

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	CalAdvocates 022-Q002		
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PG&E Witness:		Requester:	Holly Wehrman

QUESTION 002

During the Q&A portion of the Grid Operation, Design, and Maintenance session of the WMP workshop held on April 27, 2023, a caller raised concerns about the feasibility of undergrounding in rocky and steep terrain and in wetlands. In response, PG&E stated that it was evaluating tools and techniques to perform undergrounding in those areas.

Regarding undergrounding in areas with *steep and rocky terrain*:

- a) Please list and describe the current difficulties or obstacles to undergrounding in rocky and steep terrain.
- b) What tools and techniques is PG&E evaluating to improve the feasibility of undergrounding in rocky and steep terrain?
- c) What is PG&E's estimate of the current unit cost of undergrounding in rocky and steep terrain?
- d) Please state whether the unit cost provided in response to part (c) is based on mileage of overhead circuits removed or mileage of underground circuits installed.
- e) Regarding the unit cost given in response to part (c) of this question, when does PG&E expect to be able to reduce the unit cost to less than \$3.0 million per mile?
- f) Of the WMP undergrounding projects that PG&E plans to execute in 2023-2024, do any involve installing a significant amount (greater than 0.1 miles) of underground conductor in rocky and steep terrain?
- g) If the answer to part (f) is yes, please list each such project.

ANSWER 002

- a) The primary difficulty of steep terrain is accessing the site with the heavy equipment necessary to perform undergrounding work. Even when the site can be accessed, in some cases it may be unsafe to operate equipment on steep terrain which therefore limits the options available to the construction crew for undergrounding the electric line. For rocky terrain, the primary obstacle is the time and labor required to dig to the required trench depth. Digging in hard rock may wear out equipment, require non-standard / larger equipment (e.g., a rock wheel, hoe ram), or potentially be so difficult and time-consuming that it requires re-routing a project. In extreme circumstances, PG&E has had to use explosives to blast certain hard rock or break

up rock using expansive epoxy (e.g., drill holes in the hard rock and add epoxy to the holes to expand and crack the hard rock). At a minimum digging in hard rock is more time consuming and costly and may simply be infeasible in some cases.

- b) For rocky and/or steep terrain, PG&E is currently piloting at-grade construction where a cable “tray” is installed inside a casing at ground level to house the electric cables. PG&E has also engaged with some early-stage technologies to dig / drill / excavate in hard rock areas including “rock plasma blasting”. Some existing technologies, like Rock Wheels and boring machines, can operate effectively in certain environments but not others (“cobble” environments with a collection of hard rock but not a uniform consistency can be particularly challenging).
- c) PG&E has estimated that it can cost up to three times as much to underground lines in areas that are steep and have hard rock as compared to “normal” environments. Of course, the exact conditions of any particular project are highly variable and it is very unlikely that any project would be completely in hard rock and/or steep terrain conditions. Another data point is that some PG&E contracts with the civil construction vendors performing undergrounding work identify a “cost adder” that is applied to the linear footage of trench installation when hard rock encountered, that adder could range from approximately \$50 - \$300 per linear foot (which could mean an adder of ~\$275K to \$1.6M per mile, just for the civil construction portion of the undergrounding project cost).
- d) All of PG&E’s unit cost data or forecasts related to Undergrounding are based on the underground primary distribution circuit miles installed.
- e) We do not have an estimate of the total unit cost in rocky and steep terrain in part because, as noted in the response to subpart c) no project is completely made up of hard rock and steep terrain, most projects contain some mix of terrains and soil conditions. As noted in PG&E’s GRC System Hardening Underground Unit cost forecast by year (Table 4-11), PG&E expects to reduce total unit cost of the portfolio of undergrounding work to less than \$3.0 million per mile in 2025. Those unit cost forecasts represent the average across the portfolio of all undergrounding work, meaning that some projects will still cost more than \$3 million per mile (including potentially hard rock or steep terrain projects) while others will be executed for less than the targeted unit cost (e.g. \$2.96 million per mile in 2025).
- f) The significant majority of undergrounding projects in the WMP portfolio are expected to encounter some level of rocky and/or steep conditions. However, at this time PG&E does not track data on the terrain type by mile for completed or planned undergrounding projects. As noted previously, the severity of the rocky and/or steep conditions varies significantly across each project.
- g) Not applicable. PG&E does not track the terrain type by mile when undergrounding miles.