

2018 FORECASTING WORKSHOP REVIEW

ST. PAUL, MN

Tutorial: **Incorporating Variable Generation Forecasts into Power System Operational Procedures – Where is it Applicable? - A Market Operations Tutorial for Everyone**

Chairs: Erik Ela and Aidan Tuohy, EPRI

The tutorial this year focused on understanding how forecasts are applied in the context of power system operations. The perspectives of a US Independent System Operator (Southwest Power Pool), European Transmission System Operator (REN from Portugal) and large US utility (Xcel Energy) were all provided in the first half of the session, focusing on how the markets work and where they use forecasts. In the second half, more specific applications were described, including how ERCOT procures and deploys ancillary services with increased wind penetration and how ISO New England considers gas pipeline interactions in operations. Finally, EPRI provided a look at future research issues and described how forecasts may be applied in the future.

Session 1: **Opening Plenary - Meteorology, Climate and the Electric Sector - Forecasting for an Integrated Energy System**

Chair: Sue Haupt, NCAR

The Plenary Session 1 focused on the future and the need to understand the longer-term changes in weather and climate. This session treated seasonal and climate scale advances in forecasting for the energy industry, including how forecasting these scales could impact energy industry decisions.

Session 2: Solar and Wind R&D Advances

Chair: Justin Sharp, Sharply Focused

Session 2 covered a range of solar and wind forecasting R&D advances. Tassos Golnas introduced DOE's \$12M Solar Forecast Part 2 project, consisting of three areas of focus: test framework, improved irradiance forecasts, and improved power forecasts with a probabilistic focus and integration into operations. The second speaker described the Test Framework task area in more detail, the objective of which is to develop a standalone, objective and standardized framework for evaluating solar (and ultimately wind) energy forecasts. The third speaker summarized EPRI's recent research efforts with various partners to examine the use of offsite sensors to improve forecasts. The fourth speaker addressed the issue of over-estimating inter-plant correlations in small behind-the-meter PV facilities. The issue was illustrated with a clear example and a proposed solution that creates a probabilistic output by combining modeling methods with new high spatio-temporal resolution from GOES-16 satellite data. The last pair of speakers focused on the outcome of the recently completed Wind Forecasting Improvement Project 2 (WFIP2). The field project and the skill improvements obtained in the foundational NWP models through the improvement of physical parameterizations during the project were described, as well as how the WFIP2 decision support tool methodology and foundational improvements can yield value and be a useful operational tool.

Session 3: Integration of Probabilistic Forecasts into the EMS and MMS – Status and Prospects

Chair: Bob Zavadil, EnerNex

Session 3 featured a very dynamic discussion of the evolving needs for incorporating uncertainty forecasts into the Energy Management System (EMS) and Market Management System (MMS) software. There were three pairs of speakers, each pair representing an ISO and the vendor who supplies their EMS and MMS software; CAISO/Siemens, SPP/GE, and NYISO/ABB. The discussion was driven by increasing amounts of wind and solar energy in the electric system, the associated levels of uncertainty in the forecasts, and the increasing ability of forecast providers to provide probabilistic information about the forecasts. Each pair of speakers provided information on how the situation was currently being handled in their systems, which ranged from first steps to modify the EMS and MMS software to incorporate uncertainty forecasts, to not yet being at that stage. Large over-forecast errors can lead to reliability concerns in the event of a shortage, and large under-forecast errors can lead to economic issues from a generation surplus. There was consensus that the use of probabilistic information in market operation would lead to better outcomes as this capability was added to the EMS and MMS software.

Session 4: Integration and Use of Solar Forecasts for Operating Storage Systems, Distribution Systems and Real Time Markets

Chair: Mark Ahlstrom, NextEra Energy

The four presentations covered wide-ranging but related aspects of dealing with distributed resources and combinations of storage, solar and wind resources. The presentations covered the value of higher temporal resolution (as fine as one-minute forecasts for battery systems), the reduction in variability from wind and solar combinations (even before considering storage), the potential use of models rather than data to deal with increasing privacy considerations from customers on the distribution system, and the complex issues related to using the information about distributed resources by system operators (including the need to consider longer-term needs to plan for generator and transmission outages). In the questions and discussion time, attendees showed strong interest in the “models versus data” concepts (a topic that may need more discussion in future workshops) and in the rapidly emerging cost effectiveness of storage and projects that combine storage with other resources.

Session 5: VG Forecasting and Market Operation Experience

Chair: Alain Forcione, IREQ

The model for variable renewables participation in ancillary services markets is taking shape:

- In Europe, the integration of the continental market now supports this participation and balancing of resources at the global level

As much in North America as in Europe, the integration of uncertainties in the calculation of dynamic reserves starts to be formalized:

- Texas is starting to optimize its dispatch strategies accordingly

To maximize this, all participants continue to improve their forecasting systems:

- Emphasis on forecasts adapted to solar production, with related challenges
- Real-time data requirements
- Combination of models, vendors, etc.
- Integration into SCADA / EMS

Session 6: VG Forecasting and Market Operation Advances

Chair: Craig Collier, DNV/GL

A diverse set of panelists demonstrated that there are new ways to produce and use forecast data along its supply chain, from predicting market congestion, to making better use of temperature forecasts and efficiencies of newer technologies, predicting extreme events (like lightning, and icing), reduction in biases in the raw NWP, as well as post-processing via better informing of forecasts based on historical performance.

While we had the somewhat contrarian view presented that there was little room for further forecast improvement, we also were presented with evidence that there is work ongoing to improve the modeling (e.g., HRRR, RAP) which bears out with lower errors.

Session 7: Advances in Forecast Applications and Market Design

Chair: Erik Ela, EPRI

Session 7 included a set of expert speakers discussing different unique changes to their operational structures, market designs, or utilization of renewable forecasts used in these processes. An overarching theme was renewed applications and interests in higher resolution and closer-to-real-time forecasts. The CAISO, seeing potential benefits from understanding the short-term ramps further in advance, is designing its day-ahead market to move to fifteen-minute resolution. Thus, requiring the use of higher granularity in the forecasts that they use a day in advance. MISO is evaluating potential changes to its settlement rules for uninstructed deviation for wind generators during dispatch down directions, making the MISO forecast for real-time operations more important to achieve accuracy. WEPROG, a forecasting company in Europe, has been providing forecast information on the probability of high speed wind cut off events for the Irish grid operator Eirgrid. The last two presentations provided details on public renewable resource data including comprehensive forecast data for both distribution and transmission-related applications. The data can be used by both bulk power system and distribution planners to conduct studies and understand what the potential operational impacts may be.

Session 8: Closing Plenary – Joint Session with IEA Wind Task 36 on Forecasting for Wind Energy

Chair: John Zack, AWS Truepower

Session 8 consisted of an overview presentation and subsequent panel-audience discussion of the ongoing activities of the IEC and IEA working groups on wind forecasting to compile reference documents intended to provide forecast users with information that can enable them to select or design forecasting solutions that optimize the value for their respective applications. A core theme of the lively discussion segment of the session was that a generally unsatisfied need of many system operators is a capability to reliably provide alerts or warnings of extreme (e.g. high amplitude ramps) or unusual and significant events (e.g. icing or cut-out events in areas where they are infrequent) on an intra-day or day-ahead basis. It was generally recognized that non-traditional forecast content or format (e.g. probabilistic or event-optimized forecasts) would likely have to be explored to provide greater value to users for these situations.