ASK THE EXPERTS

How Artificial Intelligence is Dramatically Impacting Energy Forecasting

ARNIE DE CASTRO
Product Manager, SAS

JENNIFER WHALEY
Principal Systems Engineer, SAS

Recently, the Department of Energy (DOE) prepared a report in response to the October 30, 2023 "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence" (AI). This detailed response describes the potential for AI to "improve planning, permitting, investments and operations of the electric grid." The expectation is that this leading technology will significantly improve the ability to drive new models that will more accurately forecast both renewable energy production as well as load and demand.

The balancing of supply and demand is critical to ensure energy availability, reliability and costs, particularly in spot market purchases. Accurate forecasts over the short-, mid- and long-term have significant impacts on the bottom line cost to consumers, given the wide variation in wholesale energy prices driven by the timing of purchase agreements. Short-term purchases cost more than long-term arrangements. Weather vendors providing accurate weather data, historical and forecasted, are a dominant contributing element to the overall forecasting process for future energy supply and load/demand.

Weather conditions have a significant influence on load. Many improvements have been made to weather forecast models over time, given the number of years that weather has been tracked and the amount of information that has been captured and analyzed to refine the relationship between load and temperature. Electric Vehicles (EVs) now add a new variable to the load equation since charging time will vary by day and location. Also, it is essential to consider the role that renewable distributed energy resources (DER) that employ solar photovoltaic (PV) and wind resources have on the generation side of the equation and their relationship to weather and accurate forecasting. Continuing improvements are being made to the efficiencies of these technologies, coupled with the geographic diversity of these resources. Therefore, for vendors using newer weather models, the resulting intelligence is essential to understanding the capability of these assets to provide a high level of trust.

We spoke with **Arnie de Castro**, product manager for industry products at SAS, and **Jennifer Whaley**, principal systems engineer at SAS, who provided valuable insights into the current and future trends for AI in energy forecasting.

How does the rapid deployment of distributed energy resources, both behind and in front of the meter, change energy forecasting?

The intermittent nature of these resources, due to the influence that weather has on production capability, means that there is a greater dependency on the accuracy of forecasting models.

PV production is directly related to key factors such as irradiance and temperature. Cloud cover can radically change production in a relatively short period of time. Wind speed and direction can change rapidly as well, impacting output of these resources. While battery energy storage can often mitigate many of these variations, a significant amount of intelligence is required to make an optimal decision on its use for network reliability and system resilience, such as frequency deviation or energy cost arbitrage. AI is a vital component to accurately model these assets to ensure trustworthy information on their current and future capability.

With the geographic diversity of DER, knowing what asset capability is, where it is, and its potential contribution to the grid, as well as the load in a specific area, is a driver of locational marginal pricing (LMP).

How do you see AI impacting energy forecasting tools?

Most of the successful forecasting tools today leverage neural networks and machine learning to build on a process similar to how the human brain works. These networks leverage layers of nodes that interconnect and interact with similar nodes. AI, in its broadest sense, mimics human functions like problem-solving and continual learning. These are built on a foundational basis of managing large amounts of data, extracting key parameters, patterns and trends, and using computational algorithms to help predict future outcomes based on similar sets of conditions.

While AI has become the new buzzword raising concerns about machine takeover, it is a very powerful tool that is being further expanded upon to improve accuracy and trust in predicted outcomes.

How does processing power improve the accuracy of forecasting?

The ability for significant processing power in a cloud-based environment enables companies to benefit from the collection and aggregation of information while still maintaining the privacy and partition of sensitive data. More data, higher quality of data, sophisticated models and greater use of information and intelligence are all unlocked with greater processing power that can be made available.

Do you see a potential for a tsunami of data that can inundate a utility?

With the increasing ability to deploy sensors and the lower costs for communicating the data, this is a growing risk that will be amplified with AMI 2.0 upgrades, where more edge data will be captured and used for grid optimization. For improved forecasting, many utilities are deploying smaller weather stations that can be used to provide essential microclimate data that is in close proximity to many generation assets that are sourced from renewable sources such as wind and solar. Ingesting, parsing, and aggregating these telemetry points in an efficient manner is critical to helping improve models and providing the level of detail necessary to have accurate data from which to plan and operate the grid.

Why would a utility consider a cloud-based solution over an on-premises instance for forecasting?

While many utilities have a strong and deep IT department, often these organizations are taxed with maintaining other key system operational applications like SCADA and energy management systems which frequently are of the highest priority for support. Providing a safe and secure infrastructure that can be scaled to meet the needs of the organization is an effective means of serving these communities that need access to data, analytic tools and results in a streamlined manner without having to depend on IT resources that may be stretched for support.

A cloud-based solution can have a greatly shortened implementation cycle, provide standardized means for interface, lower the cost of training and support, and ultimately result in a lower total cost of ownership (TCO) and provide a greater return on investment (ROI).

What capabilities should an organization seek when looking for an energy forecasting solution?

The most important factor is the accuracy and trust that a provider can offer. The reliance on accurate information over the very short term through to the long term will set the standard for reliance on the tool for actionable and meaningful results. In addition to the efficacy of the tool itself, one must also consider training, technical support, system availability and cyber security.