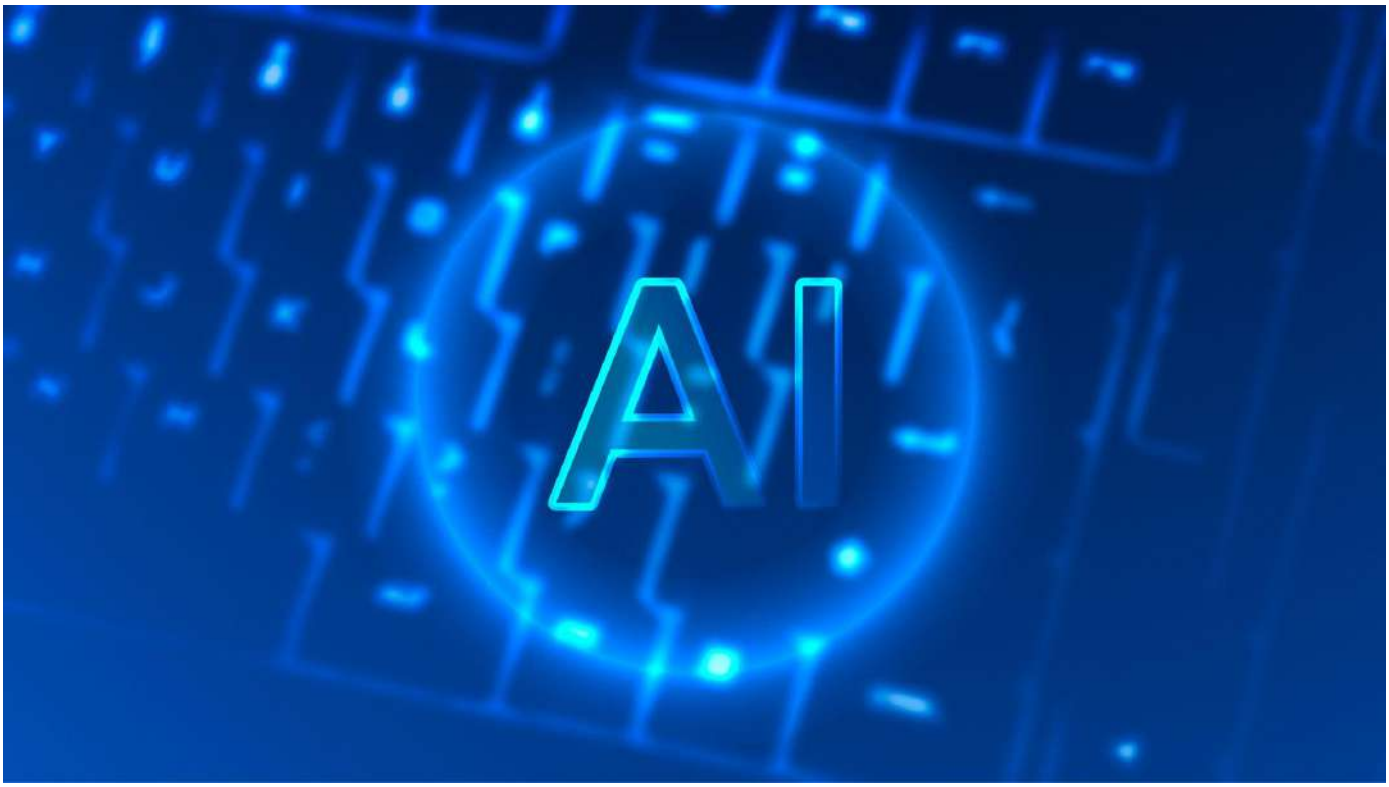

From Grid Alerts to Action: Importance of AI-Powered Grid Services in North America

by Asad Tariq, *Analyst I – at PTR Inc.*

- Power grid alerts are becoming more frequent in Canada and the US due to extreme weather.
- Grid operators are using costly conventional power resources to address grid alerts.
- The AI-powered grid services could serve the grid operators to manage the grid alerts in cost-effective ways.

The power sector in North America is currently undergoing a major shift from power generation through fossil fuels to renewable sources in order to fulfill climate commitments. While clean and affordable energy is a definite advantage, the intermittency of renewable energy resources poses a significant challenge for power grids. In the month of August, the North American region faced three major grid alert events in the jurisdictions of AESO (Alberta Electric System Operator), ERCOT (Electric Reliability Council of Texas), and SPP (Southern Power Pool).

In the year 2022, ERCOT, AESO, and SPP reported three, one, and two grid alert events, respectively. The extreme weather conditions and the reduced generation of renewable energy resources were the main reasons behind the initiation of the grid alerts.

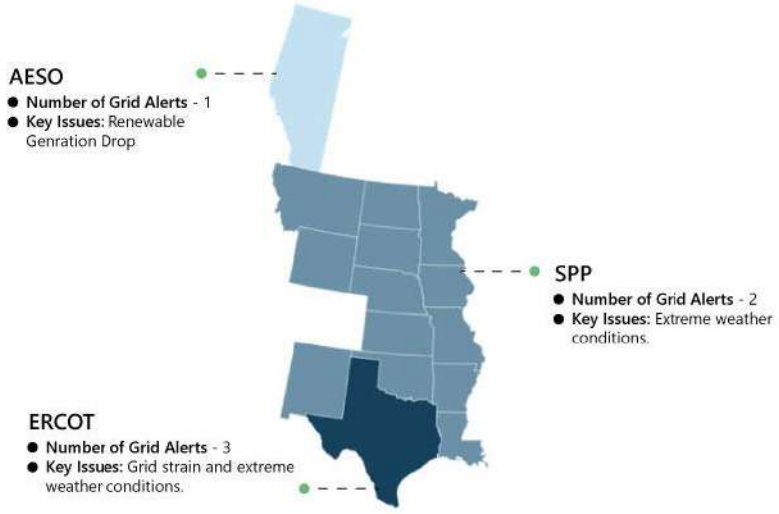

Figure 1: Grid Alerts and Their Causes Reported in AESO, ERCOT, and SPP During 2022.

Source: PTR Inc.

Recently, Texas and Alberta, the two of the most energy-rich power networks in North America, encountered grid alerts due to hot weather, heavy load demand, and poor wind conditions. During grid alert events, grid operators implemented various strategies to manage the situation. AESO utilized traditional energy resources, SPP utilized interconnections with neighboring networks, and ERCOT relied on its demand response reserves to address the imbalance between generation and demand. PTR has observed that these issues can be resolved through the deployment of AI-powered grid flexibility services.

AI-Powered Grid Services - A Game Changer for North America's Power Grid

The grid alert events highlight the lack of renewable energy management and forecasting, leading to the strain on the grid and an imbalance in the generation and demand. These issues can be solved by AI-powered grid flexibility services such as automated demand response, virtual power plants, and distributed energy resource management systems. These AI-powered solutions are capable of providing efficient management of the renewables as well as load curtailment along with economic feasibility.

In this regard, virtual power plants (VPP) can be a powerful solution to address resource adequacy challenges. VPPs can harness the growing use of flexible distributed energy resources (e.g., smart thermostats, EVs, batteries) to provide valuable services to the power grid. Small adjustments in settings, like thermostat temperature, can yield substantial peak demand reductions when aggregated across participants in a region.

ERCOT's Best Practice - A Road Map to Follow by SPP and AESO

Despite encountering the maximum number of grid alert events, Texas has been the least vulnerable state among all. This is attributed to innovative smart grid applications that utilize grid flexibility to cater to grid strain issues. In recent years, Texas has shown a strong inclination towards demand response programs and virtual power plants.

Demand response status in Texas

The demand response capacity of Texas has been steadily increasing in recent years. According to ERCOT, the demand response capacity in Texas has grown from just under 2,000 megawatts (MW) in 2010 to more than 4,000 MW in 2020.

ERCOT operates a demand response program that incentivizes customers to reduce their energy usage during periods of high demand. The program has been successful in reducing peak demand and preventing blackouts. The state also has several programs that provide financial incentives for customers who reduce their energy usage.

In addition to ERCOT's demand response program, Texas has several independent system operators (ISOs) and regional transmission organizations (RTOs) that manage the state's power grid. These organizations also have their own demand response programs that ensure the state's power grid remains reliable and resilient.

VPPs supporting the Texas Grid

Texas has put efforts into utilizing flexible resources to tackle the grid peak load and congestion issues. In this line, ERCOT has been bringing VPPs into their grid network. Recently, grid alert scenarios have led to the addition of two VPPs in the ERCOT network, taking up the installed capacity to 7.2 MW. The VPP will enable ERCOT to manage renewable energy resources and behind-the-meter flexibility resources such as batteries and electric vehicles to cater to the peak load demands. It is anticipated that VPPs will cater peak demand scenarios in the upcoming winter season.

Key Suppliers of Grid Flexibility Services

Electric utilities in the US have been using AI-powered grid services to effectively handle renewable energy resources at both behind-the-meter and utility-scale levels. This involves utilizing demand response and distributed energy resource management systems (DERMS). However, the recent shift in the trend is towards VPP solutions that offer advantages in terms of economically dispatching flexible resources and balancing supply and demand.

When it comes to the leading suppliers, EnergyHub is at the forefront, offering AI-powered grid flexibility services. They are followed by AutoGrid and Generac Grid Services/Enbala.

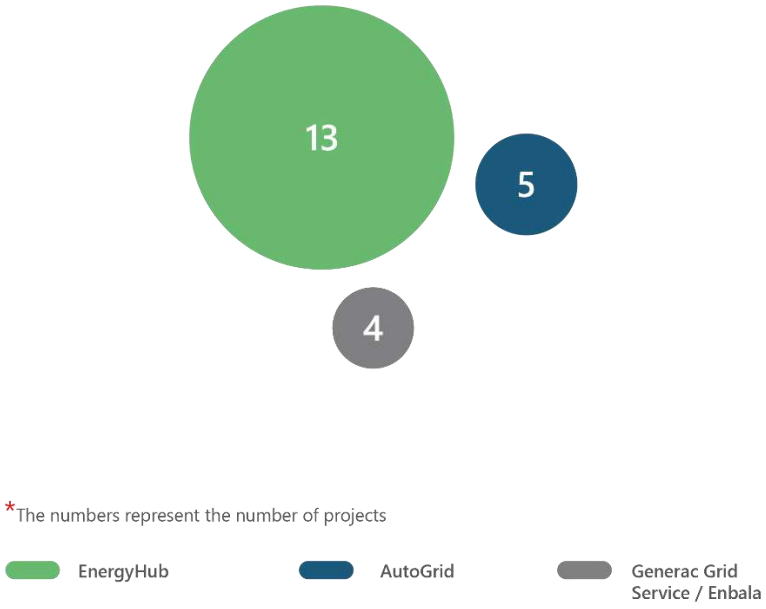

Figure 2: Standing of Key AI-powered Grid Flexibility Services (Including Demand Response, DERMS, and VPP).

Source: PTR Inc.

Looking Ahead

The extreme climate conditions and the intermittent nature of renewable energy sources have presented substantial challenges for major grid operators like AESO, SPP, and ERCOT. AESO and SPP have experienced a notable decline in generation capacity as they are relying on only conventional generators as a solution for intermittency linked with renewable energy.

In contrast, Texas has adopted a proactive stance by embracing behind-the-meter flexibility through the deployment of demand response programs and VPP solutions. The incorporation of AI-powered grid services has notably enhanced the resilience of ERCOT's grid infrastructure, even in the face of a higher frequency of grid alert events over the past year when compared to SPP and AESO. This strategic shift toward AI-driven grid solutions has bolstered the grid's capacity to withstand and mitigate potential disruptions, which is a good omen for the power industry as it enables the widespread integration of renewable energy with the electricity grid.

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