

California Wildfires, Utilities and Grid Resiliency - Part 2

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1. Introduction

"If at first you don't succeed, try, try again. Don't give up too easily; persistence pays off in the end."

- Traced back to 'Teacher's Manual' by American educator Thomas H. Palmer (1782-1861).

This is the third time I've started on this paper. The first time, I was dissatisfied and set it aside. Later I came back to it and revised it into something else (linked below), where a major portion was devoted to PG&E's recent situation and actions.

<https://www.energycentral.com/c/pip/california-wildfires-utilities-and-grid-resilience>

The second time I was about 60% done, and was satisfied with the result. However I came across a really good, authoritative reference (the first one below), that completely discounted much of what I was writing. I'm hoping that the third times a charm (probably an ancient origin).

2. The Challenge

This is a hugely complex problem, and resolving it will be painful for all parties. The state of California, and specifically Governor Newsom, realized this early this year as PG&E started talking about filing for Chapter 11 bankruptcy. The State of California assembled a strike force to create a report summarizing the situation. This report was issued on April 12, and is referenced here.¹

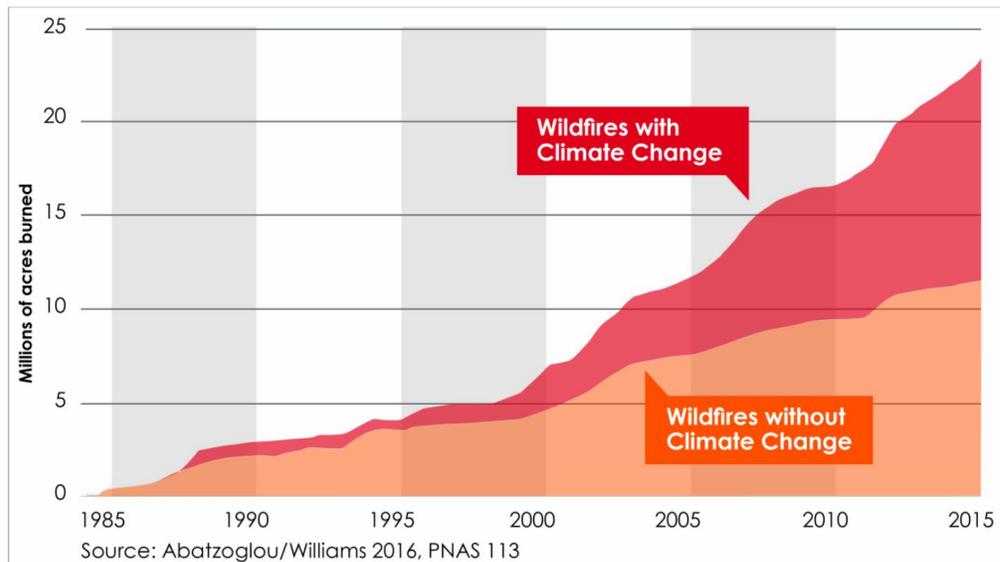
By the way, the above challenges are not unique to PG&E. California's other two large investor owned electric utilities (SCE and SDGE) also must deal with the same challenges, although perhaps to a lesser degree.

2.1. Wildfire Details and Causes

From reference 1: *"California faces a dramatic increase in the number and severity of wildfires. Fifteen of the 20 most destructive wildfires in the state's history have occurred since 2000; ten of the most destructive fires have occurred since 2015. While wildfires are a natural part of California's ecology, the fire season is getting longer every year—with most counties now experiencing fire season from mid-May to mid-December and several counties facing fire danger year-round. Warmer temperatures, variable snowpack, and earlier snowmelt caused by climate change make for longer and more intense dry seasons, leaving forests more susceptible to severe fire."* See the chart below for the overall trend.²

¹ Governor Newsom's Strike Force (note from author: although I tried really hard to tract this group down, I came up almost empty. The only hint I got was from the PDF file metadata which said the source was "California Department of Finance"), "Wildfires and Climate Change: California's Energy Future", April 12, 2019, <https://www.gov.ca.gov/wp-content/uploads/2019/04/Wildfires-and-Climate-Change-California%E2%80%99s-Energy-Future.pdf>

² Cal Fire, Top 20 Most Destructive California Wildfires, 8/8/2019, https://www.fire.ca.gov/media/5511/top20_destruction.pdf



"At the same time that our climate is changing and fueling the devastating force of wildfires, increased development in the wildland-urban interface (WUI) has placed more residents in the potential path of destruction. Today, approximately 25 percent of the state's population (over 11 million people) lives in high fire-risk areas, including the WUI.³

"The combination of more powerful wildfires and more Californians living in their paths has resulted in enormous, incomprehensible loss. Last year, 85 people died in the Camp Fire alone and 19,000 homes and other structures were damaged or destroyed. According to data from Butte County, more than 60 percent of those victims were over 60 years old. Paradise and other towns were devastated. The Camp Fire was only one of approximately 7,600 wildfires in 2018. Damage estimates for the 2018 wildfire season are staggering, with insured losses alone exceeding \$12 billion.⁴ Thousands of Californians who lost their homes, and their livelihoods in these fires, are still without permanent homes and struggling to rebuild their lives.

2.2. State Investor-Owned Utilities

Again from reference 1: *"California's electric utilities must be part of the solution to this problem. In the past four years, equipment owned by California's three largest investor-owned utilities sparked more than 2,000 fires.⁵ Utility-caused fires tend to spread quickly and be among the most destructive. Hundreds of thousands of miles of electrical transmission and distribution lines snake across the California landscape, often igniting fires during extreme wind events and in remote areas, making early detection and fire suppression extremely challenging. Longer fire seasons make utility-caused fires even*

³ Leventhal Center for Advanced Urbanism, Cataloguing the Interface: Wildfire and Urban Development in California, (Spring 2018), <http://lcau.mit.edu/project/cataloguing-interface-wildfire-and-urban-development-california>

⁴ California Department of Insurance, Insured Losses From The 2018 California Wildfires, (Jan., 28, 2019), <http://www.insurance.ca.gov/0400-news/0100-press-releases/2019/upload/nr14-2019Insured-Losses-2018-Wildfires.pdf>

⁵ Carolyn Kousky, et. al., Wildfire Costs In California: "The Role of Electric Utilities", Wharton Risk Management and Decision Processes Center (Sept. 2018), <https://riskcenter.wharton.upenn.edu/wp-content/uploads/2018/08/Wildfire-Cost-in-CA-Role-of-Utilities-1.pdf>

more likely. Hardening the electrical grid is thus a critical component to overall wildfire risk management. Our utilities—public and private—must make needed investments to reduce the risk of utility-ignited fires and, with the new reality of climate change, must do so now.

"At the same time, the current system for allocating costs associated with catastrophic wildfires—often caused by utility infrastructure, but exacerbated by drought, climate change, land-use policies, and a lack of forest management—is untenable both for utility customers and for our economy. Multi-billion dollar wildfire liabilities over the last several years have crippled the financial health of our privately and publicly owned electric utilities. Pacific Gas & Electric Company (PG&E) filed for bankruptcy in the face of massive potential liability for wildfire damages. Other investor-owned and public utilities have experienced recent credit ratings downgrades, with San Diego Gas & Electric (SDG&E) and Southern California Edison Company (SCE) now precipitously hovering just above junk status. Utilities rely on credit to finance ongoing infrastructure investments, including fire mitigation. As utilities' credit ratings deteriorate, their borrowing costs increase and those costs for capital necessary to make essential safety improvements are passed directly to customers. These downgrades, and the prospect of additional utility bankruptcy filings, directly impact Californians' access to safe, reliable and affordable electricity.

"The Report sets forth three concepts to address this central question--the imminent wildfire liability issues facing California's utilities--each as described further in Part 3:

"Concept 1: Liquidity-Only Fund. *This concept would create a fund to provide liquidity for utilities to pay wildfire damage claims pending CPUC determination of whether or not those claims are appropriate for cost recovery and may be coupled with modification of cost recovery standards.*

"Concept 2: Changing Strict Liability to a Fault-Based Standard. *This concept would involve modification of California's strict liability standard under inverse condemnation to one based on fault to balance the need for public improvements with private harm to individuals.*

"Concept 3: Wildfire Fund. *This concept would create a wildfire fund coupled with a revised cost recovery standard to spread the cost of catastrophic wildfires more broadly among stakeholders..."*

I reviewed the text of AB 1054 and it looks like the state ended up with a Wildfire Fund, but I've put a link to this bill below and you can form your own opinion.

https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB1054

2.2.1. Utility Fire Mitigation Responsibility

From reference 1: *"This largely utility-defined fire mitigation program resulted in inconsistencies in investment among the state's investor-owned utilities. SDG&E engaged in a robust fire mitigation and safety program after experiencing devastating fires in its service territory in 2007 and has become a recognized leader in wildfire safety.*

"More recently, SCE implemented a wildfire safety program designed to mitigate the challenges of wildfires, including the development of operational practices and inspections, vegetation management activities, and community outreach.

"PG&E has begun to implement wildfire safety measures, but its efforts lag behind the other IOUs, which is particularly troubling given that it serves 40 percent of California's utility customers and many counties in high-risk areas."

3. PG&E Resolution

From reference 1: *"PG&E is a textbook example of what happens when a utility does not invest in safety after numerous deadly reminders to do so over many years. Even today, PG&E is taking advantage of the bankruptcy process to promote the interests of investors over fire victims and other stakeholders. California will advocate for fair treatment of victims and employees, as well as to uphold the state's clean energy commitments in the bankruptcy process. The state will:*

"Monitor – and intervene – in the bankruptcy proceedings to protect California's interests. PG&E is a private entity, but its misconduct has had grave consequences for the state and its people.

"Evaluate options to satisfy wildfire claims from the last two years so fire victims are treated fairly.

"Demand that a reorganized PG&E serve the public interest. After years of mismanagement and safety failures, no options can be taken off the table to reform PG&E, including municipalization of all or a portion of PG&E's operations; division of PG&E's service territories into smaller, regional markets; refocusing PG&E's operations on transmission and distribution; or reorganization of PG&E as a new company structured to meet its obligations to California."

The reform described above will not be easy. PG&E's grid must be hardened in any areas that are susceptible to wildfire, and vegetation management must receive an immediate priority by all responsible parties.

PG&E has a huge service area covering one of the largest urban areas in the U.S. (San Francisco Bay Area with over 7 million people⁶), many medium-sized cities outside of that area (populations of 50,000 to 500,000), and a really large rural area with challenging topology and climate. Much of this area is being made more difficult to safely service by the effects of climate change, and these effects will just keep on coming for at least the next century or two.

Also the state is implementing numerous changes to PG&E's customer base via open access (OA) and community choice aggregation (CCA). Increasing renewables, battery energy storage systems and distributed energy resources (DER) of various types at all sizes of utility customers are being driven both by the state's climate change goals and high electricity prices.

3.1. Can PG&E Remain Financially Viable?

PG&E proposed a preliminary reorganization plan in September. Shortly thereafter I found a good summary and critique of their plan and paraphrased it in the paper posted to Energy Central and linked below (Section 3.3). Although PG&E has not issued a final plan yet, the PUC has started an Order Instituting Investigation (OII) on this subject (second link below).

⁶ Bay Area Census, <http://www.bayareacensus.ca.gov/index.html>

<https://www.energycentral.com/c/cp/wildfire-2019-repercussions>

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M313/K942/313942079.PDF>

The CPUC must approve a plan of reorganization resolving PG&E's insolvency proceedings and make determinations as to the acceptability of such plan in light of factors relating to safety, California's climate goals, and ratepayer impacts, among other things.

Also note that AB 1054 is described in the above paper (section 4), and it sets a deadline of June 30, 2020 for the Bankruptcy Court to address and approve any modifications made to the reorganization plan in order for PG&E to become eligible to participate in the wildfire fund established by this bill. In addition to establishing the fund, AB 1054 lists a number of additional Bankruptcy Court and regulatory determinations that must be made by June 30, 2020 in order for PG&E to participate in the wildfire fund.

The AB 1054 wildfire fund may mitigate damages caused by PG&E that occurred in 2019.

Regarding PG&E's financial viability in the face of DA, CCA and DER, I expect that PG&E's financial management team have already modeled these, and can comment on this, although these models are based on assumptions that may, or may not be realistic. This is especially true of DER. If PG&E is allowed to increase their rates, it is highly likely that many customers will resort to their own energy resources (mainly solar plus storage).

3.2. Toughening PG&E's Grid?

The first major problems in this job is the sheer size of PG&E. Both its service area, and grid are huge. See the figure below for their service area size (appx. 420 miles from north to south). Other facts:^{7 8}

- Grid size: 106,681 circuit miles of electric distribution lines and 18,466 circuit miles of interconnected transmission lines.
- 5.4 Million Electric customer accounts.
- Approximately 24,000 employees (electric and gas operations)

⁷ PG&E, Company Profile, https://www.pge.com/en_US/about-pge/company-information/profile/profile.page

⁸ PG&E, Understand the Smart Grid, https://www.pge.com/en_US/safety/how-the-system-works/electric-systems/smart-grid/smart-grid.page



- Supporting charging infrastructure for approximately 245,000 EVs growing to over 300,000 by 2020. California has set a target of 5 million zero-emission vehicles in California by 2030, of which PG&E would represent about 40%, or 2 million vehicles.
- Supporting 312,000 solar rooftop photovoltaic (PV) systems growing to over 640,000 by 2020.
- Continued growth in battery storage, including 580 mandated megawatts (MW) contracted by 2020. PG&E's vision is to lead in storage and includes planning to compete-to-own 1,000 MW energy storage by 2030.
- An extensive grid control communication network that includes a comprehensive supervisory control and data acquisition (SCADA) system, a grid management system and an advanced metering infrastructure (AMI) system that supports two-way communications to each customer account's meter.

Oh yes, and PG&E is also a major gas utility with 42,141 miles of natural gas distribution pipelines and 6,438 miles of gas transmission pipelines. They also have their major challenges with these operations.

I believe PG&E will have the information on the improvements that will be required and cost. They have run many pilots on using their cyber-assets to secure the grid against being an ignition source.⁹ However they have also been resistant to undergrounding distribution or transmission lines where necessary. I believe the latter needs to be put on the table. Because their grid is so large, I tend to believe their estimate of 10-years to complete this work.

The final question becomes how we will pay for this?

One additional comment: The paper linked in the Introduction identifies most wildland fires are that involve major loss of homes and lives. These are all in wildland-urban interface bushland (chaparral) areas. From the standpoint of the number of customers this is a small part of PG&E's service area. For the next few years Public Safety Power Shutoffs (PSPS) in these areas will continue, and many PG&E customers are already adding generators, etc. (note that I have a home in one of these areas). Part of a final solution will involve the grid, but it may also involve securing the homes and people via chaparral-fuels management to make fire-fighting easier, and beefing up fire-fighting infrastructure to make sure that these fires can be controlled and limited to the wildland (see next section). The stongest dry high-wind events will probably still require PSPS, and the residents and businesses in these areas will need to provide backup for critical loads.

4. Current and Future Wildfire Mitigation

From reference 1: *"On March 22, the Governor, citing the extreme peril posed by wildfire risk, issued an Emergency Proclamation directing CAL FIRE to immediately implement 35 emergency projects identified to protect lives and property. CAL FIRE will utilize existing funding totaling \$30 million from the Forest Health and Fire Prevention Program to immediately execute the priority fuel reduction projects.*

"The proclamation suspends certain requirements and regulations. To ensure environmental protection, CAL FIRE requested input from regulatory agencies, and will employ a set of best management practices designed to identify and avoid sensitive natural and archaeological resources...

"After decades of disinvestment, the state has committed hundreds of millions of dollars in recent years to improve the health and resiliency of the state's forests. Despite these increases, much work remains to be done. Over the next five years, the state will commit over \$1 billion for critical fuel reduction projects, to support prescribed fire crews, forest thinning, and other forest health projects. In addition, the Governor redeployed the National Guard to support fire prevention efforts and is proposing to expand the California Conservation Corps to focus on forest management.

"Since 2010, California has nearly doubled the number of acres treated annually by fuel reduction, and has tripled the number of acres treated by prescribed burning. However, these efforts—less than 33,000 treated acres in 2017-18—are dwarfed by the number of

⁹ Pacific Gas and Electric Company Smart Grid Annual Report – 2018, https://www.pge.com/pge_global/common/pdfs/safety/how-the-system-works/electric-systems/smart-grid/AnnualReport2018.pdf

acres that require attention. California's Forest Carbon Plan sets a goal of treating 500,000 acres of private land every year.

"As the owner of 57 percent of California's forestland, the federal government must do its fair share to reduce fire risk. Specifically, the Governor has joined the governors of Washington and Oregon to call for the federal government to double the investment in managing federal forestlands in our states due to the high-risk of wildfires..."

"In recent years, the state has added additional year-round fire engines and firefighters to address longer, more severe fire seasons. The state has also launched a major initiative to replace Vietnam War-era helicopters with new state-of-the-art helicopters with enhanced firefighting capabilities. The Governor's Budget proposes to further expand the state's firefighting surge capacity by adding additional crews and engines. The Budget also includes funding to operate C-130 federal air-tankers."

"To spur engagement from innovators in fire safety technologies and more effectively fight fires, Governor Newsom signed Executive Order N-04-19 to modernize the state contracting process for goods and technology systems. The "Innovation Procurement Sprint" will enable CAL FIRE to identify solutions to more effectively detect wildfire starts and predict the path of wildfires."

The following update is referenced here:¹⁰

"Invest in technology and innovation. The state should deploy new technologies, including weather stations, drones and artificial intelligence."

- *"The Governor proposed, and the Legislature approved, 100 new statewide infrared cameras to help detect wildfires"*
- *"The Governor proposed, and the Legislature passed, a comprehensive upgrade to California's antiquated 9-1-1 system"*
- *"The Governor launched an "Innovation Procurement Sprint" to get the most cutting-edge tools into the field and tackle the wildfire threat"*
- *"The Governor secured delegation of authority from the U.S. Secretary of Defense to fly infrared-equipped Unmanned Aerial Systems in support of Cal FIRE missions"*
- *"The Governor partnered with the Federal Government to secure state access to satellite based technology to detect wildfire ignitions"*
- *"The Administration partnered with XPRIZE to design an incentive prize for firefighting innovations"*

One final comment regarding the above excerpts. These tend to use the word "forests" for all fire-sensitive wildlands, whereas the primary such areas are not forests, but chaparral bushlands. I believe we can forgive the state team to making a common mistake of including foothill bushlands with mountain forests. If you would like to see more about this go to the prior paper linked below.

<https://www.energycentral.com/c/ec/fires-and-storms-%E2%80%93-part-1-rev-b>

¹⁰ Catastrophic Wildfires, Climate Change and Our Energy Future, Governor Newsom's Strike Force Progress Report, June 21, 2019, <https://www.gov.ca.gov/wp-content/uploads/2019/06/Strike-Force-Progress-Report-6-21-19.pdf>