EPRI

SUCCESS STORY

EPRI Collaborates with Electric Companies to Develop New Transmission Ratings that Balance Risk and Capacity While Meeting Regulatory Requirements

Energy service providers are continuously pushed to deliver electricity in greater quantities and at lower cost. In addition to managing a variety of line designs and innovative technologies, utility engineers must also contend with evolving standards and regulations. In 2022, for example, the U.S. Federal Energy Regulatory Commission (FERC) issued Order 881, significantly changing the landscape for transmission ratings and power flow. The order requires new methods to be deployed by 2025 for real-time, forecasted, and long term (seasonal) ratings based on changes in air temperature and solar cycles.

While intended to improve the accuracy of ratings, the new requirements can also expose electric companies to new types of risk and complexity. An incorrect selection of ratings can lead to asset damage and risks to public safety. Directly adopting new ratings such as ambient adjusted ratings without performing a risk assessment can decrease asset health and create concerns for public safety and system reliability. Companies require guides and assistance in developing new rating methods that both comply with new requirements but also align with their tolerance for risk and need for capacity.

NO ONE SIZE FITS ALL

Over multiple collaborative projects, EPRI has been refining methods to develop and apply transmission ratings. The safe operating limits vary by utility due to the nuances of their line and system construction, the desired asset life, as well as their maintenance practices. The appropriate ratings also vary geographically due to local weather and climate patterns. However, providers share an overarching need for data-driven, risk-informed decision making to balance the push for more power flow.

A fundamental component of the EPRI methodology is risk analysis. Risk factors such as asset health, conductor lifespan, line clearances, and regulatory limits are considered. The baseline of historical performance can be calculated and compared to "what-if" scenarios for multiple new rating methods. This allows electric companies to understand the risk-reward tradeoffs and select ratings that best fit their goals and needs. These projects leverage significantly more data than a traditional rating

> *"Currently, there's no standardized approach for selecting weather parameters for line conductor ratings. EPRI's risk-based framework offered a more consistent conductor rating methodology, ensuring uniform risk levels across Duke Energy's territories with varying climates. EPRI's industry-wide reach also allows us to benchmark our new philosophy against various methods used by our peers. Furthermore, EPRI's ability to deliver the study within the limited FERC Order timeline keeps our project on schedule."*
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> ~ **PRASAD YENUMULA**
> *Principal Engineer, Transmission Engineering Systems and Standards,* Duke Energy

project with over a billion rating calculations performed with each company, considering a large set of weather data for multiple conductor types and different rating methods.

EPRI developed a methodology that produces a range of ratings options ranking from low-risk options that may reduce power flow to higher-risk options that can increase capacity, reducing congestion and potentially deferring other costly capital upgrades. High-risk options may shorten asset life or pose challenges with meeting the National Electrical Safety Code (NESC) requirements, creating an upper limit on the grid. By collaborating across a range of utilities, EPRI could observe potential pitfalls caused by atypical designs, components, or practices and share those across the industry. EPRI modified past research to suit the needs of each member to ensure they can both comply with the new requirements while meeting internal key metrics. Each utility brought unique requirements that forced the optimization of new ratings framework that could suit any need without undue complexity. The utilities can then apply these ratings to provide optimized power flow to customers, which balances reducing system congestion with asset health and public safety.

Duke Energy, which serves a geographically diverse area, is one of several companies that engaged EPRI to help early on to meet FERC Order 881. Duke Energy sought greater consistency across states that had previously developed ratings methods independently. As a result of this research, Duke Energy will have a high level of consistency in ratings methods and the level of risk will be uniform across all states even though they have different climate patterns.

BENEFITS FOR ELECTRICITY PROVIDERS AND CUSTOMERS

By leveraging a data-driven approach and making risk informed decisions, a utility can adopt the ratings methods that best align with its needs. Electric service providers may benefit by improving operating efficiency, decreasing conductor replacement, decreasing costs associated with line upgrades, and reducing the likelihood of issues related to electrically overloading lines. Optimized line ratings help limit congestion as well as the frequency and severity of remedial actions.

Several key learnings and ratings framework improvements will continue to aid electric companies in coming years. Under FERC 881, companies will be required to periodically reevaluate their ratings to affirm their accuracy in the face of changing climates. The tools can also be used to aid adoption of future requirements for DLR (currently described in FERC NOPR 22-5). As energy

Ratings risk tends to be more important at lower voltages, e.g., these 115kV lines will overload rapidly if a 500kV line goes out.

providers are driven to comply with additional requirements for managing extreme weather, interconnection management, renewable integration, and other factors – the risk-based ratings assessment method can help "right size" a solution that aligns with a wide array of stakeholder and compliance requirements.

The public will benefit from ratings increases that help reduce congestion and therefore energy costs. The public also benefits from the risk optimization that ensures a longer lasting grid with reduced maintenance costs. Leveraging the risk framework to ensure lines do not exceed clearances means there is reduced chance of flashovers from lines into public spaces, or into vegetation which is a potential wildfire initiator.

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3002029227 **June 2024**

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