APEx Association of Power Exchanges

NEWSLETTER

Volume XXIV | March 2023

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ASSOCIATION OF POWER EXCHANGES

APEx annual conference 2023
Sep 20-22, 2023
ISTANBUL, TURKEY

APEx Objective

To facilitate the development and communication of ideas and practices in the operation of global competitive electricity markets. One of its primary intentions is to provide a platform for the sharing of information between its members.

Juan Carlos

President of the Board Coordinador Eléctrico Nacional

Challenges in the Chilean Power Grid

The way the power grid is operated, and the market developed, is changing substantially in Chile due to the massive integration of variable renewable energy (VRE) generation and the goal to accelerate and ensure an efficient, secure and reliable energy transition to a net zero generation matrix is raising several challenges for the grid and the wholesale energy market.

The penetration of VRE is increasing rapidly in Chile, having reached in 2022 levels of 33% in terms of energy and 68% as instantaneous power peak, and this trend with much higher levels of VRE insertion is expected to continue and deepen in the coming years. In addition, the radial and extended topology of the main bulk grid, more than 3,000 km long, along with the remote location of the renewable resources from the main load centers, makes it even more challenging to keep the grid secure and stable.

In this context, the Chilean system operator (Coordinador Eléctrico Nacional - CEN) has developed a roadmap that puts forth its vision and lays out the enabling conditions to achieve a reliable operation with 100% of renewable generation by the year 2030. In order to make this accelerated energy transition scenario viable, it is necessary to prepare the grid to integrate new technologies, execute the necessary investments in renewable generation and storage, ensure a reliable supply of demand 24 hours a day, 365 days of the year, and to implement the necessary regulatory changes and energy market reforms to achieve such a challenging goal.

The transition to the operational conditions that could arise in the coming years will necessarily require that the design of the power grid considers a substantial leap in its level of security, strength, and flexibility. The grid of the future will have to cope with increasingly complex dynamics

In the Spotlight

Major Winter Storm Impact on PJM Region

Extreme weather through the weekend of Dec. 23–25, 2022 coupled with unusually high generation outages, resulted in a number of PJM emergency procedures, including the deployment of demand response to reduce load and an RTO-wide Call for Conservation, the first such appeal since the 2014 Polar Vortex.

PJM shared its preliminary analysis of operating and market conditions during Winter Storm Elliott over the Christmas weekend in December, outlining how PJM and its members preserved the reliable flow of power and how market prices reflected system needs through record-breaking cold and unplanned generation outages. Despite the advance planning for the winter storm by PJM and its members, the power supply mix was much tighter than PJM had expected and while many resources did perform well, generator-forced outages were significant.

Storm Preparation and Warnings

Winter Storm Elliott, which has been dubbed a bomb cyclone and "historic Arctic outbreak" by the National Oceanic and Atmospheric Administration, impacted a large portion of the United States from the Northwest, Midwest, South and throughout the Northeast/mid-Atlantic regions; Christmas Eve would bring the lowest high temperatures on record for Dec. 24 for Washington, D.C., Philadelphia and Baltimore. PJM

Continued on Page 02

saw an unprecedented 12-hour average temperature drop of 29 degrees on Dec. 23.

PJM's has extensive preparations for every winter, including data collection on fuel inventory, supply and delivery characteristics, emissions limitations, and minimum operating temperatures; meetings with federal and state regulators and neighboring systems to review winter preparations; and weekly operational review meetings with major natural gas pipeline operators.

In the days leading up to the storm's arrival in the PJM footprint, PJM notified its members on Dec. 20 of the approaching frigid temperatures with a Cold Weather Advisory for the Western Region of the PJM footprint from Dec. 23 through Dec. 25. The advisory was expanded to the whole footprint on Dec. 22.

Introduced in 2022, a Cold Weather Advisory conveys expectations that PJM members will implement freeze protections, such as windbreaks, shelters or temporary heaters, and report operating limitations to PJM.

Cold Weather Alerts followed, first for the Western Region and then for all of the PJM region by Dec. 23. The Cold Weather Alert calls for specific measures to prepare for imminent weather, including review of deferrable maintenance, fuel limitations and enhanced communication with PJM, specifically regarding anticipated difficulties procuring fuel in the spot market that would result in unavailability of generation.

Conservative Approach

Going into the weekend, PJM forecasters were concerned about the unpredictability of demand, given the extreme weather converging with the holiday weekend.

At the start of the day on Dec. 23, PJM had approximately 12,000 MW of forced (or non-planned) outages among its generation fleet. This heralded the start of a challenging day that would impose extraordinary demands on the PJM bulk electric system.

To account for the uncertainty of the conditions, PJM set up the operating day with 155,750 MW of available generation that Friday. That well exceeded the PJM load forecast peak of about 127,000 MW for the day. Friday's actual peak load was approximately 10% above PJM's forecast. Drivers of the load forecasting challenge included extreme cold temperatures, an unusually rapid temperature drop, and different load behavior than expected over a holiday weekend.

Unprecedented Demand

Winter Storm Elliott was unprecedented for that time of year, given the severe temperature drop and resulting spike in load. The record-breaking plunge of 29 degrees over 12 hours on Dec. 23 surpassed the previous PJM record of a 22-degree drop during the 2014 Polar Vortex.

As cold weather gripped the PJM region Dec. 23 and power needs spiked, PJM began seeing high levels of forced generation outages. PJM

in the transition from conventional synchronous resources to inverter-based resources (IBR), balancing increasing and uncertain volumes of VRE. These requirements shall consider, at least, security of supply at all times, frequency management and control, voltage control and grid strength, ability to operate in islands, post-fault black-start recovery, adequate coordination of protections, and power system resilience.

The enabling technologies for the energy transition not only should be able to operate securely and reliably in a more complex and uncertain environment where power electronics will be dominant, but also provide the technical attributes to allow maintaining the capabilities that the grid of the future requires. These attributes shall be defined and validated by the system operator in conjunction with the market participants and equipment manufacturers in order to specify and test their control and protection architectures as well as their effectiveness in advanced modeling tools and simulation environments.

System Operators all over the world shall review, adapt and improve their planning and operation methodologies, processes and tools according to the new reality with a grid with high levels of VRE and a predominance of IBR technologies, in order to reliably and efficiently reach their carbon neutrality goals.

APEx provides an opportunity for all market operators to learn from each other as this transition continues.

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implemented emergency procedures, including calls for synchronized reserves, an RTO-wide Maximum Generation Emergency Action and a call on demand response.

As temperatures fell, power demand rose to a peak of about 135,000 MW Friday evening. Around the same time, forced outages reached as high as 34,500 MW. Shortly before midnight Friday, PJM issued a Call for Conservation for the entire footprint, asking consumers to cut back on their energy use where possible between the hours of 4 a.m. on Dec. 24 through 10 a.m. on Dec. 25.

The demand continued after the peak on Dec. 23 and into Dec. 24. Even the valley, or low point of demand, on Dec. 24 was significantly greater than any other peak, or high-point of demand, for that date in a decade.

Generation outages further expanded to an initially estimated level of nearly 46,000 MW by Saturday morning. Factoring in a number of reserve generators that missed scheduled start times Saturday morning or operated at less than capacity, combined with PJM's inability to replenish pumped storage based on the lack of availability of generators overnight, PJM was missing approximately 57,000 MW of its generation fleet by the morning peak of Dec. 24, the coldest day of the holiday weekend.

More than 90% of the forced outages came with no notice or less than one hour's notice. That meant that dispatchers were calling generators to bring them online, only to be told for the first time that the unit wasn't available.

Emergency Procedures Preserve Reliability

Starting Saturday morning, more than 30 PJM members and stakeholders amplified PJM's Call for Conservation through social and traditional media. This seemed to work, as electricity demand leveled off over the course of Saturday, and peak demand Saturday came in less than what was forecasted.

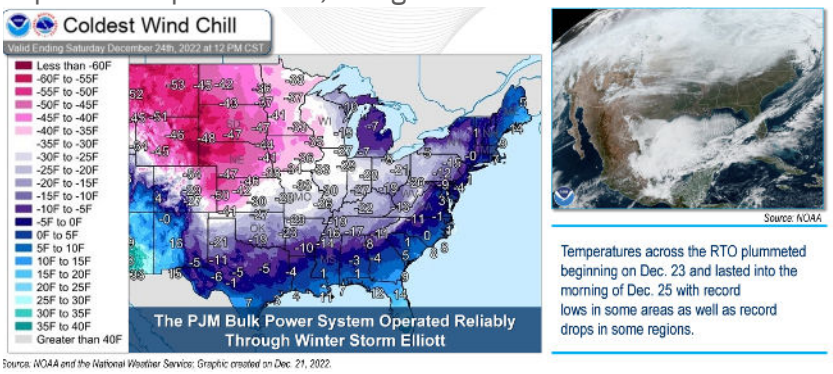
Altogether, calls for conservation, a Maximum Generation Action and demand response are believed to have eased operating conditions through the Dec. 24 morning peak of about 129,000 MW and the evening peak that day of about 126,000 MW. As that Saturday continued, PJM also petitioned and received an order from the U.S. Department of Energy to ensure that certain generation units would remain available. PJM was able to come out of its Maximum Generation Emergency at 10 p.m. on Saturday night, meet the morning peak on Dec. 25, and end all emergency procedures at 10 p.m. Sunday.

Markets

PJM's review indicated that market prices accurately reflected the system conditions and needs through the event.

Generators were subject to 277 five-minute Performance Assessment Intervals over the 23 hours that emergency procedures were in effect on Dec. 23–24. During Performance Assessment Intervals, PJM measures generator performance in line with the capacity they have committed, and assesses penalties for under-performance and bonuses for over-performance. These requirements of PJM's Capacity Performance program, instituted in the wake of the 2014 Polar Vortex, are intended to incentivize generators to better perform in extreme conditions. Preliminary estimates of total penalties could be between $1 billion and $2 billion. The calculation of the final penalties will take several months.

Evaluating the effectiveness of Capacity Performance will be part of PJM's comprehensive analysis of the events of Dec. 23–25. This review will also include analysis of impacts to energy and congestion markets and a review of extreme cold-weather load forecasting. PJM plans to report results, along with recommendations and actions, in April 2023.



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The **Association of Power Exchanges (APEx)** is excited to announce that we will be holding an in-person conference in Istanbul, Turkey.

APEx
Annual Conference 2023
Sep 20-22, 2023

Hotel Swissotel The Bosphorus – ISTANBUL, TURKEY

*Details will be forthcoming and communicated.

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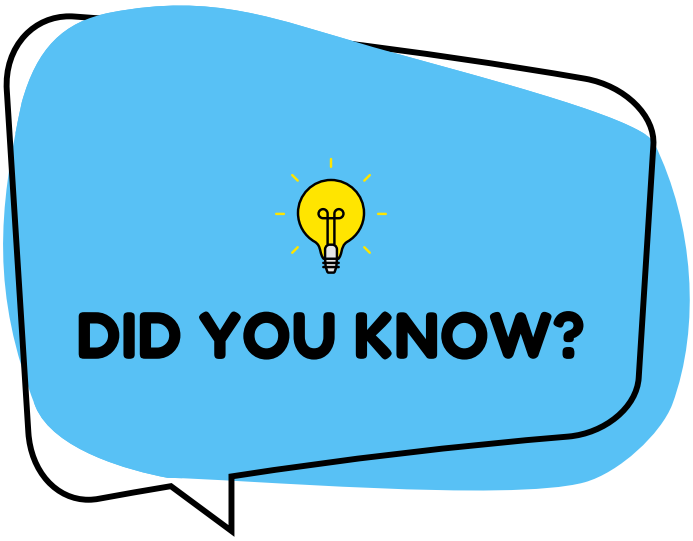

- APEx stands for Association of Power Exchanges.
- APEx was established in 1996 at the first annual conference of the Australia Energy Market Operator (AEMO) in Melbourne, Australia.
- APEx is a non-profit corporation and all 11 APEx Board Directors volunteer their time.
- APEx Board Directors represent areas throughout the world and many attend monthly Board of Director Meetings during off business hours.
- APEx has hosted 26 annual conferences in 20 different countries across 5 different continents.
- The new APEx website will be live mid-2023 and will provide links to industry resources, annual conference papers, APEx resources, membership information, upcoming events and more.
- In 2023, APEx plans to offer opportunities for trainings, additional seminars and of course, another annual conference!

To have your member company featured "In the Spotlight," please send an email to:
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