

5 key areas to mitigate wildfire risk

Managing wildfire risk with electrification



Recent high-profile wildfires caused by electrification equipment have increased scrutiny of electrical utilities and their wildfire management practices. ABB's portfolio of wildfire management solutions is helping utilities across the country meet regulators' expectations and protect the communities they serve.

Notable wildfires elevate the importance of wildfire management planning

Data from the National Interagency Fire Center shows that the number of wildfires in the U.S. and the amount of acreage burned can vary widely from year to year. Some years are hotter and dryer than others, and all it takes is one spark on the wrong day to set off a blaze that destroys property and lives. According to the California Public Utility Commission, about 10% of the time, ignition comes from power lines and equipment owned by local utilities.

In response to devastating fires that swept through California in 2018 and 2023, electrical utilities in that state are required to prepare and implement a Wildfire Mitigation Plan. Measures include preemptive actions like power line inspections, vegetation management, and infrastructure upgrades to bolster grid resilience and reduce wildfire risks.

Of course, wildfires are not unique to California, and other fire-prone states like Arizona, Oregon,

Washington and Texas are also considering or implementing similar measures. The move towards more purposeful wildfire management planning reflects a broader recognition of the critical role utilities have in wildfire prevention and the importance of a proactive approach to safeguarding lives, properties and natural resources.

In addition, wildfire risk mitigation offers significant financial benefits to power utilities by decreasing the likelihood of costly damage and other liabilities associated with wildfires ignited by electrical infrastructure. Furthermore, proactive wildfire mitigation efforts can improve system resilience, minimizing the possibility of widespread power outages and the associated costs of emergency response, repairs and customer compensation. By prioritizing wildfire mitigation, utilities can also help avoid regulatory fines, lower insurance costs, and enhance their reputation with customers and investors, potentially translating to better financial stability and investment returns in the long run.

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**Distribution
connectors**
Blackburn® overhead
connectors
encompass a
complete line of
splices, taps and
terminals for all
overhead distribution
applications.
Blackburn Storm-
Safe® breakaway
service entrance kits
are quicker to replace.
More uptime, more
reliability, more
customer satisfaction
and quick service

1. Grid hardening

Most utility-related wildfires start with an act of nature that results in a powerline fault and a combustible event. Vegetation contact with a power line is a frequent ignition point for utility-caused fires. Just as powerful winds can topple even the sturdiest of trees, they can also down utility poles. Even birds and squirrels can create power line faults that create a spark.

Some approaches to wildfire management have stood the test of time: Clearing vegetation around utility poles and wires is as important now as it ever was. However, a new generation of grid components has emerged to augment traditional wildfire management strategies with solutions that prevent a fault from happening or prevent the fault from starting a fire. In the modern power grid, grid hardening includes both mechanical and digital solutions for mitigating the risk of wildfires.

Mechanical solutions for arc prevention and containment

In the digital age, it's easy to overlook mechanical solutions to modern problems, but that would be a mistake. ABB has evolved many of its distribution grid components with mechanical functions that help mitigate the risk of fire.

One such system, Blackburn® StormSafe®, is a service entrance breakaway disconnect system designed for residential or light commercial overhead distribution systems. This product is engineered to disconnect service entrance conductors when subjected to excessive weight caused by falling tree limbs, heavy ice loads or traffic accidents. The system reduces the potential for live wires falling to the ground and starting a fire. In addition to lowering ignition likelihood, this protective measure enhances safety for utility personnel and the public by mitigating the exposure to downed electrical lines.



The California Department of Forestry and Fire Protection administers CAL-FIRE, a program that provides exemptions for products or activities in the context of fire prevention and building materials standards. Electrification components that have earned the CAL-FIRE exempt designation are recognized as meeting the required standards. While the CALFIRE exempt designation is unique to California, it is recognized by utilities nationwide as they seek to mitigate the risk of wildfires in their state. Many ABB components designed to reduce the risk of wildfires have already earned the CAL-FIRE exempt designation, while the application process is ongoing for newer additions to the portfolio.



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Reclosers

Reclosers are predominantly located on the distribution feeder. As the continuous and interrupting current ratings increase, they are seen in substations where traditionally a circuit breaker would be located. Reclosers have two basic functions on the distribution system: reliability and overcurrent protection.

Vacuum reclosers, such as ABB's GridShield® and Eagle reclosers, use a vacuum interrupter to break and make the electrical circuit when a fault is detected. The vacuum within the interrupter quickly quenches the arc, interrupting the current. Vacuum reclosers are known for their quick operation, durability and minimal maintenance requirements due to the vacuum interrupter's sealed environment. A spark is short-lived in a vacuum, and the sealed environment contains any potential by-products of a fault that could start a fire. In addition, unlike hydraulic reclosers, vacuum reclosers don't rely on an oil or gas medium to open and close contacts, so they help eliminate the chance of a combustible materials leak contributing to the risk.



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Current limiting fuses

Hi-Tech™ is an industry brand of current-limiting fuses with advanced designs to provide superior protection in small, cost-efficient form factors to optimize value, reliability and reduce system lifecycle costs. With fault-clearing capabilities in less than one-half cycle, Hi-Tech current limiting fuses reduce the let-through energy, significantly reducing equipment stress and helping to increase safety.

Current-limiting fuses also play a significant role in helping prevent wildfires by rapidly interrupting overcurrents in electrical systems, minimizing the duration and magnitude of fault currents. These fuses are designed to operate in milliseconds when a fault occurs, significantly reducing the energy (in the form of heat and sparks) released into the surrounding environment. This swift action can help prevent electrical equipment from igniting flammable materials nearby.

ABB's Hi-Tech Valiant fuse takes current-limiting fuses a step further by creating a hermetically sealed environment. When a fault occurs, the Hi-Tech Valiant fuse contains all electrical activity, hot gases and heated metal components that might otherwise ignite a fire. To help utilities quickly and easily replace traditional fuses in fire-prone areas, ABB designed the Hi-Tech Valiant fuse to fit into many of the standard cutouts already installed.



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Flood seal, underground, and custom connectors

Homac® is one of the leaders in underground distribution connector systems for nearly 50 years and offers an extensive product line for the utilities industry.

Although it may seem minor, choosing cable accessories and connectors designed to contain sparks is also an essential element of wildfire risk mitigation. For example, the insulating rockets used in the Homac Flood-Seal® connectors have been field-tested in more than 10 million applications and undergo a dielectric test at 4000 volts for 60 seconds to test insulation integrity. This proven performance helps ensure that electrical connections remain insulated under overload conditions, reducing the cable fault probability.



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2. Digitalization

Electrification devices with built-in sensors are quickly becoming the norm on the modern electrical distribution grid. Digitalization takes advantage of currently implemented and newly installed components to provide grid operators with insights into what is happening on the grid. Instead of waiting for an outage to be reported, these systems allow the operator to see the fault in real time and reroute power from that portion of the grid. They can also help grid operators identify damaged or aging equipment that may pose a fire hazard.

To meet this need, ABB created the centralized protection system SSC600, a part of ABB's Relion protection and control family of relays. By closely monitoring various protection devices in electrical distribution networks and reacting swiftly to anomalies or faults, the SSC600 can simultaneously process grid inputs from different devices and disconnect faulty circuits before they cause arcs or overheating. Moreover, the system's ability to centralize and streamline substation controls allows for more efficient and reliable operations, helping to reduce the risk of electrical failures that can lead to wildfires.

ABB is incorporating artificial intelligence and machine learning into the SSC600 to allow operators to predict where faults may occur and take preemptive action. Sensors can detect mini faults on a line that don't cause a spark but can be precursors to larger events. These faults might result from vegetation overgrowth or an excessive squirrel population. They could also be mini faults that naturally occur on older power lines that are more susceptible to damage from natural stresses.

Like the small tremors that can predict a larger seismic event, mini faults are the early warning system for wildfire management. Through machine learning, ABB's SSC600 system can tell the grid operator within a roughly 90% probability where a fault is likely to occur. If the fault is the result of a cable failure, the system can even predict how soon the fault is likely to occur. With these insights, the operator can take preemptive action by cutting back vegetation, rerouting power around the problem area during severe weather, or prioritizing that portion of the distribution grid for line replacement and component upgrades.



3. Undergrounding

Finally, undergrounding is still a popular approach to wildfire management. Undergrounding cables can be more costly than overhead cables, but this option offers other advantages for utilities and power consumers, such as fewer outages due to severe weather.

Like overhead power lines, underground cables can experience unexpected faults. Cables can age prematurely due to overload conditions, exposure to construction damage, or poor workmanship. Minimizing outages when undergrounding requires implementing some of the same advancements found in overhead electrification components.

Homac Flood-Seal® aluminum multi-port connectors are a submersible, resealable solution for underground residential distribution (URD) connections. Keeping connections dry and clean minimizes the risk of electrical faults and extends the life of the connectors.

Digitalization is just as important for underground systems as it is for overhead lines. Maybe even more so as line inspectors can't see damage to underground cables. Sensors designed for underground systems need to be ruggedized for the environment. The internal components in the ABB RSS-1 submersible current sensor are hermetically sealed, protecting them from everyday contaminants and severe flooding.

Also designed for wet and underground environments, ABB's VIL MV voltage transformers (VTs) are suitable for control, power, relaying, or metering applications, including those in subsurface installations up to 25 kV, 125 kV BIL. Designed to function in harsh environmental conditions, including submersion, the VIL transformers help ensure reliability in areas where exposure to elements could compromise less durable equipment.

4. Role of switchgear in wildfire management

Switchgear is an integral component in both overhead and underground systems. ABB's Elastimold switchgear uses a solid dielectric insulation system, mitigating the risk of fluid leaks or spills that can occur with liquid-insulated switchgear. As with vacuum interrupters, the absence of oils or gas in the insulation significantly reduces the potential fire hazards associated with switchgear operation, especially in wildfire-prone areas.

The dead-front construction of Elastimold switchgear also helps eliminate exposure to live components, protecting workers and reducing the risk of accidental contact or sparking that could ignite fires. This design feature helps ensure that all energized parts are sealed off from direct contact, enhancing the safety of the electrical distribution system.

Elastimold switchgear is compact, allowing it to fit on an existing pad. This flexibility is crucial for upgrading and maintaining electrical distribution

systems in rugged, developed, or confined environments to avoid disturbing the existing landscape and decrease the risk of generating sparks during maintenance activities.



5. Grid modernization for wildfire management

FERC reports filed in 2023 show that grid planners expect demand for electrical power to grow twice as fast as initially anticipated. In addition, much of the electrical distribution grid has passed its expected lifespan, increasing the odds of electrical faults. The acceleration of demand for power and the challenge of aging infrastructure have made grid modernization a top priority for many electrical utilities.

At the same time, increased urbanization and unpredictable severe weather patterns have increased the urgency of comprehensive wildfire management planning. For over 100 years, ABB has focused on innovations that support the growing need for safer, more reliable electricity. Through the years, we've developed products that reduce the chance of a power outage, make power systems easier and safer to maintain, and help lower the risk to the public. Our portfolio of wildfire management solutions demonstrates our ongoing commitment to meeting the evolving needs of the electrical distribution industry.