THINK POWER SOLUTIONS

Utility Wildfire Mitigation | Whitepaper

From Reactive Patrols to Risk-Informed Grid Intelligence

How UAS, aerial inspection data, and advanced analytics are reshaping wildfire risk mitigation for electric utilities.

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Table of Contents

Executive Summary: From Reactive Patrols to Risk-Informed Grid Intelligence

Section 1: The 2018 Demarcation Point

Section 2: From Reactive Patrols to Proactive Risk Mitigation

Section 3: The Role of Drones in Utility Wildfire Mitigation

Section 4: Evidence of Industry Change

Section 5: PG&E: Accelerated Inspection and Scalable Aerial Data

Section 6: SCE: 360-Degree Inspection and Structured Field Intelligence

Section 7: From Data Collection to Risk Intelligence

Section 8: The Emerging Role of AI/ML in Wildfire Inspection Programs

Section 9: Why Desktop Inspection Matters

Section 10: A Practical Operating Model for Utilities

Section 11: Key Lessons Learned from the Industry Transition

Section 12: Think Power Solutions' Role in the Next Phase

Executive Summary

From Reactive Patrols to Risk-Informed Grid Intelligence

Wildfire risk mitigation for electric utilities has changed fundamentally since 2018. What was once largely centered on periodic inspection, reactive repair, and post-event response has evolved into a proactive, data-driven operating model built around asset intelligence, vegetation intelligence, situational awareness, system hardening, advanced protection settings, and repeatable inspection analytics.

The 2018 Camp Fire marked a clear industry demarcation point. In the years that followed, electric utilities in California accelerated wildfire mitigation programs, expanded inspections in high-fire-risk areas, adopted drone and helicopter-based data collection at scale, and began incorporating AI/ML-supported inspection review into operational workflows.

Unmanned aircraft systems, commonly referred to as drones or UAS, are not a stand-alone wildfire solution. Their value is that they serve as a scalable field intelligence layer. When used correctly, drones allow utilities to collect high-resolution, close-range visual evidence of asset conditions, mitigate for access challenges in difficult terrain, improve worker safety, reduce inspection variability, and feed structured inspection data into GIS, work management, engineering, vegetation, and risk- prioritization systems.

> "The real transformation is not the aircraft. It is the shift from reactive patrols to risk-informed grid intelligence."

Think Power Solutions has direct operational experience within this transition. Since 2019, TPS has supported desktop inspection and specialized inspection review of drone and helicopter-collected utility data, including work associated with PG&E programs. TPS also supported the pilot and launch of Southern California Edison's 360-degree distribution inspection model, which helped advance structured ground and aerial inspection workflows in high-fire-risk areas. Across PG&E and SCE-related programs, TPS has inspected more than 1 million utility assets and counting.

This white paper explains how the industry changed, where drones fit within the wildfire mitigation ecosystem, what risk-reduction outcomes utilities have publicly reported, and why the next phase will depend on integrated inspection intelligence.

1M+

Utility assets inspected across PG&E and SCE-related programs since 2019

2018

They earth at fundamentally changed utility wildfire mitigation in the U.S.

Section 1

The 2018 Demarcation Point

The 2018 Camp Fire reshaped the utility wildfire mitigation landscape. It exposed the need for a more aggressive, evidence-based, and operationally scalable approach to electric infrastructure risk in high-fire-threat areas. After the fire, the industry moved rapidly toward accelerated inspections, expanded documentation, enhanced asset review, and risk-based remediation.

For utilities, the post-2018 environment created several new operating expectations:

- inspect more assets, more frequently, and with better documentation;
- identify ignition-risk conditions earlier;
- prioritize corrective actions based on risk, not only routine maintenance cycles;
- strengthen traceability from inspection finding to mitigation action;
- improve situational awareness during high-fire-risk weather;
- reduce reliance on broad public safety power shutoffs where targeted mitigations can reduce exposure;
- develop defensible records that demonstrate what was inspected, what was found, what was corrected, and when.

Drone-based inspection emerged as one of the most important enabling technologies in this transition. Drones gave utilities a practical way to inspect structures, conductors, crossarms, hardware, insulators, transformers, switches, vegetation encroachments, and surrounding field conditions from angles that were difficult or impractical to capture through ground-only patrols. However, the deeper change was procedural. Utilities began moving toward standardized image capture, structured review, desktop inspection, condition classification, quality control, GIS association, and corrective-action tracking. These workflows allowed inspection programs to mature from “field observation” into an auditable data pipeline.

Figure 1

Industry Shift Timeline

2018 Camp Fire through the next phase of closed-loop risk mitigation.

2018
Camp Fire — industry demarcation point; exposed need for aggressive, evidence-based risk management across high-fire-threat electric infrastructure.

2019 to 2021
Accelerated Wildfire Inspections — PG&E, SCE, and others launch large- scale enhanced inspection programs; hundreds of thousands of corrective actions identified.

2020 to 2022
Structured Drone and Helicopter Data Collection — aerial inspection integrated at scale; standardized image capture, asset association, and data management workflows established.

2021 to 2023
Desktop Inspection Scale-Up — utilities build structured inspection review capacity; SCE's 360-degree model integrates ground and aerial perspectives.

2022 to 2024
Covered Conductor and System Hardening — grid hardening accelerates; undergrounding, EPSS, and advanced protection settings reduce ignition exposure.

2024 to Present
AI/ML-Supported Inspection Intelligence — machine learning tools begin triaging images and flagging defects at scale; NDAA-compliant UAS fleets deployed.

Next Phase
Closed-Loop Risk Mitigation — inspection, classification, prioritization, mitigation, verification, and learning integrated into one continuous cycle.

Section 2

From Reactive Patrols to Proactive Risk Mitigation

Traditional utility inspection programs were built around recurring maintenance cycles, compliance obligations, and response to known issues. That model remains important, but wildfire risk requires a more dynamic approach. Fire risk changes with weather, vegetation, asset condition, terrain, fuel loading, equipment age, grid configuration, and operational exposure.

The modern wildfire mitigation model is proactive. It combines asset inspections, vegetation management, drone and helicopter imagery, ground patrols, thermal inspections, GIS and asset records, weather stations, high-definition cameras, covered conductor, undergrounding, sectionalizing, grid automation, enhanced protection settings, Public Safety Power Shutoff planning, risk modeling, AI/ML-supported analytics, and work-order validation.

The Integration Imperative

In this model, drones support the front end of the risk-reduction cycle. They collect inspection-grade evidence. That evidence then becomes valuable when it is reviewed, categorized, validated, prioritized, and tied to a mitigation action.

The strongest wildfire mitigation programs do not treat UAS operations as a separate aviation function. They integrate UAS into a larger utility operating model that connects field capture, desktop review, engineering decision-making, asset management, vegetation management, and executive risk reporting.

Section 3

The Role of Drones in Utility Wildfire Mitigation

Drones have become a core inspection tool because they solve several operational problems at once.

1. **Improve Accessibility:** Many high-fire-risk circuits traverse steep, remote, or environmentally sensitive terrain. Drones allow utilities to inspect assets without always requiring climbing, bucket access, or extended ground access.
2. **Enhance Visual Evidence:** A properly flown drone inspection can capture angles and details that are difficult to see from the ground, including pole-top hardware, cotter keys, conductor attachment points, insulator condition, crossarm damage, animal nests, woodpecker damage, equipment leakage, damaged or missing hardware, and vegetation proximity.
3. **Enable Repeatability:** When inspection standards are defined clearly, drones can support consistent capture patterns across large asset populations. This consistency improves desktop review and makes data more useful for training, QA/QC, and analytics.
4. **Reduce Safety Risks:** Drones reduce the need for personnel to access hazardous terrain, climb structures, or inspect energized assets from close proximity when a remote visual inspection can provide sufficient evidence.
5. **Create Verifiable Audit Trail:** High-resolution imagery, when tied to asset IDs, GPS location, date, inspector, defect category, severity, and work- order status, creates a defensible evidence trail.

Drones are most powerful when they are not treated as an endpoint. The inspection image is only the beginning. The value is created when that image becomes an actionable record.

Section 4

Evidence of Industry Change

Publicly available utility data shows that the wildfire mitigation environment has changed significantly since 2018.

PG&E's post-Camp Fire inspection program is an early example of the industry's rapid shift. In 2019, PG&E reported large-scale visual and aerial inspections of transmission structures, distribution poles, and substations in or near high-fire-threat areas. The company also reported hundreds of thousands of corrective actions identified through that inspection effort. This demonstrated the scale of inspection activity required once utilities began systematically reviewing high-fire-risk assets.

PG&E has continued to incorporate drones into its inspection fleet. The company has described drones as an essential part of its aerial system and reported large volumes of distribution structure flights and transmission missions in 2024. This reflects a broader industry trend: drone inspection is no longer experimental. It has become a normalized component of utility inspection and wildfire mitigation operations.

SCE's public reporting shows a similar evolution. The company has reported a substantial reduction in catastrophic wildfire risk compared to pre-2018 levels, citing enhanced vegetation management, regular equipment inspections, covered conductor, and other technologies. SCE has also reported that drones now make up nearly all of its aerial inspections, supporting annual inspection of hundreds of thousands of structures across its service territory.

The important point is not that drones alone produced these results. The defensible conclusion is that drones and aerial inspection data became key enabling technologies within larger wildfire mitigation portfolios. Those portfolios include grid hardening, vegetation management, weather monitoring, cameras, protection settings, engineering review, and risk-based prioritization.

Table 1

Publicly Reported Utility Wildfire Mitigation Indicators

Selected indicators from PG&E and SCE public disclosures, post - 2018 through 2024. Figures are indicative; verify against current public reporting for precise values.

Utility	Indicator	Reported Finding
PG&E	Post-2018 inspection scale	Large-scale visual and aerial inspections in high-fire-threat areas; hundreds of thousands of corrective actions identified in 2019.
PG&E	2024 drone activity	Drones described as essential to aerial inspection fleet; large volumes of distribution structure flights and transmission missions reported.
PG&E	EPSS ignition reduction	Enhanced Powerline Safety Settings deployed; reported reductions in ignition events in targeted high-fire- risk circuits.
PG&E	Undergrounding and system hardening	Undergrounding and covered conductor programs cited as contributing to reduced catastrophic wildfire risk.
SCE	Catastrophic wildfire risk reduction	Substantial reduction vs. pre-2018 levels; attributed to inspections, vegetation management, covered conductor, and technology deployment.
SCE	Covered conductor miles	Significant miles of covered conductor installed across high-fire-risk distribution circuits.
SCE	High-fire-risk-area inspections	Annual inspection of hundreds of thousands of structures across high- fire-risk service territory.
SCE	Drone share of aerial inspections	Drones reported to represent nearly all aerial inspections; scalable UAS- led inspection program now standard.

Section 5

PG&E: Accelerated Inspection and the Rise of Scalable Aerial Data

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Section 6

Southern California Edison: 360-Degree Inspection and Structured Field Intelligence

Southern California Edison's wildfire mitigation program demonstrates how aerial inspection evolved into a structured, repeatable inspection model. SCE's 360-degree inspection approach combines ground and aerial perspectives to capture a fuller view of asset condition, surrounding field conditions, and potential ignition risks.

TPS supported the pilot and launch of SCE's 360-degree distribution inspection model. This work helped advance a more structured approach to utility inspection in high-fire-risk areas, where the quality, completeness, and consistency of inspection data are critical.

The 360-degree model is important because it recognizes that no single perspective is sufficient. Ground crews may capture context that aerial imagery cannot. Drones may capture pole-top and hardware conditions that are difficult to see from the ground. Helicopters may remain useful for specific terrain, access, or transmission inspection use cases. Desktop review can then bring these data sources together into a more complete assessment.

SCE's program also reflects another major industry shift: the movement toward secure, utility-grade UAS fleets. As utilities evaluated aircraft platforms, cybersecurity, supply chain risk, NDAA compliance, flight performance, payload capability, serviceability, and inspection suitability became increasingly important. TPS leadership supported evaluation of NDAA-compliant aircraft platforms as utilities began moving away from Chinese-manufactured aircraft and toward secure, enterprise-ready UAS solutions.

This transition is likely to continue. Utility drone programs are no longer judged only by aircraft cost or image quality. They are judged by security, scalability, platform governance, payload performance, data integrity, fleet management, pilot training, maintainability, and how well they support the utility's end-to-end inspection workflow.

Section 7

From Data Collection to Risk Intelligence

The next major change in wildfire mitigation is the movement from data collection to risk intelligence.

Many utilities now collect enormous volumes of imagery from drones, helicopters, ground crews, fixed cameras, thermal sensors, and field teams. The challenge is no longer whether data can be captured. The challenge is whether that data can be transformed into timely, accurate, prioritized, and auditable decisions.

A mature wildfire inspection intelligence model includes seven linked steps:

This is where the industry is heading. The long-term value is not in simply capturing more images. It is in building a closed-loop system where inspection data continuously improves risk identification, prioritization, and mitigation outcomes.

Section 8

The Emerging Role of AI/ML in Wildfire Inspection Programs

AI and machine learning are beginning to reshape how utilities manage inspection data. For wildfire mitigation, AI/ML can support several important functions:

- identifying likely defect conditions in large image sets;
- flagging damaged insulators, broken hardware, damaged crossarms, leaking equipment, woodpecker damage, animal nests, and vegetation concerns;
- prioritizing images for human review;
- reducing reviewer fatigue;
- improving consistency across large inspection programs;
- creating structured datasets for trend analysis;
- supporting quality control by identifying missed assets or incomplete views;
- accelerating reinspection and validation workflows.

AI/ML should not be positioned as a replacement for qualified utility inspectors. The more realistic and defensible model is human-in-the-loop inspection intelligence. AI can help triage, flag, compare, and prioritize. Experienced reviewers and utility subject matter experts remain critical for validation, severity assessment, and operational decision-making.

TPS' work across desktop inspection, field data validation, thermal inspection, GIS workflows, and ML-ready failure-mode libraries positions the company to support this next phase. The objective is to help utilities convert imagery and field data into structured, defensible, and scalable intelligence.

Section 9

Why Desktop Inspection Matters

Desktop inspection is one of the least visible but most important parts of the wildfire mitigation workflow. Flight operations produce the data, but desktop inspection turns that data into decisions.

At scale, desktop inspection must answer several questions:

- Was the correct asset inspected?
- Was the image quality sufficient?
- Were all required views captured?
- Is the observed condition normal, abnormal, damaged, missing, deteriorated, or urgent?
- Is the issue related to wildfire ignition risk, reliability, public safety, or routine maintenance?
- Does the finding require immediate escalation, engineering review, field validation, or standard repair?
- Is the record complete enough to support audit, reporting, and work execution?

TPS' inspection teams have reviewed more than 1 million assets across PG&E and SCE-related programs. That volume matters because wildfire mitigation is a scale problem. Utilities need partners who understand not only how to inspect a single asset, but how to maintain consistency and quality across hundreds of thousands of assets, multiple territories, multiple data sources, and changing program requirements.

Section 10

A Practical Operating Model for Utilities

A utility-grade wildfire inspection program should be designed as an integrated operating model, not a disconnected set of field services. The following framework reflects a practical approach.

Program Standards

Define inspection objectives, required views, image quality thresholds, asset naming conventions, defect categories, severity logic, and escalation criteria before field work begins.

Create an Auditable Record

Use the right platform for the right inspection type. Drones, helicopters, ground crews, thermal cameras, and other sensors each have appropriate use cases. The goal is complete, safe, and inspection-grade capture.

Data Intake and QA/QC

Validate that field data is complete, properly named, geospatially associated, and suitable for review. Incomplete or poor-quality data should be identified early to avoid downstream inspection gaps.

Desktop Review

Use trained inspection reviewers to classify asset conditions, identify risk indicators, and document findings consistently. Apply quality control sampling and escalation review for critical or uncertain conditions.

GIS and Work Management Integration

Tie inspection findings to asset records, circuit information, work orders, maps, and dashboards. Data that cannot be connected to utility systems has limited operational value.

Risk Prioritization

Rank findings based on likelihood, consequence, fire-threat exposure, vegetation conditions, weather sensitivity, asset criticality, and operational impact.

Mitigation and Verification

Track remediation through completion and perform follow-up validation where required. The workflow should close the loop from inspection to action

Analytics and Continuous Improvement

Use inspection outcomes to improve standards, pilot training, reviewer calibration, risk models, AI/ML datasets, and executive reporting.

Section 11

Key Lessons Learned from the Industry Transition

Several lessons have become clear since 2018.

Lesson 1: Drones are an enabling technology, not the entire solution.
Drones improve inspection access and evidence collection, but wildfire risk reduction depends on what happens after the data is collected.

Lesson 2: Standardization determines scalability.
Large programs fail when capture standards, naming conventions, inspection categories, QA/QC logic, and escalation rules are inconsistent.

Lesson 3: Desktop review is a mission-critical function.
The value of aerial imagery depends on accurate review, classification, prioritization, and integration with work management systems.

Lesson 4: Utility inspection is becoming a data discipline.
Modern inspection programs require aviation knowledge, utility asset knowledge, GIS discipline, data governance, cybersecurity, analytics, and operational execution.

Lesson 5: Secure platforms matter.
As drones become embedded in utility operations, aircraft origin, data handling, fleet management, cybersecurity, and NDAA compliance become increasingly important.

Lesson 6: AI/ML requires clean, structured, validated data.
AI-supported inspection tools are only as good as the image quality, annotation discipline, failure-mode taxonomy, and human validation process behind them.

Lesson 7: The future is closed-loop risk mitigation.
The most mature programs will connect inspection, defect classification, risk prioritization, mitigation, verification, and learning into one continuous improvement cycle.

Section 12

Think Power Solutions' Role in the Next Phase

Think Power Solutions supports utilities across the inspection data lifecycle, from field collection support and desktop inspection to QA/QC, thermal review, GIS validation, specialized inspections, and emerging AI/ML-ready datasets.

Where TPS Fits in the Inspection Data Lifecycle:

TPS' experience is built on direct involvement in large-scale utility inspection programs that helped shape the industry's movement from reactive patrols to proactive wildfire risk mitigation. Since 2019, TPS has supported desktop inspection of drone and helicopter-collected data associated with PG&E programs, as well as specialized inspection support. TPS also supported the pilot and launch of SCE's 360-degree distribution inspection model and has assisted in the evaluation of secure, NDAA-compliant aircraft platforms for utility inspection use cases.

Across PG&E and SCE-related programs, TPS has inspected more than 1 million assets and counting. That experience gives TPS a practical understanding of what utilities need from inspection partners: scalability, consistency, technical accuracy, data quality, defensible records, and the ability to turn field data into actionable mitigation intelligence.

TPS' inspection and software capabilities are aligned with where the industry is heading. Utilities need integrated tools and services that can support:

- high-volume inspection review;
- defect and failure-mode classification;
- QA/QC of imagery and field data;
- GIS and asset-data validation;
- thermal anomaly review;
- vegetation and asset-risk workflows;
- ML-ready training datasets;
- dashboard-ready inspection outputs;
- audit-ready mitigation records.

The objective is simple: help utilities find risk earlier, prioritize it more effectively, and document mitigation more defensibly.

Conclusion

The utility wildfire mitigation landscape has changed permanently. Since 2018, the industry has moved from reactive inspection and event response toward proactive, data-driven risk mitigation. Drones helped accelerate that shift by giving utilities a safer and more scalable way to collect high-resolution inspection evidence across large asset populations and difficult terrain.

But the aircraft is only one part of the system. The true value comes from converting aerial data into inspection intelligence, corrective action, mitigation validation, and continuous risk reduction.

For utilities, the next phase will require integrated programs that combine field capture, desktop inspection, QA/QC, GIS validation, AI/ML-supported analytics, secure aircraft platforms, and closed-loop remediation tracking. Programs that connect these elements will be better positioned to reduce ignition risk, improve reliability, reduce customer impacts, and demonstrate defensible action to regulators, communities, and stakeholders.

Think Power Solutions brings direct experience from the industry's transition period and ongoing utility-scale inspection programs. With more than 1 million assets inspected across PG&E and SCE-related programs, TPS is positioned to help utilities move beyond data collection and into the next era of wildfire risk intelligence.

Think Power Solutions: Built for This Moment

With more than 1 million assets inspected across PG&E and SCE-related programs, TPS brings direct experience from the industry's most demanding inspection environments. TPS is positioned to help utilities find risk earlier, prioritize it more effectively, and document mitigation more defensibly.

THINK POWER SOLUTIONS

Risk-Informed Grid Intelligence Starts with the Right Partner.

Think Power Solutions supports utilities across the inspection data lifecycle, from field collection and desktop review to QA/QC, GIS validation, and AI/ML- ready datasets.

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Pride Resource Partners, a pioneer in aerial and drone inspection programs for utilities, was acquired by Think Power Solutions in 2025. The Pride acquisition expands our project delivery capabilities across the energy, utility, and transportation sectors.

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