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by email to: wildfiresafetydivision@cpuc.ca.gov
And Service List for Proceeding R.18-10-007

Subject: Comment 2020-2022 Wildfire Mitigation Plans

Greetings Ms. Jacobs,

Introduction and Comment Summary

These comments focus primarily upon wildfire ignition prevention available through infrastructure updates, investment and innovation. PSPS events will become a permanent fact of life for California, unless a major commitment of money and expertise is applied to the problem of wildfire ignition from electric power utility equipment. Climate change impacting the State is going to continue to worsen our fire seasons.

Descriptions of progress in wildfire ignition mitigation occupies major segments of the 2020 Wildfire Mitigation Plans. It is too soon to draw any but the most obvious conclusions regarding progress.

Proceedings dating back to at least 2008, such as R.08-11-005, have addressed the issue of fire safety. The absence of references to these prior efforts is an omission that needs to be addressed in the current discussions. There should be a review / comparison of the past actions of the Commission that have addressed this issue.

The Role of Wind

The number of utility equipment ignited fires reported to the CPUC was quoted in the Los Angeles Times at 2,000 fires from June 2014 through the end of 2017. Fires that get out of control occur during dry conditions and high winds. These wildfires are impossible to stop. Wind is a major problem for overhead power circuits. High winds lead to electrical arc faults from “wire slaps”, pole and conductor failure from wind pressure loading, tree blow down, and flying debris of all types landing in uninsulated power-pole mounted equipment.

Advancements in wildfire science have focused on the role of wind driven embers and firebrands. Paradise CA was not burned down by a forest fire at least not directly. It was destroyed by wind driven embers imbedded into the crevices of buildings, setting these buildings on fire before the wildfire flame front reached the town. Fire fighters were helpless to stop the fire. There are photos of sections of that town where every structure is destroyed to ash while directly adjacent stands of forest remained merely singed.

CAL Fire / CDF specifically excluded wind driven wildfire from consideration in its Vegetation Treatment Program (VTP). The agency understands that no vegetation treatment can prevent the spread of wind driven wildfires.

The Solution is Infrastructure Investment

There is long-standing evidence that the continued use of old deteriorated and technically obsolete electrical equipment is far more likely to result in fire ignitions than is new technically advanced equipment. The abrasion worn, and broken jumper cable support hooks from the PG&E transmission towers at the Camp fire ignition site are examples of the infrastructure age and condition problem. This policy of neglecting deteriorating infrastructure has been described as "Run to Failure" by a past CPUC Commissioner. The Butte County Camp fire was a truly shocking event. And no one has forgotten the "Wine Country" fires of 2017. The Tubbs astonished firefighters by cutting directly into urbanized sections of Santa Rosa.

The PSPS Public Safety Power Shut Offs that took place in summer and fall 2019 raised complex issues of public safety, customer financial losses and massive inconvenience for nearly a million people. PSPS is not a politically viable solution. Nevertheless we can expect PSPS to continue for years to come.

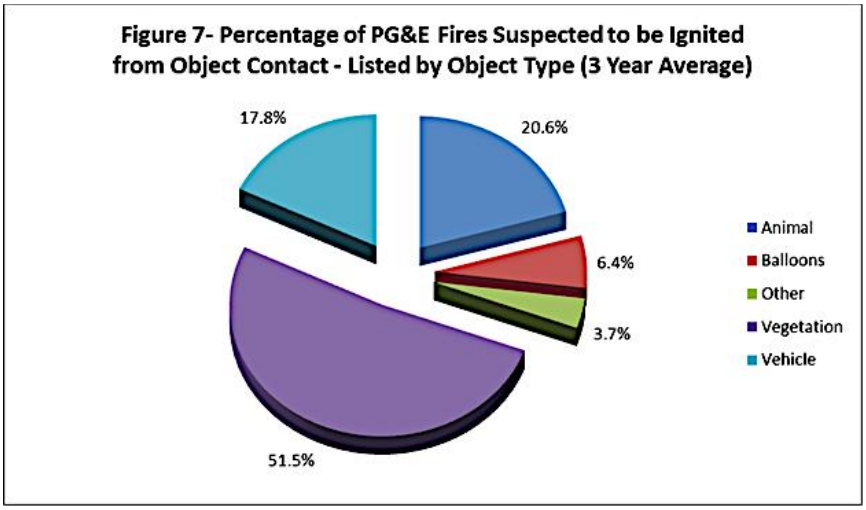
PG&E, the IOU most dramatically implicated in the ignition of numerous recent and deadly wildfires, is the same utility to submit the most redundant, vague 494 page Wildfire Mitigation Plan. I live in PG&E's service territory. This letter focuses on PG&E and compares their plan to those of Southern CA Edison (SCE) and San Diego Gas and Electric (SDG&E).

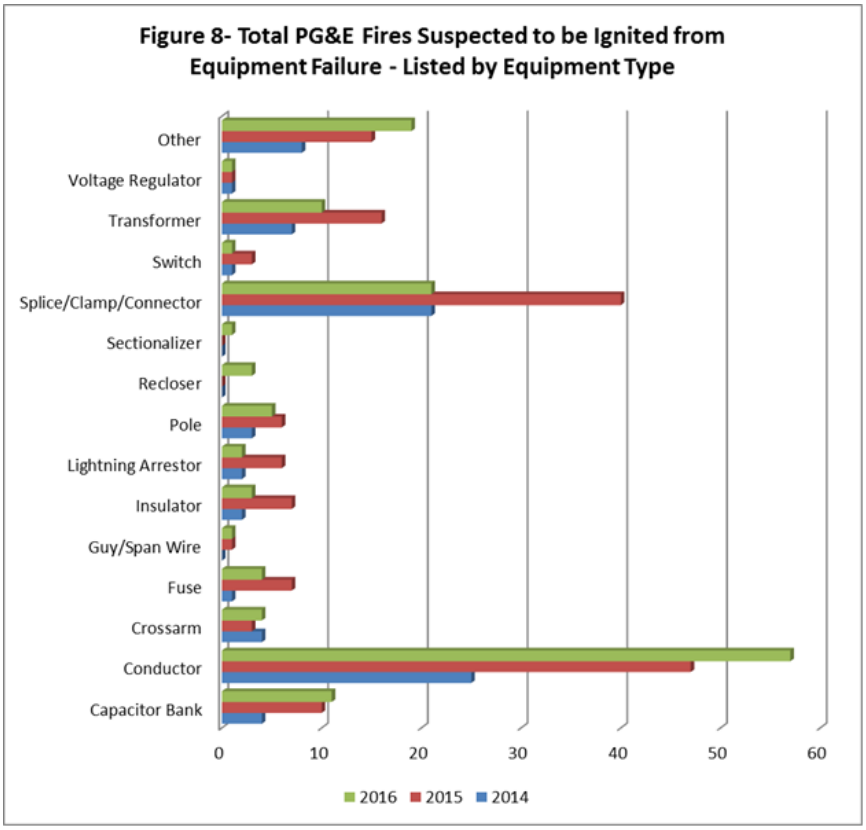
A Diversionary Focus on the Destruction of Trees

PG&E's primary solution is felling millions of trees anywhere near their dangerously obsolete equipment. This approach will never resolve the fire ignition problem**.** PG&E has attributed half of their fires to vegetation contacts. This is primarily a matter of broken branches and other debris. Attempting to solving half the problem is not the goal. Insulated "covered" conductors solve most vegetation contact problems. Only storm blowdown of large trees would result in an electrical conductor fault if conductors were insulated. High impedance arc fault interruption protection would dramatically reduce this remaining hazard.

The following two charts below are from a 2014-2016 Fire Incident Data Collection, Decision 14-02-015 February 5, 2014. “The CPUC adopted a Fire Incident Data Collection Plan that requires certain investor-owned electric utilities to collect and annually report certain information that would be useful in identifying operational and/or environmental trends relevant to fire-related events.“

It is notable that the second chart identifies conductors, conductor splices/clamps and connectors as the most common failure point.





The environmental impacts from "Enhanced Vegetation Management" or EVM have been disregarded by the Commission. I've read the Filing record of R1810007 since it opened in 2018. No Commission order, ruling, or decision has addressed the issue of natural resource impacts or climate impacts according to AB 32 and succeeding legislation. As PG&E's EVM continues, the number of homeowner complaints and violations of Resource Agency codes will mount.

PG&E's representative announced at the February 18, 2020 Commission Workshop in San Francisco, that the company intended to spend $680,000,000 on "vegetation management". $500,000,000 of those funds were to be spent felling mature trees, primarily outside of their utility right of ways and extending to what PG&E calls "strike distance", or the height of the tallest tree capable of someday falling toward PG&E circuit. This is the 200 foot distance from a circuit that PG&E says it needs protection from with EMV. The remaining $18,000,000 would be spent on some version of more conventional tree cutting/trimming. The impacts across PG&E's rural service area in Tier 2 and 3, will be highly destructive to environments, to geologic stability, and to homeowner property. These funds should be spent replacing old bare wire and cable.

PG&E maintains the delusional notion that they can prevent vegetation contact during high wind events that blow debris horizontally out of tall trees for long distances. Any small object of any material that bridges between out of phase conductors can cause a creep or a flash-over electrical fault current between uninsulated conductors and between pole mounted connection points. High voltage electricity behaves strangely. Any non-conductive debris (wood, plastic, bodies of electrocuted animals etc.) can enable a powerful electrical fault current. These electrical faults shower the "sparks" igniting wildfires. PG&E's "vegetation management" is a diversionary tactic to delay the inevitable, i.e. infrastructure investment, staff training, new technology.

Do the Commission and PG&E think that every forested rural road will become a V shaped mangle of felled old trees 400 feet wide? I've seen recent cutting of 200 feet width under an overhead circuit. It is an unacceptable level of destruction. The notion that a trained arborist is selecting hazard trees is not the case. PG&E has been aggressively cutting down tall old trees for many years. This is not begin in 2018. Random and intensive tree removals by PG&E that exceed Commission clearance standards started more than 10 years ago and have ramped up every year since. There's been no published review to demonstrate the success of this activity.

Updating the General Orders is the Solution

The solutions to fires ignited by electric power equipment will ultimately be solved through updates to the General Orders. These are the construction codes for power utilities.

The notion that each individual utility should submit plans for wildfire mitigation applying to their own systems alone is misdirected. SB 901 is not leading to the results envisioned. From an electrical engineering standpoint, all the electric power utilities in California operate similar power generation, transmission and distribution systems. They purchase equipment from the same vendors. They all use similar equipment in similar circumstances.

The unwieldy process of addressing each utility's Plan as a separate process is time-consuming and puts the regulated entity in the odd position of setting their own standards for the Commission to approve.

The Commission has the full powers to address the defects and omissions in their General Orders. Wildfire Mitigation Plans should move forward upon the initiative of the Commission and its engineering staff. The goal is to dramatically improve the fire and electrocution safety performance of all utilities operating in California. SB 901 did not obstruct the Commission's authority.

The WMPs produced to date are too unspecific and variable in content. They lack clear obligatory completion dates and specific safety performance targets. This has resulted in the inundation of everyone involved with a huge document record that is confusing to everyone. The Commission itself must get to the bottom of the problem of wildfire ignition and solve it.

Perhaps as a result of the 2007 San Diego County Witch Creek-Guejito–Poomacha Fire Complex, the idea arose to install cameras to detect fires that have already started. Anemometers (wind speed measurement devices) are the next addition to a new role for SDG&E and other utilities to perform weather monitoring. Both of these strategies require connection to an integrated safety control center. If the utility power distribution equipment is not equipped with SCADA (Supervisory Control and Data Acquisition) servo control to remotely operate switches, reclosers etc. then there is no capacity to remotely de-energize a faulted circuit and prevent a wildfire ignition.

Where I live, PG&E takes hours to get a lineman on site to manually use a "hot stick" to pull open a fused link on an energized and arcing downed wire. This is after a 911 call providing a specific location address for the downed wire/cable.

Fires ignited in any wildland setting during hot dry windy weather expand very rapidly. Detecting fires after they are already burning in these meteorological condition is insufficient. Such fires may already be out of control before adequate firefighting equipment and personnel arrive on site.

There are many types of utility equipment and designs known to be involved in wildfire ignitions. A very short list would be:

(1) Weak strength and uninsulated main conductors, jumper cables and wire,
(2) Over use of splices to re-connect previously separated wire or cable

(3) Expulsion fuses and other dangerous outdated circuit protection equipment
(4) Unshielded power pole mounted equipment with uninsulated connections, and
(5) Inadequate use of SCADA or Supervisory Data Acquisition and Control.

Example of a Fire Proof Electrical Pole with Additional Mounted Equipment

What follow is a section of Alameda County code written in 2005 to reduce fires and avian electrocutions at Altamont Pass. Many birds, especially those with large wing spans are electrocuted on power poles. Their burned bodies cause arc faults by contact with uninsulated cable, wire and connections. This is a wildfire ignition problem as well as a wildlife destruction problem.

These same corrections addressed below would reduce fire ignitions occurring in any power pole mounted equipment. No discussion of jumper wire/cable exists in PG&E's 2020 WMP.

ALAMEDA COUNTY COMMUNITY DEVELOPMENT AGENCY

ALTAMONT PASS WINDFARM FIRE REQUIREMENTS EXHIBIT C ALTAMONT PASS WINDFARMS FIRE REQUIREMENTS ADOPTED 9-22-2005

V. AVIAN ELECTROCUTION PROTECTION

A. Existing Overhead Power Lines. Riser poles, corner poles, poles with pole top transformers, capacitor banks and metering sets shall be equal to or exceed the following:
1. All jumper wires shall be insulated with a minimum 5 kV rating.
2. All exposed terminals shall be covered by approved wildlife boots.

EXHIBIT C- 5 - ALTAMONT PASS WINDFARM FIRE REQUIREMENTS 3.

All straight combination arms on riser poles shall be made of non-conductive material. Aluminum type material is prohibited.

4. Bonding of pole top devices mounted on non-conductive arms shall be done with insulated wire.

5. Poles with a history of electrocutions shall be modified on a case by case basis within 30 days from the date of the electrocution event.

Review of Selected Technology Proposals from PG&E and SCE and SDG&E

"5.3.3.17.3 Relationship Between System Hardening and Enhanced Vegetation Management

To better understand the interactions of multiple mitigations, PG&E previously performed a simple analysis of historical drivers of fire ignitions in HFTDs.**16** System hardening (covered conductor plus pole replacement, exempt equipment and transformer replacement) was identified to mitigate 56% of the historical ignitions by itself. EVM was identified to mitigate 31% of the historical ignitions by itself. When combined, system hardening and EVM were together identified to mitigate 79% of historical ignitions. Because of this projected increase in mitigation when adding EVM to system hardening in HFTDs, PG&E is continuing to perform EVM in locations where system hardening has been completed."….

Comment: PG&E is stating that EMV will continue even in proximity to circuits that have been "hardened" per their Plan. In this case "hardening" refers to cable, poles, expulsion fuses and transformers. It specifically excludes the use of modern computer operated circuit protection.

"5.3.3.3 Covered Conductor Installation
PG&E does not have a stand-alone targeted program to replace bare conductor with covered conductor. Instead, PG&E will install covered conductor and replace existing poles, cross-arms, and other equipment as part of PG&E's System Hardening Program. PG&E System Hardening Program is discussed in Section 5.3.3.17 below.
Furthermore, all new construction of more than 4 spans will require covered conductor and compliance with TD-9001B-009, excluding maintenance and emergency.

Comment: PG&E has dramatically increased the costs of replacing its uninsulated conductor cable and wire by stating its intention <u>to completely rebuild circuits from the ground up.</u> In many cases this is likely unnecessary. Also it slows down the process of installing insulated conductors, the most important upgrade necessary.

5.3.3.17.2 Distribution System Hardening
The Distribution System Hardening Program is an ongoing, long-term capital investment program to rebuild portions of PG&E's overhead electric distribution system. Under this program, PG&E is upgrading approximately 7,100 circuit miles in Tier 2 and Tier 3 HFTD areas.

PG&E operates over 25,000 circuit miles of distribution in Tier 2 and 3 landscapes. By some notion they decided that less than 1/3 of these circuits in HFTD (Tier 2 and 3) will be upgraded. Considering the age, condition and abundance of old equipment that PG&E retains in service, this is an unjustified evasion of their responsibility to operate safely.

"3.2 Recent Drivers of Ignition Probability, Last 5 Years
Operation of Non-Exempt Fuses
PG&E estimates it has roughly over 15,000 non-exempt fuse devices located in the Tier 2 and Tier 3 HFTD areas. As mentioned above, the operation of these fuses pose a potential fire risk and PG&E has a plan to replace these units over the next several years."

> **"5.3.3.7 Expulsion Fuse Replacement**
> PG&E proposes to eliminate non-exempt overhead line equipment in HFTD areas over time. Non-exempt equipment is equipment that may generate electrical arcs, sparks, or hot material during its normal operation. Due to these characteristics, PRC Section 4292 requires all utilities to maintain at least a 10-foot clearance of vegetation from the outer circumference of any pole that has non-exempt equipment…."

Comment: "**Non-exempt fuses" refer to fuse cutouts that CDF / CalFire determined years ago were dangerous for wildfire ignitions. The term "non-exempt" refers to standards set by CDF.** The Commission's General Order 95 is silent regarding the use of these dangerous devices. Non-exempt fuses have the same problems as all expulsion, or rupturing fuse capsules. When these devices trip (blow) on an overcurrent event the fuse expels hot molten metal and other hot debris onto the ground. This is not just a fire safety problem. Any pedestrian beneath one of these fuses when it blows can be injured severely. The fact that such clearly dangerous fire igniting equipment has remained in service so long after CDF's determination of a fire hazard is another indication of the outdated and obsolete nature of so much of PG&E's infrastructure.

Supervisory Data Acquisition and Control

SCADA is now an old technology. But its use by CA power utilities has been irregular at best. There is no direct statement provided by PG&E stating that they can remotely operate (open/de-energize) any of their reclosers, sectionalizers or other switch gear, outside of substation mounts. If PG&E has remote servo-operation of its reclosers, then they need to state this clearly and also explain to what extent they have this capacity. As far as I can determine a lineman must be on site to manually de-energize at pole mounted reclosers. It is a half solution to remotely detect an opening circuit breaker or a blown fuse. I and my associates in Santa Cruz County have repeatedly waited hours for power to be shut off to downed energized wires. This problem arises every few years during winter storms. Deadly electrical hazards called high impedance arc faults have been allowed to arc to earth for long periods as I waited for PG&E to send a lineman to manually cut power.

Major Advances in Circuit Fire Safety Are Available Today Through the Use of Computer Operated Protection Relays

PG&E, SCE and SDG&E have all begun to finally address the issue of advanced circuit protection.

SDG&E

“5.3.3.2.

The Advanced Protection (AP) program develops and implements advanced protection technologies within electric substations and on the electric distribution system. AP aims to prevent and mitigate the risks of fire incidents, create higher visibility and situational awareness in fire-prone areas, and allow for the implementation of new relay standards in locations where protection coordination is difficult due to lower fault currents attributed to high impedance faults.

More advanced technologies, such as microprocessor-based relays with synchrophasor/phasor measurement unit (PMU) capabilities, real-time automation controllers, auto-sectionalizing equipment, line monitors, direct fiber lines, and wireless communication radios comprise the portfolio of devices SDG&E installs in substations and on distribution circuits to allow for a more comprehensive protection system along with greater situational awareness via SCADA in the fire-prone areas of the HFTD. This portfolio of advanced technology allows SDG&E to implement new protection systems, such as:

Falling Conductor Protection (FCP) designed to trip distribution overhead circuits before broken conductors can reach the ground energized;

Sensitive Ground Fault Protection for detecting high impedance faults resulting from downed overhead conductors that result in very low fault currents;

Sensitive Profile Relay Settings enabled remotely on distribution equipment during red flag events to reduce fault energy and fire risk;

High Accuracy Fault Location for improved response time to any incident on the system;

Remote Event Retrieval and Reporting for real-time and post-event analysis of system disturbances or outages;

SCADA Communication to all field devices being installed for added situational awareness;

Increased Sensitivity and Speed of Transmission Protection Systems to reduce fault energies and provide swifter isolation of transmission system faults;

Comment: Some of these statements are redundant. But SDG&E appears to have investigated and has begun to install a broad array of Computerized Protection Relay capability. However I am not able to determine what equipment is actually installed.

An SDG&E engineer worked with Schweitzer Engineering and Quanta Technologies to publish a report in 2015 that explained the use of synchrophaser equipment to detect and very rapidly de-energize "downed energized wires" before the wire makes earth contact. This if functional would represent a major circuit safety advancement. This is similar to High Impedance Arc Fault Interruption but is even faster. The report called this "protection speed" or so fast that a falling cable is de-energized before it contacts the earth and begins to ignite a fire.

SCE

> "5.3.2.2.3 Transmission Open Phase Detection (SH-8)
> In 2019, SCE evaluated and deployed a protection scheme to detect an open phase (broken conductor) condition on its transmission system. SCE validated the open phase detection scheme by utilizing RSCAD (a power system simulations software) to model a transmission line and replicate an open phase condition. Through simulations testing, SCE optimized the open phase detection scheme and successfully detected an open phase condition, allowing de-energization of the line before it could contact a grounded object resulting in a fault event."

> "5.3.3.2.3 Rapid Earth Fault Current Limiter (REFCL)
> Through the past decade, research in Australia has led to the development of special protective technology for distribution system ground faults that are expected to greatly reduce the ignition probability. This technology is known as Rapid Earth Fault Current Limiters (REFCLs). REFCL is a system that quickly detects a ground fault (does not work for phase faults) and reduces the fault current to a level that would prevent an ignition even if there is direct contact of energized conductor with dry grass. In 2019, SCE performed a detailed technology feasibility assessment on how REFCL could be applied to its distribution systems. The assessment indicated that a large portion of the SCE's distribution electric system can accommodate system and protection design changes that could allow the implementation of this technology. REFCL offers improvements for minimizing ignition events from single line to ground faults."

> "5.3.3.2.4 Distribution Open Phase Detection (AT-3.4)
> SCE is investigating a distribution Open Phase Detection (OPD) scheme to determine open conductor conditions. This will allow the protection system to isolate a separated conductor prior to the wire contacting the ground, while leveraging existing distribution hardware in HFRA. In 2019, SCE evaluated the feasibility of performing a Distribution OPD pilot. In addition, SCE installed devices called Remote Sectionalizing Reclosers (RSRs), which include three phase voltage sensing and relaying capabilities that can be leveraged for detecting open conductor conditions. The circuitry between an interrupting device, like an RAR, and the end point RSR is monitored by the OPD scheme. Site reviews

of five RARs were performed where RSR devices had been previously applied as circuit ties. These five locations were selected for 2020 pilot installation efforts for advancing the distribution OPD scheme."

Comment: These technologies sound promising but they have are all investigations. The end of this letter will describe technologies available today that perform these same functions.

PG&E

5.1.D.3.4 SmartMeter™ Partial Voltage Detection (Formerly Known as Enhanced Wires Down Detection)
Type: Emerging (Pre-commercial) Technology
Description: This project is described in Section 5.3.2: Situational awareness and forecasting - SmartMeter™ Partial Voltage Detection (Formerly Known as Enhanced Wires Down Detection)

5.1.D.3.5 Line Sensor Devices
Type: New Technology (Commercially Available Offering)
Description: This project is described in Section 5.3.2: Situational Awareness & Forecasting – Line Sensor Devices
Program Area: Grid Design and System Hardening – New and Emerging Technologies
PG&E is reducing the risk of fire ignition and potential impacts on public safety through the adoption of system hardening methods enabled through innovative technologies. Mitigations leveraging new or emerging technologies include the following:

5.1.D.3.6 Proactive Wires Down Mitigation Demonstration Project
Type: Emerging (Pre-commercial) Technology
Description: The EPIC 3.15, Proactive Wires Down Mitigation demonstration project, seeks the ability to automatically and rapidly reduce the flow of current and risk of ignition in single phase to ground faults through the use of Rapid Earth Fault Current Limiter (REFCL). The REFCL Technology has been shown by the Victoria State Government (Australia) to directly reduce the risk of wildfires for single line to ground faults.4 REFCL works by moving the neutral line to the faulted phase during a fault, which significantly reduces the energy available for the fault. This significantly lowers the energy for single line to ground faults by reducing the potential for arcing and fire ignitions, as well as better detection of high impedance faults / wire on ground. REFCL technology is only feasible for three-wire uni-grounded circuits, which make up the majority of PG&E's distribution circuits within high fire threat areas. Successful implementation of REFCL technology has potential to more reliably detect high impedance ground faults and energized wire down events and minimize this risk to public safety. PG&E began planning the project in early 2019; demonstrations are planned to begin in 2020 on operational assets to test its capabilities and applications within PG&E's system.

Comments:

1) Using pings from SmartMeters is an after-the-fact indicator. This is not effective for determining the exact location of the fault nor does it automatically de-energized a faulted circuit.

2) REFCL Technology is the same system SCE is testing. This is not yet operational.

3) PG&E mentions High Impedance Arc Fault detection but makes no commitment to use it. It is not operational on PG&E's system

Major electrical engineering companies have already designed systems to use computer technology to make major advances in circuit safety with automatic fault detection and de-energization.

(1) General Electric https://www.gegridsolutions.com/multilin/

(2) Schweitzer Engineering Laboratories https://selinc.com/

Protective Relays

SEL revolutionized power system protection by building the first microprocessor-based protective relay. Today, SEL leads in protective relays with high-speed, secure, and dependable fault detection; accurate fault location; and comprehensive automation and control functions. SEL relays have the highest mean time between failures (MTBF) in the market (over 500 years).

Categories

Generator Protection
Substation Protection
Transmission Protection
Distribution Protection
Merging Units
Motor Protection

https://selinc.com/solutions/technologies/ - arc-sense-technology

"Arc Sense Technology
Detect More Faults Than Ever Before With Arc Sense Technology
Arc Sense technology (AST) from SEL is an innovative solution that detects high-impedance faults (HIF) on a distribution system. A high-impedance fault occurs when a conductor contacts a ground surface but does not produce a large fault current. SEL's patented AST detects and clears faults that might not be detected by conventional overcurrent elements. AST algorithms

provide improved fault detection over traditional methods as well as enhanced security when compared to existing technologies. Dedicated event reports provide information on high-impedance fault activity for event analysis."

(3) ABB https://new.abb.com/medium-voltage/apparatus/arc-fault-protection

ABB is a Swiss company that has developed an impressive array of circuit protection equipment for generation, transmission and distribution.

It is quite odd that the major IOUs in CA all appear to be re-inventing the wheel. The advanced computer operated circuit management and protection equipment that would dramatically improve the fire safety of CA power utility equipment has been through R&D and is available today from the companies above and others that I do not have time to mention.

It is the obligation of the Commission to get to the source of this confusion and require the installation of new safety relays and circuit management.

Conclusion

The equipment to solve the CA utility fire ignition crisis is available today *of the shelf*. The investment necessary will be costly. But this is absolutely necessary. No sensible person would accept that CA should rely upon outdated dangerous electrical systems and a permanent reliance upon Planned Power Outages every time the wind comes up in late summer and fall. We have the knowledge to avoid another wildfire disaster from failed outdated utility equipment.

Regards,
Kevin Collins