent coal and 30 percent natural gas, so when PJM needs capacity for frequency regulation, it's largely coming from greenhouse-gas spewing generators that are inefficient, expensive and unpopular to environmentally conscious consumers and regulators.

Given such market forces, PJM managers have placed a strong focus on implementing fast grid balancing resources, such as flywheels, batteries and demand response. Enbala is one of the technologies the RTO relies on for rapid response to reliability challenges.

moment-to-moment fluctuations. Since participating distributed energy resources are flexible and don't require a continuous energy supply, Enbala's technology doesn't compromise comfort levels within participating buildings.

Enbala's system quickly responds to frequency deviations because it manages the control setpoints of all resources in two-second increments, allowing the software to adjust load up and down in pace with the dynamic needs of the grid. The response from individual sites is consolidated and viewed as a single, dispatchable

resource for PJM. That means the grid operator gains a real-time, dynamic response solution that unobtrusively controls customer load devices to keep the electricity grid in balance.

Results: Reliability and Customer Engagement

PJM achieved its goals with Enbala technology: increased system reliability and efficiency. Dispatch performance, a score calculated based on the three elements of delay, accuracy and correlation, has consistently come in at just under 90 percent with the Enbala solution. Market averages hover in the 70 percent to 80 percent range.

The solution also lowers reliance on fossil-fuel-based generators, thereby cutting greenhouse gasses. In a study conducted by the Bloom Centre for Sustainability, Enbala's demand-side regulation service platform decreased greenhouse gases by 5,500 tonnes for every 100 MW of regulation service provided each year through decreased use of marginal peakers. The Enbala solution also reduced smog-related emissions (NOx and SOx) by 38 tonnes for each MW of regulation service.

In addition, Enbala technology eliminates some of the inefficiency inherent in reliance on peaker plants. Generator capacity scheduled for regulation service can't be bid into the grid and, since the peakers typically operate below nominal output, efficiency takes a hit. Plus, the rapid ramp up and down required for regulation service creates wear on generators, which means Enbala's solution lowers overall O&M costs.

Finally, the solution reflects the RTO's focus on embracing demand response opportunities. Through curtailment service providers working with retail consumers and other programs, PJM has lined up 12,314 megawatts of demand response and energy-efficiency

resources for the 2017/2018 delivery year. That figure represents more committed demand response resources than those in any other organized U.S. wholesale electricity market.

About PJM Interconnection

About PJM: PJM Interconnection, founded in 1927, ensures the reliability of the high-voltage electric power system serving 61 million people in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. PJM coordinates and directs the operation of the region's transmission grid, which includes 62,556 miles of transmission lines; administers a competitive wholesale electricity market; and plans regional transmission expansion improvements to maintain grid reliability and relieve congestion. Visit PJM at www.pjm.com.

Enbala: The Operating System for Distributed Energy Resources

Operational since 2011, Enbala software facilitates real-time management of distributed resources. The platform manages and optimizes real and reactive power, storage system levels, and other power system parameters, while maintaining operations within defined constraints. This ensures that customer operations are unaffected, intermittent generation is utilized to its maximum capacity, and power system losses are minimized. The managed devices may include generation, storage systems, and customer devices. This control and optimization technology is capable of managing a wide variety of applications to support the decentralized, evolving electric grid.

Fast Facts: PJM

- 100s of geographically distributed devices (including compressors, chillers and aerators)
- 2-second communications and control interval
- 24x7 operations
- 3 years of operation

Project Benefits

- Reliable balance of electricity supply and demand
- Reduced utility operating and maintenance costs
- Positive engagement and program participation by commercial end users
- Enhanced grid reliability and efficiency
- Deferred investment in new infrastructure

