DANOVO
ENERGY SOLUTIONS
A QUANTA SERVICES COMPANY

WILDFIRE RISK ASSESSMENT AND MITIGATION STRATEGIES

USE CASE

Independent, objective, and practical expertise in electric power



USE CASE

Our team of experts has developed an advanced, data-driven framework for quantitative wildfire risk assessment tailored to electric utilities. This framework integrates ignition probability models and fire spread simulations, enabling utilities to pinpoint high-risk wildfire zones and enhance their risk mitigation efforts.

Key additional benefits include guidance for deployment of monitoring technologies, standardization across teams to enhance alignment on wildfire risk protocols, and adoption of industry practices in data governance to ensure reliable, integrated asset management.

CUSTOMER/INDUSTRY CONTEXT

The customer is an investor-owned utility operating within an island territory that is prone to wildfires. Our framework supports utilities in prioritizing risk mitigation strategies, reinforcing their resilience, and reducing wildfire vulnerability.



KEY BENEFITS

1. **Assess risk:** Quantify wildfire risk and assess the level of readiness for an electric utility's wildfire response.
2. **Utilize short-term mitigation strategies:** Develop short-term wildfire mitigation options including preemptive de-energization.
3. **Establish long-term mitigation options:** Develop long-term mitigation strategies, including resilience investment prioritization and a wildfire situational awareness system.

PROBLEM STATEMENT

This utility faces a high wildfire risk due to:

- **Climate change:** Rising temperatures, frequent and severe heatwaves, and prolonged drought.
- **Aging infrastructure:** Increased risk of equipment-related ignition.
- **Expansion of Wildland-Urban Interfaces (WUI):** Closer proximity to flammable vegetation and communities.

In addition, financial, operational, and regulatory limitations have hindered the utility's ability to establish an effective wildfire risk management strategy. These challenges are compounded by the significant threat that wildfires pose to power infrastructure, often resulting in widespread outages and disruptions to essential services.

OVERVIEW

Our team designed a quantitative, simulation-based framework to assess and manage wildfire risk from power equipment. This framework leverages ignition probability models and fire spread simulations to produce dynamic, weather-dependent heatmaps, identifying high-risk areas under varying conditions. Data insights support informed decision-making, guiding the utility's wildfire risk management and operational planning.

TECHNOLOGIES USED

- **Data processing engine:** Python-based tool for reconciling and structuring unstructured input data.
- **Ignition probability model:** Python-based classification models to estimate ignition likelihood.
- **Wildfire spread simulation:** Utilizes FARSITE/FlamMap for fire spread modeling.
- **Risk score calculation:** Combines ignition probability and fire spread data for risk scoring.
- **Visualization tools:** GIS, Power BI, and Python packages for intuitive data visualization.
- **Decision support tool:** A multi-objective tool for supporting wildfire mitigation decisions.

IMPLEMENTATION PROCESS

- Data collection and preparation: Gathered data from multiple sources, including grid outage records, historical wildfire data (MODIS, USGS, NFIRS), and weather patterns, to calculate ignition probability.
- Wildfire spread simulation: Modeled wildfire spread with FlamMap, incorporating landscape and weather conditions to stimulate spread probability and impact.
- Risk score calculation and visualization: Integrated ignition and spread probabilities into a composite risk score, using GIS data and Power BI for visualization.
- Decision-making support: Developed a multi-objective decision tool to support risk mitigation efforts.

DETAILED USE CASE DESCRIPTION

Specific scenarios:
The fire spread simulations consider a spectrum of weather conditions—to severe or very severe fire weather. This range allows for comprehensive risk assessments under various potential weather impacts.

Workflow process:
The wildfire risk assessment process follows a structured workflow, beginning with data collection and leading to risk score calculations and visualizations.

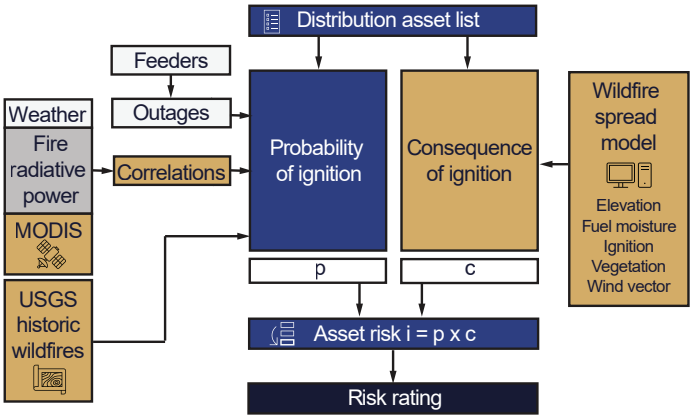


Figure 1 Wildfire Risk Assessment Process.

RISK SCORE HEATMAPS

Heatmaps are generated to visually represent the fire spread, probability of ignition, and wildfire risk across the study area, in various scenarios.

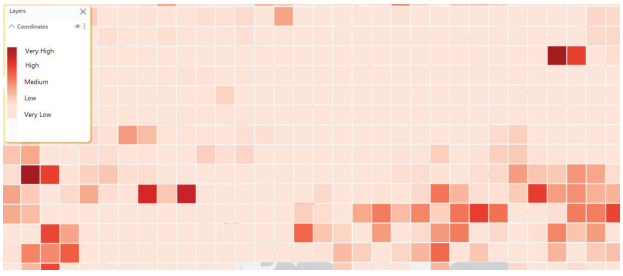


Figure 2 Risk Score Heatmap in Baseline Fire Weather Scenario.

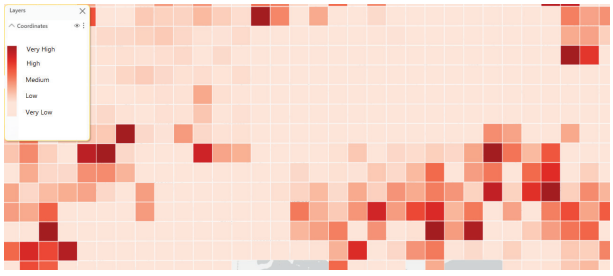


Figure 3 Risk Score Heatmap in Severely Adverse Fire Weather Scenario.

CHALLENGES AND LESSONS LEARNED

Challenges:

- Limited access to validated data from customers and local agencies.
- Insufficient historical wildfire and essential impact datasets.
- Scarcity of local weather station data.

Solutions:

- Collected wildfire and proxy data from sources like USGS, NASA's MODIS, and local fire departments.
- Gathered historical weather data from ECMWF to simulate wildfire conditions.
- Enhanced wildfire spread simulation with advanced fire modeling tools.

Lessons learned:

- Leveraged diverse data sources to compensate for limited historical records.
- Recommended advanced monitoring technologies, such as high-definition cameras, to improve hazard detection and real-time monitoring capabilities.

Visit our website at https://www.danovoenergy.com/offering/asset-and-risk-management/wildfire-risk-management/ to explore our Wildfire Risk Management Solutions offering and see more project references.

For more information, connect with our Wildfire Mitigation experts via info@danovoenergy.com

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Who:

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Industry-recognized thought leaders.

Engineers and MBAs with the ability to address business and technology strategy, as well as the most specialized issues.

Experience spanning the entire lifecycle, from planning to EPC implementation with Quanta companies, to asset management and renewal.

Why:

Independent, objective, and practical advice and solutions.

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Testing, commissioning, integration, and post-installation evaluations of technologies via sustainable technology integration labs.



Accelerate the outcomes for your projects.
Contact and follow us today.

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