Innovation

Simulating Future Grid Reliability

New Framework to Link Separate Models and Capabilities

By Garrett Hering

Earlier this year, the Federal Energy Regulatory Commission (FERC) issued guidelines to help electric utilities, transmission operators, planning authorities, and other stakeholders better understand potential grid reliability impacts stemming from the U.S. Environmental Protection Agency's Clean Power Plan.

The guidelines encourage the creation of modeling tools and techniques to improve analysis of reliability related to "emerging and ongoing trends in the power industry." These include more:

- Variable renewable energy generation
- Reliance on natural gas
- Flexible operation of fossil-fueled and nuclear power plants

To address this, EPRI is developing and demonstrating an advanced modeling framework for use with existing simulation tools and methods to provide more rigorous reliability analysis. The framework will enable transfer of data among various tools covering different timescales so that they can be used to determine potential reliability impacts of diverse policies and industry trends. Ultimately the framework will be used by power system planners.

"With the grid adding extensive variable energy resources such as wind and solar, no comprehensive tool exists that equips researchers and resource planners to adequately assess reliability concerns," said EPRI Technical Executive Adam Diamant.

The framework initiative builds on EPRI's portfolio of production cost and generation capacity expansion modeling tools, including its Electric Generation Expansion Analysis System (EGEAS) software and U.S. Regional Economy, Greenhouse Gas, and Energy (US-REGEN) model. It also supports EPRI's Integrated Grid work and research to identify modeling gaps to better understand power system changes.

Testing Today's Tools

EPRI began by reviewing today's commercially available and research-focused models. In one study, researchers used the National Renewable Energy Laboratory's FESTIV model to look at how new flexible ramping products can affect grid operations.

"FESTIV is helpful for studying flexible ramping products and other aspects of grid operations, but it's not able to capture all reliability impacts. We want to link these types of tools with other tools to get a fuller picture," said EPRI Project Manager Erik Ela.

Applied individually, FESTIV, US-REGEN, and other software tools can't model the full complexity of the changing power system and the impacts on reliability. Modelers need a greater ability to link inputs and results across various tools.

For example, researchers may be able to use US-REGEN to assess how a particular deployment of generation capacity will affect electricity prices, power company revenues, and emissions. But other tools, such as FESTIV, are needed to gauge whether that capacity has sufficient operational flexibility to maintain prescribed system frequency.

Making Tomorrow's Models

EPRI will investigate how to enable data flows among various models to identify and evaluate reliability concerns such as frequency response, voltage control, and operational flexibility.

With a final version slated for the end of 2017, EPRI plans to use the framework as the foundation for future research and will work with electric utilities to refine and test it on electric system operations.

Key EPRI Technical Experts

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