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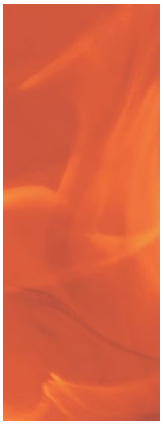
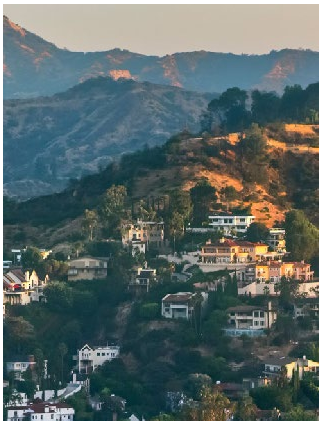
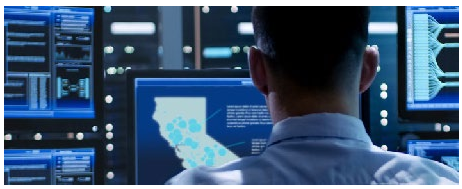


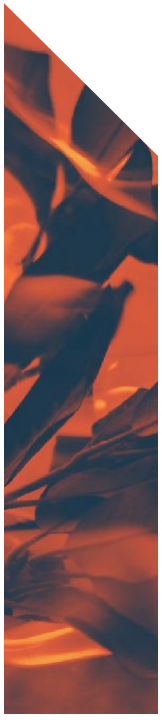


REDUCING UTILITY-RELATED WILDFIRE RISK

Utility Wildfire Mitigation Strategy and Roadmap for the Wildfire Safety Division

December 2020





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Preface

In 2019, the California Public Utilities Commission (CPUC) initiated a project to create a vision, strategy, and roadmap to outline its efforts to systematically reduce the risk of ignition of wildfires from utility infrastructure. The CPUC recognizes that wildfire threat is only increasing – globally and in California – with utility-related ignitions responsible for a disproportionate share of wildfire-related consequences. The newly-established Wildfire Safety Division (WSD) within the CPUC will play a particularly critical role in addressing this growing wildfire risk as it pushes forward its efforts. In 2021, the WSD will transition to the California Natural Resources Agency (CNRA), per AB 1054 and AB 111, where the WSD mission will continue as the Office of Energy Infrastructure Safety (OEIS).

To direct their efforts, the WSD is seeking to define longer-term objectives that can support the WSD, the utilities whose Wildfire Mitigation Plans (WMPs) the WSD is charged with reviewing and approving or denying, and other relevant stakeholders in working toward both near-term and longer-term solutions. More broadly, this effort recognizes opportunities to learn from global practices and other industry examples, while supporting California's ability to continue defining new paradigms and standards for addressing utility-related wildfire risk.

For this project, the WSD partnered with the Boston Consulting Group (BCG) to draw on learning from utility-related wildfire management in California, other states, and globally from other wildfire-prone countries. The WSD, the CPUC, and BCG also worked with a number of other state agency stakeholders (e.g., California Department of Forestry and Fire Protection (CAL FIRE), California Governor's Office of Emergency Services (Cal OES), and entities within the California Natural Resources Agency such as the Forest Management Task Force) to develop its strategy, recognizing that the ultimate effectiveness of utility-related wildfire efforts requires the WSD and utilities to closely and thoughtfully coordinate with a broader set of activities both within and outside of the CPUC.

Section 1 lays out the context for defining the WSD's vision, strategy, and roadmap. Section 2 proposes a strategic approach for the WSD over the next ten years. Section 3 lays out priority actions the WSD has developed and is pursuing to achieve its objectives in the near-term and longer-term. Section 4 further defines critical areas where the WSD and utilities should continue to collaborate with the broader set of California stakeholders to support utility-related wildfire mitigation efforts.

Over time, this vision, strategy, and roadmap – and related activities – will evolve as the WSD and utilities continue to learn from their experiences, and from others.

Executive Summary

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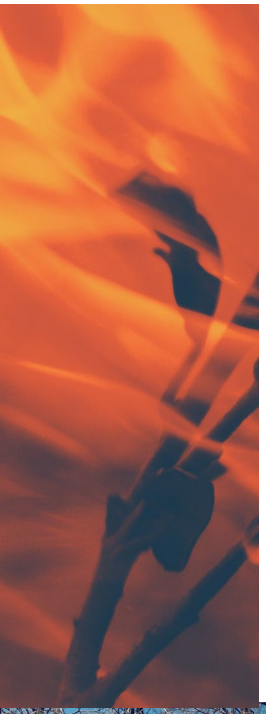

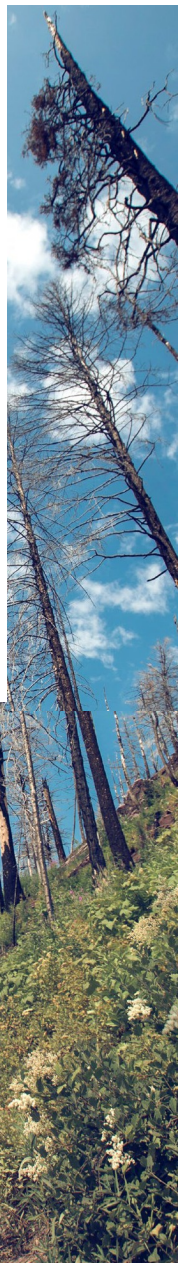

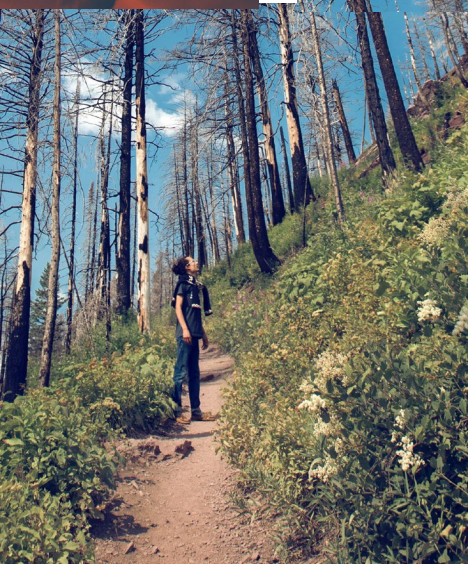

Executive Summary

Wildfires have caused significant social, economic, and environmental damage on a global scale. In California, electric utilities are responsible for some of the most devastating wildfires in recent years.[1] As the evaluator and approver of utilities' Wildfire Mitigation Plans, the newly established Wildfire Safety Division must ensure utility wildfire mitigation efforts sufficiently address increasing utility wildfire risk.

The effects of wildfires are becoming more intense: in many fire-prone areas, wildfire seasons are growing longer and average wildfire sizes are increasing.[2] At the same time, wildfires are occurring in areas that have not faced significant risk in the past.[3] In the United States alone, over 775,000 homes are at 'extreme' risk of wildfire, with the value of those homes equivalent to over $200 billion.[4] Firefighting costs are also rising, along with spending on prevention and mitigation efforts.[5]

California is one of the areas most threatened by large-scale, high-intensity wildfires. In the past thirty years, the state has witnessed larger, more frequent wildfires than in the earlier 20th century.[6] Events in 2017, 2018, and 2020 were especially extreme: California surpassed modern records for fatalities, property damage, area burned, and largest single wildfire by acreage.

Utility-related wildfires disproportionately contribute to California's wildfire crisis, where ignitions related to utility infrastructure led to wildfires that caused 109 fatalities in 2017-2018.[7] California's largest electric utility, Pacific Gas and Electric (PG&E), filed for Chapter 11 bankruptcy protection amidst $30 billion in potential liabilities from

[1] CAL FIRE. *CAL FIRE Investigators Determine Causes of 12 Wildfires in Mendocino, Humboldt, Butte, Sonoma, Lake, and Napa Counties*. June 8, 2018. https://www.fire.ca.gov/media/5100/2017_wildfiresiege_cause.pdf; CAL FIRE. *Investigation Report: Nuns Fire*. October 8, 2017; CAL FIRE. *Investigation Report: Atlas Fire*. October 8, 2017; California Public Utilities Commission. *Appendix A: SED Incident Investigation Report for 2018 Camp Fire with Attachments*. November 8, 2019. https://www.cpuc.ca.gov/CPUCNewsDetail.aspx?id=6442454974#November2018.

[2] Jolly, W.M., et al. *Climate-induced variations in global wildfire danger from 1979 to 2013*, Nat. Commun. 6: 7537, 2015. https://doi.org/10.1038/ncomms8537.

[3] Artés, T., Oom, D., Rigo, D., et al. *A global wildfire dataset for the analysis of fire regimes and fire behaviour*. Sci Data 6, 296, 2019. https://doi.org/10.1038/s41597-019-0312-2.

[4] Calgiano, F., et al. *2019 Wildfire Risk Report*. CoreLogic, September 2019. https://storymaps.arcgis.com/stories/cb987be2818a4013a66977b6b3900444.

[5] Cave, Damien. "The world burns all year: are there enough planes to douse the flames?" *New York Times*, November 21, 2019. https://www.nytimes.com/2019/11/21/world/australia/fires-water-tankers-climate-change.html.

[6] Bedford, L., et al. *Statewide Summary Report*. California's Fourth Climate Change Assessment, July 2019.

[7] California Department of Forestry and Fire Protection (CAL FIRE). *Wildfire Activity Statistics*. 2018.

wildfires in 2017 and 2018.[8] Although 2019 saw fewer devastating wildfires, millions were impacted by Public Safety Power Shutoff (PSPS) events executed by utilities to prevent their assets from igniting fires.[9] By October, 2020 saw the highest acreage burned on record, with over 4,000,000 acres burned, including the largest *single* fire (the Creek Fire) and the largest fire (the August Complex Fire) in California history.[10] Utility infrastructure is aging and is not being modernized quickly enough to address changing conditions. Significant investment in existing maintenance, new technologies, and grid redesign is needed to address longer-term risks. Utilities, the California Public Utilities Commission (CPUC), and the Wildfire Safety Division (WSD[11]) are all focused on these issues.

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From 2017-2018, utility-related wildfires killed 109 people.

Rising wildfire risk has been driven by a complex set of factors tied to climate change, land planning and management, and demographic trends. Climate change has a significant impact on wildfire risk as increasing temperatures and erratic precipitation decreases vegetation and soil moisture content and snowpack levels, while extending droughts and summer fire seasons. Shifting weather patterns also impact extreme wind events, which can quickly dry vegetation to create fuel and propagate large fires.[12,13] Twentieth-century land management practices, especially policies of fire suppression, have led to significant fuel accumulation in forests, which can result in hotter and faster burning fires throughout the state. A growing population living in the wildland-urban interface (WUI)[14] means that more communities are exposed to wildfire risk, and also that more electrical infrastructure is being built in wildfire-prone areas. This occurs as electric utilities are required to provide service in high fire threat areas, where downed power lines may come into contact with dry forest fuel, or foreign objects, such as trees, may come into contact with energized wires, potentially generating sparks that can ignite wildfires.

Although wildfires related to utility infrastructure are a global issue, there is not yet a definitive standard or template to guide utilities in California on how to manage the growing risk. While the WSD and electric utilities have looked at initiatives and technology innovations in other wildfire-prone geographies, in research communities,[15] and in other industries or sectors, no one has developed a comprehensive solution.

[8] Wichter, Zach. "California's Largest Utility Says It Is Bankrupt. Here's What You Need To Know," *New York Times*, January 29, 2019. https://www.nytimes.com/2019/01/29/business/pge-bankruptcy.html.
[9] Batjer, Marybel. *Letter to Telecos for Information and Hearing.* CPUC, November 13, 2019. https://www.cpuc.ca.gov/deenergization/
[10] CalFire, "Current Year Statistics," https://www.fire.ca.gov/stats-events/. Last accessed October 16, 2020.
[11] The WSD will transition into the OEIS by July 1, 2021 and all duties and responsibilities will transfer with it.
[12] Williams, A. P., Abatzoglou, J. T., et al. *Observed impacts of anthropogenic climate change on wildfire in California*. Earth's Future, 7, 92–910, (2019). https://doi.org/10.1029/2019EF001210.
[13] Although extreme offshore winds like the Santa Ana winds are projected to decrease in intensity and frequency, continued warming and delayed onset of precipitation is predicted to offset this decrease.
[14] University of Wisconsin-Madison Silvis Lab. "Wildland-Urban Interface Change 1990-2010." 2019.
[15] CPUC. "Wildfire Technology Innovation Summit." March 2019.

As an important first step in 2018 and 2019, the California legislature adopted a set of legislation focused on utility wildfire safety, specifically passing Senate Bill 901 (Dodd, 2018), Assembly Bill 1054 (Holden, 2019), and AB 111 (Committee on Budget, 2019), which established requirements for utilities to submit Wildfire Mitigation Plans (WMPs), among other things. These plans, and the related legislation, were established to improve utility wildfire safety by requiring utilities to clearly describe their initiatives aimed at mitigating wildfire ignition risk from their own infrastructure. Infrastructure.[16] This is one example in how California is setting the global standard for utility wildfire mitigation.

With a primary mandate to ensure electric utilities are taking effective actions to reduce utility-related wildfire risk, the WSD must ensure utility wildfire mitigation initiatives balance near-term activities that make each wildfire season less harmful to the public, with activities focused on long-term, systematic risk reduction. To help achieve this equilibrium, four principles guide the proposed utility wildfire mitigation strategy for the WSD:

- **Effective collaboration:** Coordinating an integrated utility wildfire mitigation approach that breaks down silos and engages stakeholders in strategic decision-making and operations
- **Local perspective:** Developing a flexible, localized utility wildfire mitigation approach that takes into account differences in wildfire risk exposure in communities
- **Long-term resilience:** Creating a utility wildfire mitigation vision that extends the planning horizon to focus on longer-term resilience and adaptation
- **Risk-informed, data-supported decisions:** Using data effectively to understand and plan for risk, and set up stakeholders to act in a way commensurate to reducing risk

To work towards these four principles in the context of utility-related wildfires, a clear vision is proposed for the WSD in Section 2 of this report: ***A sustainable California, with no catastrophic utility-related wildfires, that has access to safe, affordable, and reliable electricity.***

[16] Under recent legislation (AB 1028, SB 901, AB 1054, AB 111), and with guidance from the CPUC, utilities (specifically 'electric corporations') are now required to prepare a Wildfire Mitigation Plan

In an effort to take action today towards this proposed vision, the WSD has begun pursuing four priority actions, outlined in Section 3 of this report. These four priority actions are:

1. **Utility wildfire mitigation plans:** Revised WMP process, including focus on understanding risk and program effectiveness to drive continued improvement and rigor over time
2. **Utility metric reporting:** Metrics to track and assess utility progress and performance against outcomes over time, ensuring continuous learning and adaptation
3. **Detailed risk assessment:** Modeling and analysis of wildfire risk from utility assets to communities and natural resources to support resource allocation
4. **Data and analytics strategy:** Strategy to enable information sharing across stakeholders to support processes such as the WMP evaluation in the near-term, and drive analytics in the longer-term that will support prevention, response, and recovery activities

While these four actions are a critical first step, this report also highlights certain areas where the WSD, and utilities, need to work collaboratively with other agencies, such as the California Department of Forestry and Fire Protection (CAL FIRE) and the California Governor's Office of Emergency Services (Cal OES), and with local communities to successfully achieve the proposed vision.[17] These proposed areas of collaboration, detailed in Section 4, center around the processes, tools, and capabilities necessary to support the mitigation efforts of the utilities in the long-term:

Governance and coordination: Ensure utilities utilize planning and coordination mechanisms, incentives, and accountability measures to direct multi-stakeholder efforts and engage local communities

Culture and behavior: Develop a safety and risk management culture within utilities that is not focused solely on compliance, but proactively drives towards the vision for utility wildfire mitigation

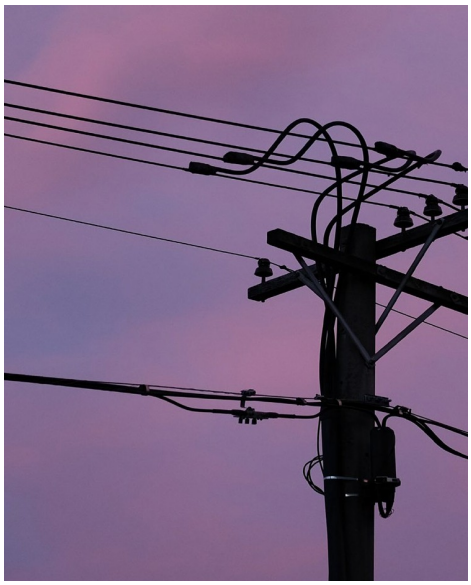
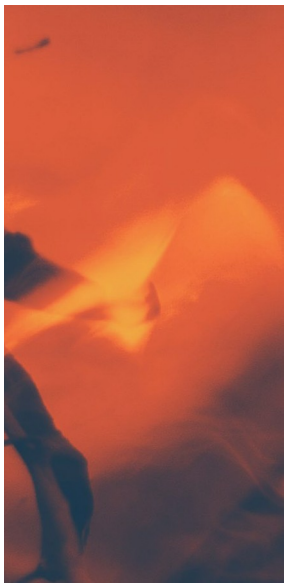
Applied science, technology, and data: Leverage advancements in science, technology, and data and analytics to support more informed decision-making and create a shared understanding of utility-related wildfire risk

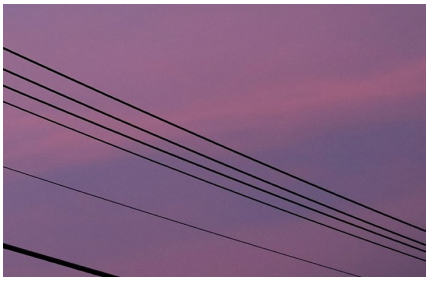
Workforce development: Support the cultivation of a skilled, capable workforce at every level – from top leaders to those that are working on utility wildfire mitigation activities (e.g., foresters, electric linemen)

Changes to legislation and regulation governing utility wildfire mitigation, as well as funding available for prevention and mitigation initiatives, will also guide the WSD's efforts and their direction to the utilities.

[17] The WSD will transition into the OEIS by July 1, 2021 and all duties and responsibilities will transfer with it.

While utilities are already undertaking wildfire mitigation activities and building capabilities subject to CPUC regulation, they must continue to make progress. Utility activities need to incorporate longer-term thinking and take a more robust strategic approach focused on the most impactful actions – all with a local lens. Given the complexity of the issues, the strategy outlined in this report is a proposal to build on existing work and is intended to be a living document to be updated as the WSD and utilities learn more and refine their efforts.



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Background

1 **Background**

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1

Background

Utility-related wildfire risk poses a growing challenge in California today.

In the Western U.S., hotter and drier weather is connected to higher tree mortality and lower vegetation moisture, creating conditions prone to severe wildfires.[18] Fire risk indicators, such as the Canadian Fire Weather Index, are registering the highest warning signs seen in the last 30 years. Canada, Spain, Portugal, Greece, and Chile have all seen deadly wildfires, causing billions of dollars in damages. In 2018, the year of the Camp Fire (California's most deadly fire), British Columbia also faced devastating losses as fires burned over three and a half million acres.[19] In 2019 and early 2020, wildfires burned over two million acres in the Brazilian Amazon,[20] and over 25 million acres in Australia.[21]

15/20

most destructive wildfires in California occurred in the past 10 years

6/20

deadliest wildfires in California occurred in 2017, 2018, and 2020

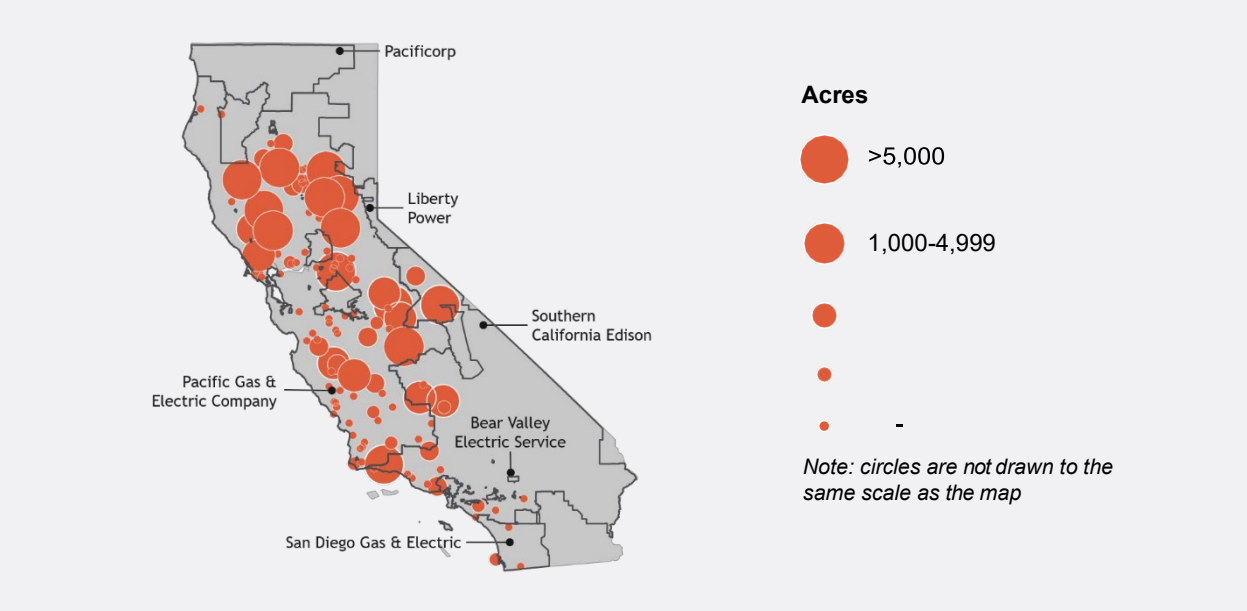
High-severity fires have hit California particularly hard in the past decade. Fifteen of the twenty most destructive wildfires in the state's history have occurred in the past ten years; six of the twenty deadliest wildfires occurred in 2017,2018, and 2020.[22] In late October 2019, several blazes precipitated the evacuation of more than 200,000 people, leading Governor Gavin Newsom to declare a state of emergency.[23] 2020 saw the highest acreage burned on record, the largest *single* fire, and the largest fire in California history.

Wildfire ignitions related to utility infrastructure disproportionately contribute to California's crisis. From 2014-2017, electrical power caused only 9% of wildfire ignitions but accounted for 42% of acreage burned on land where the state is responsible for fire management.[24] Of the 20 most deadly fires in the state's history,

[18] Williams A. Park, et al. *Temperature as a potent driver of regional forest drought stress and tree mortality*. Nature Climate Change, 3: 292, 2013. https://doi.org/10.1038/nclimate1693
[19] Marsh and McLennan Companies. *The Burning Issue: Managing Wildfire Risk*. 2019. https://www.mmc.com/content/dam/mmcweb/insights/publications/2019/oct/THE%20BURNING%20ISSUE%20-%20MANAGING%20WILDFIRE%20RISK_screen_final.pdf.
[20] CBS News. "Brazil's Bolsonaro says he will accept aid to fight Amazon fires." August 27, 2019. https://www.cbsnews.com/news/amazon-wildfires-brazil-spurns-20-million-aid-offer-from-g-7-nations-today-2019-08-27/.
[21] Reuters. "Australian Authorities Warn Bushfire Reprieve Will Be Over Soon." The New York Times. https://www.nytimes.com/reuters/2020/01/07/world/europe/07reuters-australia-bushfires.html
[22] CAL FIRE. "Top 20 Largest California Wildfires," "Top 20 Most Destructive California Wildfires," "Top 20 Deadliest California Wildfires." https://www.fire.ca.gov/stats-events/.
[23] Hepler, Lauren, and Nicholas Bogel-Burroughs. "Half a Million May Lose Power in Another Round of California Blackouts." *New York Times*, October 27, 2019. https://www.nytimes.com/2019/10/27/us/kincade-fire-california.html.
[24] State Responsibility Areas (SRA) are land where CAL FIRE has a legal responsibility to provide fire protection. It excludes lands classified as Federal Responsibility Areas (FRA) and Local Responsibility Areas (LRA). California has 31 million acres of SRA,

35% of fatalities can be traced to utility-related wildfires.[25] As seen in Figure 1, fires reported by investor-owned utilities (IOUs)[26] have occurred across the state. Wildfires triggered by utilities have also impacted regions in other countries including Australia, Brazil, Canada, Portugal, and Spain, as well as other regions in the United States (as detailed further in Appendix 1: Global Strategies for Utility Wildfire Mitigation).

Figure 1: Wildfires ignited from electric utility infrastructure in California over 10 acres (2014-2018)



Note: Includes 1) self-reported IOU ignition data for PG&E, SDG&E and SCE (CPUC Fire Incidents Data 2014-2017) and 2) CAL FIRE data for fires over 1,000 acres with electrical power as cause of fire (CAL FIRE, 2014-2017 Wildfire Activity Statistics, April 2019)

Sources: CPUC Fire Incidents Data 2014-2018, (2018); CAL FIRE, 2014-2017 Wildfire Activity Statistics, (April 2019)

1.1 Drivers of Utility Wildfire Risk

WSD defines wildfire risk as both the probability of wildfire ignition and the expected severity of the ignited wildfire measured by the impact on public safety, property, and natural resources.

This risk is driven by the complex interaction of several factors:

- Climate change
- Fire management and suppression
- Wildland-urban interface population
- Utility infrastructure
- Extreme weather events

approximately one third of land in California. This includes where CAL FIRE directly protects the SRA and contract counties where CAL FIRE provides funding for county fire protection agencies to provide an initial response on SRA land in that county.

[25] Based on CAL FIRE data, excluding private electrical connections such as the 2017 Tubbs fire which was caused by a private connection.

[26] The CPUC regulates investor-owned utilities, which are private electricity providers. Pacific Gas and Electric, San Diego Gas and Electric, and Southern California Edison are the three largest within California. Three additional small and multi-jurisdictional utilities (SMJUs) are also IOUs under the jurisdiction of the CPUC

Fire has always been a natural and critical component of California's forest landscapes, yet the recent high intensity fires in California today are more harmful to the environment. Additionally, the risk of wildfire increases even further when a utility's downed power lines, faulty transformers, unmitigated object contact and other infrastructure problems interact with the four factors above.

Climate Change

Climate change is impacting fire behavior drivers in numerous ways. Higher temperatures and more erratic precipitation result in drier soil and reduced snowpack, creating more frequent drought conditions that are prone to major fires. Limited moisture also weakens tree defenses against invasive species such as bark beetles, resulting in increased tree mortality and a buildup of combustible vegetation.[27] Together, these trends can lead to the conversion of forest to scrubland, which is an even more combustible type of fuel. This threat is underlined by the death of an estimated 147 million trees in California from 2010-2018, a ten-fold increase from similar periods in the 1970s.[28]

Although researchers have drawn different conclusions about the effect of climate change on wind regimes, extreme wind events such as the Santa Ana and Diablo winds have created the most devastating wildfires in California.[29] Extreme wind events can impact the severity of a fire and how quickly it might spread. In fact, 2019 extreme wind events in Southern California were the strongest since 2007, causing the National Weather Service to issue an "extreme" red flag warning, a term that had never been used before.[30] California will continue to experience drier, longer fire seasons with extreme winds.

The projected impacts of climate change in California are significant. As demonstrated in state-funded research and published in the Fourth California Climate Assessment, under a business-as-usual case, the total area burned will grow by 63% over the 1976-2005 average by 2050, as shown in Figure 2 below. Through meeting the targets of the Paris Climate Accord, experts expect the number would only grow by 20%. Nevertheless, the greater size, scope, and frequency of wildfires will only increase the already substantial risk to life and property across California.

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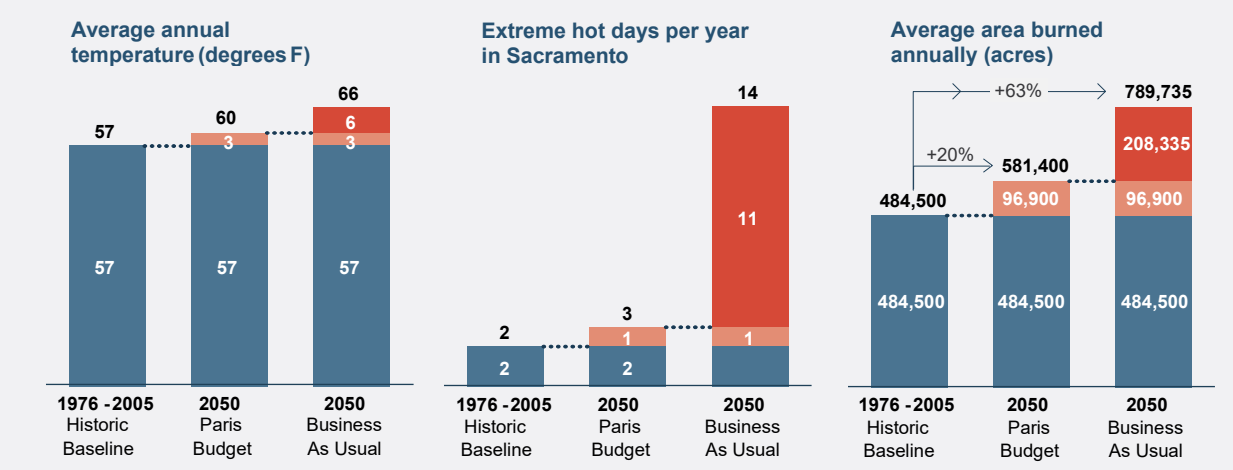
[27] CNRA, Cal EPA, CAL FIRE. *California Forest Carbon Plan*. May 2018. http://resources.ca.gov/wp-content/uploads/2018/05/ California-Forest-Carbon-Plan-Final-Draft-for-Public-Release-May-2018.pdf.
[28] USDA Forest Service. *2018 Tree Mortality Aerial Detection Survey Results*. February 11, 2019.
[29] *Statewide Summary Report*. California's Fourth Climate Change Assessment, July 2019. https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf.
[30] Sutton, Joe, Hanna, Jason, and Silverman, Hollie. "Fire conditions near LA prompt the National Weather Service to issue its first-ever extreme red flag warning." *CNN*, October 29, 2019. https://www.cnn.com/2019/10/29/us/california-fires-tuesday/index.html.

Figure 2: Projected impacts of climate change in California under different scenarios

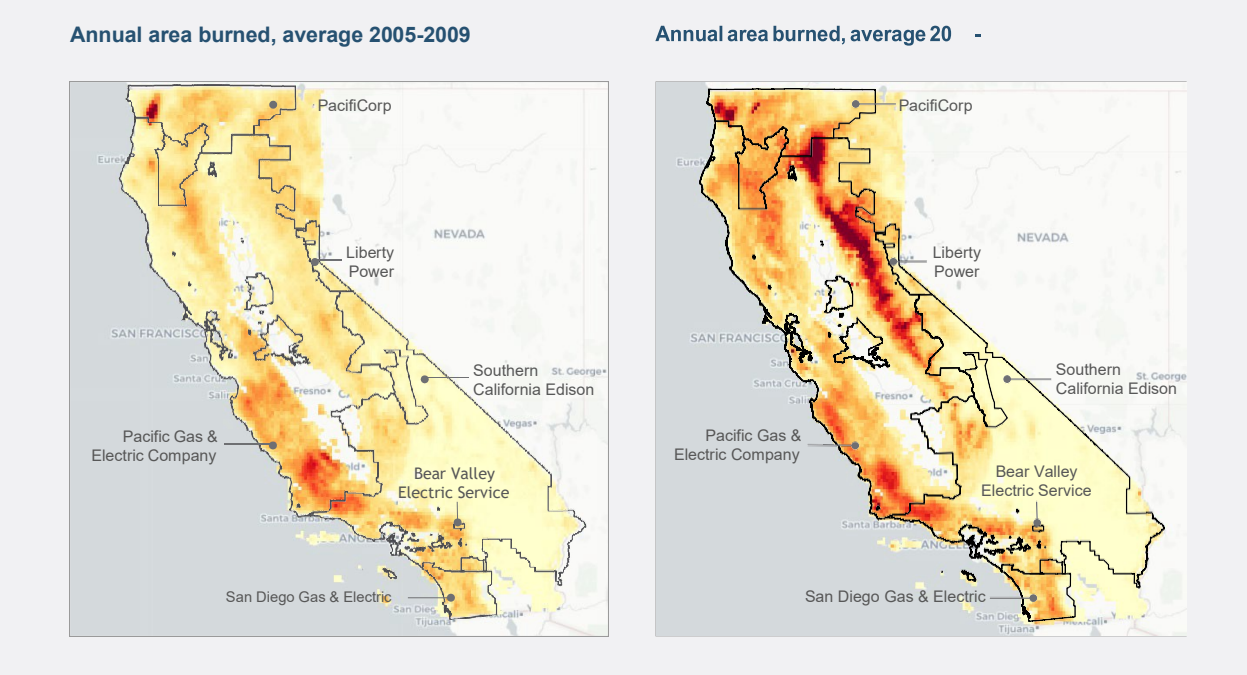


Note: Business as usual case represented by RCP 8.5 scenario, historic baseline from 1976-2005 average.
Source: California's Fourth Climate Change Assessment, Statewide Summary Report, (July 2019)

Northern California will see a particular increase in average annual area burned, as indicated by the darker red in Figure 3 below. In the northern part of the state, more than half of PG&E's 70,000-square mile service territory is located in areas defined by the CPUC Fire-Threat Map as facing extreme or elevated risk today (located in a High Fire Threat District – or HFTD),[31] a number that will almost certainly increase given the trends outlined in this section.[32] The situation is similar in Southern California, where utilities will also operate in more high-risk areas going forward. Southern California Edison (SCE) has about 35% of its service territory (of 50,000-square miles) in HFTD today,[33] and San Diego Gas & Electric (SDG&E) has 54% of its overhead circuit miles in HFTD (within their 4,100-square mile territory).[34]

[31] High Fire Threat District (HFTD): A designation by the CPUC and CAL FIRE that a particular area is especially prone to wildfire propagation
[32] PG&E. *Amended 2019 Wildfire Safety Plan*. February 2019. http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M266/K647/266647757.PDF
[33] Southern California Edison. *2019 Wildfire Mitigation Plan*. February 2019. http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M263/K645/263645320.PDF
[34] California Public Utilities Commission. *Order Instituting Rulemaking to Implement Electric Utility Wildfire Mitigation Plans Pursuant to Senate Bill 901*. October 2019. http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M316/K882/316882215.PDF.

Figure 3: Projected changes to annual area burned over time



Note: Projections use Cal-Adapt's CanESM2 (Average) model under RCP 8.5 (Business-as-usual) scenario

Source: Cal-Adapt, "Wildfire modeling tool," (2019) and California Public Utilities Commission, CPUC Fire Map, (2018)

To address climate change, California set ambitious policy goals to support a transition to renewable energy. The Renewables Portfolio Standard (RPS), established in Senate Bill (SB) 1078 (Sher, 2002) is one of the state's key programs for renewable energy. In 2018, SB 100 (de Leon, 2018) set updated RPS targets, requiring 60% of electricity retail sales to be served by renewable resources by 2030.[35] Largely as a result of this program, the California Air Resources Board (CARB) reported that 2016 electricity sector greenhouse gas (GHG) emissions were 37.6% below 1990 levels.[36] California's global leadership in implementing laws to reduce the causes and impacts of climate change is coupled with an effort to build stronger climate resilience throughout the state, including directing electric utilities to better prepare for the continued wildfire threats exacerbated by climate change.

[35] California Public Utilities Commission. "Renewables Portfolio Standard (RPS) Program" 2020. https://www.cpuc.ca.gov/rps/.
[36] California Energy Commission. *Greenhouse Gas Emission Reductions*. December 2018. https://www.energy.ca.gov/sites/default/ files/2019-12/Greenhouse_Gas_Emissions_Reductions_ada.pdf.

Fire Management and Suppression

While fire is an inherently destructive phenomenon, it plays a critical role in California's ecology. The California Forest Carbon Plan explains how, prior to 1900, many lower-intensity fires in mixed conifer forests helped reduce excess fuel, thin vegetation, and reduce competition for sunlight, nutrients, and water, resulting in healthy forests resilient to drought and native bark beetle outbreaks.[37] However, modern efforts to suppress all fire has led to a dangerous accumulation of potential fuels around the state. This includes both an increase in dead fuel stocks, as well as a buildup of "ladder fuels"[38] in unhealthy forests that allow fire to climb up from the forest floor into the tree canopy. Moreover, in many areas logging has resulted in a lower canopy and other changes in forest composition, making it easier for fires to propagate.[39]

While California is experiencing an increased number of severe fires recently, the state has seen fewer fires in the past 100 years, compared to the historic norm. At its most extreme, many areas of Northern California have seen a 67% (or more) reduction in fire frequency compared to pre-1908 historic fire regimes.[40]

This is in part because of significant efforts from the California Department of Forestry and Fire Protection (CAL FIRE) and the California Governor's Office of Emergency Services (Cal OES) to ensure public safety. Today California is often recognized as a global leader in coordinated wildfire response. Organizations such as FIRESCOPE, a cross-agency body established in the 1980s, have been especially successful in supporting coordination across local, state and federal fire agencies.[41]

Over the past century, the design and success of wildfire suppression policies have contributed to the exact conditions today that, conversely, result in the current wave of large-scale, high-intensity wildfires.

With fewer small fires to reduce sources of fuel, vegetation keeps building up, increasing the potential for hotter, higher-intensity fires.[42] Furthermore, large-scale, high-intensity wildfires are not only a consequence of climate change; they also negatively contribute to it by emitting carbon dioxide and particularly harmful black carbon into the air. To address these issues, experts calculate that as many as 15 million acres or almost half of all forestland in California need some sort of restoration.[43] This is particularly true in ten counties in Northern California, here more than 75% of land is forested.[44]

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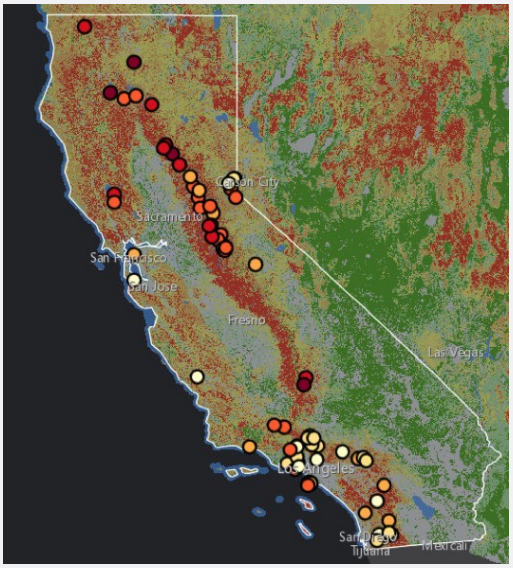
[37] CNRA, Cal EPA, CAL FIRE. *California Forest Carbon Plan*. May 2018.
[38] Ladder fuels are combustible materials, both live and dead, that provide a path for a surface fire to climb up into the crowns of shrubs or trees, according toe CAL FIRE.
[39] CNRA, Cal EPA, CAL FIRE. *California Forest Carbon Plan*. May 2018.
[40] Safford, Hugh, and Van de Water, Kip. *Using Fire Return Interval Departure (FRID) Analysis to Map Spatial and Temporal Changes in Fire Frequency on National Forest Lands in California*. USDA Forest Service, 2014.
[41] Cal OES. "FIRESCOPE California." 2020. https://firescope.caloes.ca.gov/Pages/About.aspx
[42] CNRA, Cal EPA, CAL FIRE. *California Forest Carbon Plan*. May 2018.
[43] Ibid.
[44] USDA Forestry Service. *National Assessment – Resources Planning Act (RPA)*. 2019. https://www.fia.fs.fed.us/program-features/rpa/

Wildland-Urban Interface Population

Today over a quarter of California's population—some 11 million people—live in areas where human development meets wildland fuels, otherwise known as the wildlife-urban interface (WUI). The state has the nation's largest number of homes in such areas (an estimated four and half million structures).[45] If nationwide trends hold true, with 41% population growth in the WUI and 33% growth in size of the WUI since 1990,[46] the number of residents living in the WUI will continue to rise. Even more at-risk are the almost three million people that live in very-high fire severity zones in California today.[47]

Many vulnerable populations, such as individuals that have fewer resources, limited access to a car, older individuals, individuals with disability, or those that live in areas with low-density housing, are impacted even more severely by living in high-risk fire areas. As Figure 4 shows, of the 75 communities that live in the highest-risk fire areas, almost 90% of the communities located in Northern California have moderate to very high social vulnerability, whereas this is true for only about 40% of the highest-fire risk communities located in Southern California.[48]

Figure 4: High-risk communities in California in 2019



- Very High Social Vulnerability
- High Social Vulnerability
- Moderate to High Social Vulnerability
- Moderate Social Vulnerability
- Low to Moderate Social Vulnerability
- Low Social Vulnerability

Note: Map includes the 75 California communities where over 90% of residents (in communities of 1,000 people or more) live in Very High Fire Severity Zones. This map highlights the relative social vulnerabilities in these communities, which impacts how well they may be able to respond and recover.

Source: Direct Relief, "Which California Communities are Most Vulnerable to Wildfires?" (July 30, 2019)

[45] Governor Newsom's Strike Force. *Wildfires and Climate Change: California's Energy Future*. April 12, 2019.
[46] Radeloff, Volker C., et al. "Rapid growth of the U.S. wildland-urban interface raises wildfire risk." *Proceedings of the National Academy of Sciences*, March 2018. https://www.pnas.org/content/115/13/3314
[47] Meyes, Talya. "Which California Communities are Most Vulnerable to Wildfires?" *Direct Relief*, July 30, 2019. https://www.directrelief.org/2019/07/which-california-communities-are-most-vulnerable-to-wildfires/.
[48] Meyes, Talya. "Which California Communities are Most Vulnerable to Wildfires?"

Of course, the more people who live in fire-prone WUIs, the greater the risk to lives and property. The risk of wildfire also increases with the expansion of electrical service in new WUI development areas, as electric utilities have an obligation to serve homes in their service area. One researcher estimated over one million additional homes will be built in the California WUI in the next 30 years.[49] Moreover, the presence of homes in the WUI makes preventative measures (e.g. fuel management) and suppression more costly. Firefighters have to take residences into account as they plan fire breaks, water drops, prescribed burns, and other measures.[50] Larger populations also mean that emergency egress during wildfires becomes more challenging. Taken together, all of this contributes to a potential for greater damage and a higher risk of fatalities in the case of a wildfire outbreak.

Utility Infrastructure

The severity of utility-related wildfire risk is not unique to California's IOUs. In Texas, in a three-and-a-half-year period, over 4,000 ignitions were related to power lines, resulting in over 640,000 acres of land burned and significant investment from the state to prevent future events.[51] In Victoria, Australia, utility-related fires caused the majority of deaths in the infamous 2009 "Black Saturday" fires.[52]

The most common cause of utility-related ignitions is vegetation contact. In the case of California, utility ignition data reported by the three IOUs for all fires that burned ten acres or more from 2014-2018 show that 53% of ignitions were caused from contact with foreign objects, of which 35% are from contact with vegetation. A second common cause of ignition for fires over ten acres is equipment failure (32%), of which splices/clamps/connectors and conductor failures are the specific failures that make up the greatest share of ignitions.[53]

Unusually strong winds exacerbate these problems. For example, SDG&E weather equipment installed in 2010-2011 recorded data indicating wind gusts exceeding 100 mph.[54] These public safety risks will continue to grow, as the likelihood of trees flying into power lines or lines slapping together increases, and as climate change amplifies vegetation risk due to invasive species and tree mortality.

[49] Mann, Michael L., et al. "Modeling residential development in California from 2000 to 2050: Integrating wildfire risk, wildland and agricultural encroachment." *Land Use Policy.* November 2014. https://doi.org/10.1016/j.landusepol.2014.06.020
[50] Radeloff, Volker C., et al. "Rapid growth of the U.S. wildland-urban interface raises wildfire risk." https://www.pnas.org/ content/115/13/331.
[51] Texas Wildfire Mitigation Project. "How do power lines cause wildfires?" 2014. https://wildfiremitigation.tees.tamus.edu/faqs/how- power-lines-cause-wildfires
[52] Fairley, Peter. "How an Australian State Fought Back Against Grid-Sparked Wildfires." *IEEE Spectrum*, November 2019. https://spectrum.ieee.org/energywise/energy/the-smarter-grid/how-an-australian-state-faced-devastation-from-gridsparked-wildfires
[53] California Public Utilities Commission. *Fire Incidents Data*. https://www.cpuc.ca.gov/fireincidentsdata/.
[54] Stark, Kevin. "PG&E Wants to Make a Massive Investment in Weather Stations. Here's Why." *KQED Science*, May 28, 2019.

1.2 Current State of Utility Wildfire Mitigation in California

To better understand the state of utility wildfire mitigation in California, this report's authors studied practices from around the world, interviewing experts and exploring lessons learned from other wildfire-prone geographies, such as British Columbia, Canada, Victoria, Australia, Spain, Portugal, and other areas of the U.S. The authors also reviewed hazard mitigation approaches for other climate-related natural disasters, such as floods and hurricanes, and examined approaches from risk-exposed industries, such as financial institutions, oil companies, the aviation industry, and national security agencies. These findings were then compared to the in-depth research collected on California's current mitigation programs via interviews, site visits, and secondary research to identify gaps and opportunities.[55] The observations and ideas gleaned from this research were discussed in formal CPUC workshops and in a Steering Committee with representatives from the WSD, the CPUC, CAL FIRE, Cal OES, and other state agencies.

The majority of this report focuses on the IOUs within California, as their scale enables them to lead a significant share of wildfire mitigation efforts. Publicly-owned utilities (POUs) and electrical cooperatives are also not subject to WSD approval of their wildfire mitigation activities and investments. While this report focuses on the IOUs, the specific recommendations and actions should also be considered by POUs and electrical cooperatives in order to address growing wildfire risk across the state.

Appendix 1 of this report examines California's current utility wildfire mitigation efforts in more detail, and also highlights several interesting, innovative practices for utility wildfire mitigation in other geographies that could inform further program development in California. These include:

Vegetation management practices that leverage advanced tools to track, predict, and detail vegetation around utility assets. The data is then used in close collaboration with contractors via specialized vegetation management software.

Technology innovation in Victoria, Australia, where a state program evaluates and pilots new technology in order to drive innovation independent of electric utilities. The program builds an impartial understanding of how effective new technologies are in reducing wildfire risk and accelerates adoption of technologies proven to cost-effectively reduce risk, such as the Rapid Earth Fault Current Limiter (REFCL).

[55] These included the CPUC; SDG&E, SCE, PG&E, and other utilities; CAL FIRE; Cal OES; other federal and state agencies; community organizations like local Fire Safe Councils; research and academic institutions with fire science expertise; technology and software solutions companies; and public safety and environmental advocacy groups and individuals.

Risk assessment and mapping that uses sophisticated modeling and incorporates the latest insights from fire science to develop a single source of truth for wildfire risk in a specific geography.

Incentive programs specific to wildfire mitigation activities, such as one used to change utility behavior in Victoria, Australia. Their "F-Factor scheme" provides a monetary incentive to utilities for minimizing ignitions, and penalizes them for ignitions weighted by their severity. The CPUC has previously leveraged a variety of performance-based ratemaking mechanisms, though applying incentives to wildfire mitigation specifically may be a novel application of such programs focused on specific, measurable outcomes.

The WSD and California utilities are already implementing many best practices in order to prevent utility-related ignitions and minimize the severity of wildfires. IOUs in California are enhancing vegetation management practices and investing in innovative technologies, described in their 2020 WMP submissions. They are also investing in advanced fire propagation and simulation modeling to conduct more sophisticated risk assessment and mapping. However, directly replicating one mitigation approach to other utility service territories is not always the best approach as it may not account for the current and projected future differences between the size of the utilities' customer base and systems, as well as the variability and complexity in climate, ecosystems, and demographics. In California this is especially true, with differences amongst the three largest IOU service territories as outlined in Section 1.1.

In spite of recent progress, California utilities still have significant opportunity to improve their prevention programs, especially related to their long- term vision for and governance of utility wildfire risk reduction programs. The remainder of this report details an overall approach to utility wildfire mitigation, with four specific actions the WSD is taking to continue to drive improvements in wildfire mitigation efforts, as well as recommendations to further enable long-term risk reduction.

2

Strategic Approach for the WSD

2 Strategic Approach for the WSD

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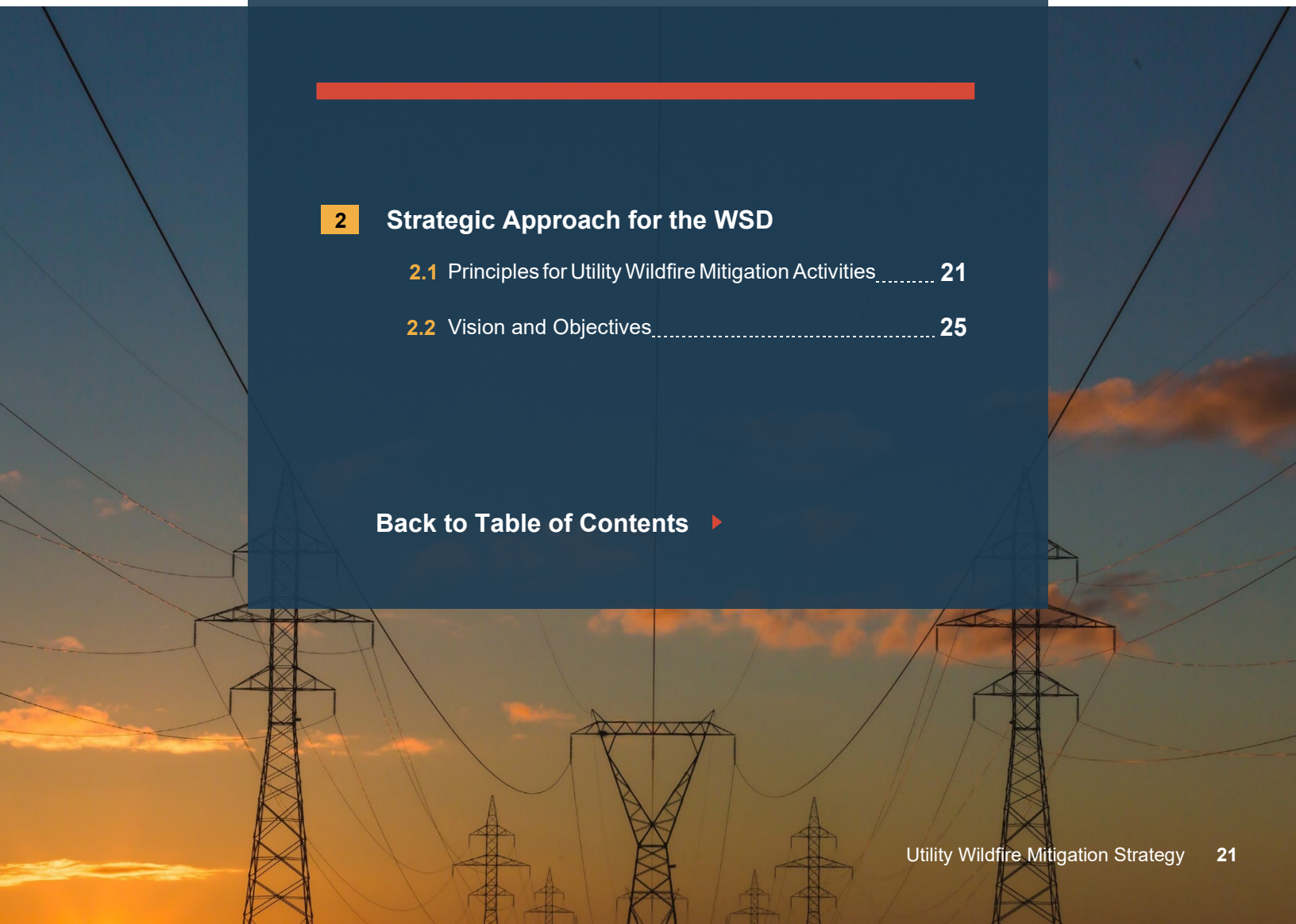


2 WSD Strategic Approach

Approaches to utility-related wildfire mitigation must sustainably address growing utility-related wildfire risk in the long-term.

As outlined in Section 1, wildfire risk stemming from electrical infrastructure in California is expected to grow in coming years. While initial utility actions outlined within the 2019 WMPs are important, they are only a first step in mitigating this long-term risk. The ongoing effort to balance near-term fixes that will make each wildfire season less harmful to the public while focusing on long-term sustainability is not easy. To reduce the risk, the WSD, and the electric utilities whose WMPs the WSD is charged with reviewing and approving or denying, must first critically examine their actions today to ensure they are aligned to the ultimate goal of reducing utility-related wildfires.

With this in mind, four principles were identified from disaster management best practices and California's own disaster management expertise to inform the WSD's overall strategic approach to regulating utility wildfire mitigation efforts. These four principles are:

- **Effective collaboration**
- **Local perspective**
- **Long-term resilience**
- **Risk-informed, data-supported decisions**

To enact these four principles in the context of utility-related wildfires, a long-term vision for the WSD is proposed in Section 2.2:

A sustainable California, with no catastrophic utility-related wildfires, that has access to safe, affordable, and reliable electricity.

As the WSD pursues this vision, six objectives aligned to wildfire risk reduction with provision of safe, reliable electricity should guide the WSD and utility decision makers.

2.1 Principles for Utility Wildfire Mitigation Activities

The four principles outlined below are areas that are critical to success in any disaster prevention and management program. They can, and should, be used to inform the WSD's overall approach to evaluating utility wildfire mitigation activities.

1 Effective and Inclusive Coordination

In disaster management research, better coordination among stakeholders was the factor most commonly identified as contributing to successful disaster management throughout the life cycle of prevention, preparedness, response, and recovery.[56] Cal OES also identified coordination as a priority in their organizing frameworks: "unity of effort, unity of command, and the effective utilization and integration of resources are critical."[57]

As established in Section 1.1, utilities are central actors in helping to prevent future wildfires, of which many in recent years were generated from ignitions related to utility infrastructure. Today, utilities are primarily accountable for prevention activities that reduce the likelihood of ignitions stemming from their equipment, such as system hardening, vegetation management, and safe grid operations. While utilities have not historically been accountable for broader prevention activities, such as fuel management or community emergency planning, or response and recovery activities (excluding power restoration), they must work consistently and effectively with a broad set of actors—and vice versa—for wildfire mitigation actions to be successful. To this end utilities are responsible for integrating their efforts with other actors, including landowners, public safety partners, policy makers, and residents of the communities they serve.

For this reason, the approach to utility wildfire mitigation recommended in this report is intended not to encourage utilities to implement additional standalone activities, but to deepen utility collaboration with communities and other stakeholders as part of their prevention and mitigation strategies.

Utilities are making progress on this front by:

- Deploying new technologies and building capabilities to both identify ignition precursors and to detect actual ignitions earlier, all in support of emergency response actions
- Sharing grid and weather information (e.g. real time access to camera and weather station feeds) with public safety partners, as well as researchers and the general public, taking all confidentiality and security precautions due.

[56] Moore, Melinda, et al. *Learning from Exemplary Practices in International Disaster Management*. RAND Health, 2007. https://www.rand.org/dam/rand/pubs/working_papers/2007/RAND_WR514.pdf.
[57] California Governor's Office of Emergency Services. *California Catastrophic Incident Base Plan: Concept of Operations.* September 23, 2008. https://www.caloes.ca.gov/PlanningPreparednessSite/Documents/CA%20Catastrophic%20Incident%20Base%20Plan%20Conops.pdf

- Collecting and sharing useful information that improves understanding of the conditions of utility assets as well as information related to the surrounding environment that represents the highest risks of ignition (e.g. extreme winds)

Opportunity exists to further leverage data for broader coordination, and in California utilities can work with universities and other organizations to build on existing programs. Many of the electric utilities today also leverage technology that models fire propagation. These programs, however, are executed in silos with limited collaboration to increase overall understanding of fire spread in the state. One example is in Victoria, Australia, where a tool called Phoenix RapidFire supports fire spread simulations and is used by local communities, fire suppression professionals, regulators, utilities, and others to establish a common source of accurate information about potential fire risk and to drive coordinated decision-making (further detailed in Appendix 1).

2 Localized Perspective

Another emphasis in disaster management is the importance of solutions that are focused on local perspectives. In the context of utility wildfire mitigation activities, it is critical for the WSD and utilities to place heightened emphasis on flexible, localized approaches that take into account differences across communities. In Victoria, Australia, this is done in coordination with Bushfire Committees that leverage risk-based decision-making processes to identify local values-at-risk. In California, utilities could better leverage existing structures to inform and adapt mitigation activities. For example, local hazard mitigation plans and local Fire Safe Councils can better inform the development of utility Wildfire Mitigation Plans and support the planning of local mitigation activities like vegetation management, all supplemented by more advanced data and analytical approaches.

3 Long-term Resilience

Best-in-class disaster management requires long-term planning backed by actions focused on longer-term resilience that incorporate lessons learned from past events. This approach has been applied in places like Virginia Beach and the Florida Keys, which have moved toward long-term resilience against flooding from rising sea levels by rethinking the design andlocation of new development and addressing difficult choices for existing communities.[58]

[58] Flavelle, Christopher, and John Schwartz. “As Climate Risk Grows, Cities Test a Tough Strategy: Saying ‘No’ to Developers.” *New York Times*, November 19, 2019. https://www.nytimes.com/2019/11/19/climate/climate-real-estate-developers.html

Although climate change is a driver in this culture shift towards long-term adaptation and resilience, it has not yet been realized in utility wildfire prevention. Utility focus continues to be on preparing for the next wildfire season, whether related to Public Safety Power Shutoff (PSPS) events or preventing ignitions. While short-term action is required to prevent utility-related wildfires, to keep communities safe, and to create room for dialogue focused on long-term actions, these short-term actions cannot be done in isolation. Longer- term thinking must also begin now. One tangible example of the ongoing, short-term impact is the significant use of diesel-fueled generators during the past year of PSPS events,[59] an activity that could impact the state's climate change goals. Future activity needs to focus not only on what should be done next year, but also on what is required to prepare for the next 10, 20, or 30 years. Difficult questions must be asked about the future of the electric grid, resource management, land use, and community development.

4 Risk-informed, Data-supported Decision Making

In natural disaster preparedness and response, the ability to determine the level of risk and then effectively notify the public to take action is essential.[60] From floods to tornadoes, being able to predict who will be at risk and when to take action has saved lives in California and around the world. Today, more effective tools are needed to predict and communicate wildfire risk. For example, in California today each of the three large IOUs have developed their own version of a Fire Potential Index (FPI) which they use to gauge and communicate risk.[61] These utilities' FPIs were developed separately, and account for weather, live and dead fuel moisture, and other conditions of their assets. Having different risk indices for different situations is important to adequately characterize risk exposure, but not even the utilities' FPIs can be compared to each other, as each has different levels of granularity.[62] Additionally, fire agencies such as CAL FIRE need more access to the detailed inputs in order to understand how to best utilize this information. Moreover, utility FPIs do not always correspond with the National Weather Service's Red Flag Warning (RFW) system that indicates risky conditions or Fire Weather Watches. This difference can generate conflicting views of risk with real implications (e.g., PSPS decisions) and can be confusing for the general public to understand. Additionally, tornadoes and

Three utility Fire Potential Indexes were developed separately, with differing levels of granularity

[59] California Air Resources Board. *Emission Impact: Additional Generator Usage Associated with Power Outage: Draft*. January 30, 2020. https://ww2.arb.ca.gov/sites/default/files/2020-01/Emissions_Inventory_Generator_Demand%20Usage_During_Power_Outage_01_30_20.pdf.

[60] Ringel, Jeanne S., et al. *Lessons Learned from the State and Local Public Health Response to Hurricane Katrina*. RAND, 2007. https://www.rand.org/content/dam/rand/pubs/working_papers/2007/RAND_WR473.pdf

[61] SDG&E has also developed a Vegetation Risk Index (VRI) to describe the ignition risk posed by the characteristics and mix of vegetation in strike proximity to their powerlines; SCE, PG&E and SDG&E 2019 WMP submissions, https://www.cpuc.ca.gov/SB901/.

[62] SDG&E and SCE have three operating levels of the FPI (normal, elevated, or extreme conditions); PG&E has five levels.

hurricanes have 'scales' used to define the gravity of an event (e.g., Category 1-5 hurricanes); however, no such scale exists related to wildfires.[63]

A more granular use of data and technology also presents significant opportunity to improve decision making. A cohesive approach to data and analytics would support constructive dialogue and allow the WSD, utilities, and effected communities to better understand what prevention efforts work, and to improve resilience tactics.

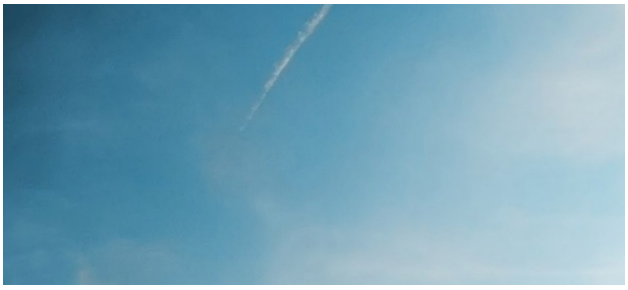
These four principles — effective and inclusive coordination, localized perspectives, long-term resilience and risk-informed, data supported decision making — are essential building blocks to incorporate into any approach that the WSD takes to evaluate and assess compliance to utility wildfire mitigation efforts and that the utilities take to reduce wildfire risk from their infrastructure. By incorporating four principles into a strategic vision, supported by ongoing near-term and longer-term actions, the WSD can better address the drivers of wildfires caused by ignitions stemming from utility infrastructure.

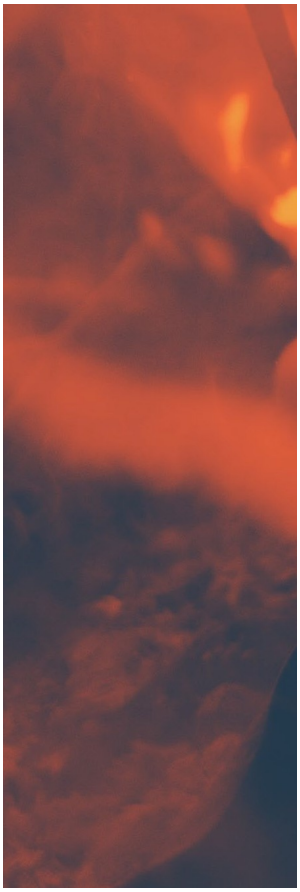
[63] Tedim, Fantina, et al. "Defining Extreme Wildfire Events: Difficulties, Challenges, and Impacts." *Fire*, 2018. 1(1), 9, doi:10.3390/fire1010009.

2.2 Vision and Objectives

The four principles described in Section 2.1 are a critical foundation for any WSD action. However, before the WSD pursues additional actions or revises their existing approach, they need to more clearly articulate the problem to solve. Without this clarity, utilities may continue to focus on technical solutions or standalone activities. Only by articulating the holistic challenge can the WSD put the role of the utilities in the right context and clearly define the vision and objectives for utility wildfire mitigation. The WSD has clarified its vision and objectives, and the division is now advancing the conversation about adjusting and prioritizing ongoing (or new) efforts.

To clearly define this challenge, this report puts forth a single, unified vision informed by local conditions and a set of related objectives. A well-articulated vision has multiple benefits. First, it provides simple, actionable guidelines for the WSD and utility leaders already involved in wildfire mitigation and shifts their focus towards a longer-term strategy. It enables existing fragmented, near-term decisions to be made in the context of longer-term planning. It defines common objectives that bring together disparate utility activities to foster collective commitment to meet measurable objectives and goals. It enables the WSD and utilities to effectively prioritize ongoing activities. Finally, it outlines the constraints that inform explicit decision-making and leads to thoughtful trade-offs around competing objectives.





The WSD and the utilities' roles to directly mitigate catastrophic wildfires is clear ensure fewer and less consequential wildfires are caused by utility infrastructure. A significant amount of activity today is already underway in pursuit of this goal, including legislation focused on utility wildfire safety adapted by the California Legislature in recent years. However, ongoing short- term actions now need to build towards sustained, long-term activities that are required to minimize the impact of wildfires not just during the next fire season, but for many seasons to come.

Vision

The proposed activities in this report provide the foundation to achieve a new long-term vision for the WSD and the utility sector:

A sustainable California, with no catastrophic utility-related wildfires, that has access to safe, affordable, and reliable electricity.

This is a bold and aspirational vision, that is used for the purposes of this strategy and not meant at this time to be used to enforce penalties or interpret statute, but rather to give the WSD and utilities something to strive towards together and to set a high bar for the WSD and utilities to re-imagine a different future for California.

Proposed actions that build on ongoing activities in order to achieve this vision focus on catastrophic wildfire risk. Although it may have different meanings in different contexts, "catastrophic wildfire" has been used in legislation, reports, and action plans in California to refer to wildfires that pose a threat to lives, property, and resources.[64] Cal OES leverages the National Response Framework to define a catastrophic incident as one that may result in thousands of casualties, isolate affected areas, cause massive disruption of the area's critical infrastructure, overwhelm the response capabilities of state and local resources, or have long-term economic impacts.[65] However, because these definitions are so broad, it is difficult to identify specific fires as "catastrophic," making it hard to compare the progress of different regions in California—not to mention around the globe.[66]

For the purpose of this strategy only, "catastrophic" refers to any fire in California that meets one or more of following criteria, which are derived from California's historic deadly and destructive fires.[67] The criteria are:

Public Safety
Directly causes one or more deaths

Property
Damages or destroys over 500 structures

Natural Resources
Burns over 140,000 acres of land

The strategy outlined in this report is meant to help California prevent utility-caused wildfires of this magnitude from happening again. Specific objectives within this vision, which focus on areas where the risks to life and property are greatest, are outlined here.

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[64] This report is not aiming to apply this definition of the term catastrophic to other reports, or to any other situation. The outline within this section is solely meant to provide additional guidance within this report.
[65] California Governor's OES. *California Catastrophic Incident Base Plan: Concept of Operations.* September 23, 2008. https://www.caloes.ca.gov/PlanningPreparednessSite/Documents/CA%20Catastrophic%20Incident%20Base%20Plan%20Conops.pdf
[66] As discussed in Appendix 2, research to 'categorize' fires suggests differentiating between extreme wildfire events (which focus on responding to large, rapidly spreading fire) and wildfire disasters (which depend on local, socio-economic impact). The proposed vision and objectives focus on the 'disaster' aspect of catastrophic wildfire and outline objectives grounded in the State environment today.
[67] Every one of the top twenty deadliest fires in California history caused five or more fatalities; however, any fire that causes one or more fatalities is catastrophic. The top twenty most destructive fires also damaged over 500 structures and burned over 140,000 acres each.

WSD Wildfire Mitigation Objectives

Public Safety

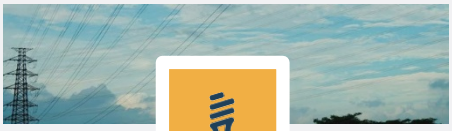
Strive for zero deaths due to utility-related wildfires or mitigation activities

Property

Reduce losses to structures and critical infrastructure from utility-related wildfires

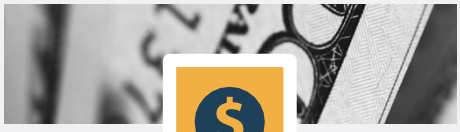
Natural Resources

Support efforts in reaching 100% sustainable forests, watersheds, and communities



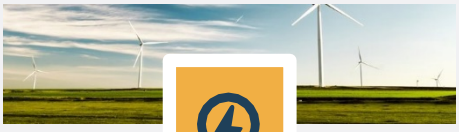
Reliability

Limit planned and unplanned outages due to utility-related wildfires and mitigation activities



Affordability

Ensure utilities prioritize and make prudent wildfire mitigation investments



Climate Action

Ensure utility wildfire mitigation activities also advance climate change goals

Objectives

The CPUC regulates services and utilities, protects consumers, safeguards the environment, and assures Californians' access to a safe and reliable electric grid. Within the CPUC, the WSD is responsible for evaluating utility efforts to decrease utility- related wildfire risk. This responsibility continues when the WSD moves to the CNRA and becomes the Office of Energy Infrastructure Safety (OEIS) by July 1, 2021. It is therefore a priority for the WSD to minimize the risk catastrophic utility-related wildfires have on public safety, property and natural resources.[68] Furthermore, the WSD must focus on ensuring communities maintain access to reliable, low-cost electric energy that continues to support the state's climate goals, as utility-related wildfires, and utility wildfire mitigation activities should maximize ratepayer benefits. The six objectives below are meant to create safer communities while also encouraging utilities to reduce the most risk with prudent investments while maintaining reliability of the grid.

Public safety: strive for zero deaths due to utility-related wildfires or mitigation activities

Ensuring communities can live without fear of the next fire is core to wildfire mitigation, and zero deaths is the only acceptable safety objective when 170 people have died from wildfires in the past ten years. Mitigation activities all aim to move this number to zero.

Property: reduce losses to structures and critical infrastructure from utility-related wildfires

Limiting the impact to property is second to individual safety but must remain a priority for the WSD and for utilities. The vast majority of structures impacted by wildfire in California today are residential, and a world with no catastrophic wildfires must minimize the impact on property.

Natural resources: support efforts in reaching 100% sustainable forests, watersheds, and communities

Mitigation efforts also will work to ensure resilient, sustainable forests, watersheds, and communities. While this objective does not set a specific goal for acreage burned, achieving sustainable and resilient forests means supporting ongoing activities, including efforts led by the California Natural Resources Agency and supported by the California Air Resources Board and the Governor's Forest Management Task Force (FMTF).

[68] The articulated fire severity objectives were informed by how CAL FIRE sets its objectives and priorities around fire suppression, one example being CAL FIRE's objective to keep 95% of fires to 10 acres or less.

Reliability: limit planned and unplanned outages due to utility-related wildfires and mitigation activities

Electric utility (and other services that rely on electrical power including water and wastewater) reliability must not be impacted significantly from wildfire mitigation activities, or from catastrophic wildfires.[69] Furthermore, PSPS must decrease in scope from today, as outlined later in this section.

Affordability: Ensure utilities prioritize and make prudent wildfire mitigation investments

Utilities should consider the most reasonable ways to mitigate each driver of risk before selecting initiatives to pursue based on magnitude of risk reduction, cost, and other important factors.

Climate action: ensure utility wildfire mitigation activities also advance climate change goals

Utilities must support greenhouse gas (GHG) targets of reducing emissions to 40% below 1990 levels by 2030, which means mitigation activities must also support climate change goals (e.g. limit diesel generators usage due to PSPS).[70]

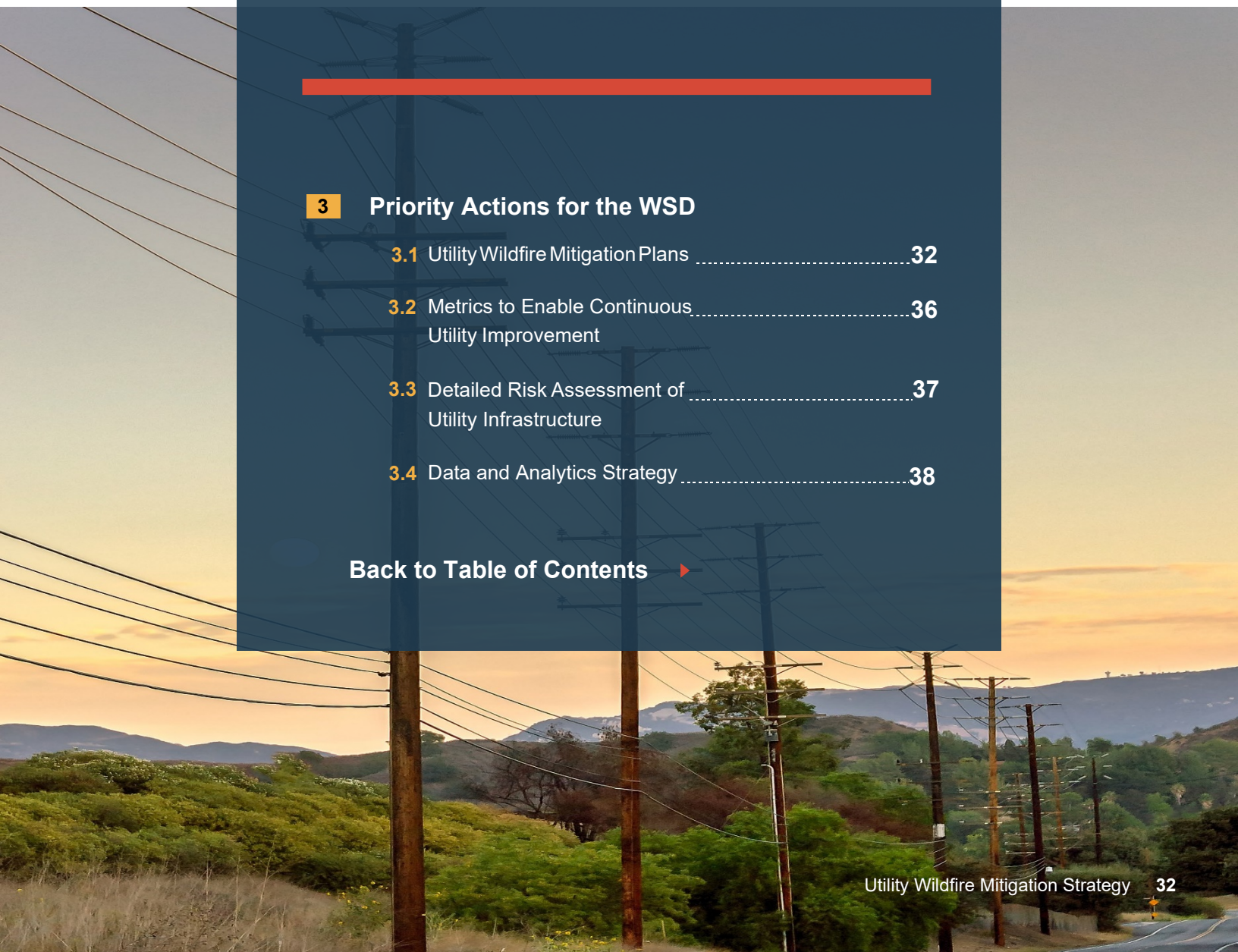
This proposed vision and the six objectives should be achieved while also limiting the use of PSPS to minimize the impact on communities in California. PSPS was used significantly during the 2019 wildfire season, showing its central role in utility wildfire mitigation strategies today. However, the CPUC has explicitly directed utilities to expand their 2020 Wildfire Mitigation Plans to reduce the need for PSPS events[71] and state leadership and residents across California view the magnitude of past years' PSPS events as unacceptable. Moreover, the impact of PSPS events on safety and climate change goals today is intolerable, and any actions working towards the overall vision above must also work to minimize the need to use PSPS as a wildfire mitigation tool.

It is hoped that these objectives can provide guidance towards the longer-term WSD vision and spur further conversations and alignment between the utilities, the WSD, and other stakeholders as they work towards a combined vision, align on levels of risk, and prioritize efforts accordingly.

[69] Reliability impact can be measured by limiting the increase to the System Average Interruption Duration Index (SAIDI), which measures the system-wide total number of minutes per year of sustained outages per customer served.
[70] California Energy Commission. *Greenhouse Gas Emission Reductions.* December 2018. https://www.energy.ca.gov/sites/default/files/2019-12/Greenhouse_Gas_Emissions_Reductions_ada.pdf.
[71] California Public Utilities Commission. *CPUC Takes Additional Decisive Actions to Hold Utilities Accountable and Increase Public Safety*. October 28, 2019. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M318/K885/318885370.PDF

3

Priority Actions for the WSD



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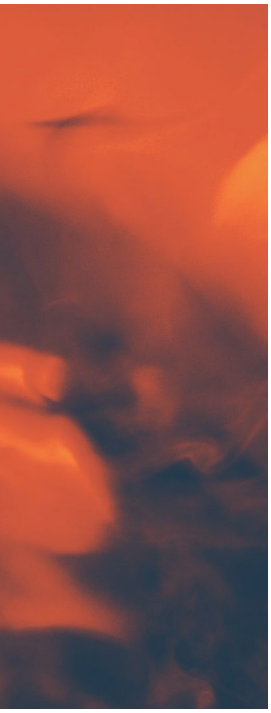
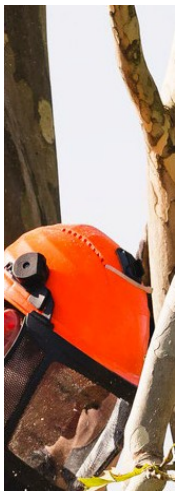


3 Priority Actions for the WSD



Together, the principles and proposed vision outlined in Section 2 are intended to guide the creation of a robust action plan that can enable the WSD to take on utility wildfire challenges over the next 20-30 years. In the meantime, there is an urgent need to focus on the near-term to make next fire season less disruptive and devastating than the catastrophic events of 2017 and 2018, the widespread PSPS events of 2019, and the record-shattering breadth of fires in 2020. In parallel, initiating longer-term mitigation and adaptation activities will systematically reduce risk for the people of California. Consequently, the WSD has begun to both prepare for the next wildfire season and to address risk mitigation for 2021 and beyond by initiating four priority actions:

1. **Utility Wildfire Mitigation Plans:** Annual revisions to the Wildfire Mitigation Plan process and guidelines to better incorporate a more rigorous understanding of risk and the efficiency of program spending. Deploying the Utility Wildfire Mitigation Maturity Model to understand the sophistication of utility wildfire mitigation capabilities and to establish a baseline, track development over time, and identify best practices.

2. **Metrics to Enable Continuous Utility Improvement:** Developing a process and set of metrics to track and assess the approach, progress and results of a utility's WMP over time and ensure the continuous improvement and adaptation of utility wildfire mitigation tactics.

3. **Detailed Risk Assessment of Utility Infrastructure:** Modeling and analyzing wildfire risk from utility assets to communities, including wildfire risk from risk events. Ensure utilities use the data to inform prioritization of utility wildfire mitigation activities, including use of PSPS.

4. **Data and Analytics Strategy:** Developing a data and analytics strategy and provide the resources to support WMP review in the near-term and to drive analytics and better coordination in the longer-term.

The WSD is currently pursuing these activities within the CPUC and expects to continue them after transitioning to the CNRA in 2021 and becoming the Office of Energy Infrastructure Safety.

3.1 Utility Wildfire Mitigation Plans

The WSD's longer-term goal is for utilities to minimize both catastrophic wildfires related to electric utility infrastructure and PSPS impacts by developing mature wildfire mitigation capabilities and by designing a more resilient grid. The Wildfire Mitigation Plan (WMP) is the primary mechanism that the WSD has to hold electrical corporations—the three large IOUs, small and multi-jurisdictional utilities (SMJUs), and independent transmission operators (ITOs)—accountable for reducing wildfire risk and the use of PSPS. The WMP process seeks to enable the WSD to evaluate utility contributions to the WSD's vision and objectives for wildfire mitigation. In the inaugural 2019 WMP cycle, however, the CPUC had neither sufficient information nor the tools necessary to ascertain whether a utility's wildfire mitigation approach put it on the path to reducing wildfire risk and, if so, by what year this goal would be achieved.

In 2019, this oversight tool was focused on utility action in the near- to mid-term, prioritizing what the utility could achieve by the next fire season. The WMP process and its requirements were not designed to drive the long-term planning needed, both within utilities and across stakeholder groups, to address the state's wildfire crisis. Furthermore, the 2019 WMP guidelines did not require utilities to report information on their capabilities in a sufficiently standardized way that could be easily compared across time and against best practices. This limited the ability for the CPUC and utilities to objectively assess effectiveness of new initiatives, and to better understand the efficiency of the capital spent on wildfire mitigation.

Based on lessons learned from the 2019 process, the WSD has improved upon the CPUC's 2019 approach to better understand a utility's capabilities in addressing wildfire risk and has developed a set of metrics to gauge measurable utility progress toward the WSD's objectives. Five tools aided the WSD's evaluation of utilities' 2020 wildfire mitigation efforts, with additional detail provided in the public CPUC proceeding Rulemaking (R.)18-10-007:

- **Wildfire Mitigation Plan Guidelines:** Require utilities to file specific, structured, and comprehensive WMPs and structured and standardized data and commit the utilities to achieving results
- **Utility Wildfire Mitigation Maturity Model and Assessment:** Apply a maturity model and assessment to objectively evaluate utility capabilities in reducing wildfire risk using a consistent methodology and framework
- **Utility Survey:** Collect utility information relevant to the Utility Wildfire Mitigation Maturity Model to assist the WSD's maturity assessment
- **Wildfire Mitigation Plan Metrics:** Track each utility's ongoing wildfire mitigation approaches, progress, and outcomes
- **Supplemental Data Request (SDR):** Define a broader set of utility data used to evaluate utility plans, activities, and outcomes in greater detail. The purpose of the Supplemental Data Request is to obtain supplemental data that the utilities may have available in 2020, before potentially formalizing the request for the 2021 annual update

As part of their 2020 WMP filing in February, utilities followed the updated WMP Guidelines and completed the Utility Survey in preparation for their WMP submission. WSD staff used data collected from the WMPs and the Utility Survey to evaluate utility wildfire mitigation maturity based on the Utility Wildfire Mitigation Maturity Model, issuing final action statements on the 2020 WMPs on June 10, 2020, which the Commission ratified on June 11, 2020.

Collectively, these tools are enabling the WSD to evaluate different aspects of utility wildfire mitigation efforts: the quality of a utility's mitigation efforts, its compliance with relevant rules and regulations, the maturity of current and planned utility capabilities, and measurable performance against outcomes. The updated WMP Guidelines are helping the WSD ensure that utilities both comply with today's requirements and also improve their capabilities and performance over time, while collecting relevant, standardized, and sufficient data. The WMP Guidelines will also enable the WSD to better assess compliance to these activities.

The updated WMP Guidelines also contribute to a foundational understanding of utility wildfire risks and mitigation measures for both utilities and other stakeholders and will continue to help them develop a longer-term plan. While future guidelines will iterate upon the 2020 WMP Guidelines, the 2020 WMP Guidelines help establish a baseline for the risk that each utility faces and will enable planning over the three-year WMP cycle and beyond. In particular, the 2020 WMP Guidelines focus on longer-term investments and grid modernization, and are a first step toward enabling all stakeholders, including communities, to engage in longer-term planning that can reduce the probability of an ignition being caused by utility infrastructure, and the potential consequences should such an ignition occur. In addition to the revised guidelines, the newly introduced Utility Wildfire Mitigation Maturity Model ('maturity model') is designed to provide a more objective and standard judgment of the utility's capabilities, including the targets for improvement.

The Utility Wildfire Mitigation Maturity Model assesses maturity on

52 capabilities in

10 categories

The maturity model describes 52 utility wildfire mitigation capabilities and corresponding maturity levels, organized into ten different categories, as outlined in Figure 5. Each capability is scored from zero (lowest maturity level) to four (highest maturity level) based on a set of objective criteria unique to each capability. The maturity levels are informed by practices surveyed from wildfire-prone geographies, including California; how well utilities adhere to existing regulations; and the effectiveness of their wildfire mitigation efforts.

The maturity model can be deployed in many ways. For the 2020 utility WMP submissions, the WSD implemented the maturity model in order to gauge the capabilities, processes, and initiatives that each utility deploys to address wildfire risk, as well as the capabilities that the utility is concretely planning to build over the three-year scope of their WMP. As part of their WMP submission, the utilities provided supporting data in structured templates as well as qualitative descriptions, and completed the Utility Survey to assist the WSD with maturity model scoring. During annual updates, the WSD plans to re-assess each utility's level of maturity, tracking its improvement relative to the utility's own targets.

The maturity model can be used to drive continued improvement by requiring an increase in maturity over time. Even though the maturity assessment on its own does not establish an absolute maturity "passing score," the WSD may eventually require a minimum improvement commitment as a condition to approve each WMP. The maturity model will also help to identify and share best practices among the utilities across each of the 52 individual capabilities. The WSD can work with subject matter experts to update the maturity model criteria. This will establish an evolving view of best practices and lessons learned from wildfire mitigation activities and will drive continued improvement over the longer term. Details on the maturity levels and implementation plan for the maturity model for 2020 are provided in the public CPUC proceeding R.18-10-007. The maturity model is a tool that can be applied to the evaluation of the wildfire mitigation maturity or the WMPs of not just IOUs but also POUs or electrical cooperatives, whose wildfire mitigation efforts are not subject to WSD approval.

Figure 5: Maturity model categories and capabilities

Category	I. Capability	II. Capability	III. Capability	IV. Capability	V. Capability	VI. Capability
A. Risk assessment and mapping	1. Climate scenario modeling	2. Ignition risk estimation	3. Estimation of wildfire consequences for communities	4. Estimation of wildfire and PSPS risk-reduction impact	5. Risk maps and simulation algorithms	
B. Situational awareness and forecasting	6. Weather variables collected	7. Weather data resolution	8. Weather forecasting ability	9. External sources used in weather forecasting	10. Wildfire detection processes and capabilities	
C. Grid design and system hardening	11. Approach to prioritizing initiatives across territory	12. Grid design for minimizing ignition risk	13. Grid design for resiliency and minimizing PSPS	14. Risk-based grid hardening and cost efficiency	15. Grid design and asset innovation	
D. Asset management and inspections	16. Asset inventory and condition assessments	17. Asset inspection cycle	18. Asset inspection effectiveness	19. Asset maintenance and repair	20. QA/QC for asset management	
E. Vegetation management and inspections	21. Vegetation inventory and condition assessments	22. Vegetation inspection cycle	23. Vegetation inspection effectiveness	24. Vegetation grow-in mitigation	25. Vegetation fall-in mitigation	26. QA/QC for vegetation management
F. Grid operations and protocols	27. Protective equipment and device settings	28. Incorporating ignition risk factors in grid control	29. PSPS op. model and consequence mitigation	30. Protocols for PSPS initiation	31. Protocols for PSPS re-energization	32. Personnel qualifications and practices
G. Data governance	33. Data collection and curation	34. Data transparency and analytics	35. Risk event tracking	36. Data sharing with research community		
H. Resource allocation methodology	37. Scenario analysis across different risk levels	38. Presentation of relative risk spend efficiency for portfolio of initiatives	39. Process for determining risk spend efficiency of vegetation management initiatives	40. Process for determining risk spend efficiency of system hardening initiatives	41. Portfolio-wide initiative allocation methodology	42. Portfolio-wide innovation in new wildfire initiatives
I. Emergency planning and preparedness	43. Wildfire plan integrated with overall disaster/ emergency plan	44. Plan to restore service after wildfire related outage	45. Emergency community engagement during and after wildfire	46. Protocols in place to learn from wildfire events	47. Processes for continuous improvement after wildfire and PSPS	
J. Stakeholder cooperation and community engagement	48. Cooperation and best practice sharing with other utilities	49. Engagement with communities on utility wildfire mitigation initiatives	50. Engagement with AFN populations	51. Collaboration with emergency response agencies	52. Collaboration on wildfire mitigation planning with stakeholders	

3.2 Metrics to Enable Continuous Utility Improvement

Metrics allow the WSD to monitor progress of utility wildfire mitigation initiatives at a greater granularity than has historically been possible. Individual activities can be tied back to plans and linked to outcomes to better understand both progress of individual utility activities and their impact on overall outcomes.

The 2019 WMP submissions did not establish a consistent set of metrics to track the outcomes of utility mitigation programs. The utility-submitted "metrics" primarily tracked the level of execution of each planned initiative without actually tracking the outcomes nor the effectiveness of the plan. These utility-submitted metrics were deemed "program targets" by the CPUC in Decision 19-05-036, as they serve to track completion of the activities that the utilities set forth in their WMPs.

Because no standard metrics were defined across utilities, comparing progress in wildfire risk reduction efforts and comparing outcomes across utilities has been difficult. Going forward, the WSD aims to use a set of metrics to evaluate utility implementation of WMPs. This includes three types of metrics:

Progress metrics are designed to track concrete actions toward reducing wildfire risk.

Program targets can continue to be employed by the utilities to track progress towards their own commitments. Utilities could update these by using the off ramp / change order process[72] to ensure that program targets remain relevant.

Outcome metrics track measurable and quantifiable performance against related outcomes.

[72] D.19-05-036 establishes a process whereby utilities can modify, reduce, increase, or end "mitigation measures that are not working, or otherwise require modification" by filing a Tier 3 Advice Letter "Reports on Possible Off Ramps" that describes "any concerns about the effectiveness of any program in the WMP." See: CPUC, Decision 19-05-036, June 3, 2019, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M296/K577/296577466.PDF. The name "off ramp" was changed to "change order" in Resolution WSD-002.

Progress metrics track WMP risk reduction activities in general to ensure utilities make investments and complete wildfire mitigation work as proposed, such as the extent of hardening across the grid.

In addition to progress metrics, utilities are also expected to develop a revised set of program targets to track implementation of their self-defined set of initiatives in their WMPs, such as completing the vegetation management activities outlined in their WMPs.

Outcome metrics for the WMP track performance against the wildfire mitigation objectives of the WSD: safety, property, natural resources, affordability, reliability of electricity supply, and climate action. Examples include fatalities caused by utility-related wildfires or by mitigation efforts, and structures damaged or destroyed by wildfires.

The specific metrics will continue to evolve as the WSD learns from each year's WMP evaluation but take into account six key principles. In general, the set of metrics must:

1. Provide a complete picture of a utility's contribution to and impact on longer-term objectives
2. Track information that can be used to inform action—for example, grid operations or capital allocation
3. Include lagging indicators to understand past incidents and help prevent recurrence, as well as leading indicators that can be used to prevent potential future incidents
4. Provide normalized data across utilities to ensure comparability across years and service territories
5. Use data analysis to determine which metrics best predict and/or reflect wildfire risk, and update the list of metrics accordingly
6. Be auditable so that the WSD and third parties can independently verify all utility reported metrics

The WSD aims to formalize the requirements for 2021 and beyond in the next WMP process.

3.3 Detailed Risk Assessment of Utility Infrastructure

In order to best prioritize wildfire risk reduction efforts and resource allocation, utilities must be able to quantify the potential impact of each type of initiative on wildfire risk. Prioritization of short-term wildfire risk reduction is informed by:

- the probability of ignition along the grid;
- the consequence of those ignitions on specific communities, given ignition location, propagation path, location of residents, and other key factors such as routes for evacuation and emergency responder ingress; and,
- the impacts of the PSPS that would be necessary to prevent such ignitions.

Calculating these three factors first requires utilities to have a detailed understanding of the location and condition of their equipment, the characteristics of vegetation and fuel stocks across their service territory, the ignition and wildfire propagation risk at each point of the grid, the location and needs of residents, and the location and limitations of other infrastructure such as roads or local energy resources. Utilities must then be able to use this information to conduct a risk assessment of their systems to identify what factors drive the greatest risk. They must be able to identify, for example, a particularly vulnerable type of equipment or a high level of risk exposure to a community—and to pinpoint the communities that are at greatest risk as a result of these cumulative factors. This information can then drive utilities' prioritization of wildfire mitigation activities, including system hardening, grid modernization, vegetation and fuels management, and community engagement. Some of these factors can be identified by reviewing past ignitions and risk events, in combination with historical weather patterns. A number of factors, though, may only be assessed by wildfire propagation modeling and other advanced analytical approaches.

The 2020 WMP Guidelines incorporate risk analysis and scenario modeling of utility infrastructure as part of the maturity model capabilities in two categories: risk assessment and mapping and resource allocation methodology. The goal of including these categories is to encourage utilities to mature these capabilities in the upcoming WMP cycle. To the extent possible, the WSD will leverage the framework built in the Safety Model Assessment Proceeding (S-MAP) including the Risk Assessment Mitigation Phase (RAMP) reports.

3.4 Data and Analytics Strategy

Data and analytics will enable decisions that are faster, more consistent, and more transparent, while ensuring utilities use an informed assessment of risk in the longer- term.[73] The WSD can benefit from a holistic data strategy to address both near-term milestones (e.g., the 2020 and 2021 WMP review) and to pursue its longer-term vision. For example, the WSD could develop data-driven insights using the metrics described in Section 3.2 to ensure decisions take into account utility compliance and effectiveness as well as wildfire mitigation activity spend and are aligned with the overall wildfire mitigation goals. Such a holistic approach is especially important because it will help to inform ongoing planning and operations by the utilities, to review existing and future WMPs, to support communication regarding ongoing activities, and to support longer-term planning.

A strong data strategy also enables the WSD to support the state's overall wildfire mitigation and management activities. In the near- to mid-term, a data strategy can help the WSD better facilitate wildfire-related insights, in coordination with agencies such as CAL FIRE and Cal OES. In the long-term, this initiative could position California as a leader on the global stage, highlighting new and innovative practices, as well as collecting ideas from other geographies that are pursuing advanced data-driven wildfire mitigation solutions. A data-driven regulatory oversight process also can enable the broader CPUC to more objectively scrutinize a larger volume of important utility decisions.

Implementation of a robust, best-in-class data strategy is a gradual, multi-phased journey. This is because designing and executing a holistic data strategy often requires significant resource commitments and a fundamental shift in existing ways of working. Therefore, organizations embarking on such strategic digital transformations typically implement it in a phased approach to allow adequate pace for sustained change. With this in mind, the WSD has begun to pursue a three-phased implementation, outlined in Figure 6, and sequenced over a 12-plus month timeline. Additional detail for the suggested implementation is in Appendix 3.

[73] The WSD supports stakeholder engagement in the process to the fullest extent possible given statutory requirements and timelines. The WSD will continue to post all non-confidential information on its webpage.

Figure 6: Proposed WSD Data and Analytics Roadmap

	Shorter-term (2020)	During Next WMP Cycle (2020–2022)	Longer-term (2023+)
Objectives	Establish vision and goals Support WMP review Build capabilities	Design and build digital platform for use cases Procure software	Enable advanced capabilities Establish external stakeholder connections
People	Develop data governance playbook to provide standards for data sharing across state agencies and associated partners	Engage program management team to define needs, use cases Engage platform management team for software build-out	Enable collaboration with external stakeholders Facilitate data capture for next-generation analytics
Process	Ensure data security protocols are executed Build preliminary data dictionary and taxonomy to support standardization of data inputs	Design platform architecture Continue build-out of data taxonomy and dictionary	Enable predictive analytics and next-generation insights Transform WMP, utility ops reviews into data-driven processes
Tools	Utilize standardized templates (data schema) Develop secure file repository with standardized file	Procure platform software Integrate data collection software to connect data providers	Build out reports, dashboards, and algorithms to power predictive analytics and support proactive decision making

4

Collaboration Areas for the WSD and Utilities

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4 Collaboration Areas for the WSD and Utilities

Collaboration within the broader utility wildfire mitigation enabling environment is critical to success.

In order for the WSD to pave the way globally in wildfire mitigation, it should not only pursue the activities laid out in Section 3, but also ensure utilities work within the broader utility wildfire mitigation enabling environment. This includes building critical processes, developing new tools, and improving capabilities related to utility wildfire mitigation. Both the WSD and utilities have the opportunity to pursue activities in support of this broader enabling environment, in collaboration with other agencies and stakeholders in California.

Four critical collaboration areas where the WSD or utilities could directly work with others have been identified. These areas are ones that could make a difference in helping the state reach the kind of sustained change required to achieve resilience, versus one-off efforts that result in short-term impact.

These four areas build on one another, with successful support providing the potential to move California more quickly towards a vision of no catastrophic utility-related wildfires. They also enact the strategic principles laid out in Section 2 and drive towards overall improvements in utility wildfire mitigation.

These areas include:

- **Governance and coordination**
- **Culture and behavior**
- **Applied science, technology, and data**
- **Workforce development**

In addition to building on the four enablers, the WSD must also continue to implement policy and regulation related to utility wildfire mitigation and ensure adequate resources to complete their responsibilities.

Collaboration Areas

Governance and Coordination

Statewide Coordination

The WSD needs to work closely with a broad set of external stakeholders, and the Wildfire Safety Advisory Board (WSAB)[74] to reach the proposed long-term vision. Utilities will also have to coordinate with others as they execute their WMPs. Mitigation efforts are substantial, and require federal, state, and local agencies, as well as private actors and individual communities to work together. The following activities are select examples of ongoing or proposed efforts that would benefit from increased coordination and collaboration driven by the WSD or utilities:

Improving community wildfire preparedness and emergency response by working closely with CAL FIRE, Cal OES, community organizations such as Fire Safe Councils, County OES, and other public safety partners[75] by building risk into, and updating more often, existing Community Wildfire Prevention Plans (CWPP), local hazard mitigation plans, and by sharing information regarding specific wildfire mitigation programs in each county and with local governments.

Pursuing additional utility wildfire research and development priorities in coordination with the California Energy Commission (CEC), the California Air Resources Board (CARB), CAL FIRE, and research institutions (e.g., universities, national labs), and initiating collaborative projects to test new utility wildfire risk reduction technology and solutions independently, or with independent verification.

Driving further environmental sustainability and fuel management activities in collaboration with the Forest Management Task Force, the California Natural Resources Agency (CNRA), and the Governor's Office of Planning and Research (OPR). This could include coordinated local and state level planning to better connect utility projects to other efforts and potentially create a single source of truth for this work (e.g., GIS-supported database).

In addition to coordinating ongoing activities, the WSD is positioned to drive more formal collaboration of statewide utility-related wildfire policy and strategy. Collaboration is critical to plan for the longer term and discuss trade-offs between near-term and long-term needs. The WSD will need to collaborate with leaders from other agencies – including CAL FIRE, Cal OES, and the CNRA – to align the direction of their utility wildfire mitigation efforts with others.

[74] WSD will transition to OEIS in July 2021 and will continue to collaborate with the CPUC.
[75] "Public Safety Partners" include first / emergency responders at the local, state, and federal level; water, wastewater, and communication service providers; affected community choice aggregators and publicly owned utilities/electrical cooperatives; the CPUC; Cal OES; and CAL FIRE.

Local Coordination and Community Engagement

Communities play a critical role in assessing local risk and implementing solutions. When communities are prepared, residents can coordinate prevention activities during a fire, effectively shelter in place in designated areas, evacuate quickly, and be prepared with the supplies to keep themselves safe during wildfires and PSPS events. Potential utility engagement with local communities, including access and functional needs and marginalized communities, government organizations, and tribal organizations is especially critical in two areas:

Improving community resilience by engaging communities better and more often, especially related to ongoing mitigation efforts, and reacting to, and preparing for, potential PSPS events.

Assisting with ongoing emergency preparedness efforts by better supporting the development of ingress and egress routes, incorporating local emergency plans into mitigation activity planning, and providing input into local emergency plans, local hazard mitigation plans and other existing local emergency response systems and processes.

Local leaders involved in resilience, such as Fire Safe Council leaders or Watershed Coordinators,[76] could also benefit from a standardized 'Fire Safety Toolkit' that brings together current practices, programs, and public safety recommendations from Cal OES, CAL FIRE, and others. The WSD and utilities could contribute to such a toolkit that could be developed in coordination with CAL FIRE and Cal OES, be available in multiple languages, and have five components:

1. Overall best practices for engaging communities in prevention, mitigation, and emergency preparedness activities
2. Detailed Community Wildfire Prevention Plan outline, including risk considerations and process to prioritize assets, as well as additional context for what a plan should entail
3. An example plan to better engage communities in wildfire mitigation activities
4. Outline of existing, potential funding sources for fuel management and emergency preparedness activities (e.g., CAL FIRE Fire Prevention grants,[77] local disaster resilience grants,[78] Fire Management Assistance Grants)[79]
5. Process outline for executing best practice fuel management and emergency preparedness programs, with additional information on likely barriers and resources for leaders (e.g., Listos California)[80]

[76] Watershed Coordinators lead watershed management efforts in local communities
[77] CAL FIRE. "Fire Prevention Grants Program." https://www.fire.ca.gov/grants/fire-prevention-grants/.
[78] Cal OES. "California Disaster Assistance Act (CDAA)." https://www.caloes.ca.gov/cal-oes-divisions/recovery/public-assistance/california-disaster-assistance-act.
[79] Cal OES. "Fire Management Assistance Grant (FMAG)." https://www.caloes.ca.gov/cal-oes-divisions/recovery/public-assistance/firemanagement-assistance-grant
[80] Listos California, https://www.listoscalifornia.org/.

Culture and Behavior

It is important for utilities to develop a culture that ensures actions build toward a single vision for utility wildfire mitigation. The actions below focus on ways to shift utility culture away from a culture focused solely on compliance, towards one that encompasses public safety and risk management. Actions to build a longer-term, sustainable public safety cultures in utilities include:

Developing a safety culture assessment and initiating a comprehensive review of wildfire-related safety programs within utilities, led by the WSD per statutory requirements, with accountability to ensure all utilities improve their broader public safety culture.

Exploring options for performance-based incentives such as an incentive structure called the F-Factor scheme that is used in Australia, detailed in Appendix 1. Already, IOUs must demonstrate a link between executive compensation and public safety performance to receive a safety certification established in AB 1054[81] and AB 111.[82]

Pursuing additional actions to drive overall utility culture change, including using the WMP and other regulatory mechanisms to initiate a shift from a focus on near-term individual crisis management towards a long-term focus on public safety, improving preparedness with advanced planning and training, and a continued overall focus on prevention.

[81] Assembly Bill 1054 (Holden, Chapter 79, Statutes of 2019), (AB 1054)
[82] Assembly Bill 111 (Committee on Budget, Chapter 81, Statutes of 2019), (AB 111).

Applied Science, Technology, and Data

Continued investment in technology and innovation is also important to enable long-term utility wildfire mitigation activities. To set the foundation for resilience, the WSD and utilities could:

Pursue more advanced grid innovations by supporting efforts to test and design a modern, resilient electric system to power California not just today, but for the foreseeable future to reduce the risk of wildfires. Utility investment could build upon R&D programs such as the CPUC Electric Program Investment Charge (EPIC), while further research is also needed related to biomass-fueled generation, mini-grids serving remote communities (drawing upon work by Lawrence Berkeley National Laboratory[83]), micro-grids powered by renewable resources, and other less mature innovations.

Invest in WSD data and analytic capabilities using a data governance framework that connects the existing WSD and utility investments in data and analytics, while coordinating with other stakeholders such as CAL FIRE and Cal OES. This can avoid redundancy and support the development of more advanced technological capabilities. Such software tools coordinate activities and provide essential information to leaders dealing with emergency response, fuel management, and other prevention activities.

Advance fire science, participate in current ongoing statewide research efforts, and create a scientific research plan for wildfire mitigation. As additional WSD and utility data becomes available related to the success of mitigation activities, this could provide the backbone for new fire science research. Specific areas of interest are best practices in the face of changing climate, a better understanding of forest health and resilience, new WUI building standards, advanced utility technology, and research to support resilient communities.

[83] Hartvigsson, Elias, Stadler, Michael, and Cardoso, Gonçalo. "Rural electrification and capacity expansion with an integrated modeling approach." *Lawrence Berkeley National Laboratory*, January 2018. http://eta-publications.lbl.gov/sites/default/files/pdf_11.pdf.

Workforce Development

To support execution of the many activities laid out in this report, skills and expertise must be developed at every level – from the WSD and utility leadership to local communities:

Train additional personnel to meet current demands, as the utilities, the CNRA, and local communities have each cited the lack of skilled workers as a constraint on executing vegetation and fuel management projects. Utilities need to support programs to train personnel to design and execute fuel management programs, foresters, and Certified Arborists need to be developed or scaled further.

Increase expertise to support utility wildfire mitigation efforts. The WSD should enhance its wildfire safety capabilities and oversight capacity including: wildfire mitigation expertise to better evaluate WMPs; data and analytical skills to interpret data and drive advanced analytics; understanding the requirements to drive safety culture improvements; and advanced project management skills to engage and drive coordination across a broader set of stakeholders.

Other Critical Collaboration Areas

In addition to actions the WSD and utilities should take to collaborate with others in the four areas outlined in this section, the WSD is also responsible for implementing existing and future legislative priorities. This includes the evolution of the Wildfire Mitigation Plans, and a continued focus on proactively reducing utility-related wildfire risk. Changes to other legislation and regulation governing utility wildfire mitigation, as well as funding available for prevention and mitigation initiatives, will also direct WSD efforts.

The CPUC also has several open proceedings and has issued guidance on topics including Microgrids and Resiliency[84], De-Energization,[85] and Wildfire Mitigation Plans,[86] that will inform future evolutions of the utility wildfire mitigation strategy.

[84] California Public Utilities Commission. *Order Instituting Rulemaking Regarding Microgrids Pursuant to Senate Bill 1339*. September 19, 2019. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M314/K274/314274617.PDF.; California Public Utilities Commission.
[85] *CPUC Proposes Additional PSPS Guidelines for Utilities and Orders PG&E to Resume and Augment Corrective Action Reports.* January 30, 2020. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M326/K268/326268463.PDF.
[86] California Public Utilities Commission. *RESOLUTION WSD-001 to Establish Procedures for the Wildfire Safety Division's Review of 2020 Wildfire Mitigation Plans Pursuant to Public Utilities Code Sections 8386 and 8386.3*. January 16, 2020. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M324/K966/324966978.PDF.

5

Conclusion

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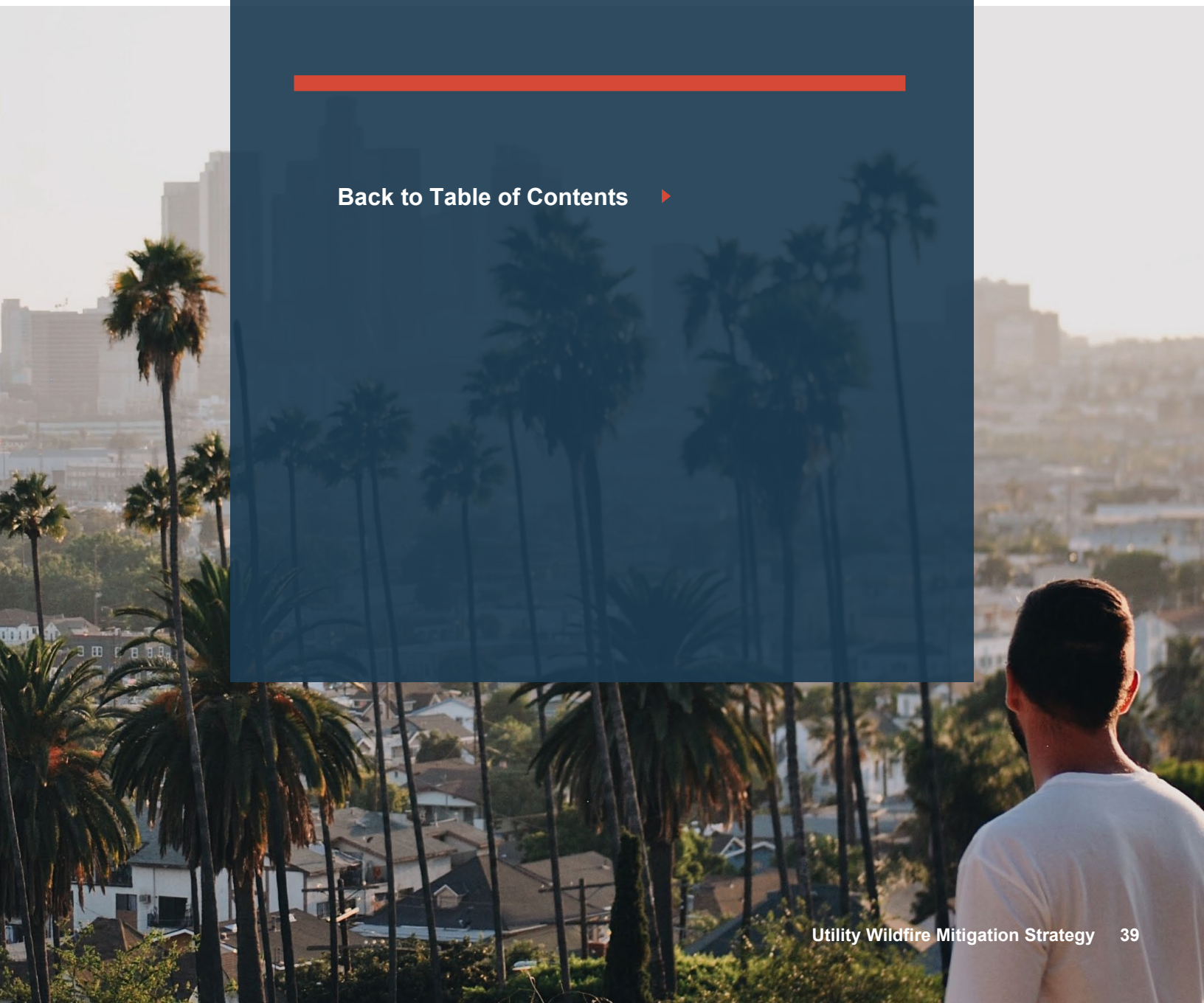


5 Conclusion

California is one of the areas most threatened by catastrophic utility-related wildfires today, as it faces unprecedented threats exacerbated by climate change. While it is a global leader in the effort to combat these costly and often deadly blazes, work remains given the recent string of severe wildfires. This presents an enormous opportunity for the WSD, along with the utilities whose WMPs the WSD is charged with reviewing and approving or denying, to formulate a best-in-class utility-related wildfire risk management strategy. Given the scale and the complexity of the problem, the task ahead will not be simple. However, solving California's utility-related wildfire challenge is certainly doable, and it will take a set of continued action, as suggested in this report, to address both immediate and long-term needs.

To start, this report proposes a comprehensive vision statement for the WSD: **a sustainable California, with no catastrophic utility-related wildfires, that has access to safe, affordable, and reliable electricity.**

Moving towards a sustainable future with no catastrophic wildfires related to electric infrastructure is a challenge, yet it can be achieved. What is needed is a clear path for action, one that takes into consideration both crucial short-term steps and a coherent plan for the long-term with the WSD and utilities driving towards common objectives. A roadmap outlining the potential path forward is laid out in Figure 7. It shows how the four principles—effective collaboration, local perspective, long-term resilience, and data-supported decision-making—could build over time with actions being taken by the WSD and utilities by the end of 2020, during the next WMP cycle (2020-2022), and in the longer-term (2023+).

To meet this ambitious vision and rise to the challenge, utilities need to continue to transform the way they operate. They need to use advanced, predictive data analytics, more accurate metrics and establish cultures that stress collaboration and public safety. In working towards these efforts, four ongoing WSD actions are aiming to drive near-term results:

1. **Revising the Utility Wildfire Mitigation Plan framework**, including a new utility Wildfire Mitigation Maturity Model
2. **Establishing outcome and progress metrics** to enable continuous improvement
3. Conducting a **detailed risk assessment** of utility infrastructure
4. Developing an **advanced data and analytics strategy**

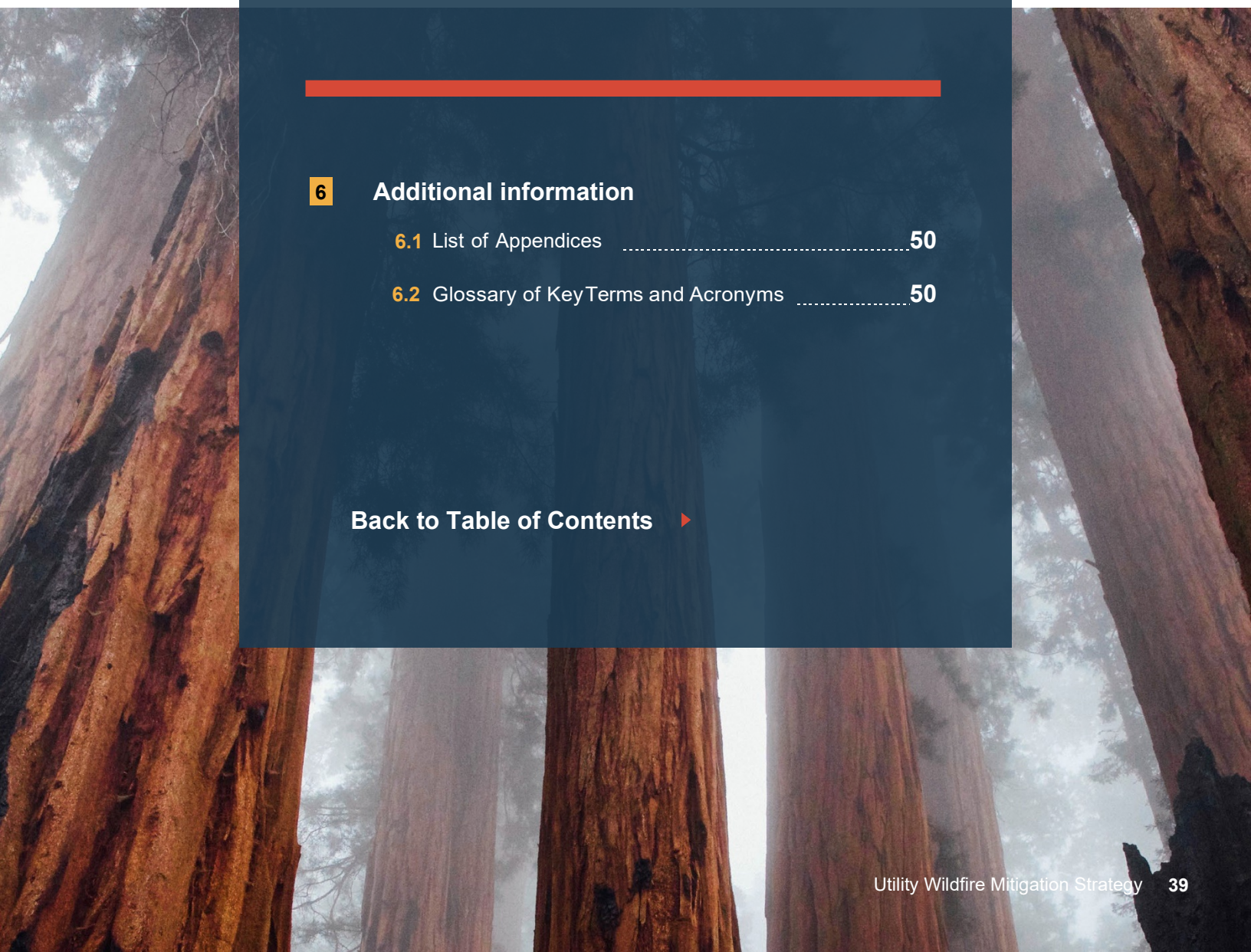
These activities are only sustainable in the long-term if the WSD and utilities collaborate with others to build longer-term resilience. To that end, four critical areas for collaboration were identified: (1) governance and coordination; (2) culture and behavior; (3) applied science, technology, and data; and (4) workforce development.

By pursuing these activities, the WSD can achieve its objectives and ensure utilities reduce utility wildfire risk, while leading innovations in global utility-related wildfire mitigation efforts. Before the next fire season, in the next three years, and in the next ten years, communities can become more resilient. It will take continued action from everyone involved, but focused activities, informed by data and coordinated together, can lead to a safer and more sustainable California.

Figure 7 Suggested high-level roadmap

6

Additional Information



6 Additional information

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6 Additional Information

6.1 List of Appendices

1. Global Strategies for Utility Wildfire Mitigation
2. WSD Wildfire Vision and Objectives
3. Utility Wildfire Mitigation Data Strategy

6.2 Glossary of Key Terms and Acronyms

Acronyms

CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Governor's Office of Emergency Services
CARB	California Air Resources Board
CEC	California Energy Commission
CNRA	California Natural Resources Administration
CPUC	California Public Utilities Commission
CWPP	Community Wildfire Protection Plan
FMTF	Forest Management Task Force
GRC	General Rate Case
IOU	Investor owned utility
ITO	Independent transmission operator
OEIS	Office of Energy Infrastructure Safety
PG&E	Pacific Gas & Electric
PSPS	Public Safety Power Shutoff
REFCL	Rapid Earth Fault Current Limiter
SAIDI	System Average Interruption Duration Index
SAWTI	Santa Ana Wildfire Threat Index
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SMJU	Small-and-multi jurisdictional utilities
USFS	United States Forest Service
WMP	Wildfire Mitigation Plan
WSAB	Wildfire Safety Advisory Board
WSD	Wildfire Safety Division of the California Public Utilities Commission
WUI	Wildland-urban interface

Key Terms

Bureau of Land Management (BLM): An agency of the United States Department of Interior that manages 15 million acres of land in California[87]

Bushfire Committee: A municipal-level non-government organization in Australia, comprised of a mix of residents, elected officials, and state fire professionals, tasked with assessing wildfire risks and developing plans for risk mitigation and wildfire response

California Air Resources Board (CARB): Agency of the California Environmental Protection Agency (Cal EPA) charged with protecting the public from the harmful effects of air pollution and developing programs and actions to fight climate change[88]

California Department of Forestry and Fire Protection (CAL FIRE): Department of the CNRA responsible for fire protection in State Responsibility Areas[89]

California Energy Commission (CEC): State's primary energy policy and planning agency, responsible for promoting innovation, permitting energy generation plants, and administering the RPS with the CPUC (among other responsibilities)[90]

California Natural Resources Agency (CNRA): State department responsible for protecting historical, natural, and cultural sites, and monitoring and controlling state lands

California Governor's Office of Emergency Services (Cal OES): State agency responsible for overseeing and coordinating emergency preparedness, response, recovery

California Public Utilities Commission: State commission empowered to oversee activities of utilities

Catastrophic wildfire: As defined in Section 2 of this report, a fire that either causes at least one death, damages over 500 structures, or burns over 140,000 acres of land

Community Wildfire Protection Plan (CWPP): Plan that guides a community's wildfire response, hazard mitigation, preparedness, and/or structure protection[91]

Defensible space: Area around a building that is cleared of vegetation, in order to slow or stop the spread of a fire

Egress: Ability to evacuate in the event of an oncoming wildfire

[87] Bureau of Land Management. "What We Manage – California." https://www.blm.gov/about/what-we-manage/california.
[88] The California Air Resources Board. https://ww2.arb.ca.gov/about.
[89] California Energy Commission. "Core Responsibility Fact Sheets." https://www.energy.ca.gov/about/core-responsibility-fact-sheets.
[90] California Forest Management Task Force. *"Restoring Health and Reducing Wildfire Threat to California's Forests."* https:// fmtf.fire.ca.gov/.
[91] Forests and Rangelands. *Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities.* USDA, March 2004. https://www.forestsandrangelands.gov/documents/resources/communities/cwpphandbook.pdf.

Federal Emergency Management Agency (FEMA): Agency of the United States Department of Homeland Security focused on domestic disaster preparedness, response, and recovery

Fire season: Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities[92]

Fire Safe Council: A community association focused on educating residents, and funding and leading measures to reduce local wildfire risk

Fuel: Combustible wildland vegetative materials, living or dead

Fuel density: Mass of fuel (vegetation) per area which could combust in a wildfire[93]

Fuel management: Removing or thinning vegetation to reduce the potential rate of propagation or intensity of wildfires

Fuel moisture content: Amount of water in local biomass, divided into live fuels (living vegetation) and dead fuels (vegetation with no living cells)[94]

General Rate Case (GRC): Regulatory proceedings that authorize the amounts utilities can charge their customers for the cost to own, operate, and maintain their facilities[95]

Governor's Forest Management Task Force (FMTF): Task force focused the state's investments in forest health by increasing the rate of forest treatments and expanding state wood product markets through innovation, assistance, and investment

Governor's Office of Planning and Research (OPR): Statewide long-range planning agency

Governor's Strike Force: Group created in early 2019 to coordinate California's efforts relating to the safety, reliability, sustainability, and affordability of its energy supply, which issued recommendations in April 2019[96]

High Fire Threat District (HFTD): Per D.17-01-009, areas of the State designated by the CPUC and CAL FIRE to have elevated wildfire risk, indicating where utilities must take additional action (per GO 95, GO 165, and GO 166) to mitigate wildfire risk

Ignition probability: The relative possibility that an ignition will occur, probability is quantified as a number between 0% and 100% (where 0% indicates impossibility and 100% indicates certainty). The higher the probability of an event, the more certainty there is that the event will occur. (Often informally referred to as likelihood or chance)

[92] United State Forest Service. "Fire Terminology." https://www.fs.fed.us/nwacfire/home/terminology.html
[93] United State Forest Service. "Fire Terminology."
[94] United State Forest Service. "Fire Terminology."
[95] California Public Utilities Commission. "Electric Utilities Rates & Costs." https://www.cpuc.ca.gov/General.aspx?id=6276.
[96] Office of the Governor of California. *Wildfires and Climate Change: California's Energy Future*.

Lagging indicator: An indicator whose movement follows that of the principal risk (e.g., an increase in a lagging indicator follows an increase in wildfire risk)

Leading indicator: An indicator whose movement anticipates that of the principal risk

Office of Energy Infrastructure Safety (OEIS): An office that will be established as of July 1, 2021 under the CNRA, per Assembly Bill 111 and Assembly Bill 1054, and will be formed out of the Wildfire Safety Division currently within the CPUC.

Prevention: Actions and strategies to reduce the risk of a utility-related wildfire

Propagation: Fire spread after ignition

Public Safety Power Shutoff (PSPS): Pre-emptive de-energization of utility circuits

Recovery: Community and housing recovery following a wildfire, including rebuilding of critical infrastructure and economic development

Renewables Portfolio Standard (RPS): The percentage of electricity procured by a utility that comes from generation other than nuclear, hydroelectricity, and combustion (non-cogeneration, above 30 MW)[97]

Response: Detection of a wildfire, as well as activities to suppress the wildfire and protect lives, structures, and economic and environmental assets

Risk-maturity: Sophistication with which stakeholders diagnose and mitigate risks, as well as the stakeholders' effectiveness in reducing the overall risk level

Santa Ana Wildfire Threat index (SAWTI): A relative metric predicting the intensity of Santa Ana winds in Southern California and the probability that they will lead to a wildfire

Situational awareness: Ability to anticipate, detect, and forecast wildfire propagation

Small and Multi-Jurisdictional Utilities (SMJUs): Regulated utilities other than PG&E, SCE, and SDG&E, many of which are also regulated in other states

State Responsibility Areas (SRA): Lands exclusive of cities and federal lands regardless of ownership, in which the primary financial responsibility for preventing and suppressing fires is that of the state, and which is not desert land,[98] totaling 31 million acres[99]

Suppression: Extinguishing or containing a fire, beginning with its discovery[100]

[97] Crume Christina and Lynette Green. *Renewables Portfolio Standard Eligibility*. California Energy Commission, January 2017. https://efiling.energy.ca.gov/getdocument.aspx?tn=217317.
[98] California Department of Forestry and Fire Protection. "Wildfire Hazard Real Estate Disclosure." https://frap.fire.ca.gov/frap-projects/wildfire-hazard-real-estate-disclosure/.
[99] California Department of Forestry and Fire Protection. *CAL FIRE at a Glance*. September 2018. https://www.fire.ca.gov/media/4922/glance.pdf.
[100] United States Forest Service. "Fire Terminology."

System Average Interruption Duration Index (SAIDI): System-wide total number of minutes per year of sustained outage per customer served[101]

System hardening: Upgrading utility equipment to reduce the chance that it ignites a wildfire

United States Forest Service (USFS): An agency of the United States Department of Agriculture that manages 20 million acres of land in California[102]

Utility-related wildfire: Wildfires caused by utility infrastructure, including all wildfires determined by the Authority Having Jurisdiction (AHJ) investigation to originate from ignition caused by utility infrastructure

Utility Wildfire Mitigation Maturity Assessment: A tool to assess maturity of utility wildfire mitigation capabilities and practices, to establish a baseline, track development over time, and identify best practices

Vegetation management: Trimming and clearance of trees, branches, and other vegetation that poses the risk of contact with electric equipment

Wildfire: A fire that ignites and spreads over undeveloped (wildland) terrain

Wildfire Mitigation Plan (WMP): A filing by utilities with the CPUC outlining planned investments and operational activities to mitigate wildfire risk

Wildfire risk: The potential for the occurrence of a wildfire event expressed in terms of a combination of various outcomes of the wildfire and their associated probabilities

Wildfire Safety Advisory Board (WSAB): Committee advising the WSD on wildfire safety and mitigation performance, including plans written by utilities, so they can develop an appropriate scope and process for assessing the safety culture of an electric utility[103]

Wildfire Safety Division (WSD): A new division of the CPUC focused on regulating utilities' mitigation of their wildfire risk

Wildland-urban interface (WUI): Any area where humans and their development meet or intermix with wildland fuel[104]

[101] Pacific Gas and Electric. "Electric Reliability Reports." 2019. https://www.pge.com/en_U.S./residential/outages/planning-andpreparedness/safety-and-preparedness/grid-reliability/electric-reliability-reports/electric-reliability-reports.page.
[102] United States Forest Service. "Ecological Restoration and Partnerships—Our California Story." https://www.fs.usda.gov/detail/r5/landmanagement/?cid=stelprdb5412095.
[103] Office of Governor Gavin Newsom. *Governor Newsom Announces California Wildfire Safety Advisory Board and California Catastrophe Response Council Members*. October 30, 2019. https://www.gov.ca.gov/2019/10/30/governor-newsom-announces-californiawildfire-safety-advisory-board-and-california-catastrophe-response-council-members/.
[104] Stein, Susan, et al. *Wildfire, Wildlands, and People: Understanding and Preparing for Wildfire in the Wildland-Urban Interface*. USDA, January 2013. https://www.fs.fed.us/openspace/fote/reports/GTR-299.pdf