Forward Thinking
ENERGY INFRASTRUCTURE CONSULTING

PROBABILISTIC RISK ASSESSMENT · WILDFIRE

Wildfire Risk Assessment for an Electric Utility Service Territory

Quantifying ignition likelihood and consequence circuit by circuit to focus mitigation where it matters most

CLIENT
Electric utility with a high fire-threat service territory, western U.S.

SERVICE LINES
Probabilistic Risk Assessment, Decision Support Tools

SCOPE
Ignition probability model, consequence model, circuit-segment risk ranking, mitigation portfolio evaluation

DURATION
9 months

3,000+	~10%	6	2–3×
circuit segments risk-ranked	of segments carrying about half of modeled risk	mitigation options evaluated on cost per unit of risk reduced	spread in risk-reduction efficiency across options

THE CHALLENGE

The utility faced growing wildfire exposure, tighter regulatory expectations for a risk-based mitigation plan, and a finite capital budget. Its existing approach ranked circuits largely on fire-threat map tier and outage history, which did not distinguish between an ignition that would be contained in minutes and one that could reach communities.

The client needed a defensible, quantitative basis for deciding where to underground, where to install covered conductor, where to rely on enhanced settings and vegetation management, and how to explain those choices to regulators and the public.

WHAT WE DID

1. **Ignition likelihood modeling.** We built ignition probability models by driver (equipment failure, vegetation contact, third-party contact, animal contact) at the circuit-segment level, using the utility's outage, ignition, inspection, and asset condition records combined with wind, fuel, and weather data. Equipment-driven ignition rates were tied to asset age, condition findings, and design type.
2. **Consequence modeling.** Ignition consequence was estimated from fire-spread simulations under representative weather scenarios and mapped to structures, population, critical facilities, and suppression difficulty. This turned each segment's exposure into an expected-loss measure rather than a map tier.
3. **Risk aggregation and ranking.** Likelihood and consequence were combined into a segment-level risk score and aggregated to circuit, district, and territory level, with uncertainty bands carried through so that decision-makers could see where the ranking was robust and where it was sensitive to data gaps.
4. **Mitigation portfolio evaluation.** Six mitigation options (undergrounding, covered conductor, enhanced protective settings, targeted vegetation management, accelerated inspection, and PSPS refinement) were modeled for their effect on likelihood and consequence. Each was scored on risk reduced per dollar and on side effects such as customer outage minutes.
5. **Decision support tool.** The models were packaged into a tool that lets planners re-rank segments as new inspection data arrives and test alternative budget scenarios.

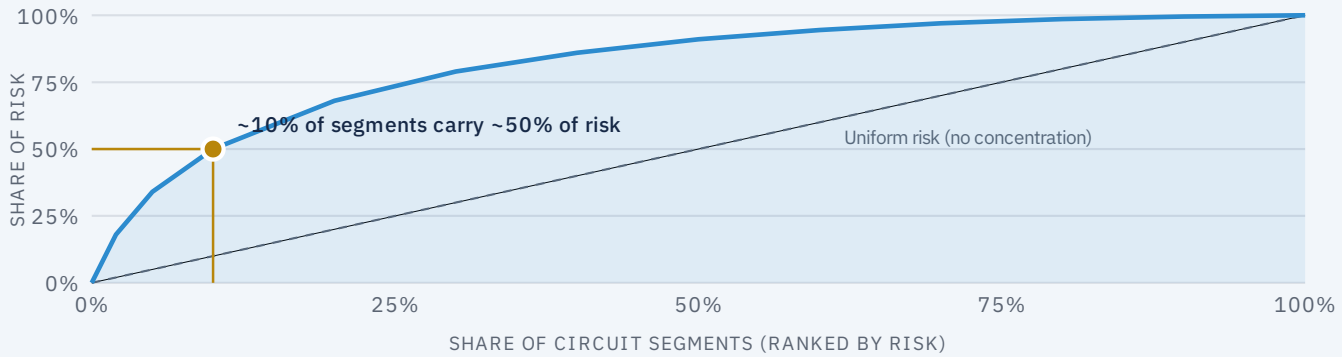
RESULTS

The analysis showed a strongly concentrated risk profile: roughly one tenth of circuit segments carried about half of the modeled wildfire risk. That concentration allowed the utility to focus its highest-cost mitigations (undergrounding and covered conductor) on a much smaller footprint than a tier-based plan would have implied.

Cost-effectiveness varied by two to three times across mitigation options depending on the segment's risk driver. Covered conductor and targeted vegetation work proved most efficient on vegetation-driven segments; enhanced settings and accelerated inspection were the efficient choice where equipment failure dominated.

The resulting mitigation portfolio delivered materially more modeled risk reduction for the same budget than the prior plan and gave the utility a quantitative narrative for its regulatory filing.

Cumulative share of modeled wildfire risk vs. share of circuit segments



Illustrative risk concentration curve. The steep initial slope is what makes targeted mitigation efficient.

IMPACT FOR THE CLIENT

Mitigation spend is now allocated on modeled risk reduction per dollar, with a transparent audit trail from data to decision.

The segment-level risk model is refreshed as inspection and weather data arrive, so the plan evolves with the system rather than being rebuilt each filing cycle.

WHAT WE DELIVERED

- Segment-level ignition likelihood and consequence models
- Territory-wide wildfire risk ranking with uncertainty bands
- Mitigation cost-effectiveness analysis for six options
- Scenario-based decision support tool for planners
- Technical basis document supporting the wildfire mitigation plan filing

METHODS AND STANDARDS

Probabilistic risk assessment · Bayesian ignition-rate estimation · Fire-spread and consequence simulation · Cost-effectiveness (risk-spend efficiency) analysis · Uncertainty and sensitivity analysis