



THOUGHT LEADERSHIP

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A Risk-Based Approach to Capital Improvement and De-Energization of Power Lines

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Electric utilities face increased scrutiny for the role overhead power lines have played in recent wildland fires. To reduce the chance of igniting such a fire, many utilities are undertaking major capital and maintenance projects to replace and harden aging infrastructure. At the same time, utilities are forced to consider the difficult operational choice of de-energizing their more vulnerable overhead lines during high fire hazard conditions. Both activities require evaluating the condition of towers, conductors, and other equipment across thousands of miles of power lines so the assets posing the greatest risk can be hardened or de-energized.

To assist with this challenge, Exponent has developed an innovative, rigorous tool for risk-informed prioritization of asset management efforts, as well as identification of candidate circuits for de-energization during high fire hazard conditions. This tool is based on elements of probability theory originally developed for nuclear power plant design and adapts recent state-of-the-art advancements in methods of seismic risk assessment.

Exponent's probabilistic risk assessment tool integrates multiple sources of data, allowing the probability of failure to be compared among various assets. Data include the age and environmental setting of equipment, inspection results, past performance during wind events, and computational analyses of structural capacities. While

much of the input information is qualitative, engineering inference and calibration to past performance is used to formulate a probability of failure as a function of wind load. This tool allows utilities to assess relative risks posed by tens of thousands of assets and act accordingly.

The tool developed by Exponent has two fundamental applications. First, asset managers can use this tool, in connection with site-specific wind hazards, to determine an annual risk of failure of towers, conductors, insulators, anchors, and other equipment. Comparing annual risk allows for a prioritization of capital and maintenance projects across an entire network and quantifies the associated risk reduction. Second, network operators can use this tool to assess the probability of failure and potential ignition given a forecast wind speed. If the probability of failure exceeds a utility's risk appetite, corrective actions can immediately be taken in the form of asset hardening or de-energization.

Exponent's multi-disciplinary team of electrical, mechanical, materials, and structural engineers and thermal scientists combines decades of failure analysis experience with a deep understanding of fragility and hazard in predicting future failures. We can help utilities make capital improvement and de-energization decisions based on a probabilistic assessment of risk.

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