RON GALPERIN
CONTROLLER

November 20, 2019

Honorable Eric Garcetti, Mayor
Honorable Michael Feuer, City Attorney
Honorable Members of the Los Angeles City Council

Re: It Only Takes a Spark: Enhancing DWP's Wildfire Prevention Strategy

While wildfires have been a fact of life for more than a century in California, residents are enduring bigger, more destructive fires in recent years. The causes vary — increasingly hot and dry weather attributable to climate change, Santa Ana winds and sometimes lightning — but 85 percent of wildfires stem in some way from the impact of humans on the environment. Arson, carelessly tossed cigarettes, and sparks from car engines or overhead power lines colliding with trees or brush are common culprits.

According to the California Department of Forestry and Fire Protection, 10 of the state's 20 most destructive wildfires on record have occurred since 2015. Of those 10, overhead power lines were responsible for six, which burned 649,000 acres, destroyed 23,500 structures and killed 108 people. Pacific Gas and Electric (PG&E), the state's largest private power utility, filed for bankruptcy earlier this year because of liabilities resulting from wildfires that ripped through Northern California in 2017 and 2018, and has implemented a regime of rolling blackouts to prevent blazes during high fire risk periods. But the danger of wildfires across the state has not diminished. October's Kincade fire in Sonoma County, which burned more than 77,000 acres, was caused by downed power lines operated by PG&E, and the subsequent 745-acre Getty Fire in Los Angeles reportedly started when a tree branch fell onto live power lines operated by the Los Angeles Department of Water and Power (DWP). Under state law, utilities can be deemed liable for damages caused by their equipment, regardless of how well or poorly the equipment was maintained.

My latest report looks at the DWP — the largest publicly-owned power utility in the country. It assesses the DWP's current wildfire prevention efforts and identifies specific actions the utility needs to take to protect communities, first responders, 1.5 million ratepayers, and our environment from the growing threat of catastrophic wildfires.

Existing wildfire risks

The DWP's power line infrastructure spans three states — California, Nevada and Utah. It consists of high voltage transmission power lines that carry electricity from power generation facilities into the area, and low voltage power lines that deliver power to residents and businesses. DWP equipment poses fewer risks than equipment owned by large private utilities — such as PG&E and Southern California Edison —

because its power lines are mostly located in non-forested urban areas; however, 15 percent of the DWP's service territory falls within state-designated wildfire threat areas. This includes 49,000 utility poles, most of which are wooden. Thirty percent of those utility poles are more than 65 years old. And 18 percent of DWP transmission towers and power lines are located in wildfire threat areas.

Additionally, the DWP has more than 1,000 outstanding fire safety-related maintenance orders in wildfire threat areas. While the DWP has attempted to keep pace with maintenance needs in fire risk zones, backlogs for certain equipment remain.

Consultants hired by the department estimate that the utility could face an average of $42 million in losses yearly for the next 100 years due to wildfires. There is currently no insurance fund for publicly-owned utilities to share financial risks, unlike the state fund created in July 2019 for private utilities.

In recent years, the DWP has taken some steps to reduce the danger of wildfires, including establishing enhanced design and construction standards for infrastructure in wildfire threat areas, replacing utility poles, cross-arms and transformers in such areas, and working on a comprehensive wildfire prevention plan. But given the increased frequency and severity of wildfires, the utility must do more to detect and inspect potential fire safety issues, address maintenance backlogs, improve its vegetation management protocols, and modernize the way it oversees its power infrastructure with better strategic planning to more proactively mitigate wildfire risks.

Innovate to improve safety

Taking aggressive steps to enhance the DWP's wildfire prevention strategy will improve the safety and reliability of the power system for years to come. My report makes the following recommendations to get there:

- Eliminate the **maintenance backlogs that currently exist** in wildfire threat areas.
- **Enhance inspections** in fire threat areas by increasing the frequency and using drone technology to evaluate utility poles and infrared cameras to detect potential equipment failures.
- Establish a **joint task assessment and inspection initiative with LAFD** to better evaluate vegetation and other risks in fire threat areas.
- **Expand the use of technology**, like LiDAR (remote light sensing technology), to evaluate vegetation risks, and implement a GIS-based inventory and workflow management system to improve vegetation management and power line maintenance operations.
- Prioritize **strategic planning to manage wildfire risks**, and **regularize reporting** to the Board of Water and Power Commissioners and City Council on fire incidents involving utility equipment.
- Deploy remote monitoring tools, like HD cameras and weather stations, in fire threat areas.
- Evaluate using **predictive analytics and artificial intelligence programs** to help the department detect wildfire safety issues.
- Assess the feasibility of **establishing a wildfire insurance fund** for publicly-owned power utilities.

I urge City leaders and the DWP to adopt these recommendations to ensure that Los Angeles does the best it can to protect precious lives and property.

Respectfully submitted,

RON GALPERIN
L.A. Controller

IT ONLY TAKES A SPARK:

ENHANCING LADWP'S WILDFIRE PREVENTION STRATEGY

RON GALPERIN
LA CONTROLLER

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It Only Takes a Spark: Enhancing DWP's Wildfire Prevention Strategy

November 2019

Executive Summary

Catastrophic wildfires are a growing concern for communities, regulators, and public safety agencies throughout California. Increasingly dangerous conditions brought about by climate change contribute to the intensity and frequency of these fires. Both natural and human factors can cause wildfire ignitions, such as lightning strikes, uncontrolled campfires, vehicle fires, or arson incidents. However, many of the State's most destructive wildfires have been caused by overhead power lines.

According to data from the California Department of Forestry and Fire Protection (CAL FIRE), **ten of the twenty most destructive wildfires in State history have occurred since 2015. Of the ten wildfires, six were caused by overhead power lines. Tragically, these fires burned almost 649,000 acres, destroyed nearly 23,500 structures, and killed 108 people**. The recent surge in catastrophic wildfires, and the human and financial toll that comes with them, has prompted agencies and power utilities to carefully examine how to reduce the likelihood that power lines will cause wildfires.

Angelenos receive their electricity from the Los Angeles Department of Water and Power (LADWP). LADWP is the largest publicly-owned power utility in the United States, supplying electricity to more than 1.5 million customers in Los Angeles and the Owens Valley region. **Now more than ever, LADWP needs to take action to protect communities, first responders, and wildlife habitats.**

LADWP's overall exposure to wildfire risk is moderate, and the department faces several wildfire mitigation challenges.

- Approximately 15 percent of LADWP's service territory falls within wildfire risk areas established by the California Public Utilities Commission's (CPUC) High Fire Threat District mapping.
- Approximately 18 percent of LADWP's high voltage transmission power lines, which extend far beyond the City's boundaries, are in either CPUC High Fire Threat Districts or Los Angeles Fire Department (LAFD) Fire Hazard Zones. Approximately ten percent of transmission lines are located in CPUC Tier 3 (Extreme Risk) Threat Districts.

- As of August 2019, LADWP data showed that there were 3,456 outstanding fire safety-related maintenance orders for distribution infrastructure in CPUC and LAFD fire risk areas. Nine of those orders were in CPUC Tier 3 (Extreme Risk) Districts. There were 996 pending maintenance orders in CPUC Tier 2 (Elevated Risk) Districts, and 2,451 pending in LAFD Fire Hazard Zones.
- The largest maintenance backlog is 2,230 utility poles identified for replacement in LAFD zones. On average, LADWP replaces poles in LAFD fire zones at a rate of 63 per year. *(**Note:** Several hours prior to the release of this report, LADWP contacted the Controller's Office to report that the maintenance backlog in LAFD fire zones is actually 30 poles. LADWP did not provide verification for this change, and therefore, we could not confirm the veracity of these claims).*
- Nearly 49,000 utility poles – most of which are wooden – fall within wildfire risk areas established by the CPUC and LAFD. Of those, nearly 30 percent are more than 65 years old, which is their typical useful life.
- LADWP does not have a program dedicated solely to wildfire planning and prevention, and it does not track incident data for ignitions caused by LADWP equipment.

LADWP has taken some steps to mitigate wildfire dangers. However, additional actions are necessary.

- The department has established enhanced design and construction standards for infrastructure located in wildfire risk areas.
- From FY 2016 through FY 2019, LADWP replaced an average of 1,945 distribution assets (poles, crossarms, and transformers) annually in CPUC and LAFD fire risk zones.
- The department does not use what are known as automatic reclosers along its high voltage transmission lines. Automatic reclosers, which send bursts of electricity through a power line after there has been a disruption, can cause fires in wildfire-prone areas.
- LADWP is in the process of developing a comprehensive wildfire prevention plan which will outline current and planned wildfire risk reduction strategies.

Moving forward, a combination of new technologies, aggressive inspection and maintenance activities, and strategic planning can help protect both the public and LADWP's financial health.

- In order to make it easier to streamline maintenance operations and identify infrastructure risks, LADWP should modernize its inventory management and maintenance systems, and explore applications for artificial intelligence tools.
- LADWP should enhance its power line inspection programs to include more frequent inspections in risky areas, and adopt new technologies that help inspectors identify fire safety threats.

- The department should aggressively work to eliminate maintenance backlogs which currently exist in fire risk areas.
- The department should work with other publicly-owned utilities in the State to consider the establishment of a joint wildfire insurance fund to help protect against wildfire related financial losses.

LADWP must improve its ability to detect fire safety issues, address emerging maintenance backlogs, and modernize its approach to managing infrastructure so that it can become more proactive in its mitigation of wildfire risks. This report and its recommendations are intended to provide LADWP with a combination of strategies and solutions that should be pursued in order to protect Angelenos from the growing threat of wildfires.

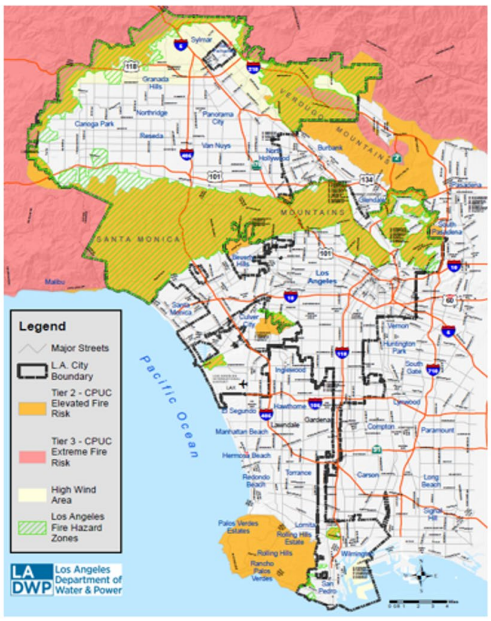
I. Wildfire Risk for LADWP

LADWP owns and operates power line infrastructure that spans three states – California, Nevada, and Utah.[1] It consists of a large, complex network of high voltage transmission power lines (3,507 overhead miles) which carry electricity from power generation facilities into the region, and low voltage distribution power lines (7,148 overhead miles) which then deliver power to residents and businesses.

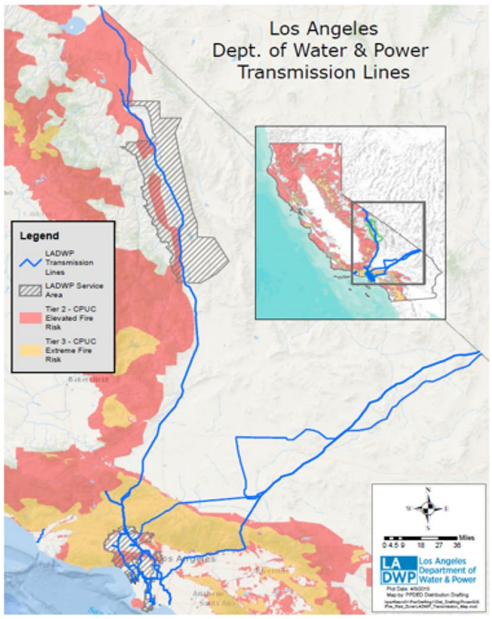
Wildfire risk related to LADWP equipment is generally lower in comparison to California's large investor-owned utilities (IOUs) like Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric. LADWP's risk profile is lower because its distribution network is primarily located in densely populated urban areas, and its transmission lines span mostly non-forested or arid landscapes where there is less vegetation to serve as a fuel source.

However, LADWP's overhead power lines located in areas designated as wildfire risk zones by the CPUC and LAFD are a concern.

Los Angeles Service Territory



Transmission Lines



LADWP, given its lower wildfire risk exposure, has decided not to take some of the more drastic wildfire safety precautions adopted by IOUs. For example, LADWP stated it does not need to initiate proactive power shutoffs, where a utility will shut off power in fire prone areas during dangerous weather conditions, such as high winds.

However, wildfire mitigation efforts by LADWP are necessary not only to promote public safety, but to protect the finances of the department. California's utilities are liable for damages caused by their equipment, whether or not their management of the equipment was negligent. California's application of a legal concept known as "inverse condemnation" can cause utilities like LADWP to face sizable liabilities in the event they cause a wildfire**.**

Wildfire damages involving power lines can be costly for a utility. The U.S. Forest Service determined that in 2013, equipment failure along an LADWP power line in the Angeles National Forest caused the Powerhouse Fire, which burned approximately 30,000 acres and destroyed 58 structures. For that fire alone, LADWP's insurers (Aegis Security Insurance Company, Energy Insurance Mutual Limited, and AXA XL) paid approximately $100 million to settle claims against the department. LADWP did not admit liability.

Both the public safety and financial risks associated with wildfires highlight the need for LADWP to reduce the likelihood that its electrical assets contribute to the ignition of a wildfire.

II. Covering Financial Losses Following Wildfires

Overall, LADWP's coverage for wildfire-related losses is approximately $360 million:

- $178 million in commercial excess liability coverage for wildfire losses; and
- $182 million set aside in its Power Revenue Fund for self-insurance.

While this is an important step in protecting against financial liabilities, risk models generated by LADWP consultants estimated that **the department can expect, on average, $42 million per year in wildfire-related losses over the next 100 years**. The financial risks posed by utility-caused wildfires warrants additional action by LADWP in order to protect its financial health, and reduce the likelihood that liability costs will be passed on to customers.

In July 2019, the State passed a law establishing a wildfire insurance fund for IOUs. The fund will receive contributions from participating IOUs, and will pay future eligible costs in the event an IOU's equipment causes a fire. Only IOUs are able to participate in this State wildfire fund. **While the establishment of such a fund among publicly-owned utilities would pose unique challenges, the ability to share financial risks with other utilities could prove beneficial for LADWP and other participants.**

To protect against future wildfire liabilities, LADWP should:

- In conjunction with peer utilities within the State, formally assess the legal and financial feasibility of establishing a wildfire insurance fund for publicly-owned utilities.

III. LADWP's Inspection and Maintenance Activities

Among the most important components of a utility's wildfire mitigation efforts are its inspection and maintenance activities. Equipment failures can cause electrical arcing, which is when electricity is no longer contained by protective equipment. If this occurs near a receptive fuel source, it can cause an ignition. One of the safest ways to carry electricity is by burying power lines underground. However, burying power lines is not always feasible and can be cost prohibitive, as it can cost millions of dollars per mile. The prevalence of overhead power lines across LADWP's power system highlights the need for the department to operate these assets as safely as possible.

LADWP performs annual patrol inspections of distribution lines, which is a visual inspection to identify obvious safety issues, and conducts more thorough checks – known as "detail inspections" – every five years, where an inspector conducts a comprehensive evaluation of distribution equipment to identify maintenance issues. Transmission lines are evaluated by semiannual helicopter patrols, and periodic detail inspections. When inspectors identify a maintenance need, they log the issue in a maintenance management system. The department prioritizes pending work based on relevant safety and power reliability needs, and crews are then dispatched to make necessary repairs or replace failing equipment.

LADWP must take aggressive action to address any identified maintenance needs in wildfire risk areas. The department's distribution infrastructure, which generally represents a greater risk than its steel tower-based transmission assets, requires special attention. As of August 2019, LADWP data shows that the department has mostly kept pace with maintenance needs in the highest risk districts. **However, the department should work quickly to eliminate maintenance backlogs which have emerged for certain types of assets. Specifically, there are:**

- 816 utility poles in CPUC Tier 2 (Elevated Risk) Districts which have been identified for replacement;
- 2,230 utility poles in LAFD Fire Hazard Zones fire risk zones which have been identified for replacement[1]; and
- 50 transformers in LAFD Fire Hazard Zones which have been identified for replacement.

LADWP should also improve its ability to detect safety issues in wildfire risk areas before they trigger an incident, especially as it relates to the department's higher risk distribution assets. **Enhanced inspection activities could include increasing the frequency of inspections, deploying drones to help inspectors find hard-to-spot problems, and increasing the use of infrared cameras to identify hot spots that may indicate equipment failure**.

Vegetation (i.e., trees, vines, and brush) contact with energized utility equipment is another major fire risk. LADWP's vegetation management program works to prevent fire dangers by eliminating vegetation and debris that may interfere with power equipment. Crews complete annual patrols along power lines, and trimmed nearly 190,000 trees near transmission and distribution lines in FY 2019.

Given the importance of LADWP's vegetation management function, the department should enhance the way it evaluates risks, and modernize its processes for tracking vegetation management operations. Other utilities have reported success following the implementation of new tree inventory management tools which help to track the work of vegetation crews, and identify vegetation trends impacting wildfire safety. Some utilities have partnered with local fire agencies to help vegetation crews identify, and learn about, fire safety risks.

To improve its ability to identify infrastructure and vegetation risks, the department should:

- Enhance its maintenance inspections in high fire threat zones. Enhancements could include, but should not be limited to: (1) inspection intervals of less than five years for detail inspections; (2) use of drone technology to improve inspectors' ability to evaluate

[1] Several hours prior to the release of this report, LADWP contacted the Controller's Office to report that the maintenance backlog in LAFD fire zones is actually 30 poles. LADWP did not provide verification for this change, and therefore, we could not confirm the veracity of these claims.

equipment on top of utility poles; and (3) inspection intervals of less than four years for hot spot-detecting infrared inspections.

- Work aggressively to eliminate maintenance backlogs so that those backlogs do not compound, and ensure the department can continue to manage workloads in high risk areas.
- Establish a joint risk assessment and inspection initiative with LAFD to supplement LADWP's evaluation of vegetation and other risk factors within high fire threat zones.

The department can also leverage new technologies which enable enhanced inspection and maintenance management capabilities, and should:

- Expand its use of LiDAR (Light Detection and Ranging) technology, or other spatial analysis technologies, to supplement vegetation management patrols of power lines and improve the department's ability to evaluate vegetation risks in high fire threat zones.
- Evaluate the feasibility and costs of implementing a GIS-based inventory and workflow management system for its vegetation management program in order to improve efficiency, and improve the department's ability to detect and analyze vegetation risks.

IV. Strategic Planning and Investments

Although LADWP has taken some preliminary steps to reduce wildfire risks, there are opportunities to improve how the department evaluates wildfire risks. For example, the department does not have any staff dedicated to wildfire prevention efforts, and the department does not track instances where its equipment sparks an ignition. Having both ignition data and staff who can evaluate wildfire safety issues across the organization is essential for LADWP to fully understand its fire risks.

Beyond staffing and data improvements, there are technology-driven solutions that can help LADWP make better operational and infrastructure planning decisions. A modern enterprise asset management system would help LADWP identify infrastructure risks. These systems help managers track the condition of assets, collect maintenance and failure data, and analyze infrastructure trends. There are also emerging technologies which leverage artificial intelligence and machine learning to analyze large amounts of real time utility data in order to detect anomalies that indicate potential equipment failures.

To improve its understanding of current and future wildfire risks, the department should:

- Integrate dedicated wildfire prevention and safety staff to support ongoing wildfire risk assessment and planning activities, such as the identification of emerging hardware risks, and analysis of whether power lines should be undergrounded in the highest fire risk areas.
- On a regular basis, provide the Board of Water and Power Commissioners and the City Council with a detailed record of fire incidents involving LADWP equipment.

Adopting new technologies would enable improved infrastructure management and monitoring capabilities. The department should:

- Deploy remote monitoring tools in high fire risk areas, such as high definition cameras and weather stations, in order to improve situational awareness and the ability to respond to fire incidents.
- Evaluate the feasibility and costs of implementing an integrated enterprise asset management system for power assets.
- Evaluate the feasibility and costs of implementing advanced predictive analytics and artificial intelligence programs capable of helping the department detect and mitigate wildfire safety and asset reliability issues.

To ensure it has sufficient resources to make necessary wildfire mitigation investments, the department should:

- In its next Power System Rate Proposal, specifically incorporate costs associated with wildfire safety initiatives to ensure the department has sufficient resources to make necessary infrastructure and information systems upgrades.

Conclusion

With catastrophic wildfires becoming the new normal in California, it is critical that LADWP improve its ability to detect and address wildfire safety concerns, and make smart infrastructure management investments which improve the safety and reliability of the power system for years to come. **Prioritizing improvements in these areas will allow LADWP to better protect ratepayers and property – and most importantly – promote public safety.**

Background

Catastrophic wildfires are on the rise in California. These fires are dangerous, destructive, and can permanently alter the cities and communities they pass through. While wildfires in the State are not an entirely new phenomenon, the size and frequency of wildfires is a growing concern for residents, businesses, and public agencies.

Several factors are increasing the intensity and frequency of fires. **Climate change is making California more susceptible to fire risks**. Extreme heat events are creating dangerous fire conditions. Dry seasons are longer and more intense, which stresses vegetation, and droughts and invasive pests like bark beetles are weakening and killing trees statewide.

With dangerous fire conditions becoming the new normal in California, the need to address fire risks associated with power lines and other equipment is becoming increasingly urgent. **California Department of Forestry and Fire Protection (CAL FIRE) data shows that of the 20 most destructive wildfires on record, ten have occurred since 2015**.[2] Of those ten fires, six were determined to have been caused by power lines, highlighting the growing risks posed by utility equipment. The destruction caused by those utility-caused wildfires was substantial.

Impact of Catastrophic Wildfires Caused By California Utilities (2015 to Present)

648,626	23,472	108
Acres Burned	*Structures Destroyed*	*People Killed*

Most California residents are served by three large investor-owned utilities (IOUs) – Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E). Each of these utilities have been responsible for major wildfires.

Witch Creek-Guejito Fires

In 2007, two fires in San Diego County, the Witch Creek Fire and Guejito Fire, merged during a Santa Ana wind event, causing the largest evacuation in the county's history. The Witch Creek-Guejito Fires burned 198,000 acres, destroyed 1,141 residences, and killed two people.[3] In both fires, electrical arcing, which is a discharge of electricity from a piece of power equipment, caused by SDG&E power lines served as an ignition source. The Witch Fire was caused by SDG&E power lines slapping together, while the Guejito Fire was caused by SDG&E power lines coming into contact with an adjacent cable communications wire.

Thomas Fire

In December 2017, the Thomas Fire moved across Ventura and Santa Barbara Counties, burning for nearly 40 days. The fire burned 281,900 acres, destroyed 1,063 structures,

and resulted in the death of one firefighter and one civilian.[4] The Thomas Fire was caused when a high wind event caused SCE power lines to slap together and arc, which deposited molten material onto the vegetation below.

Camp Fire

The November 2018 Camp fire in Butte County was the deadliest and most destructive wildfire in State history. The fire burned 153,300 acres, destroyed 18,804 structures, and resulted in 85 fatalities.[5] Several firefighters were also injured while trying to contain the fire. The fire was caused when a piece of equipment failed on a power line owned by PG&E. Investigators determined that strong winds, along with low humidity and high temperatures, caused the fire to spread quickly.

Woolsey Fire

In November 2018, the Woolsey Fire, which started near the Santa Susana Field Laboratory between the borders of Simi Valley and Los Angeles, spread across Los Angeles and Ventura Counties for more than 50 days. The fire burned nearly 97,000 acres, destroyed 1,500 structures, and resulted in three fatalities.[6] While the cause of this fire is still under investigation, the State of California is investigating whether SCE equipment ignited the fire. The utility has acknowledged that just minutes before the fire started, there was an outage incident recorded within the vicinity of the ignition.

Like other large utilities operating within the State, the Los Angeles Department of Water and Power (LADWP), the City's publicly-owned utility, owns and operates a large and complicated network of power assets. While the department has not caused a catastrophic fire similar in scale to the Camp or Woolsey fires, which were two of the most destructive wildfires in the State's history, recent incidents highlight the growing risk.

Powerhouse Fire

The U.S. Forest Service determined that in 2013, equipment failure along an LADWP power line in the Angeles National Forest caused the Powerhouse Fire. **The wildfire burned approximately 30,000 acres and destroyed 58 structures over 10 days.**[7] LADWP reported that neither the age of the equipment nor improper maintenance contributed to the wildfire's ignition. Instead, a piece of faulty equipment on a power pole known as an insulator, caused electrical arcing which sparked the incident.

LADWP's insurers settled Powerhouse Fire claims for approximately $100 million. The department paid a deductible of $3 million, of which $1 million was passed on to the manufacturer of the defective equipment. Although a settlement was determined to be the best course of action, LADWP admitted no liability for the fire and denied the sufficiency of all claims related to the fire.

LADWP is also involved in litigation related to the 2017 Creek Fire, which burned approximately 16,000 acres in the Angeles National Forest and in Los Angeles County.[8] Plaintiffs allege that LADWP power lines caused the blaze. However, authorities have not determined the cause of the fire. LADWP's internal investigation determined that its assets were not the cause.

Power equipment represents a constant fire threat to California communities. The lack of affordable housing near job centers has pushed growing numbers of residents to wildland-urban interface areas, where housing and commercial development is adjacent to undeveloped, densely vegetated landscapes. **In the City of Los Angeles alone, an estimated 630,000 people live in areas determined by CAL FIRE to be wildfire hazard zones**. There are an estimated 114,000 buildings in the hazard zones as well, and the total estimated value of those structures and their contents is $73 billion.[9]

While not all utility fire incidents become wildfires, data from the State shows just how often power equipment causes ignitions. **From 2014 through 2018, California's three largest IOUs (PG&E, SCE, and SDG&E) caused 2,583 ignition incidents where the fire traveled greater than one linear meter from ignition point.**[10] Common causes for ignitions go beyond downed power lines, including:

- Equipment contact with an interfering object, such as vegetation, balloons, animals, and vehicles;
- Equipment failure;
- Individuals vandalizing or stealing equipment; and
- Power lines slapping together, or into a third party's equipment.

The most important risk related to wildfires is the threat to public safety and first responders. **However, California utilities also face major financial risks in the event they contribute to a wildfire.** California's application of a legal concept known as "inverse condemnation" makes utilities fully liable for wildfire costs, regardless of whether they acted responsibly in relation to the incident. **In other words, if power equipment is determined to be the cause, the utility can be held fully responsible for the costs, even if there is no determination the utility was negligent.** Alabama is the only other state that applies inverse condemnation with the same level of strict liability.[11]

A catastrophic wildfire can cost a utility billions of dollars. **PG&E was forced to file Chapter 11 bankruptcy in January 2019 following a series of wildfires it caused in 2017 and 2018 in Northern California**. PG&E has reported that the aggregate liability for claims in relation to the 2017 and 2018 fires was $17.9 billion.[12] The company believes the total liability related to those fires could exceed $30 billion.[13]

Los Angeles Department of Water and Power

Los Angeles residents and businesses receive their power from LADWP, the City's publicly-owned municipal utility. LADWP is the largest publicly-owned electric utility in the United States. It supplies electricity to more than 1.5 million customers, including approximately 5,000 customers in the Owens Valley in eastern California.

The regulatory environment for utilities is complex**. LADWP differs from IOUs like SCE because it is owned by the City and primarily subject to the oversight of the LADWP Board of Water and Power Commissioners, City Council, and Mayor.** IOUs are private companies owned by shareholders, and are regulated in the State by the California Public Utilities Commission (CPUC). Though the CPUC is not LADWP's chief regulator, the department is subject to utility operating standards established by the agency, known as General Orders.

In addition to State regulatory bodies, both IOUs and publicly-owned utilities like LADWP are subject to oversight from the Federal Energy Regulatory Commission (FERC) and North American Electric Reliability Corporation (NERC). FERC is an independent agency that regulates the interstate transmission of electricity, natural gas, and oil, while NERC is a nonprofit corporation which establishes reliability standards for bulk power transmission.

Power utilities across the State are aggressively upgrading infrastructure and revising operations in an effort to adapt to an environment where fire risks are a constant threat. It is important that LADWP does the same. **Given the catastrophic wildfires seen across the state in recent years, and LADWP's own involvement in the Powerhouse Fire, LADWP must ensure it mitigates – to the greatest extent possible – the wildfire risks posed by its infrastructure and operations**.

I. Wildfire Risk for LADWP

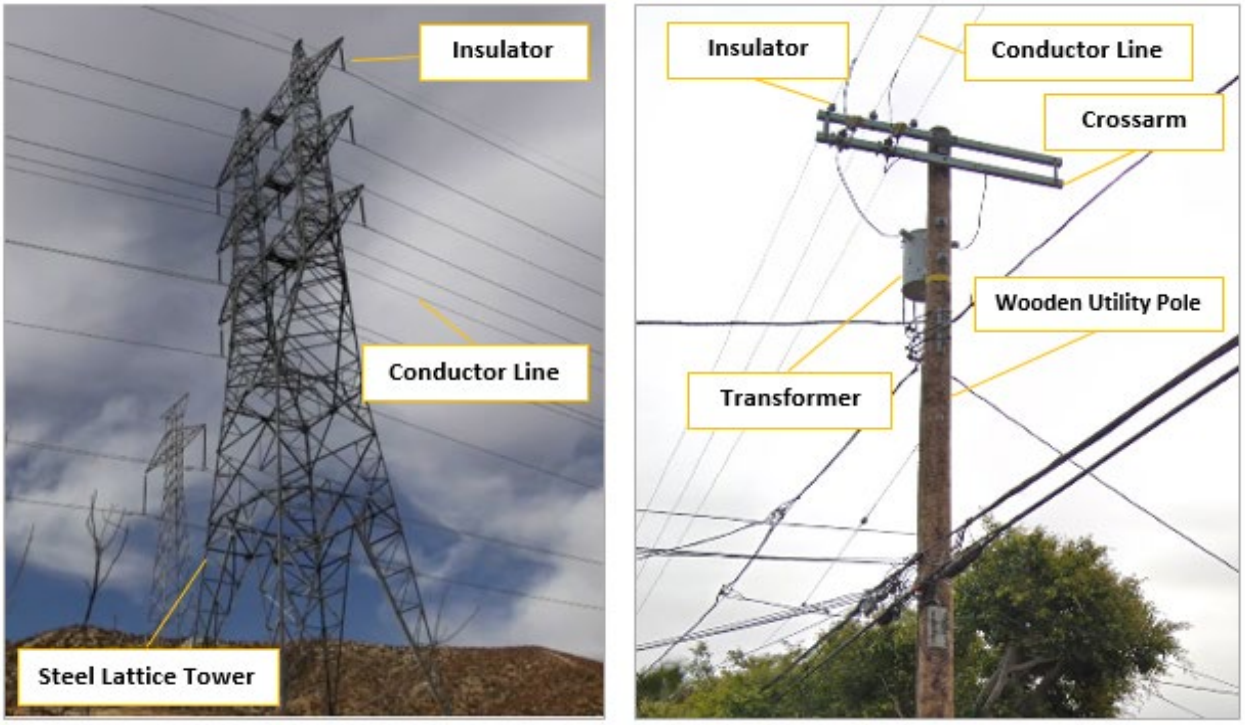
LADWP's network of power lines and equipment, which carry electricity across the State and throughout Los Angeles neighborhoods, are classified generally as either transmission infrastructure, or distribution infrastructure. The transmission system consists primarily of large steel towers and conductor cables which carry large amounts of electricity (138 – 500 kilovolts) from remote power generation stations in and outside of California, into the department's service territory. The department also has several power generation stations within the City.

The lower voltage distribution system carries electricity to customers throughout the department's Los Angeles and Owens Valley service territories. Distribution power lines are usually suspended by crossarms atop wooden poles. Equipment on the pole known as a transformer is used to covert electricity to lower voltages for consumption by residences and

businesses. A typical distribution power line servicing a residential neighborhood is around 4.8 kilovolts.

Power lines can traverse both public and privately-owned land. Utility easements, which provide LADWP the legal right to use and access portions of property for public benefit, allow the department to construct and maintain power systems. The images below show examples of LADWP's transmission and distribution infrastructure, and include labels for different types of equipment discussed in this report.

LADWP Transmission Lines (left) and Distribution Lines (right)



LADWP's power infrastructure consists of a network of power generation, transmission, and distribution assets. The department owns and operates power lines in three states – California, Nevada, and Utah. The power network consists of:

- 23 power generation plants, such as thermal, hydroelectric, and solar plants;
- 3,507 miles of high voltage overhead transmission lines;
- 124 miles of high voltage underground transmission lines;
- 7,148 miles of lower voltage overhead distribution lines; and
- 3,708 miles of lower voltage underground distribution lines.

LADWP also has an ownership stake in transmission infrastructure in Oregon and Arizona. However, the department is not responsible for the operation and maintenance of those assets.

The wildfire risk for LADWP is moderate, and the department's power infrastructure generally presents a lower level of fire risk than its larger IOU peers. The department primarily serves customers in highly urban Los Angeles, and its transmission infrastructure outside of the Los Angeles area spans mostly non-forested areas with a lower fire risk. **However, a portion of LADWP's service territory and equipment fall within areas designated by either the State or the City as wildfire risk zones, and it is critically important that the department take proactive steps to protect residents, businesses, and property**.

Fire Risk in LADWP's Service Territory

Both the CPUC and the Los Angeles Fire Department (LAFD) have developed maps which designate geographic areas where the wildfire risk is high. The CPUC jointly developed its statewide High Fire Threat District map with CAL FIRE and public safety experts in order to designate areas where additional wildfire safety precautions by power utilities may be necessary. The map takes into account historical fire maps and areas with high numbers of dead or dying trees.

LAFD's Very High Fire Hazard Severity Zones map identifies areas within the City where fire risks are extremely high, and residents living in LAFD fire hazard areas are subject to brush clearance requirements in the Los Angeles Fire Code. Property owners in LAFD fire hazard areas must clear all native brush, weeds, grass, trees, and hazardous vegetation located within 200 feet of any structure or building.

LADWP infrastructure can fall into one of three high fire risk area categories, two of which are designated in the CPUC's map, and one of which is designated by LAFD. These designations are described below.

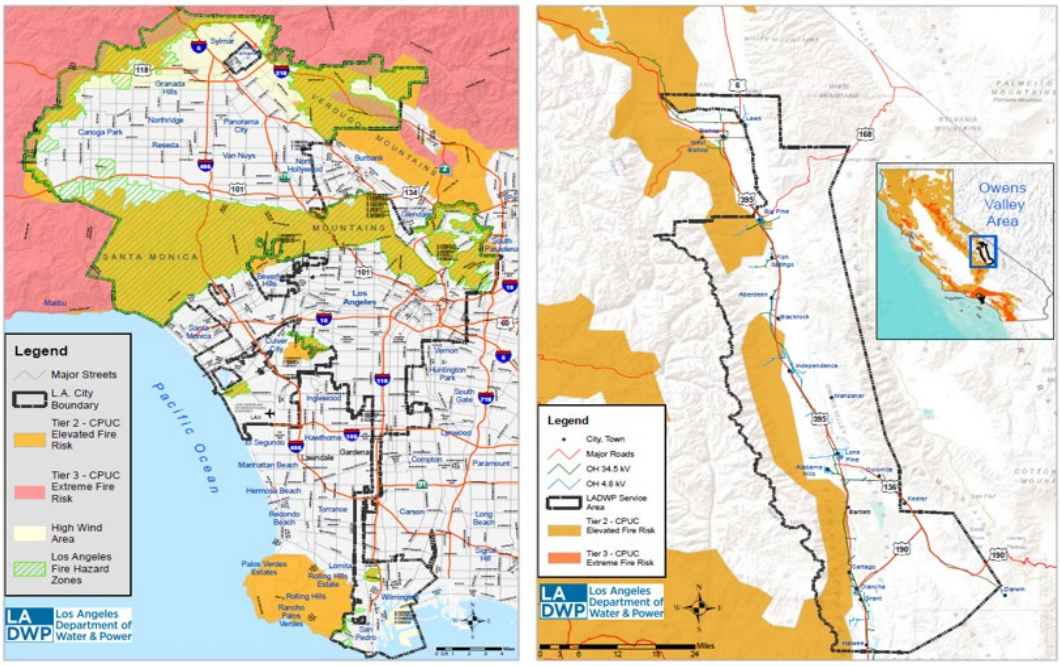
- **CPUC Tier 3 High Fire Threat Districts** – Geographic areas where the risk of fire is highest, and has been determined to be **extreme**
- **CPUC Tier 2 High Fire Threat Districts** – Geographic areas where the risk of fire has been determined to be **elevated**
- **LAFD Very High Fire Hazard Severity Zones** – Geographic areas where the City's fire department has determined the fire risk to be **high**[14]

Analysis by LADWP shows that approximately 15 percent of the department's service territory falls within CPUC Tier 2 (Elevated Risk) Threat Districts, and less than 1 percent of the department's service territory falls within the CPUC Tier 3 (Extreme Risk) Threat Districts. By comparison, about 50 percent of PG&E and SDG&E service territories, and 35 percent of SCE's service territory, are in CPUC High Fire Threat Districts.[15]

Some IOUs have taken the drastic measure of proactively shutting down power in high fire risk areas during dangerous conditions, such as high winds. LADWP, given its urban service territory and its more limited geographic exposure to fire risk areas, is not pursuing this approach. The department has determined that the fire risk is not high enough to warrant proactively cutting off power to customers because the negative impact on health, safety, and quality of life of customers does not outweigh the fire mitigation benefits. LADWP will however shut off power at the request of public safety officials in the event energized lines present a risk to the public.

The maps below show which portions of the LADWPs service territory are considered high risk.

Fire Risk Maps for LADWP's Los Angeles (left) and Owens Valley (right) Service Areas



As shown in the maps, the City's wildland-urban interface areas are the most exposed to fire dangers. Of particular concern are the outer areas of the San Fernando Valley, such as Chatsworth and Porter Ranch, and communities adjacent to the Santa Monica Mountains, such as the Pacific Palisades.

LADWP's Distribution Network

Although LADWP's transmission lines carry high voltage electricity across the State, its distribution lines present a higher fire risk because of the size of the overhead distribution network (7,148 miles), and the network's reliance on wood poles and other equipment which can be susceptible to the elements and local environmental conditions.

While the number of LADWP distribution assets in CPUC and LAFD wildfire risk areas is relatively small in relation to the entire distribution network, there are still almost 49,000

utility poles in these areas. Asset inventory information provided by LADWP provides insight into the proportion of distribution pole, crossarm, and transformer assets falling within the high fire risk districts established by CPUC and LAFD.[16]

LADWP Distribution Assets in Designated CPUC and LAFD Wildfire Risk Areas

Asset Type	Total Assets	% of Assets in Fire Risk Areas	CPUC Tier 3 (Extreme Risk)	CPUC Tier 2 (Elevated Risk)	LAFD High Fire Risk Zone
Poles	308,366	**15.8%**	0.48%	13.2%	2.2%
Crossarms*	1,280,000	**14.6%**	0.42%	12.1%	2.1%
Transformers	128,863	**10.2%**	0.26%	8.4%	1.6%

**This number was estimated by LADWP, as the number of crossarms is not specifically tracked.*

Older equipment which has not been recently upgraded can also present increased risks. **LADWP estimates that of the 48,792 distribution poles in high fire risk areas, 14,220 (29 percent) are beyond their typical useful life of 65 years**. Although the lifespan of a wood distribution pole can vary based on the type of wood and the local conditions, and many remain useful beyond 65 years, the department must address aging infrastructure in high fire risk areas.

In 2008, shortly after devastating wildfires in San Diego, LADWP took the proactive step of developing new design standards for distribution assets in wildfire risk areas. The department's Special Construction for Designated High Wind and High Fire Hazard Areas (Overhead Power Distribution Construction Standard No. C030-12) standards require several construction and design improvements to make the equipment safer. For example, the design standards require:

- Installation of alternative material poles such as ductile iron, steel, and concrete;
- Installation of fiberglass crossarms for their high strength rating;
- Installation of upgraded conductor wires and the use of multi-conductor cables in lieu of bare low-voltage conductors; and
- Increased conductor wire spacing to reduce the likelihood of lines slapping together.

The implementation of enhanced construction standards was an important step in gradually upgrading equipment in high fire risk areas. **However, it is important to note that the special construction standards for high fire risk areas apply when failing assets are being replaced, or when assets are being upgraded as part of a capital improvement program. It does not mean that all of the assets in high fire risk areas meet the department's enhanced construction standards.**

According to LADWP, certain factors can slow the department's ability to upgrade assets. LADWP staff explained the highly competitive labor market for qualified utility workers and the lengthy process for obtaining necessary permits in environmentally sensitive areas are common challenges. There are also instances where property owners will refuse LADWP's access to private property, delaying its ability to complete projects.

In addition to enhancing construction standards, one of the safest ways to carry electricity and reduce wildfire risk is to put transmission and distribution lines underground. LADWP currently has more than 3,000 miles of underground power lines. According to the department, it considers a variety of factors when determining whether a power line should be buried underground, including public safety risks, environmental regulations, and cost. LADWP staff said that while the department will bury lines in certain areas, undergrounding all assets in fire risk areas is not necessarily feasible, and would be extremely costly.

While the cost to underground a power line varies based on factors such as terrain and the type of neighborhood where the activity takes place, undergrounding can costs millions per mile. PG&E estimates that the per mile cost to convert overhead distribution lines to underground is around $3 million. This is consistent with previous analysis by LADWP, which also found that the average per mile cost to underground distribution lines was approximately $3 million dollars.[17]

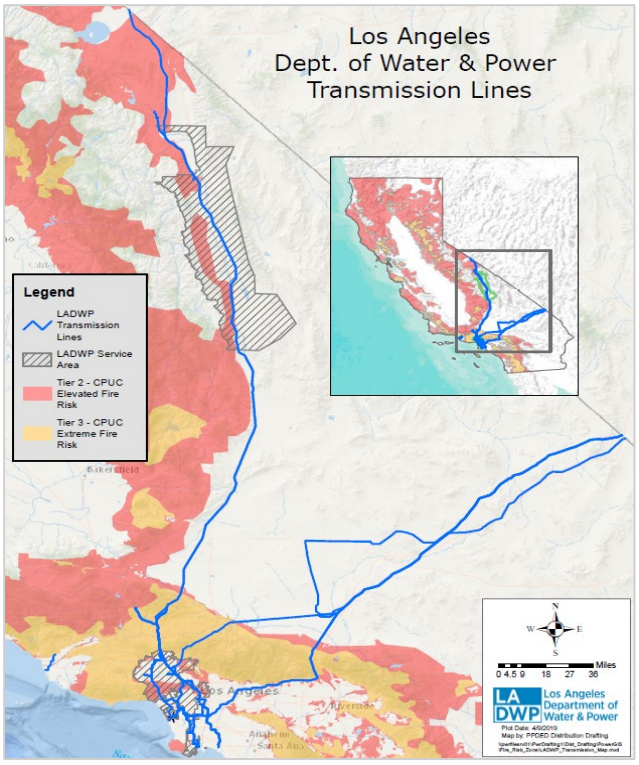
LADWP's Transmission Network

The department's transmission infrastructure consists of high voltage conductor wires on large, lattice steel towers. These towers consist of individual structural components that are bolted or welded together. The construction standards and materials used for transmission towers reduce the overall likelihood of failure, as transmission lines are critical pieces of the region's energy infrastructure.

In addition to transmission tower construction standards designed to reduce failure risks, LADWP reported that it does not use automatic reclosers across its transmission network. A recloser is designed for use on overhead networks to detect and interrupt momentary faults. These devices are equipped with a mechanism than can automatically restart the line following a fault, which will automatically send bursts of electricity through the line to test whether the line is back to normal. However, if a line is damaged and near fire-prone vegetation, the automatic recloser can cause an ignition.

Most of LADWP's in-state transmission lines traverse arid or desert landscapes with limited vegetation. However, some of LADWP's transmission assets fall within the designated CPUC and LAFD wildfire risk areas.

Transmission Line Fire Risk Map



Based on analysis of its transmission inventory data, **LADWP has determined that of its 3,507 miles of overhead transmission lines, approximately 614 (18 percent) fall within a high fire risk area. Of the department's 15,452 transmission towers, 2,437 (16 percent) fall within a high fire risk area**.

A closer look at the data shows that, compared to its distribution infrastructure, a larger portion of LADWP's transmission assets are located in Tier 3 locations – the CPUC's highest fire risk zone.

LADWP Transmission Assets in Designated CPUC and LAFD Wildfire Risk Areas

	Total	% of Assets in Fire Risk Areas	CPUC Tier 3 (Extreme Risk)	CPUC Tier 2 (Elevated Risk)	LAFD High Fire Risk Zone
Transmission Line Miles	3,507	**17.51%**	9.95%	7.27%	0.29%
Transmission Towers	15,452	**15.8%**	8.63%	6.76%	0.38%

Although transmission infrastructure is engineered to mitigate failure risks, and the transmission network has far fewer miles than the distribution system, the impact of ignition incidents related to transmission assets can be serious. In addition, it can take longer for fire

agencies to mobilize suppression operations in remote areas where transmission lines are located.

II. Covering Financial Losses Following Wildfires

It is important that LADWP implement strategies to protect its financial well-being. LADWP is protected against future claims in the event it causes a major wildfire, but only to a certain extent. The department carries a commercial excess liability insurance policy which covers $178 million for wildfire losses, with a $3 million deductible. The annual premium is approximately $31.5 million. In addition to the insurance coverage, approximately $182 million from LADWP's Power Revenue Fund is set aside for self-insurance, which can be used in the event of a catastrophic incident. **This puts total coverage in the event of a wildfire at approximately $360 million**.

Earlier this year, LADWP hired an independent consultant to complete a wildfire property liability risk model to predict potential future losses. The consultant estimated **LADWP can expect annual losses of $42 million over the next 100 years**.

It is important to note that this is only a predictive insurance model, and that annual average losses could be less than, or exceed the estimated $42 million. Claims associated with the 2013 Powerhouse Fire, which destroyed 58 structures, cost the department's insurers approximately $100 million. In any case, **a single wildfire, or a series of wildfires over a short period of time, causing losses in excess of $360 million could significantly impact the department**. The costs associated with a catastrophic wildfire would eventually be passed on to LADWP customers.

An Alternative Insurance Model

The State has recognized the difficult operating and legal environments for power utilities serving California residents. In July 2019, the Governor approved Assembly Bill 1054 which established a series of wildfire prevention and planning regulations and created a utility wildfire fund to pay eligible costs arising from a wildfire. Continuous contributions to the fund will be made by the participating IOUs, and through a ratepayer fee collected by the utilities. In order to tap into the wildfire fund to cover the costs of a catastrophic wildfire, a utility must demonstrate that it acted reasonably in caring for the equipment during the period leading up to the ignition.

While the new wildfire fund will help IOUs mitigate the impact of wildfire costs resulting from the State's inverse condemnation framework, the legislation establishing the fund allows for participation by IOUs only. There is currently no similar wildfire fund for publicly-owned utilities in the State, even though such a fund could benefit LADWP and other municipal utilities as they seek to reduce wildfire liabilities.

The establishment of a wildfire fund for publicly-owned utilities would pose unique challenges, as each utility has its own governance models and ratepayer rules, and unlike IOUs in the State, there is no single regulator for publicly-owned utilities. Despite the complexities associated with establishing such a fund, **LADWP should examine whether a joint wildfire fund among publicly-owned utilities would be a prudent step to protect against growing liability risks**.

Recommendation

Recommendation 1: LADWP should, in conjunction with peer utilities within the State, formally assess the legal and financial feasibility of establishing a wildfire insurance fund for publicly-owned utilities.

III. LADWP's Inspection and Maintenance Activities

LADWP conducts regular inspections of its distribution and transmission infrastructure. The results of these inspections inform department managers of system reliability risks – including fire safety risks – and allow managers and crews to plan and carry out maintenance activities.

Distribution System Inspections and Maintenance

LADWP conducts several types of overhead distribution system inspections with varying levels of detail and frequency. A description of distribution inspection activities is listed below. **Our review did not include an assessment of the department's compliance with policies and scheduling requirements for distribution equipment inspections.**

Patrol Inspections – LADWP performs annual patrol inspections along distribution lines. Patrol inspections are visual, non-invasive inspections where staff identify obvious safety and maintenance issues. In designated wildfire risk areas, patrols usually take place between March and April, which helps the department to identify and address concerns for the upcoming fire season.

Detail Inspections – These inspections take place every five years and are full evaluations of distribution facility equipment, where staff assess the conditions of poles, conductor lines, transformers, fuses, insulators, and other assets. Crews can also make on-the-spot repairs for certain issues identified during the inspection process.

Pole Inspections – LADWP conducts pole inspections which evaluate the condition and integrity of the distribution system's utility poles. For wood poles, inspection staff probe the utility pole to test for signs of decay or other factors which indicate the pole requires maintenance, reinforcement, or replacement. These inspections occur 20 years after initial installation, and then once every ten years thereafter.

Infrared Inspections – The department supplements its distribution system evaluations with periodic infrared inspections. These inspections consist of LADWP staff using heat sensing infrared cameras to detect "hot spots" which cannot be seen by the human eye. Hot spots can indicate potential failure points exist, such as bad connections or failing components. Teams complete infrared inspections of the distribution system on a four-year cycle.

Maintenance issues identified during inspection activities are logged and prioritized within the department's Work Management Information System. The department prioritizes repairs based on the type of reliability or safety risk identified, and whether the needed repairs are in a designated wildfire risk area.

Per the requirements of the CPUC General Order No. 95 (*Rules for Overhead Electric Line Construction*) LADWP policy is to immediately repair equipment which constitutes an imminent threat to public safety. Other maintenance needs which represent a moderate public safety risk must be repaired within six or twelve months, depending on the type of fire threat district the equipment is located in.

LADWP data shows that, as of August 2019, there were 3,456 outstanding maintenance orders in designated high fire risk areas for issues that constitute fire safety risks. There were an additional 1,018 maintenance orders for repair needs that are not considered fire safety risks, such as issues related to underground equipment.

Maintenance work order information in the following chart shows the number of assets in need of replacement as of August 2019, within designated high fire risk areas. It also shows equipment replacement figures in those high fire risk areas for FY 2016 through FY 2019.

Maintenance Data for Assets in Designated Wildfire Risk Areas (as of August 2019)[2]

CPUC Tier 3/Extreme Fire Threat *(6 Month Replacement Timeline)*							
Asset Type	*Total Assets*	*Replaced FY16*	*Replaced FY17*	*Replaced FY18*	*Replaced FY19*	***Annual Replacement Average***	***Identified for Replacement*** *(As of Aug. 2019)*
Poles	1,477	8	154	15	4	45	8
Crossarms	5,368	7	15	29	17	17	0
Transformers	334	3	2	5	6	4	1
CPUC Tier 2/Elevated Fire Threat *(12 Month Replacement Timeline)*							
Asset Type	*Total Assets*	*Replaced FY16*	*Replaced FY17*	*Replaced FY18*	*Replaced FY19*	***Annual Replacement Average***	***Identified for Replacement*** *(As of Aug. 2019)*
Poles	40,618	212	453	506	536	**427**	**816**
Crossarms	154,840	1,099	755	1,407	1,072	1,083	112
Transformers	10,797	98	71	96	140	101	68
LAFD High Fire Risk Zone *(12 Month Replacement Timeline)*							
Asset Type	*Total Assets*	*Replaced FY16*	*Replaced FY17*	*Replaced FY18*	*Replaced FY19*	***Annual Replacement Average***	***Identified for Replacement*** *(As of Aug. 2019)*
Poles	6,634	51	47	95	60	**63**	**2,230**
Crossarms	26,692	224	84	374	58	185	171
Transformers	2,062	16	16	19	26	**19**	**50**

LADWP's maintenance data indicates it has been able to address equipment fire risks in the highest CPUC Tier 3 (Extreme Risk) Threat Districts, and most of the fire risks in CPUC Tier 2 (Elevated Risk) Threat Districts. **However, maintenance backlogs for utility poles in Tier 2 and LAFD fire risk areas, and for transformers in LAFD fire risk areas, can increase the likelihood of LADWP equipment contributing to a fire ignition. Addressing current maintenance lags is critically important, as these issues can compound as the infrastructure ages and become more difficult to address in the future.**

Strengthening Distribution Inspection and Maintenance Activities

Enhancements to LADWP's distribution inspection activities would improve the department's ability to detect fire risks in designated high fire risk areas. Opportunities include increasing the frequency of inspections in high risk areas, and using drones to supplement existing inspection work.

[2] Several hours prior to the release of this report, LADWP contacted the Controller's Office to report that the maintenance backlog in LAFD fire zones is actually 30 poles. LADWP did not provide verification for this change, and therefore, we could not confirm the veracity of these claims.

Shorter Intervals for Detail Inspections

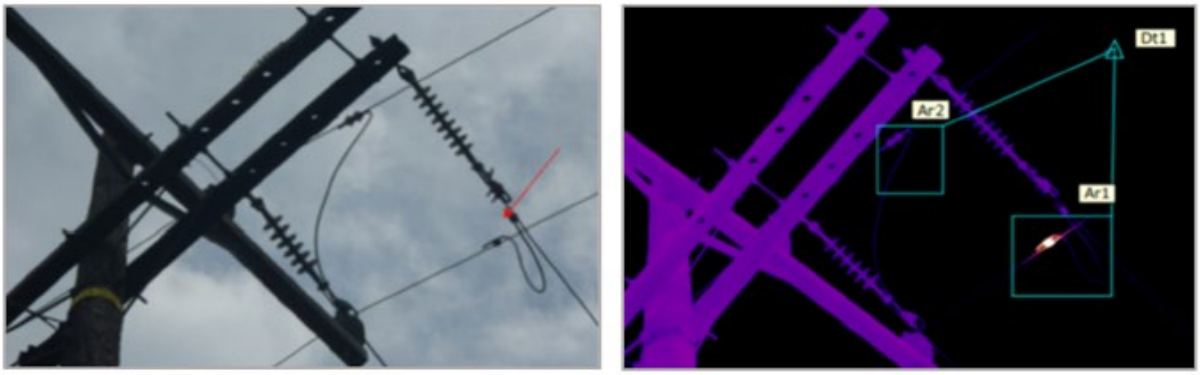
While LADWP's procedures for detail inspections are consistent with CPUC rules governing inspections, the department could benefit from more frequent evaluations of assets in wildfire risk areas. Reducing the detail inspection cycle to shorter than the current five years would improve situational awareness, and allow more opportunities for crews to identify safety issues.

SDG&E has implemented a "Quality Assurance/Quality Control Inspections" program for assets in CPUC Tier 3 (Extreme Risk) Threat Districts. The enhanced inspections exceed the requirements of the CPUC's General Order for inspections, and place a special emphasis on fire safety and ignition risks. SDG&E conducts its quality control inspections for CPUC Tier 3 (Extreme Risk) Threat Districts on a three-year cycle.[18]

Shorter Intervals for Infrared Inspections

Inspections of power infrastructure using infrared technology has been a valuable method for detecting failure and safety risks not easily identifiable through visual inspections. Though current LADWP inspection practices for distribution assets call for infrared inspections on a four-year cycle, the department could benefit from using this inspection technology with greater frequency in high fire risk areas.

A Visual Inspection Image (left) Compared to an Infrared Image (right)



Source: SCE Prepared Testimony Before the CPUC

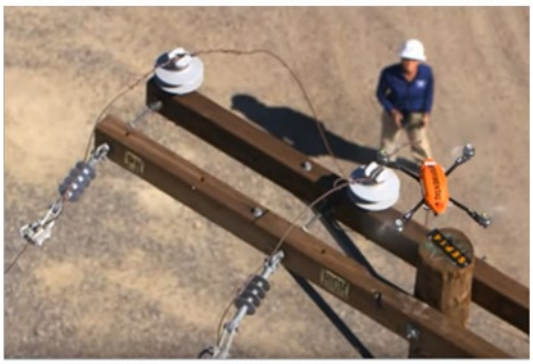
For example, SCE in 2017 began conducting biennial infrared inspections of overhead distribution equipment in high fire risk areas.[19] The images above show the value of infrared technology for inspection activity. The infrared image on the right detects a hot spot which is not visible with a standard image.

Using Drones to Improve Inspection Capabilities

Public utilities are increasingly using unmanned aerial vehicles, better known as drones, to augment inspection activities because they can provide crews and specialists with helpful images of the top of a utility pole. The use of drones can improve the ability to

identify anomalies which indicate a fire safety risk, and can increase employee safety because the evaluations can take place without individuals having to climb the utility pole for closer inspection.

Drones Can Help Identify Safety Issues



Source: SDG&E News and Video Archives

Using drones to supplement inspection and other risk assessment activities can improve the ability of LADWP to identify high threat assets in need of repair or replacement. It is important to note that the department would need to consider both Federal Aviation Administration restrictions on certain drone activities, and privacy issues associated with capturing images using drones. PG&E, SCE, and SDG&E are all developing drone programs in order to improve crews' ability to evaluate equipment and terrain, especially in difficult-to-access locations.

Transmission System Inspections and Maintenance

LADWP monitors its transmission system through a series of aerial patrols, ground-based inspections, and detailed tower inspections. Maintenance needs identified during inspection activities are entered into the department's Transmission Maintenance Database, which managers use to categorize and monitor maintenance work orders. A description of LADWP's transmission inspection activities is listed below. **This review did not include an assessment of the department's compliance with policies and scheduling requirements for transmission line inspections.**

Aerial Patrols – The department conducts regular helicopter-based aerial patrols of the transmission system to identify a wide range of safety, reliability, and security concerns. Aerial patrols occur semiannually – at least once during the first half of the year, and at least once in the second half of the year – with at least three months between intervals. During aerial patrols, staff assess the transmission towers themselves, conductor lines and their related hardware, and insulators. Aerial patrol crews also assess the right-of-way conditions along the transmission line corridors, taking into consideration vegetation or other external objects which may interfere with equipment.

Line Patrols – LADWP inspectors conduct annual line patrols of transmission lines. During these patrols, inspectors use binoculars to conduct a visual inspection of towers, conductors, insulators, and other hardware. Similar to aerial patrols, staff also assess

transmission corridor conditions to identify vegetation or other risks which may impact transmission towers or lines.

Climbing Inspections – LADWP conducts detailed climbing inspections every one or ten years, depending on the location and type of tower. Inspectors complete annual climbing inspections of tower crossings that involve other transmission lines, freeways, major highways, railroads, and bodies of water. The remaining towers are inspected on a ten year cycle. During a climbing inspection, inspectors systematically evaluate tower conditions. Staff typically start at the tower's base, and then progress up the tower and circle each section to assure 360 degree coverage. Special attention is given to critical bolts, arm supports, and conductor attachment points.

Insulator Washing – In addition to this inspection and maintenance work, LADWP conducts scheduled insulator washing on transmission lines to reduce contamination build up, which can cause arcing and short circuits. Insulators are used to safely attach power lines to transmission towers and utility poles so that the electricity does not spread from the power line to the connected equipment. LADWP crews wash transmission line insulators at least once a year with de-mineralized water, though the department washes some insulators more frequently depending on the local conditions and insulator configurations.

LADWP managers expressed a high degree of confidence in the reliability of the department's transmission lines, citing strict design and construction standards, frequent inspections, and the level of external oversight for the department's transmission infrastructure. In 2017, the Western Electricity Coordinating Council completed a transmission Operations and Planning Standards Audit, as required by Federal Energy Regulatory Commission Order 693. Based on the evidence provided, **WECC's audit team, which evaluated LADWP compliance with 35 operations and planning regulations that are aimed at ensuring the security and reliability of the nation's transmission system, found no violations**. Examples of standards within the scope of the audit included:

- Inspections and maintenance;
- Monitoring systems;
- Control center operations;
- Tree trimming and vegetation management;
- Energy emergencies and capacity;
- Emergency operations planning; and
- Communications protocols.

LADWP must remain vigilant as it inspects and maintains its transmission infrastructure, and aggressively work to address maintenance needs in high fire risk areas. **Doing so is central to reducing fire risks in those areas, which is especially important due to the remote locations of transmission assets and the damage which could result from high-voltage power lines causing an ignition.**

Vegetation Management

LADWP's vegetation management program is an important component of the department's efforts to limit the risk of trees or other types of vegetation coming into contact with energized power lines. The policy of the vegetation management program is to conduct annual patrols of transmission and distribution lines to identify limbs and debris which are at risk of interfering with equipment, as vegetation contact can create electrical arcing and fire dangers, and can cause outages. The vegetation management program has established minimum required clearance distances between vegetation and power lines. Those distances vary depending on the type of power line, and are designed to comply with applicable federal and State standards.

LADWP conducts its vegetation control activities with a combination of in-house and contract crews. The vegetation management program maintains a database to track the trees adjacent to power equipment and updates this database based on paper records and reports generated by field crews.

In FY 2019, the department trimmed a total of 189,921 trees along power lines and at LADWP facilities. **Of those trees, 3,293 were located along the power system's transmission lines**. Crews also removed 3,274 high risk trees. The department does not separately track the number of trees trimmed and removed in high fire risk areas.

Strengthening Vegetation Management Activities

While trimming nearly 190,000 trees per year is an important step in reducing vegetation risks, **there are opportunities to further improve the vegetation management function and reduce fire risks**. Those opportunities include expanding its use of spatial analysis technology, implementation of a new tree asset management system, and leveraging the expertise of LAFD staff.

LiDAR

Light Detection and Ranging (LiDAR) is a remote sensing technology that uses a laser to analyze reflected light to create 3D images that accurately capture vegetation dimensions, and the proximity of vegetation to adjacent equipment. LiDAR is a powerful tool which could supplement the existing subject matter expertise of crews, and the vegetation patrol process. LiDAR is already used for certain transmission engineering

projects. Expanding its use in high fire risk areas would help the department spot vegetation risks not easily identified through visual inspection.

Integrated Tree Asset Management

A GIS-based tree inventory management system, with integrated work order management capabilities, can boost vegetation management efficiency and reduce fire risks. This type of system can help program managers track, analyze, and manage workflows, and would allow the vegetation management program to keep a comprehensive maintenance log for each inventoried tree. A secondary benefit is that these systems enable analytics which can identify vegetation trends, like which tree species have the highest growth rates, which trees have the highest rates of failure, and which regions are most susceptible to vegetation risks based on local factors.

Joint Risk Assessments with LAFD Personnel

LADWP is uniquely situated when compared to IOUs to leverage the expertise of other City departments. LADWP could benefit from conducting joint vegetation management inspections with LAFD personnel, where LAFD fire specialists can aid in identifying high risk conditions which present an ignition risk. SCE already partners with local fire departments within its service territory to conduct joint evaluations of vegetation risks.[20] According to SCE staff, the inspections not only improve the vegetation management process, but are an opportunity for firefighters and utility workers to cross train on utility management and fire safety issues.

Recommendations

Recommendation 2: In high fire threat areas, LADWP should work aggressively to eliminate maintenance backlogs so that those backlogs do not compound, and ensure the department can continue to manage workloads in high risk areas.

Recommendation 3: LADWP should enhance its maintenance inspections in high fire threat zones. Enhancements could include, but should not be limited to, the following:

(1) Inspection intervals of less than five years for detail inspection;

(2) The use of drone technology to improve inspectors' ability to evaluate equipment on top of utility poles; and

(3) Inspection intervals of less than four years for hot spot-detecting infrared inspections.

Recommendation 4: LADWP should establish a joint risk assessment and inspection initiative with LAFD to supplement LADWP's evaluation of vegetation and other risk factors within high fire threat zones.

Recommendation 5: In wildfire risk zones, LADWP should expand its use of LiDAR, or other spatial analysis technologies, to supplement vegetation management patrols of power lines and improve the department's ability to evaluate vegetation risks.

Recommendation 6: LADWP should evaluate the feasibility and costs of implementing a GIS-based inventory and workflow management system for its vegetation management program in order to improve efficiency, and improve the department's ability to detect and analyze vegetation risks.

IV. Strategic Planning and Investments

Strategic changes to the department's wildfire mitigation efforts, and broader infrastructure management changes, would boost the ability of the department to identify wildfire risk trends, and efficiently address those safety risks. These changes would improve not just reliability and operational efficiency with regard to wildfire risk areas, but would also support improved efficiency for the entire power system.

Currently **the department does not have staff dedicated solely to wildfire prevention efforts, and the department does not track instances where its equipment sparks an ignition**. Having both ignition data and staff who can evaluate wildfire safety issues across the organization is critically important if the department is to fully understand the wildfire safety risks across its power system. **Opportunities also exist to leverage new asset management, analytics, and monitoring technologies to enhance the department's ability to detect fire safety risks and trends**.

Formal Wildfire Mitigation Plan

LADWP is in the process of developing its first ever comprehensive Wildfire Mitigation Plan. This plan was required by California Senate Bill (SB) 901, which was approved by the Governor in September 2018. Per the requirements of SB901, the plan must include several elements, including, but not limited to:

- Descriptions of the preventive strategies and programs to be adopted to minimize the risk of electrical lines and equipment causing catastrophic wildfires;
- Methodologies for identifying and presenting enterprise wide safety risks and wildfire risks;
- A comprehensive list that identifies, describes, and prioritizes all wildfire risks, and drivers for those risks, throughout the service territory;

- Descriptions of risks and risk drivers associated with design, construction, operation, and maintenance of equipment and facilities;
- Plans for inspections of electrical infrastructure;
- Descriptions of the metrics to be used to evaluate the wildfire mitigation plan's performance and the assumptions that underlie the use of those metrics; and
- Descriptions of the processes and procedures to be implemented to monitor and audit the implementation of the mitigation plan, and to monitor and audit the effectiveness of electrical line and equipment inspections.

The Wildfire Mitigation Plan is due before January 1, 2020. Upon completion, LADWP's Wildfire Mitigation Plan must be presented to the Board of Water and Power Commissioners for review. SB901 also requires the department to obtain validation from a qualified independent evaluator, who will review and certify the comprehensiveness of the plan. Subsequent legislation approved by the Governor in July 2019, Assembly Bill 1054, will allow utilities to develop a comprehensive mitigation plan once every three years, with annual updates between comprehensive plans.

According to LADWP, the mitigation plan has been an opportunity to bring together subject matter experts and program managers from across the department in order to identify strengths and weaknesses related to fire safety issues. The mitigation plan should provide for improved wildfire safety planning, and increased accountability.

A Dedicated Wildfire Safety Program

While the development of its first comprehensive Wildfire Mitigation Plan is an important step in evaluating risks and strategies, **LADWP does not have a dedicated wildfire mitigation and safety program which can provide technical wildfire expertise, and supplement existing infrastructure safety and reliability programs**. Currently, an Electrical Services Manager, and a Transmission and Distribution District Superintendent within the department's Power Transmission and Distribution Division are the lead authors and coordinators for LADWP's Wildfire Mitigation Plan. While these individuals are highly qualified utility management experts, their primary responsibility is managing maintenance and engineering projects, whereas wildfire safety planning is a new, secondary responsibility.

Given the increasing risks and liabilities associated with utility-caused wildfires, the department would benefit from having a dedicated wildfire safety team. PG&E, SCE, and SDG&E have all developed programs dedicated to wildfire safety. These programs work with operational, emergency management, and planning groups within the utilities to help continually monitor infrastructure risks, environmental risks, and emerging wildfire safety trends.

The IOUs' dedicated wildfire safety teams typically consist of cross-functional subject matter experts. For example, SDG&E has established both a Community Fire Safety Program to examine and improve the safety of its electrical system, and a Fire Science and Climate Adaptation Unit. SDG&E's fire safety staff consists of meteorologists, fire coordinators, and community resiliency experts who work to improve the utility's understanding of regional fire risks and the impact of climate change.[21]

LADWP could improve its overall preparedness by having in-house expertise that can monitor wildfire risks, evaluate emerging wildfire safety technologies, and continuously analyze risks in order to help the department prioritize infrastructure investments. **This group could help managers proactively identify and mitigate emerging hardware risks, and analyze the costs and benefits of undergrounding power lines in certain fire risk areas. The need for LADWP to analyze both the current wildfire risk environment, and emerging risks, will not end upon completion of the Wildfire Mitigation Plan**.

Collection and Analysis of Fire Incident Data

LADWP does not specifically track fire incidents caused by its power equipment. As a result, the department **lacks critical information which should be used to inform the development of wildfire safety plans and maintenance activities**.

California's IOUs must consistently track incidents where their assets cause ignitions. In 2014, the CPUC adopted the Fire Incident Data Collection Plan, which required certain IOUs to collect and annually report fire incident information. The information allows for the identification of operational and environmental trends which are contributing to fire events. The utilities must report any self-propagating fire where resulting fire traveled greater than one linear meter from the ignition point.

The tracking of ignition incidents by LADWP would provide the department with crucial data and lessons which could be used to inform infrastructure and maintenance planning. Furthermore, the reporting of such information to appropriate oversight bodies within the City could improve transparency and accountability with regard to fire safety issues, as ignition data is a key risk indicator. Useful data for each incident would include:

- Location;
- Type of equipment involved;
- Cause of the incident (equipment failure, foreign object contact, etc.);
- Age or estimated age of the equipment involved;
- Fuel source;
- Responding fire agency (when applicable); and
- Amount of space burned.

Remote Monitoring Tools

An important component of wildfire mitigation activities is the ability to monitor assets and conditions in real time, and adjust operations as necessary. **Remote monitoring tools, if deployed by LADWP in wildfire risk areas, would improve situational awareness and the utility's ability to monitor equipment and conditions in remote areas**.

An HD Camera Enables Fire Incident Monitoring

Source: SCE Prepared Testimony Before the CPUC

One tool which could improve the department's situational awareness is the deployment of **high-definition (HD) cameras**. HD cameras can help utilities to quickly identify and triangulate fire incidents to allow for faster fire suppression response times. They can also help to ensure firefighting assets are deployed to areas where they can have the most impact.

Utilities commonly deploy pan-tilt-zoom cameras, which give remote operators directional and zoom control. The State's three IOUs have deployed, or are in the process of deploying, networks of HD cameras in high fire risk areas. SCE plans to achieve 90% visual coverage of its high fire risk areas by 2020 with the deployment of 160 cameras.[22]

Weather stations are another tool that could support improved situational awareness. Utilities commonly use weather stations to identify high risk weather conditions which could impact power equipment, allowing the organization to adjust operations as necessary to reduce ignition risks. SDG&E owns and operates a network of over 175 weather stations affixed to distribution and transmission equipment.[23]

Enterprise Asset Management Systems

Given the complexity and large scope of LADWP's power infrastructure and operations, the department is forced to rely on multiple systems to track assets, inspections, maintenance, and inventories. **However, a shift by LADWP toward the use of integrated enterprise asset management (EAM) systems to manage transmission and distribution assets could help the department manage wildfire risks moving forward, in addition to helping the department improve the overall reliability of its systems**.

Many infrastructure management agencies and utilities are adopting EAM models and systems. EAM systems typically include integrated inventory, maintenance management, business

management, and analytics applications which improve an organization's ability to manage infrastructure over the lifecycle of the asset.

While the development and implementation of an EAM system would be a major undertaking, LADWP is already taking steps which lay the groundwork for such a program. LADWP is in the process of developing a comprehensive GIS-based inventory of its power lines, which will be an invaluable tool for the department. This inventory information, coupled with data about the age and specifications of the equipment, inspection histories, and maintenance data, would improve the department's ability to:

- Make risk-based infrastructure investment decisions;
- Streamline and manage inspection and maintenance activities without relying on manual processes and paper records;
- Monitor and optimize maintenance performance; and
- Use advanced data analytics to identify asset failure and other safety risks which present a fire danger, such as the identification of specific equipment types or materials that are causing a higher than acceptable number of safety incidents.

Emerging Advanced Analytics Technologies

Future opportunities may exist for LADWP to use artificial intelligence and other advanced analytics tools to leverage data and predict potential failures before they cause a wildfire, or other public safety incident. Artificial intelligence is generally defined as technology which can learn from its analytical actions in order to draw conclusions and identify patterns. This is usually enabled by automation which can efficiently process, and run calculations on, large amounts of data.

An example of one such application is waveform analytics. **Waveform analytics is an emerging technology where pattern recognition tools analyze electrical waveform data from a utility's power system in order to detect potential problems, and based on the waveform, predict the cause of the problem**. This tool allows utilities to then take informed, proactive hazard mitigation actions in order to address potential safety and reliability issues.

California's IOUs are already implementing advanced analytics technologies which will enhance their ability to correlate data, identify and predict safety risks, and develop actionable safety strategies. For example, SCE has proposed implementing an artificial intelligence and predictive modeling program which will analyze real time grid data in order to identify early warning signs for potential faults. Similarly, SDG&E has plans to data mine its vegetation management information systems and use artificial intelligence tools to correlate vegetation and metrological information. This analysis will help SDG&E program managers

identify the highest risk areas, and will provide them with a more detailed understanding of how atmospheric conditions impact tree growth rates.

Funding for Future Wildfire Mitigation Investments

LADWP, as a propriety department of the City, generates its own revenue from customers paying for water and power services. As authorized by Section 676 of the City Charter, price rates for LADWP's power services are periodically adjusted to reflect changes in operating costs, investments to maintain and upgrade infrastructure, and costs associated with regulatory and legal mandates. Changes in power rates are proposed by the Board of Water and Power Commissioners in a Power System Rate Proposal. The Power System Rate Proposal is subject to the approval of the City Council and Mayor.

It is important to recognize that there will be costs associated with future wildfire mitigation activities undertaken by LADWP. Some of the recommendations discussed in this report, such as improving the collection and reporting of fire ignition data, and joint risk assessments with LAFD, can be accomplished with minimal additional costs. However, **larger strategic initiatives, such as the implementation of EAM systems and advanced predictive analytics tools, would require significant investments by the department**.

LADWP must ensure that it has the resources necessary to implement a comprehensive wildfire mitigation strategy, including resources which will allow the department to eliminate current and future maintenance backlogs in high fire risk areas. To that end, **the department should consider the costs of wildfire safety initiatives in its next Power System Rate Proposal. The incorporation of wildfire safety costs into its next rate proposal would help LADWP cover the expenses associated with making the power system safer, and improve the department's ability to reliably deliver electricity to its customers**.

Recommendations

Recommendation 7: LADWP should integrate dedicated wildfire prevention and safety staff to support ongoing wildfire risk assessment and planning activities, such as the identification of emerging hardware risks, and analysis of whether power lines should be undergrounded in the highest risk areas.

Recommendation 8: To enhance accountability and provide wildfire risk insights to LADWP leadership and City policymakers, the department should, on a regular basis, report to the Board of Water and Power Commissioners a detailed record of fire incidents involving LADWP equipment. The reports should also be referred to relevant City Council committees for review.

Recommendation 9: LADWP should deploy remote monitoring tools in high fire risk areas, such as HD cameras and weather stations, in order to improve situational awareness and the ability to respond to fire incidents.

Recommendation 10: LADWP should evaluate the feasibility and costs of implementing an integrated enterprise asset management system for power assets.

Recommendation 11: LADWP should evaluate the feasibility and costs of implementing advanced predictive analytics and artificial intelligence programs capable of helping the department detect and mitigate wildfire safety and asset reliability issues.

Recommendation 12: In its next Power System Rate Proposal, LADWP should specifically incorporate costs associated with wildfire safety initiatives to ensure the department has sufficient resources to make necessary infrastructure and information systems upgrades.

Conclusion

Catastrophic wildfires will continue to be a constant threat to Angelenos, and LADWP must implement wildfire prevention strategies which reduce the likelihood that its power equipment sparks a fire. A major wildfire caused by LADWP equipment could threaten public safety and cause significant financial losses for the department. **By taking steps to aggressively identify and address fire dangers, and modernizing its approach to analyzing its infrastructure and associated fire risks, LADWP can be better prepared to confront the growing wildfire threat.**

Endnotes

[1] LADWP also has an ownership stake in transmission infrastructure in Oregon and Arizona, but is not responsible for its operation and maintenance.
[2] "Top 20 Most Destructive California Wildfires." CAL FIRE. 2019.
[3] "Major Fires in San Diego: 2007 Witch Creek-Guejito Fires." City of San Diego Fire Department.
[4] "Cal Fire Incident Report: Thomas Fire." CAL FIRE. 2019.
[5] "Cal Fire Incident Report: Camp Fire." CAL FIRE. 2019.
[6] "Cal Fire Incident Report: Woolsey Fire." CAL FIRE. 2019.
[7] United States Forest Service Report of Instigation: Powerhouse Fire-Angeles National Forest. 2014
[8] "Cal Fire Incident Report: Camp Fire." CAL FIRE. 2018.
[9] "City of Los Angeles 2018 Local Hazard Mitigation Plan." City of Los Angeles Emergency Management Department. 2018.
[10] Based on analysis of the CPUC Safety Enforcement Division's 2014-2018 fire incident data for PG&E, SCE, and SDG&E
[11] Kousky, C., Greig, K., Lingle, B., & Kunreuther, H. (2018). "Wildfire Costs in California: The Role of Electric Utilities." University of Pennsylvania Wharton Risk Management and Decision Process Center.
[12] PG&E Securities and Exchange Commission Form 8K, August 30, 2019.
[13] PG&E Securities and Exchange Commission Form 8K, January 13, 2019.
[14] The LAFD Very High Fire Hazard Severity Zone areas do overlap with the CPUC's High Fire Thread District Maps. Information in this report regarding electrical equipment in high fire risk areas, which was provided by LADWP, takes into account overlapping areas to eliminate duplications in the data.
[15] "Wildfires and Climate Change: California's Energy Future." Office of Governor Gavin Newsom. 2019.
[16] Due to how LADWP tracks conductor line maintenance and upgrades, it was unable to provide conductor line data at the time of this study.
[17] Council Fire No.09-1741: Utility Undergrounding Program Second Report. (2010). Los Angeles: Los Angeles Department of Water and Power.
[18] San Diego Gas and Electric Company Wildfire Mitigation Plan, February 2019.
[19] Southern California Edison Company Wildfire Mitigation Plan, February 2019.
[20] Southern California Edison Company Wildfire Mitigation Plan, February 2019.
[21] San Diego Gas and Electric Company Wildfire Mitigation Plan, February 2019.
"Richie Veihl: From Firefighter/EMT to SDG&E Fire Coordinator." SDG&E News. July 19, 2019.
[22] Southern California Edison Company Wildfire Mitigation Plan, February 2019.
[23] San Diego Gas and Electric Company Wildfire Mitigation Plan, February 2019.

Summary of Recommendations

Number	Recommendation	Responsible Entity
Covering Financial Losses Following Wildfires		
1	LADWP should, in conjunction with peer utilities within the State, formally assess the legal and financial feasibility of establishing a wildfire insurance fund for publicly-owned utilities.	LADWP
LADWP's Inspection and Maintenance Activities		
2	In high fire threat areas, LADWP should work aggressively to eliminate maintenance backlogs so that those backlogs do not compound, and ensure the department can continue to manage workloads in high risk areas.	LADWP
3	LADWP should enhance its maintenance inspections in high fire threat zones. Enhancements could include, but should not be limited to, the following: (1) Inspection intervals of less than five years for detail inspection; (2) The use of drone technology to improve inspectors' ability to evaluate equipment on top of utility poles; and (3) Inspection intervals of less than four years for hot spot-detecting infrared inspections.	LADWP
4	LADWP should establish a joint risk assessment and inspection initiative with LAFD to supplement LADWP's evaluation of vegetation and other risk factors within high fire threat zones.	LADWP
5	In wildfire risk zones, LADWP should expand its use of LiDAR, or other spatial analysis technologies, to supplement vegetation management patrols of power lines and improve the department's ability to evaluate vegetation risks.	LADWP
6	LADWP should evaluate the feasibility and costs of implementing a GIS-based inventory and workflow management system for its vegetation management program in order to improve efficiency, and improve the department's ability to detect and analyze vegetation risks.	LADWP
Strategic Planning and Investments		
7	LADWP should integrate dedicated wildfire prevention and safety staff to support ongoing wildfire risk assessment and planning activities, such as the identification of emerging hardware risks, and analysis of whether power lines should be undergrounded in the highest risk areas.	LADWP

8	To enhance accountability and provide wildfire risk insights to LADWP leadership and City policymakers, the department should, on a regular basis, report to the Board of Water and Power Commissioners a detailed record of fire incidents involving LADWP equipment. The reports should also be referred to relevant City Council committees for review.	LADWP
9	LADWP should deploy remote monitoring tools in high fire risk areas, such as HD cameras and weather stations, in order to improve situational awareness and the ability to respond to fire incidents.	LADWP
10	LADWP should evaluate the feasibility and costs of implementing an integrated enterprise asset management system for power assets.	LADWP
11	LADWP should evaluate the feasibility and costs of implementing advanced predictive analytics and artificial intelligence programs capable of helping the department detect and mitigate wildfire safety and asset reliability issues.	LADWP
12	In its next Power System Rate Proposal, LADWP should specifically incorporate costs associated with wildfire safety initiatives to ensure the department has sufficient resources to make necessary infrastructure and information systems upgrades.	LADWP