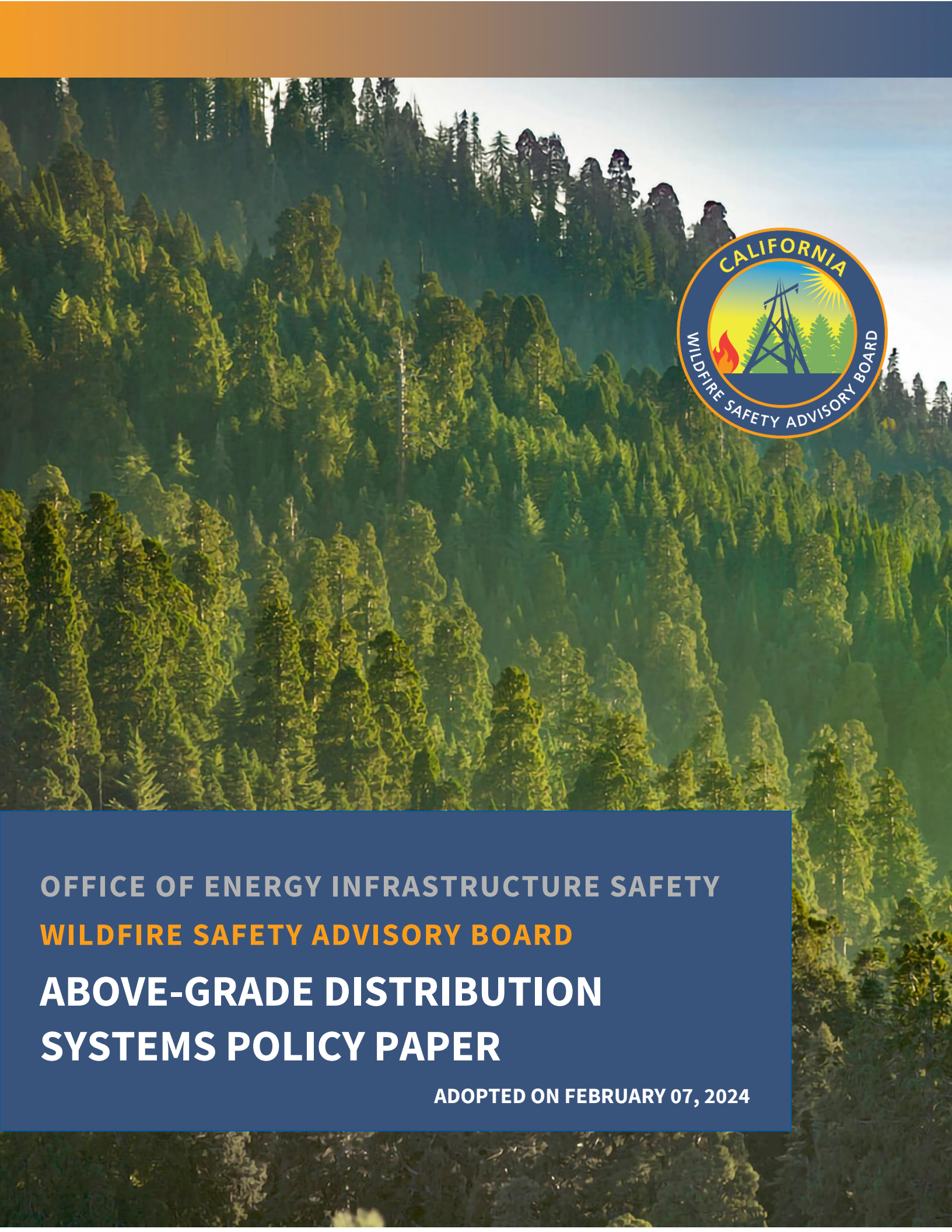


OFFICE OF ENERGY INFRASTRUCTURE SAFETY

WILDFIRE SAFETY ADVISORY BOARD

ABOVE-GRADE DISTRIBUTION SYSTEMS POLICY PAPER

ADOPTED ON FEBRUARY 07, 2024

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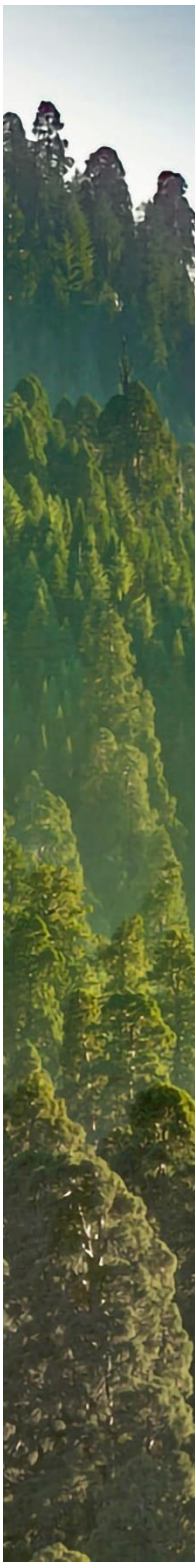
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EXECUTIVE SUMMARY



Above-Grade Distribution Systems (AGDS) are a group of nascent electric system construction methods in which conductors are installed in encased conduit that is mounted either above-, at-, or just below-grade. AGDS construction may offer a safe, time-efficient and cost-effective alternative to converting overhead lines to underground (undergrounding) and other fire hardening measures. Currently California Public Utilities Commission (CPUC) and certain local regulations (together, regulations) define the parameters of the California utility distribution network design and construction to a limited number of system designs and technologies. Technological advances to this infrastructure cannot be deployed without regulatory modifications to permit other options to undergrounding. To address this issue, the Wildfire Safety Advisory Board (Board) recommends modifying the regulations to include a clear and efficient regulatory pathway from the testing of experimental design to the inclusion into regulations for innovative designs and technologies that can revolutionize California's electric grid. Furthermore, the Board recommends that State consider expanding the regulations for electric utility system design and construction to include AGDS as an allowable construction technique.

BACKGROUND

California's investor-owned utilities are generally limited to overhead pole and wire construction and underground buried cable in conduit construction for their electrical distribution systems under General Orders (GO) 95 and 128 respectively. Underground construction is recognized as safer and more reliable than overhead as underground systems are not exposed to the same hazards, such as tree limbs, that can damage overhead facilities and cause ignitions. However, converting overhead systems to underground is an expensive process that is not suitable for all locations. One exception to the current distribution design and construction rules is GO 128 Rule 15.2, which allows the utilities to pilot experimental installations distinct from currently accepted overhead and underground construction.[i] Currently, there is one such experimental pilot utilizing AGDS construction methods that began construction in late 2023 in PG&E's service territory.[ii]

However, the next steps following this and any additional pilot projects are unclear. Currently, there are no agreed upon metrics for success in experimental pilots and no process exists within GO 128 for revising the current regulations to accommodate new designs should they prove to be successful.[iii] Thus, without a CPUC rulemaking or legislative changes, new, innovative and possibly superior system designs cannot be deployed at scale.

In 2019, the State Legislature passed Assembly Bill (AB) 111 which added Section 326.a.7 to the Public Utilities Code (P.U.C.) which requires the Office of Energy Infrastructure Safety (Energy Safety) to review utility safety regulations in coordination with the Board and provide recommendations to the CPUC to address the dynamic risk of climate change and mitigate

wildfire risk.[iv] As part of its effort to coordinate with Energy Safety and inform the review of the CPUC's utility safety regulations, the Board is preparing policy papers such as this.

On December 4, 2023, the Board held its fourth quarter meeting which included presentations from PG&E and Rudd Engineering[v] on an AGDS pilot in the town of Woodside, California and discussion. The presentations provided an overview of the technologies, components, construction techniques and details on the sites chosen.[vi] From these presentations and discussion, the Board and the public gained additional insight into the current state of the AGDS technology, where it can be optimally deployed, and some of the challenges and opportunities with the technology.

Discussion While the construction of AGDS systems is not broadly in use by electric utilities in California or in North America, above-grade construction has precedents in the gas transmission sector and by sewage utility corridors (utilidors) in locations with geologies where it is infeasible to construct underground sewage systems.[vii] In California, there has been a growing acceptance to alternative construction techniques to mitigate wildfire risk besides overhead bare conductor with its associated risks, and underground construction with its high costs (up to $6.1 million per mile).[viii] AGDS with its variety of benefits may soon be among the promising alternatives.

One of the main benefits of AGDS is that it offers a construction alternative to underground conversion where the geologies or topographies are unsuitable, such as in the California Sierra Nevada where many locations are characterized by solid granite and steep topography. This would be analogous to other alternative distribution construction techniques such as installing conduit in concrete stanchions or installing armored, exposed conduit along the sides of bridges crossing water bodies. This construction method would not be suitable for all locations but would be appropriate for low or no traffic areas such as in the wildlands.

From a safety perspective, AGDS may offer comparable wildfire ignition reduction risk to undergrounding and covered conductors due to encapsulation with materials such as polymers. Above-grade systems are protected against most vegetation contact that bare, overhead conductors are exposed to and are not at risk of falling over due to high winds knocking trees or limbs into the lines or poles toppling. By having the lines installed in secure, above-grade facilities, operators can significantly de-risk their systems in the event of high-fire risk conditions. For instance, the Dixie fire in PG&E's service territory, which resulted from a tree making prolonged contact with overhead powerlines, could have been prevented if above-grade construction was used on the system rather than overhead lines.

With proper engineering techniques, the safety profile of AGDS may be comparable to risers, where the overhead lines transition to underground, as conductors are encased in insulating materials so they can be securely mounted along the side of the pole. AGDS construction can also potentially reduce workforce injuries related to undergrounding work and/or vegetation management.

Additionally, AGDS systems may be constructed more quickly than undergrounding. AGDS components can be off-the-shelf and quickly installed. If, the relevant regulatory bodies

revise GO 128 or create a new GO to include AGDS as a permissible system design and clarify appropriate, compliant construction techniques, then construction timelines would likely be shortened upon implementation. In lieu of the current excavation processes involved with trenching, boring, and repaving roads as is the case for most undergrounding work, AGDS has the ability to be constructed above-grade or installed just below grade in shallower trenches. This may also limit the environmental impact by eliminating the need for intrusive excavation work in addition to fewer vegetation thinning operations. Moreover, AGDS construction would likely be more cost effective due to shortened project timeframes and reduced labor and machinery needed. In addition to reduced construction timeframes and costs, above-grade systems would also likely enjoy shorter permitting and environmental review processes relative to undergrounding.

Furthermore, above-grade systems may have a longer lifespan than overhead conductors and be as easy to maintain when installed with geolocation devices to help locate the system when covered in snow or debris, such as when a fault occurs or when it comes time to replace the conductor.

However, AGDS will not be able to scale and achieve any of these benefits without modifying or adding to the existing regulations concerning the design and construction of electric distribution systems. An additional caveat is that the benefits including cost and wildfire risk reduction are not fully clear as the technology has never been deployed to date. Additional testing will be needed to bear out the benefits and to shape any programs for deploying the technology at scale.

NEXT STEPS

The Board offers the following recommendations and next steps.

- The Board recommends that Energy Safety consider additional workshop or a working group to discuss the use of AGDS in electric distribution networks and better understand the use cases and benefits on such designs. This should include the utilities and stakeholders such as the CPUC, California Department of Forestry and Fire Protection (CAL FIRE) and the U.S. Forest Service.
- Energy Safety should encourage further utility-funded pilots of AGDS systems to test different design concepts while conducting its own study on the safety and efficiency of different AGDS systems designs. As part of this effort, the metrics of success should be clarified for these pilots.
- A regulatory process for considering AGDS as a permissible system design under GO 128 or in a new GO may be warranted.
- Further consideration and piloting may be warranted to determine if above grade, at grade or slightly below grade construction would be appropriate for electric transmission systems. Should AGDS be included in GO 128 or be written into a new GO following additional testing and regulatory review, updates to Electric Tariffs Rules 15

(distribution line extensions) and 20 (municipal-driven undergrounding) and P.U.C. Section 320 (undergrounding along State Scenic Highways) to include AGDS as an alternative construction technique for these programs may be warranted.

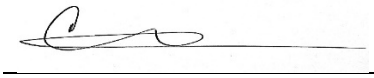
- A reconstruction standard should be considered for inclusion into the Electric Tariff Rules that would require all reconstruction of distribution systems following natural or manmade damage to either be constructed as underground or AGDS systems (if incorporated into GO 128 or written into a new GO for AGDS).
- An update of GOs 95 and 128 should be considered to include a clear and efficient path and regulatory process from the testing of experimental system design, construction and technologies to their inclusion into regulations. This should include determining metrics for success, setting clear and predictable timeframes for an application, advice letter, or other process. This should also include creating an equivalent of GO 128 Rule 15.2 for GO 95 to test innovative overhead system designs.
- If AGDS is incorporated into the GOs, then Energy Safety should consider engaging with stakeholders and local governments to include AGDS as an acceptable deviation with municipal requirements for underground line extensions for new construction.[ix]

APPROVAL

The California Wildfire Safety Advisory Board's Policy Paper on Above-Grade Distribution Systems was approved on February 7, 2024, and are hereby executed.



Jessica Block, Chair



Christopher Porter, Vice Chair



Ralph M. Armstrong Jr., Board Member



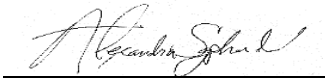
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[i] GO 128 Rule 15.2 reads:
It is the intent of this rule to assist in advancements or changes in the art without mitigation of safety. For this purpose, experimental installations which deviate from one or more of these rules may be made, provided: Precautions are taken to secure safety to property and to persons engaged in the construction, maintenance, and operation of underground systems, and to the public in general; and A full statement of the conditions involved in such experimental installation is filed with the Commission not less than 15 days prior to experimental modification of facilities or construction of any experimental facilities. Where such experimental construction would result in the installation of direct buried cable, duct, grounds, handholes, manholes or services with clearances, depths or protection other than provided by these rules, a copy of such statement shall concurrently be mailed to all utilities, local agencies or persons likely to be affected by such installation.

[ii] The project began construction in late 2023 in the small, rural town of Woodside, California in the San Francisco Bay Area. The project will convert 0.75 miles of overhead distribution lines to the ground-mounted system which will be characterized by cable in conduit that will be encapsulated in a geopolymer composite and fully enclosed in an exterior fire-proof cable tray assembly. (Jim Gill, "Re: Statement of Conditions for Experimental Installation of Ground Level Distribution System Pursuant to General Order 128, Rule 15.2," in PG&E Letter to the CPUC dated March 28, 2023, p.2,4, https://energysafety.ca.gov/wp-content/uploads/2023/09//pge_atch01_experimental-installation-letter.pdf).

[iii] Similarly, GO 95 also lacks such a process and furthermore does not have an equivalent rule for experimental overhead system design.

[iv] P.U.C. §326.a.7 requires energy Safety to "Review, as necessary, in coordination with the California Wildfire Safety Advisory Board and necessary commission staff, safety requirements for electrical transmission and distribution infrastructure and infrastructure and equipment attached to that electrical infrastructure, and provide recommendations to the commission to address the dynamic risk of climate change and to mitigate wildfire risk."
https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=326&lawCode=PUC.

[v] Rudd Engineering is a consulting firm working on the behalf of EnergyLink, which is the supplier of PG&E's AGDS pilot components.

[vi] For more information, including a recording of the fourth quarter Board meeting, please see the meeting webpage at https://energysafety.ca.gov/events-and-meetings/events/wildfire-safety-advisory-board-meeting-12-4-2023/.

[vii] For instance, in Canada's far northern communities such as in Inuvik, utilities cannot be constructed undergrounded due to the permafrost. (Mackenzie Scott, "Inuvik's utilidor, nearly 65 years old, will cost $80M to replace," *CBC*, December 11, 2019, https://www.cbc.ca/news/canada/north/inuvik-utilidor-replacement-1.5391835).

[viii] California Public Utilities Commission, "CPUC Undergrounding Programs Description," accessed July 10, 2023, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/electric-reliability/undergrounding-program-description.

[ix] For instance, the City of Palo Alto has had a requirement since 1965 that all new electric distribution line extensions are to be constructed underground. (Palo Alto Municipal Code Chapter 12.16, https://codelibrary.amlegal.com/codes/paloalto/latest/paloalto_ca/0-0-0-69173#JD_12.16.010).