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PREPARED TESTIMONY OF
ERIC BORDEN

ADDRESSING SAN DIEGO GAS AND ELECTRIC'S TEST YEAR 2024 WILDFIRE MITIGATION HARDENING MEASURES AND RELATED WILDFIRE RISK MODELING ISSUES

Submitted on Behalf of

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. Introduction and Overview of Recommendations[1]

Compared with the other 187 Investor Owned Utilities (IOUs) in the United States, San Diego Gas and Electric (SDG&E) has the *fifth* highest electric rates as of 2021,[2] including a summer on-peak rate of *83 cents* for the utility's default time of use rate.[3] Given these circumstances, one would think SDG&E might utilize its over-a-decade head start on wildfire mitigations, along with vastly improving wildfire risk modeling efforts, to carefully target its wildfire mitigations in a manner that maximizes risk reduction benefits while minimizing rate impacts on their customers. Rather than take advantage of its experience in wildfire mitigation and risk management, however, the utility makes virtually no use of risk analysis, risk spend efficiency (RSE) calculations, nor any other data at its disposal to make a case to the Commission for why its massive cost proposals for hardening measures should be adopted. Under even a minimal standard of review, SDG&E's failure to support its request with adequate evidence would support the rejection of its entire proposal.

That said, we certainly recognize and agree that the utilities, even SDG&E, must continue to act aggressively to mitigate the risk of catastrophic wildfire. That's why we show, unequivocally with the utility's own risk data, that wildfire risk mitigation can be done in a much more reasoned and cost-effective manner to reduce the risk of wildfire caused by SDG&E's system while moderating the impact on customer rates.

The purpose of this testimony is to address SDG&E's largest wildfire capital expenditures, "strategic undergrounding" and covered conductor deployment, both considered grid "hardening" activities. We wish to note upfront that these are not the only two programs SDG&E has proposed to mitigate wildfire and Power Safety Public Shutoff (PSPS) risk. In addition to its $1.9 billion in proposed hardening programs SDG&E's programs include $400 million in capital

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[1] This testimony is sponsored by Eric Borden from Synapse Energy Economics. His resume and a summary of previous testimonies is provided as an attachment to this testimony.

[2] Electricity Information Administration (EIA), Table 6, https://www.eia.gov/electricity/data.php.

[3] SDG&E TOU-DR1, as of 1/1/23, https://www.sdge.com/sites/default/files/regulatory/1-1-23%20Schedule%20TOU-DR1%20Total%20Rates%20Table.pdf.

and $700 million in O&M expenditures from 2024-2027 (in 2021 constant dollars).[4] This testimony does not address that spending.

We make the following findings and recommendations regarding SDG&E's proposal in the ensuing sections:

- Proportionally, SDG&E faces less wildfire risk than the other large IOUs, yet its proposal would spend significantly more on wildfire mitigation on a per customer and per mile basis;
    - In addition to facing less risk, SDG&E has already mitigated substantial wildfire risk since the Witch Fire, the impact of which is not reflected in the utility's proposal;
- SDG&E's undergrounding-first proposal was proposed with no affordability constraints, and has little rationale other than to maximize capital spending.
    - SDG&E seeks to underground a slightly *higher* percentage of its High Fire Threat District (HFTD) as PG&E over the next ten years;
- When corrected, SDG&E's cost-effectiveness analysis shows the risk reduction benefits of undergrounding for mitigating wildfire risk are significantly less than the costs.
- Analysis of SDG&E's risk data demonstrates that covered conductor is significantly more cost-effective than undergrounding across the utility's High Fire Threat District (HFTD).
- A more reasoned approach to undergrounding and covered conductor deployment allows TURN's proposal to provide 78 percent of the wildfire risk reduction benefits for 35 percent of the costs compared with SDG&E's proposal, a savings of over $1 billion (shown below) from 2024-2027.
    - The difference in risk reduction between the proposals **represents a less than 1 percent impact compared with total statewide wildfire risk.**[5]

When calculated correctly, we find that the cost-effectiveness of undergrounding for mitigating wildfire risk is significantly worse than virtually all other mitigation measures.

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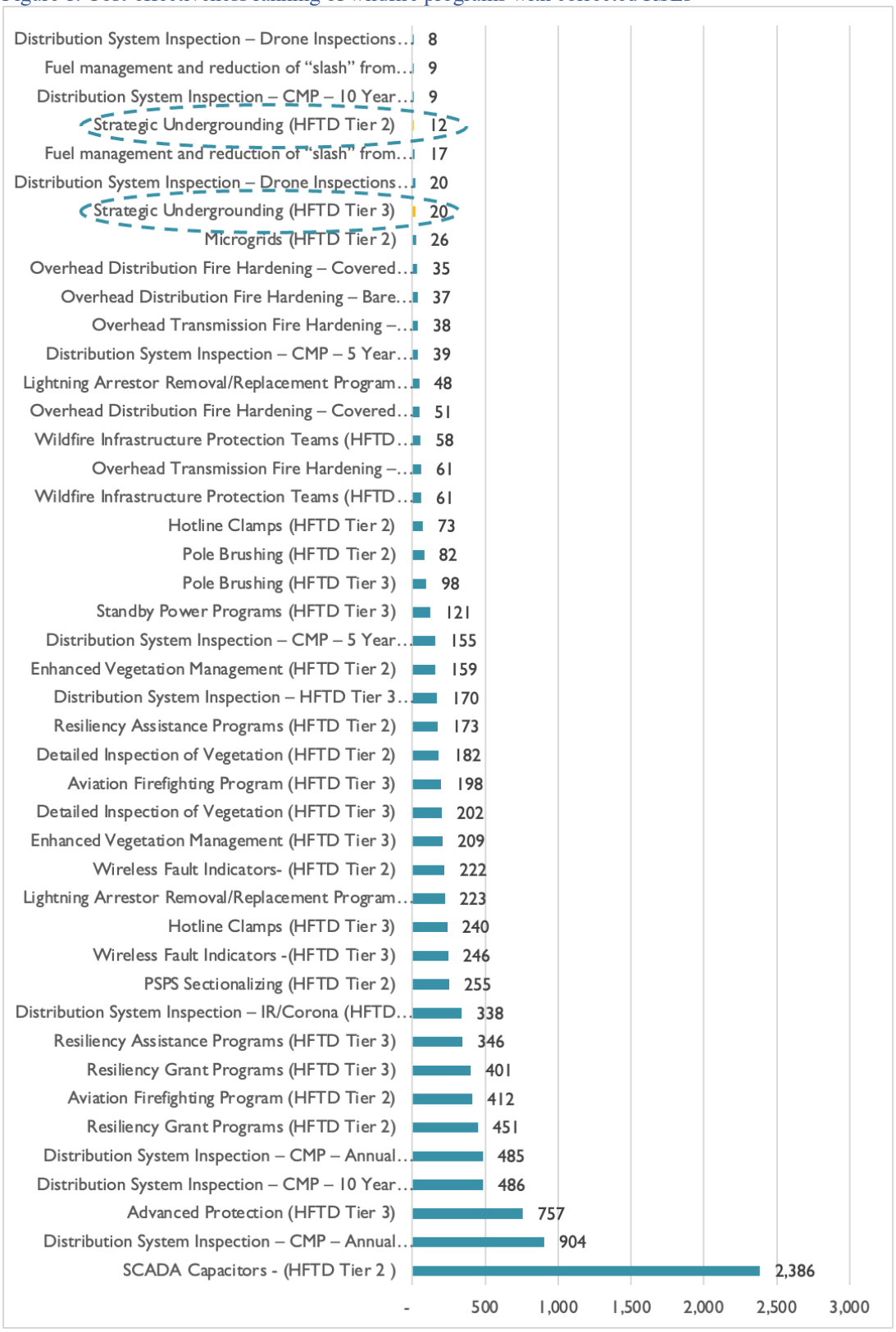
[4] See Figure 2 for proposed capital expenditures. SDGE-13, p. JTW-B-8 for O&M expenditures in TY 2024. SDG&E states in TURN-15, question 4d, that "SDG&E does not forecast project-specific Post-Test Year (PTY) costs, except for those identified as PTY capital exceptions." We therefore assume flat O&M costs from the 2024 forecast in 2021 dollars. All dollar figures are presented in constant 2021 dollars to be consistent with SDG&E's testimony. A note of caution: the utility's escalation factors are meaningful, so actual costs will be much higher, around an additional 11 percent in the test year, and going up in the post test years. TURN-30, question 3, Excel attachment, contains escalation factors for wildfire programs.

[5] Since TURN's proposal reduces 12 percent less risk than SDG&E's, and we estimate San Diego's statewide wildfire risk is around 6 percent at most, this represents a .72 percent difference. TURN's proposal costs 35% or $1.2 billion less than SDG&E's.

Figure 1. Cost-effectiveness ranking of wildfire programs with corrected RSEs[6]



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The tables below summarize TURN's and SDG&E's proposals for undergrounding and covered conductor.[7]

Table 1. Undergrounding miles and costs, TURN vs. SDG&E

	2024	2025	2026	2027	Total
	Miles - Undergrounding				
TURN	35	35	35	35	140
SDG&E	125	150	160	170	605
TURN-SDG&E	-90	-115	-125	-135	-465
	Costs - Undergrounding ($M, 2021)				
TURN	$ 82.6	$ 94.7	$ 95.5	$ 96.8	$ 370
SDG&E	$ 295.0	$ 405.8	$ 436.7	$ 470.1	$ 1,607.5
TURN-SDG&E	$ (212.4)	$ (311.1)	$ (341.2)	$ (373.3)	$ (1,238.0)

Table 2. Covered conductor miles and costs, TURN vs. SDG&E

	2024	2025	2026	2027	Total
	Miles - Covered Conductor				
TURN	100	100	100	100	400
SDG&E	60	40	40	40	140
TURN-SDG&E	40	60	60	60	260
	Costs - Covered Conductor ($M, 2021)				
TURN	$ 71.9	$ 71.9	$ 71.9	$ 71.9	$ 287.4
SDG&E	$ 59.8	$ 60.4	$ 63.3	$ 67.2	$ 250.7
TURN-SDG&E	$ 12.0	$ 11.5	$ 8.5	$ 4.7	$ 36.7

[6] Incorporates changes from TURN-4, and modifications to RSE described in Section IV. Cross functional factor (CFF) costs are included in TURN-4 alternative calculations, so we have also included those costs here to accurately compare our adjusted RSEs with TURN-4 values. This did not affect the calculation significantly.
[7] Since over 99 percent of SDG&E's undergrounding and covered conductor programs are capital expenditures, we assume all costs are capital in this testimony.

Table 3. All hardening miles and costs, TURN vs. SDG&E

	2024	2025	2026	2027	Total
	Total Miles - Hardening (UG + CC)				
TURN	135	135	135	135	540
SDG&E	185	190	200	210	745
TURN-SDG&E	-50	-55	-65	-75	-205
	Total Costs - Hardening ($M, 2021)				
TURN	$ 154.5	$ 166.5	$ 167.4	$ 168.6	$ 657.0
SDG&E	$ 354.8	$ 466.1	$ 500.1	$ 537.3	$ 1,858.3
TURN-SDG&E	$ (200.3)	$ (299.6)	$ (332.7)	$ (368.6)	$ (1,201.2)

Undergrounding represents a massive capital investment and the accompanying expansion of rate base. It is in the utility self interest to exploit wildfire fears to invest in capital intensive mitigations; it is the Commission's job to constrain utility spending to maximize risk reduction consistent with just and reasonable rates. TURN offers a more than reasonable alternative approach to hardening measures that provides significant wildfire mitigation benefits while moderating the impact on customer rates.

Section II of this testimony provides an overview of SDG&E's support for its undergrounding proposal, finding it is almost entirely lacking and not based on risk, seen in a comparison to other utility risk and spending proposals. Section III provides an overview SDG&E's wildfire risk modeling. Section IV discusses our finding regarding the primary flaws with SDG&E's RAMP RSE risk modeling: inclusion of a flawed PSPS risk calculation for the undergrounding program, lack of tranche granularity, an unreasonable assumption for the number of acres burned in a catastrophic wildfire, and not including an overhead to underground conversion factor. Section V corrects SDG&E's RSE calculation based on the issues presented in Section IV – this shows that undergrounding is one of the least cost-effective alternatives and that the costs of undergrounding exceed this mitigations' wildfire risk reduction benefits. Section VI explains why the utility should increases its forecast of covered conductor deployment, complemented by more targeted undergrounding. Finally, Section VII provides additional analysis to compare SDG&E's and TURN's proposals.

II. SDG&E's Wildfire Hardening Program is Burdensome and Unsupported

A. SDG&E Proposes Extraordinary Spending on Undergrounding but does not Adequately Support the Proposal

SDG&E proposes a multitude of programs to address wildfire risk and the impacts of Public Safety Power Shutoffs (PSPS) events. However, by far the largest capital expenditure spending category is undergrounding of electric lines – the single most expensive mitigation measure at SDG&E's disposal. The second largest expenditure is covered conductor, though SDG&E reduced its forecast for covered conductor and increased its undergrounding forecast mid-way through this proceeding. Together, these two programs comprise 82 percent of wildfire mitigation capital expenditures, 71 percent and 11 percent for undergrounding and covered conductor, respectively.[8] The costs and number of miles these costs correspond to are shown in the figures below.

[8] TY 2024 figures are provided in Appendix B of SDG&E-13-2R. Total expenditures for each year (2024-2027) provided in TURN-15, Question 4c-d (Excel attachment). Costs for post test years (PTYs) were found in SDG&E's risk workpapers for each program, which I adjusted for SDG&E's revisions in SDG&E-13-2R, Table JW-75, p. JTW-173. This table also shows the number of miles for the revised proposal.

Figure 2. Covered conductor, undergrounding, and wildfire capital expenditures ($2021, millions)

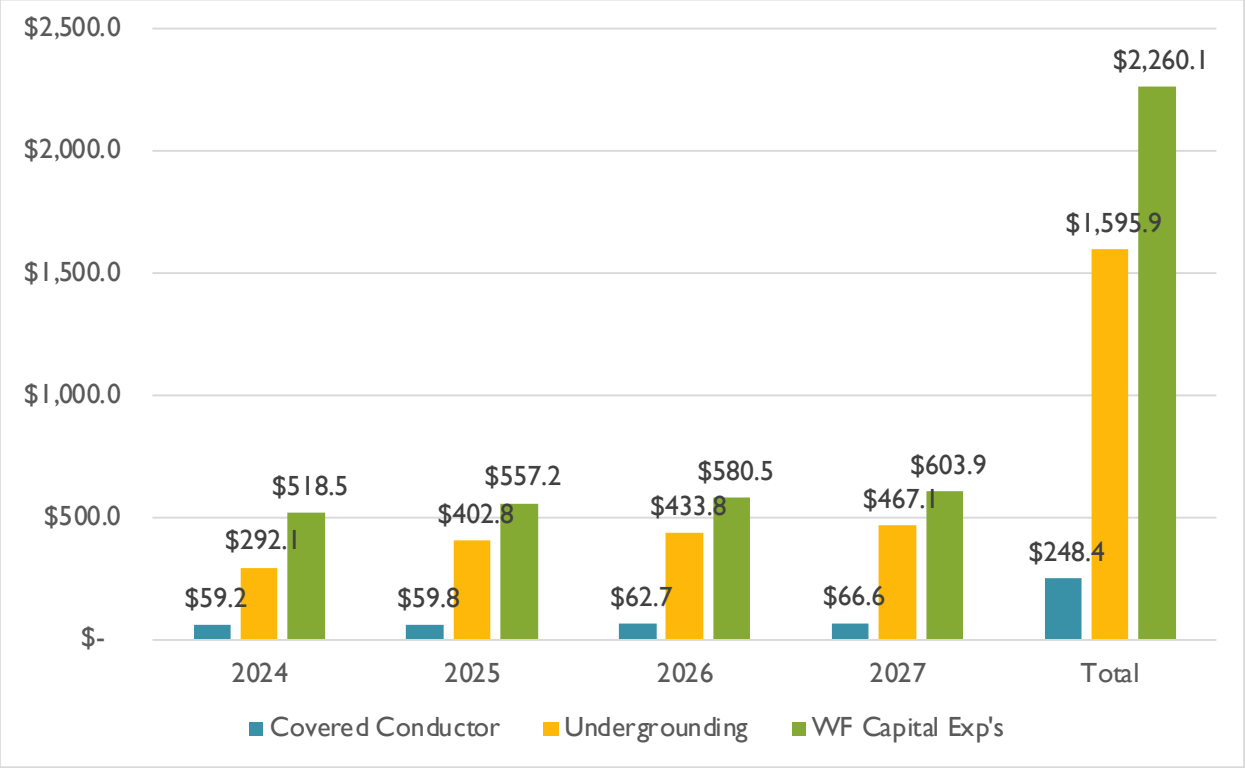
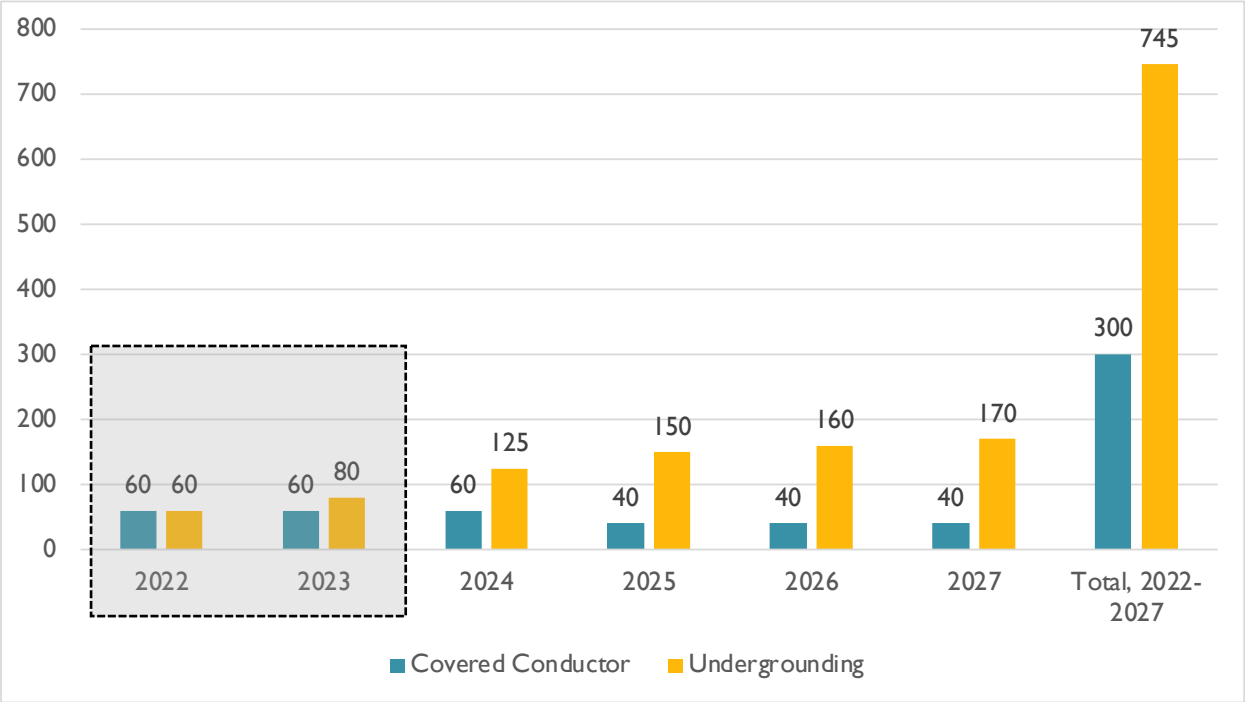


Figure 3. SDG&E proposed covered conductor and undergrounding miles per year



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From 2022-2027, SDG&E proposes cumulative mileage of 300 and 745 miles for covered conductor and undergrounding, respectively. While 2022 and 2023 are not within scope of this GRC for planning purposes, from a risk reduction perspective they, along with previous risk reduction activities, are relevant to the level of risk addressed by SDG&E's proposal and should be considered by the Commission in its decision-making.[9]

SDG&E touts the high mitigation effectiveness of undergrounding for both wildfire mitigation and PSPS. It states that based on "careful analysis of the data and the cost impacts of various mitigation strategies, SDG&E selected its course because it provided the best value approach—achieving the most risk reduction possible without exponential increases in costs."[10] In one of the limited number of analytical statements in its testimony, the utility quantifies its expected risk reduction over the next ten years (though not for this rate case) – "while they come at a cost, SDG&E estimates that it can achieve an 83% reduction in risk through 2031 by implementing the measures incorporated into its WMP."[11] Yet the only figure analyzing the relationship in risks and costs in the utility's wildfire testimony has no units and is "illustrative," intended to show the "relationship between cost and risk reduction."[12]

Despite repeated discovery requests, SDG&E was not able to provide any quantitative affordability constraints used to formulate its proposal, simply affirming that its approach is a "best value approach – achieving the most risk reduction possible at the most reasonable cost to customers." These platitudes have not been supported by analysis, data, or facts.[13]

SDG&E's longer term "plan" is to underground 1,500 miles of its High Fire Threat District (HFTD) through 2032,[14] equivalent to around 43 percent of its HFTD. This is a slightly higher

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[9] These years' forecasts are included when comparing risk reduction for TURN's vs. SDG&E's proposal.
[10] SDG&E-13, p. JTW-10.
[11] SDG&E-13, p. JTW-10.
[12] TURN-15, question 6a. The utility would not or could not share any data behind SDG&E-13, Figure JW-1, p. JTW-11.
[13] TURN-15, question 3.
[14] TURN-15, question 24e. This is in underground miles. "SDG&E estimates that the 1,500 miles of underground distribution will replace approximately 1,250 miles of overhead distribution."

percentage than proposed by PG&E in its equally egregious and unfounded proposal to underground 10,000 miles of its HFTD over the next 10 years, equivalent to 40 percent of that utility's HFTD.[15]

SDG&E does not provide expected costs through 2031 to accomplish its intended risk reduction – based on current unit costs, this will amount to nearly $4 billion (2021 dollars) which equates to between $8 and $12 billion over the life of the asset once the full revenue requirement is totaled.[16] For context, this is significantly more than the current annual revenue requirement for the entire utility, around $5 billion.[17]

B. SDG&E's Proposal Does Not Account for its Level of Risk or Previous Wildfire Mitigation Investments

1. SDG&E's Territory Represents Less Risk than Other Utilities Yet its Proposal is Less Affordable

Multiple sections of this testimony demonstrate that SDG&E's undergrounding and covered conductor proposals do not adequately incorporate cost-effectiveness and affordability. One way to view this issue is to examine the existing level of risk SDG&E's service territory. The following figures show a variety of metrics by which to assess wildfire risk in each of the utility territories: red flag warning (RFW) circuit mile days for each of the utilities;[18] the number of distribution ignitions at each utility;[19] the percent of acres burned in San Diego since 2008 (the last year available from CalFire records);[20] and the percent of damages incurred in San Diego

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[15] 1,500 / 3,455 HFTD miles = 43% (SDG&E). 10,000 / 25,080 HFTD miles = 40% (PG&E). HFTD miles from utility 2022 WMP filings. This does not account for an overhead to underground conversion ratio, which means less overhead miles will be removed than indicated here.

[16] I expect that between inflation and revenue requirement additions (return, taxes, etc.) revenue requirement would more than double from constant 2021 dollars over the 40 year depreciation life of underground assets.

[17] See 2022 Senate Bill 695 Report from the CPUC, p. 29.

[18] 2022 Wildfire Mitigation Plan Filings (WMP Filings), Excel Table 6, for each utility. RFW circuit mile days are "calculated as the number of overhead circuit miles that were under an RFW multiplied by the number of days those circuit miles were under said RFW. For example, if 100 overhead circuit miles were under an RFW for 1 day, and 10 of those miles were under RFW for an additional day, then the total RFW OH circuit mile days would be 110."

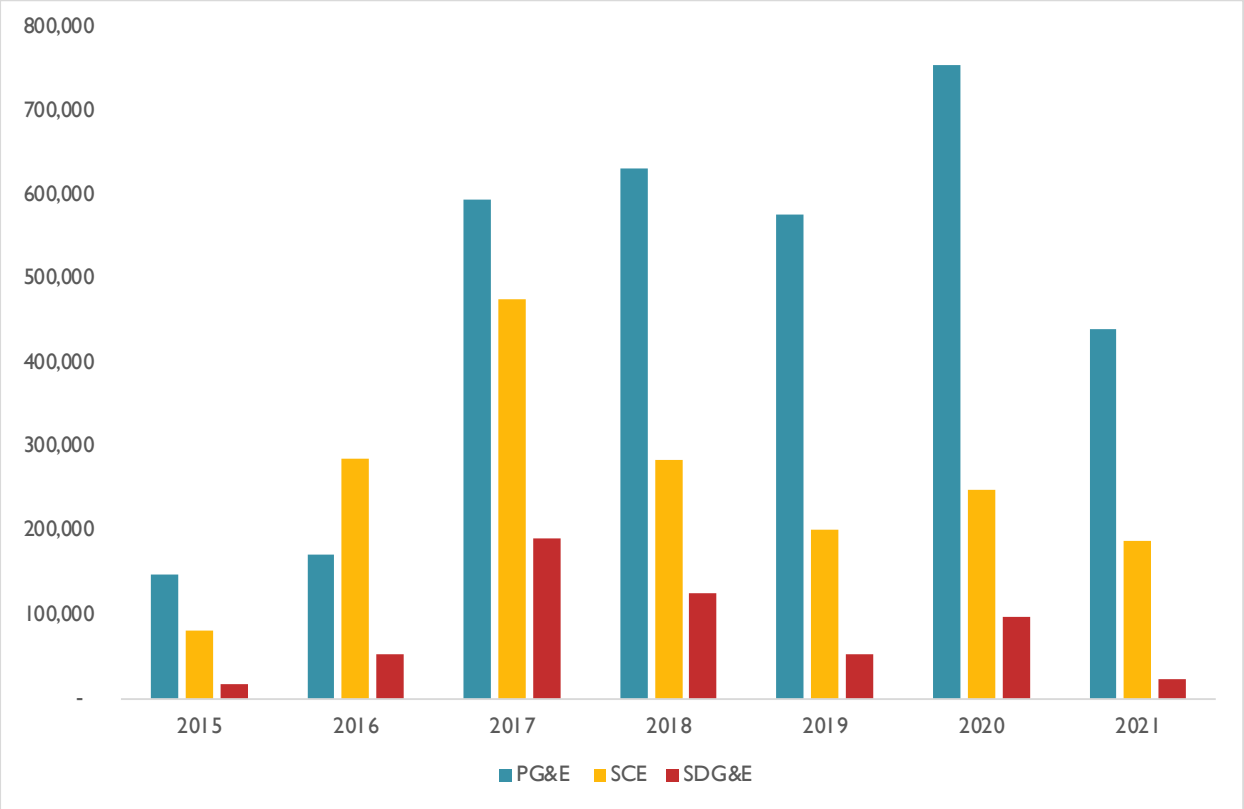
[19] WMP Filings, Excel Table 7.2.

[20] Analyzed from CalFire Redbook Data, CalFire, https://www.fire.ca.gov/our-impact/statistics.

County historically of the statewide total. Since utility wildfire risk is a portion of total statewide wildfire risk, these figures can be viewed as identifying the *maximum* potential level of risk for a wildfire caused by SDG&E.

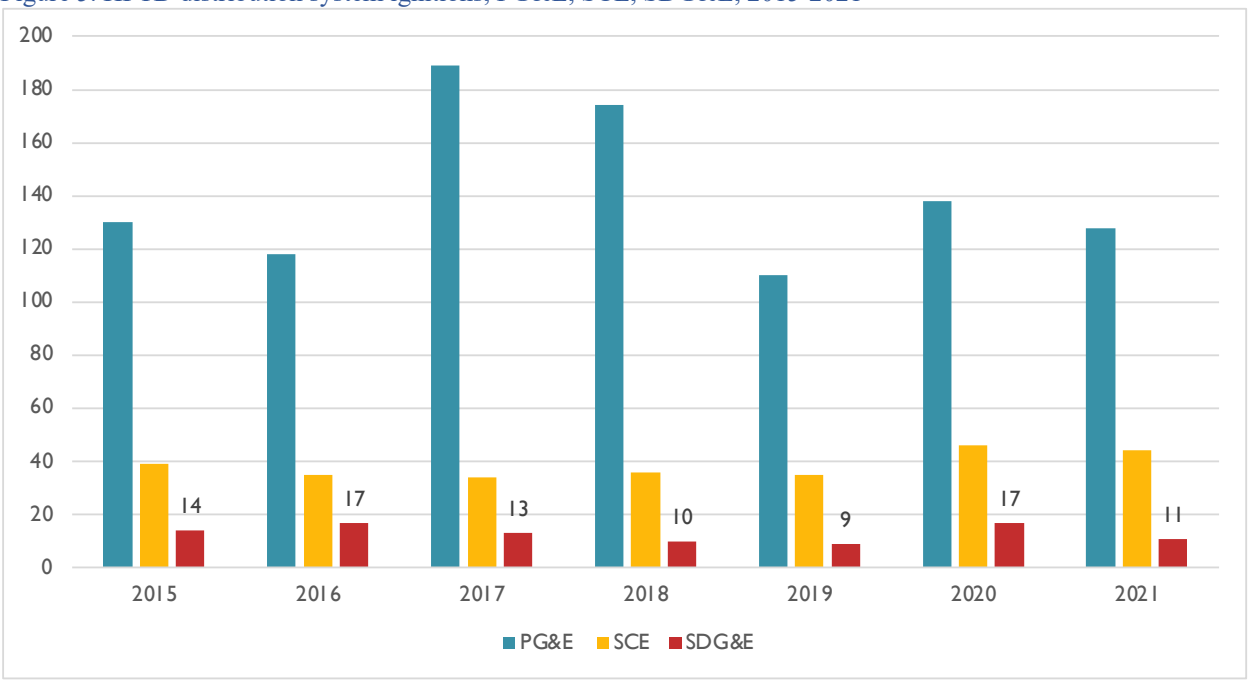
The figure below shows that risky wildfire weather (high winds on hot, dry days) comes in contact with less miles over less time for SDG&E's system than the other utilities. Red Flag Warning (RFW) circuit mile days is the number of overhead circuit miles that were under an RFW multiplied by the number of days of the RFW. Between 2015 and 2021, PG&E had between 212 percent and 1,819 percent greater number of RFW circuit mile days. –SCE had between 126 percent and 722 percent more RFW circuit mile days over the same time period.

Figure 4. Red flag warning circuit mile days: PG&E, SCE, SDG&E, 2015-2021



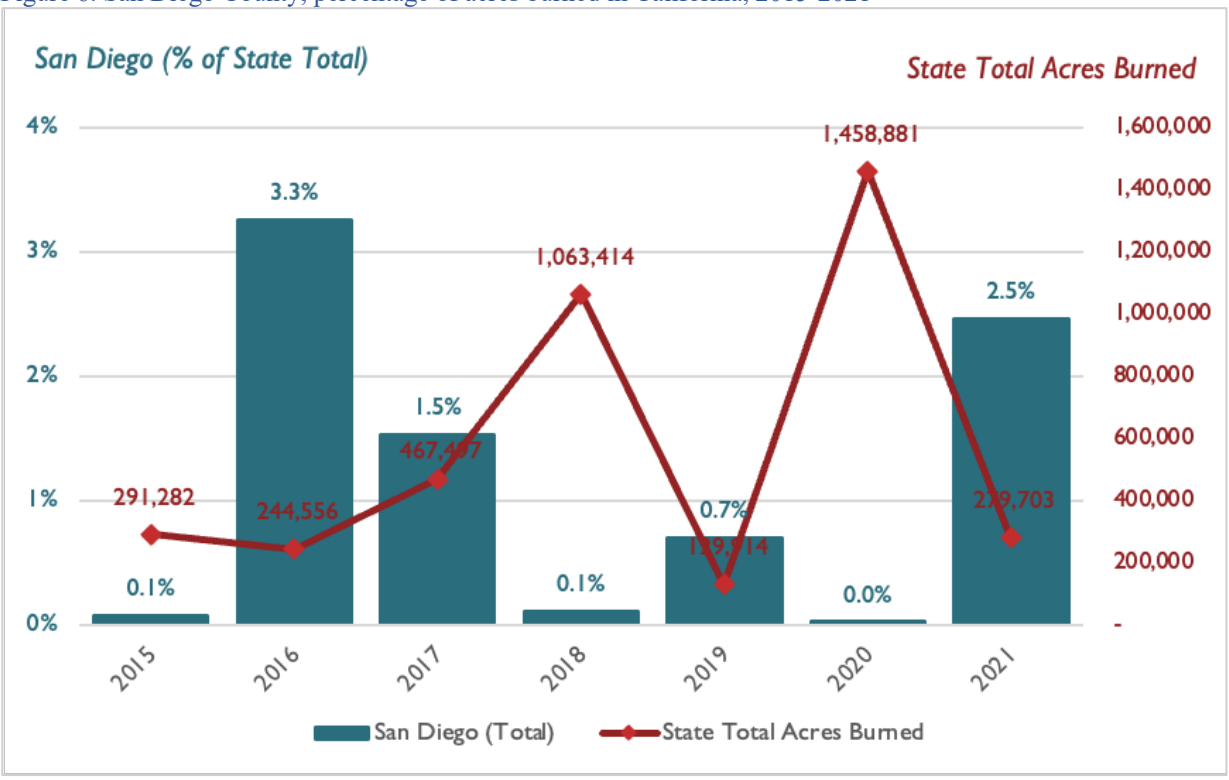
Similarly, SDG&E faces significantly fewer ignitions on its system each year than its sister utilities.

Figure 5. HFTD distribution system ignitions, PG&E, SCE, SDG&E, 2015-2021



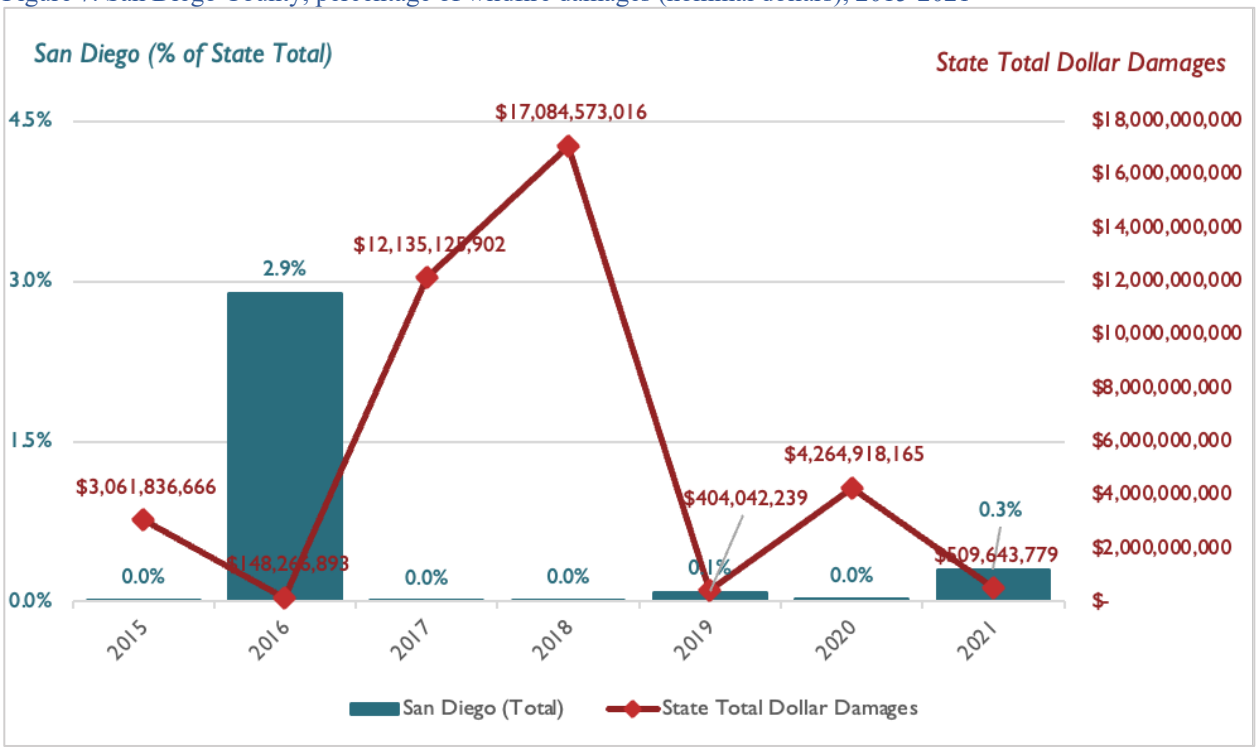
Acres burned in SDG&E's service territory, approximated here by San Diego County, was between 0 and 3.3 percent of the total acres burned across the state from 2015-2021.

Figure 6. San Diego County, percentage of acres burned in California, 2015-2021



Finally, property and other types of economic damages caused by wildfires in San Diego County were between 0 and 2.9 percent of the statewide total from 2015-2021.

Figure 7. San Diego County, percentage of wildfire damages (nominal dollars), 2015-2021

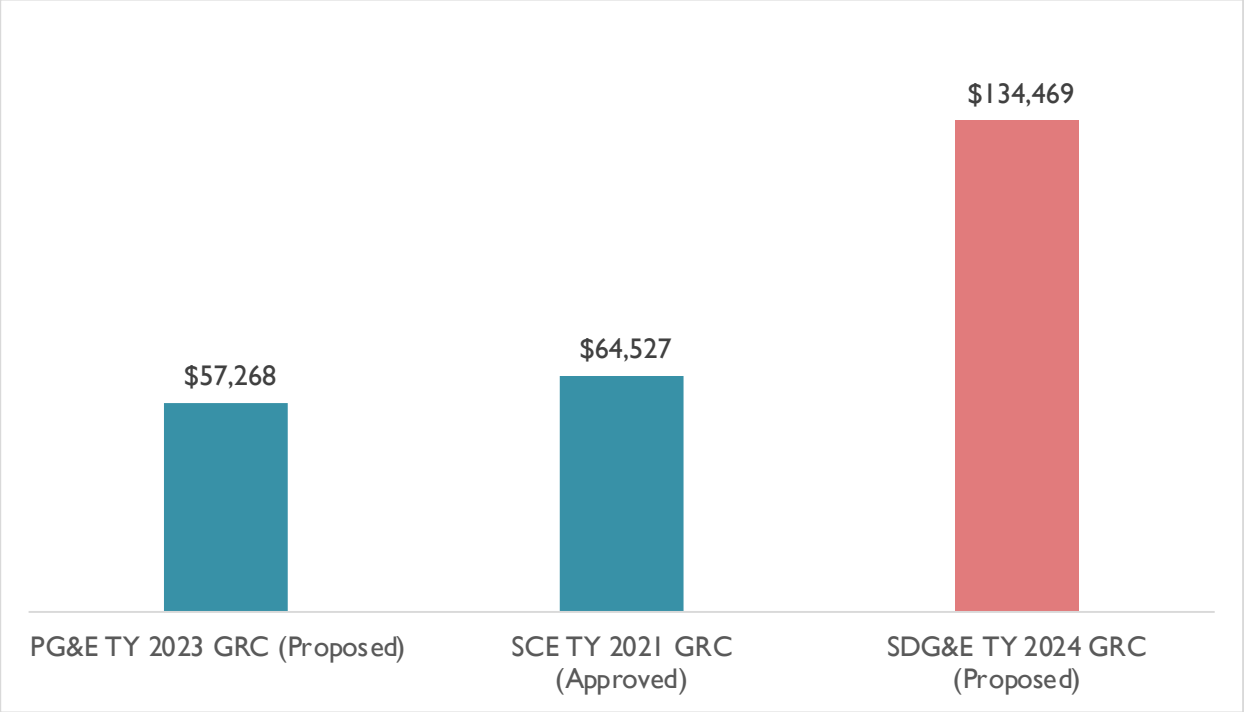


While in recent years statewide wildfire risk has ranged from approximately 0 to 3 percent in San Diego County, if we include the 2007 Witch Fire this statistic is closer to 6 percent from 2007-2021.[21] This provides a reasonable estimate for comparison of SDG&E's service territory with the rest of the state.

Despite comprising a small share of state wildfire risk, SDG&E's plan is to spend *more* on undergrounding and covered conductor than was approved for SCE and was proposed by PG&E in these utility previous rate cases on a *per mile* and *per customer basis*.

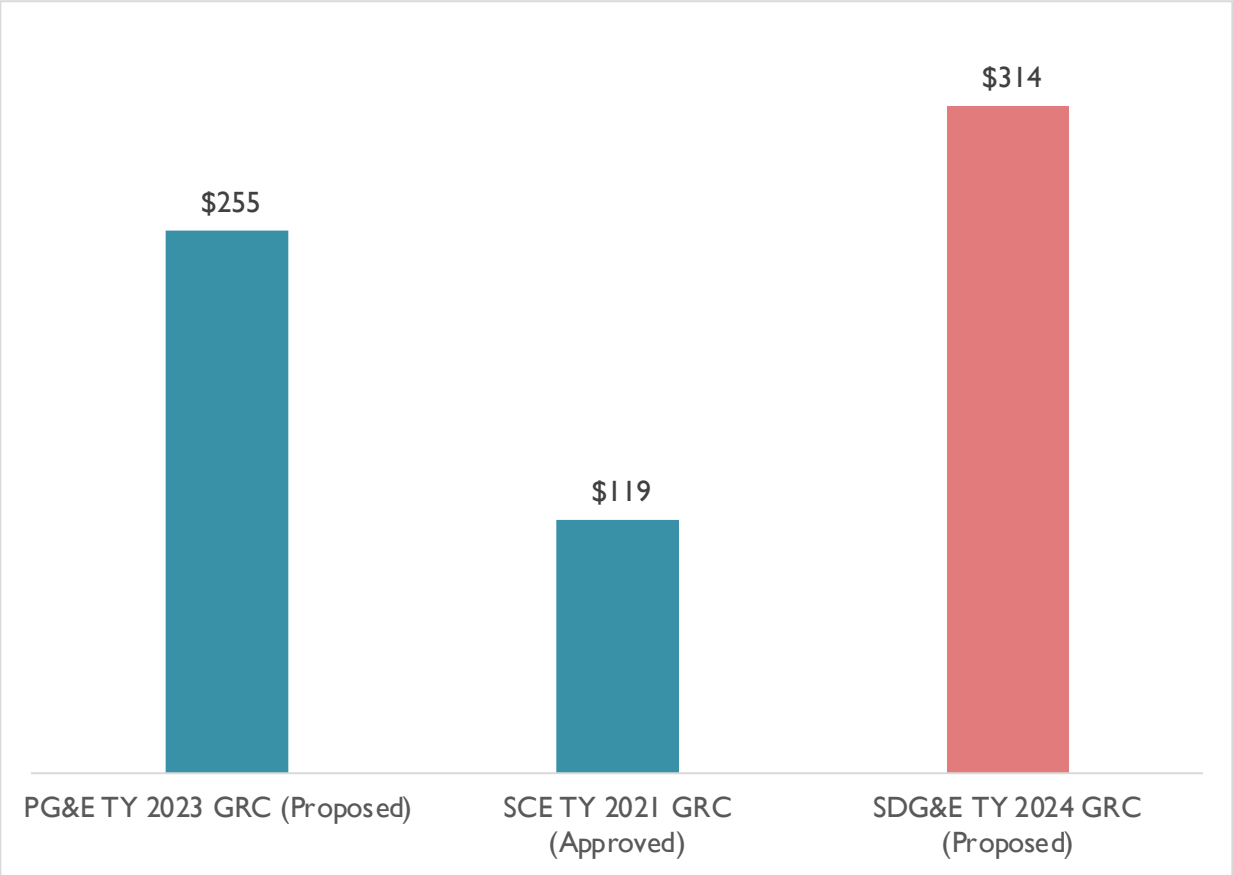
[21] The Witch Fire in 2007 was 197,990 acres of 1,520,362 that burned statewide that year. Including this in the 2008-2021 data set increases San Diego acres burned to 6 percent of the state from 2007-2021.

Figure 8. PG&E, SCE, SDG&E average annual undergrounding and covered conductor cost per HFTD overhead distribution circuit mile ($ 2021)[22]



[22] HFTD overhead distribution circuit miles from utility WMP filing Excel tables, 2022, Table 8. Cost figures from A.21-06-021, PG&E Reply Brief, Table 4-1, p. 328 (undergrounding), PG&E WP Table 4-23 summarized in A.21-06-021, Testimony of Eric Borden on Behalf of TURN (TURN-11), p. 28 (covered conductor); SCE figures from A.19-08-013, SCE-04, Vol5A, Table II-7, p. 29 (covered conductor), and Table II-18, p. 52 (undergrounding); SDG&E TY 2024 figures are provided in Appendix B of SDG&E-13-2R. Total expenditures for each year (2024-2027) provided in TURN-15, Question 4c-d (Excel attachment). Costs for post test years (PTYs) were found in SDG&E's risk workpapers for each program, which I adjusted for SDG&E's revisions in SDG&E-13-2R, Table JW-75, p. JTW-173.

Figure 9. PG&E, SCE, SDG&E average annual undergrounding and covered conductor cost per customer ($ 2021)



The charts above are not intended to suggest the other IOU spending is reasonable. The other IOU requests were similarly unbound by cost-effectiveness and affordability constraints, and TURN has advocated for reductions of both, including well beyond the final Commission approved SCE budget.[23] Despite PG&E and SCE's disregard for rate increases outpacing inflation, SDG&E's proposal still manages to be even less affordable for its customers, especially considering the spending proposed is largely unnecessary when compared to the level of risk in other utility territories.

[23] See A. 19-08-013, Prepared Testimony of Eric Borden Addressing Southern California Edison's Test Year 2021 General Rate Case Wildfire Management, Wildfire Risk, Vegetation Management, and New Service Connection Policy Issues and Cost Forecasts (TURN-02); A.21-06-021, Testimony of Eric Borden Addressing Pacific Gas and Electric Wildfire Mitigation Measures (TURN-11), June 2022.

2. SDG&E's Proposal Does Not Reflect Its Significant Investment in Wildfire Risk Mitigation.

SDG&E's proposal also does not reflect the more than decade plus that it – through its ratepayers – have invested in mitigating wildfire risk since the Witch Fire. As the utility highlights in its opening testimony,

> SDG&E has established itself as an industry leader in wildfire mitigation. These efforts have been recognized by the utility industry, California state officials, and leading credit ratings agencies. S&P Global Ratings described SDG&E's position on the forefront of wildfire innovation as follows:
>
> Over the past decade [SDG&E] has been a leader in wildfire on through the implementation of technology and system hardening. These measures reduce the probability that the company will be the cause of a catastrophic wildfire. As a direct result of the company's proactive ingenuity . . . the company has developed a strong track record of either avoiding wildfires or not being the cause of a catastrophic wildfire.[24]

SDG&E then states "in the face of a changing climate, increased drought, and the development of a year- round fire season, SDG&E cannot rest on its past achievements."[25]

Indeed, SDG&E spent $626 million on its traditional hardening program from 2012-2022. Part of this work involved replacing 14,156 poles over 700 circuit miles. SDG&E did not track the replacement of multiple other types of equipment over this time period.[26] The $626 million does not include expenditures on cameras, aviation services, drone technology, and other investments;[27] a recent article approximates these expenditures have reached $3 billion in total.[28]

SDG&E's wildfire mitigation proposal not only negates its past ratepayer funded achievements it also proposes the most aggressive and expensive approach available to it, undergrounding a significant percentage of the utility's overhead lines in its HFTD.

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[24] SDGE-13, p. JTW-1-2:19-2.
[25] SDGE-13, p. JTW-2:3-5.
[26] TURN-4, question 1, attach TURN-SEU-004_ATTACH_Q1_Q2_Q3_Q4_5804.
[27] SDG&E, https://www.sdge.com/community-fire-safety-program.
[28] San Diego Union Tribune, *SDG&E gets a big thumbs-down from callers on potential rate increases,* March 2023, https://www.sandiegouniontribune.com/business/story/2023-03-07/callers-give-a-big-thumbs-down-to-a-potential-rate-increase-for-sdg-e.

III. Wildfire Risk Modeling Should Inform Commission Decision-Making and Help Identify a More Optimal and Affordable Scope for Wildfire Mitigation Hardening Measures

Risk modeling is not the only lens through which to understand and scope utility wildfire mitigation efforts, but it likely represents the most useful set of tools at the Commission's proposal to understand the implications of various proposals. This section addresses SDG&E's risk modeling efforts in this case, including the fact that the utility has not sufficiently incorporated affordability and an overview of wildfire risk results from the utility's most granular risk model.

A. SDG&E Has Not Sufficiently Incorporated Affordability and Cost-effectiveness Thresholds

SDG&E's proposal does not implement any affordability thresholds, and lacks reasonable cost-effectiveness criteria. Risk modeling is a tool to apply these type of criteria, and SDG&E's proposal falls short of using the tools at its disposal to craft a reasonable approach to wildfire safety investment. If anything, SDG&E's proposal *maximizes costs* to ratepayers by concentrating almost exclusively, particularly for capital expenditures, on the single most costly risk mitigation at its disposal on a per mile basis, undergrounding.

When SDG&E was asked to "explain and quantify how [it] used RSE calculations and affordability constraints to inform its GRC proposal," the utility repeated platitudes from testimony, like,

> SDG&E's GRC request is the product of careful consideration of the optimal means to safely and reliably provide electrical service to customers and reduce the risk of utility-related ignition and public safety power shutoffs—consistent with regulatory and statutory mandates—in a just and reasonable fashion.[29]

SDG&E does not address, however, how was this accomplished. Was there one single initiative deemed too large or inefficient from a risk reduction perspective? How does this comport with

[29] TURN-15, question 3.

the utilities' "underground first" strategy? My review of SDG&E's testimony, workpapers, and discovery responses has found absolutely no indication of any type of affordability constraint imposed by the utility. There is nothing to support SDG&E's proposal, other than the simplistic notion that reducing more risk, regardless of the cost, is better than the alternative. Only a monopoly utility could even consider such a spend-first approach, much less testify that it is the right one.

B. Overview of SDG&E Risk Modeling: RAMP and WiNGS

SDG&E's risk modeling is outlined in its Risk Assessment Mitigation Phase (RAMP) filing, updated for various modeling changes in the GRC.[30] The end result of the risk modeling is the risk spend efficiency (RSE) statistic, which provides the risk reduction per dollar forecast. SDG&E calculates this separately for test year and post test year. The only two risk tranches used by SDG&E for calculating the RSE of wildfire mitigations are Tier 2 and Tier 3 of the utility's HFTD. SDG&E models both wildfire risk and public safety power shutoff risk as part of its undergrounding proposal – there are several issues with the latter calculation, discussed further below.

Underlying this risk modeling is a more granular model that calculates risk at the circuit segment level called the Wildfire Next Generation System (WiNGS) model.

> As modeling efforts have improved based on stakeholder input and the availability of data, SDG&E's next generation system, WiNGS-Planning built upon the RSE methodology in RAMP and evaluates both wildfire and PSPS impacts at the sub-circuit/segment level to inform investment decisions by determining which initiatives provide the greatest benefit per dollar spent in reducing both wildfire risk and PSPS impact. The key decisions being driven from the WiNGS-Planning model are how to most efficiently and effectively apply wildfire and PSPS mitigations in the backcountry. Currently, the main mitigations being proposed in the model results are undergrounding and covered conductor, starting in 2023.[31]

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[30] SCG-03/SDG&E-03: Chapter 2. My testimony with Courtney Lane provides an overview of this modeling and recommends a few changes to the calculation to make it more accurate. These are incorporated where applicable in this testimony.

[31] SDGE-13, p. JTW-9: 23-30.

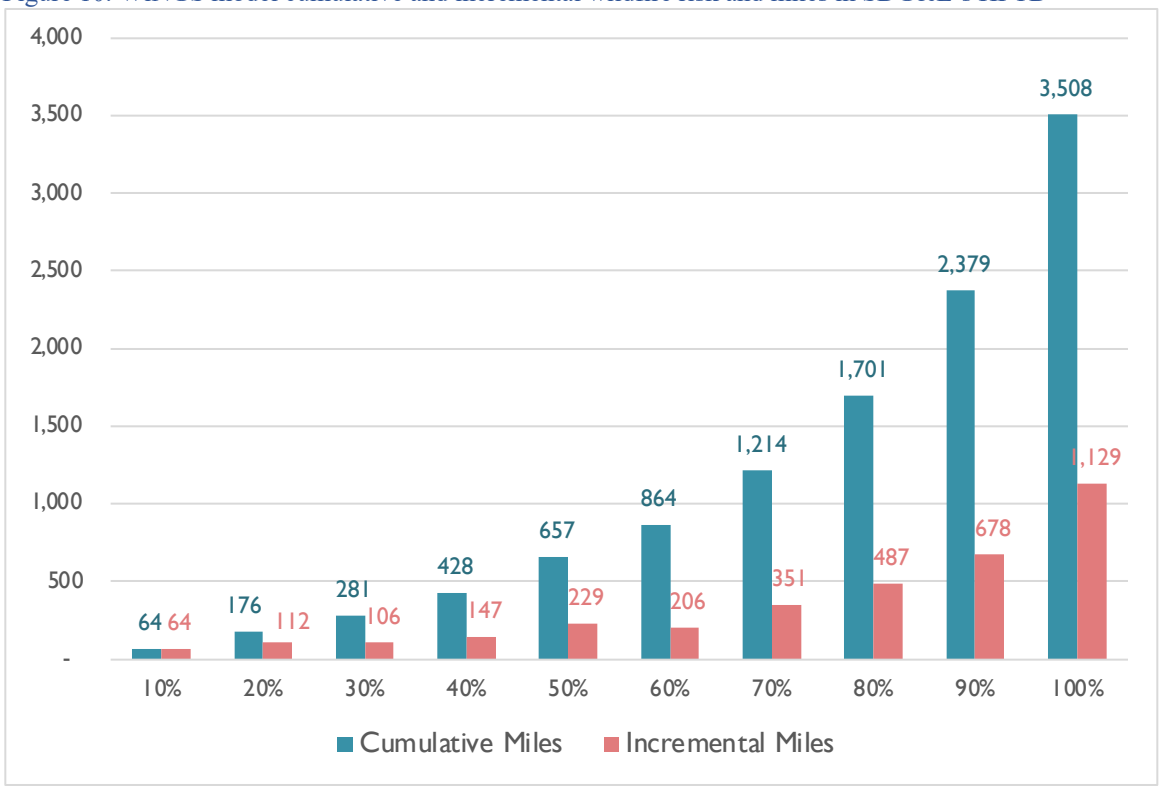
Below, I present RSE results, WiNGS results, and discuss various errors or inaccuracies in SDG&E's RSE risk modeling that forms the basis of how to develop a more optimal forecast of undergrounding and covered conductor deployment.

1. SDG&E's Wildfire Next Generation System (WiNGS) Model Results

WiNGS more granular modeling results are extremely helpful for understanding how the concentration of risk in SDG&E's territory is distributed. It also helps to develop alternative recommendations based on granular risk tranches, rather than overly broad ones such as tier 3 and tier 2 HFTD, modeled by SDG&E in its RSE analysis.

A limited number of miles in SDG&E's territory represent the highest risk miles. The figure below shows the number of cumulative and incremental miles for each 10 percent of risk in SDG&E's HFTD, when sorting HFTD circuit segments in SDG&E's WiNGS model from highest to lowest risk.

Figure 10. WiNGS model cumulative and incremental wildfire risk and miles in SDG&E's HFTD[32]

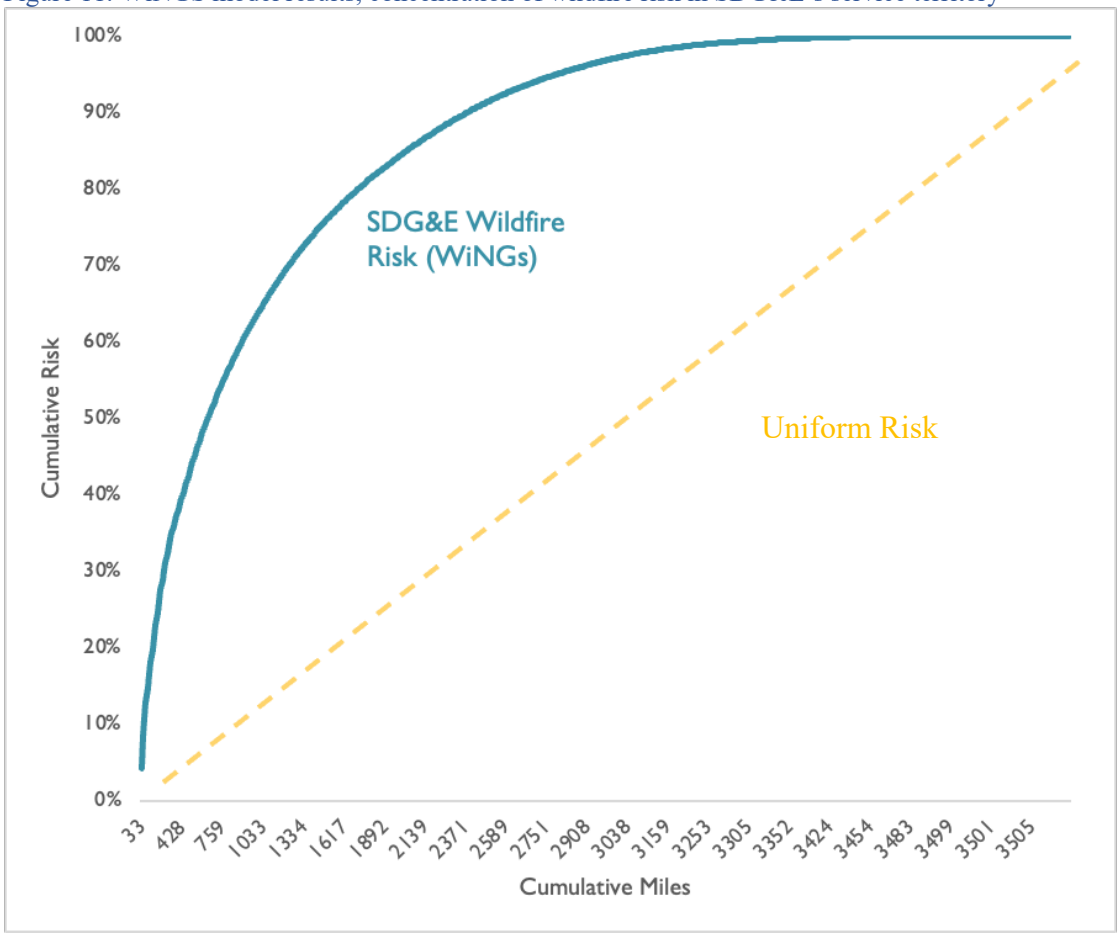


Risk in SG&E's HFTD is relatively concentrated – for example, the top 50 percent of wildfire risk is contained over 657 miles, and the bottom 50 percent over 2,840 miles.[33] This is shown graphically below, where cumulative overhead HFTD miles are plotted against cumulative risk, again when ranking circuit segments from highest to lowest risk.

[32] TURN-31, AttachQ1a_10493_10492, tab Q1a_sup_2. WiNGS data was extremely difficult and required a lengthy process to obtain from SDG&E, and ultimately was not given in the form requested through discovery. The data I was able to obtain is presented in this testimony.

[33] This does not add to 3,508 miles because the circuit segment after the 50th percentile is 11 miles long and I count this segment in the top 50 percent not the bottom 50 percent.

Figure 11. WiNGS model results, concentration of wildfire risk in SDG&E's service territory[34]



IV. Issues with SDG&E's Risk Assessment Mitigation Phase Risk Spend Efficiency Risk Modeling

There are significant flaws in SDG&E's calculation, including the fact that the undergrounding RSE is inappropriately driven mostly by PSPS risk reduction rather than wildfire risk reduction. The results are provided for only two risk tranches. Furthermore, the risk calculations for covered conductor and undergrounding are sufficiently different from one another that the cost-effectiveness of these mitigations cannot be compared directly with one another using SDG&E's

[34] *Ibid.*

RSE results.[35] I present a more accurate view of cost-effectiveness for covered conductor and undergrounding in Section VI.

There are several issues with SDG&E's RSE risk modeling and application thereof.[36] These pertain to RSE results rather than the more granular WiNGS model discussed above.[37] These are discussed in ensuing sections.

A. SDG&E's Undergrounding Risk Spend Efficiency Calculations are Inappropriately Driven by PSPS Risk Mitigation

The primary flaw in SDG&E's RSE calculation related to its strategic undergrounding program relates to the calculation of PSPS risk reduction in the benefits of the calculation.[38] First, these benefits are overstated – they significantly outweigh the benefits of undergrounding for wildfire risk reduction, as explained further below. Second, they make it difficult to compare the undergrounding program to other mitigation programs that reduce PSPS risk – undergrounding is, upon further examination but perhaps quite obviously the *least* cost-effective way of reducing PSPS risk, as seen in SDG&E's own RSE results. We discuss these problems further below.

1. SDG&E's PSPS Risk Reduction Calculation for its Undergrounding Proposal is Flawed

SDG&E calculates the risk in its service territory of wildfire and PSPS by multiplying the likelihood or probability of the risk event (LoRE) by the consequence of the risk event (CoRE),

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[35] SDG&E seems to have assessed risk reduction for these programs on circuits with very different risk profiles, which makes the results non-comparable. Namely, the number of ignitions before hardening are 50 percent less for covered conductor than for undergrounding, so covered conductor appears significantly less cost-effective. This is clearly not evaluating these solutions on an apples to apples basis. However, we have overcome these limitations by utilizing much more granular WiNGS model data to assess cost-effectiveness, discussed below. See SDG&E Revised Excel RSE workpapers for strategic undergrounding and covered conductor.

[36] These are distinct from issues we raise in TURN-4 regarding RSE calculation methodology.

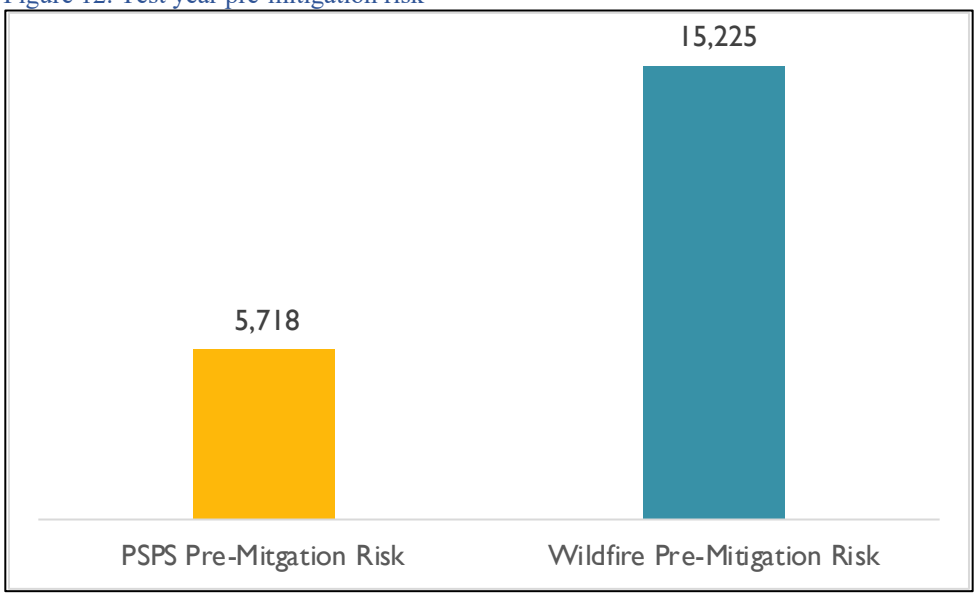
[37] That said, SDG&E (after significant delay and multiple requests) only provided the results of the WiNGS model, not the inputs.

[38] To be clear, I do not object to the inclusion PSPS risk mitigation benefits in wildfire risk modeling, but it must be modeled correctly.

before SDG&E's proposed mitigations are applied – this is called "pre-mitigation risk." LoRE, CoRE, or both can be reduced by a proposed mitigation measure, whereby SDG&E assumes a "mitigation effectiveness," or percentage of risk reduced, for the particular mitigation based on historical data, subject matter expertise, or some combination. For example, the mitigation effectiveness for undergrounding is assumed by SDG&E to be 98 percent for wildfire risk and 100 percent for PSPS risk. This is then applied to the pre-mitigation risk to calculate the amount of risk reduction that goes into the RSE calculation. The number of overhead miles or scope of the project must also be considered to correctly calculate expected risk reduction.

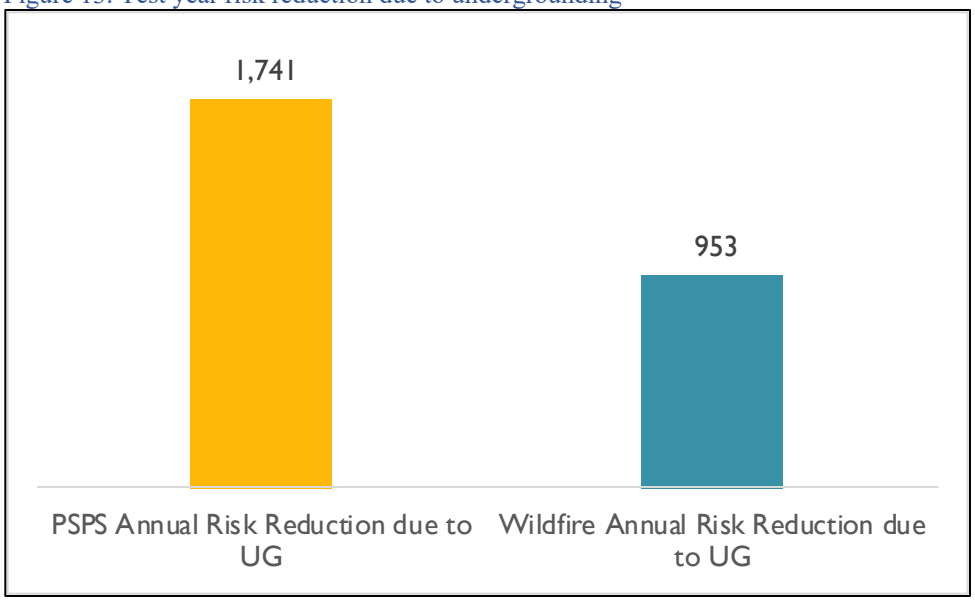
The results of SDG&E's PSPS risk reduction calculations – which are added to wildfire risk reduction to form the basis of the undergrounding RSE[39] - are flawed on their face. First, as would be expected, pre-mitigation PSPS risk is significantly less than wildfire risk, yet PSPS risk *reduction*, once undergrounding has been accomplished per SDG&E's proposal, is significantly higher than wildfire risk reduction when undergrounding the exact same miles..

Figure 12. Test year pre-mitigation risk[40]



[39] As discussed in TURN-4, the RSE statistic is calculated by subtracting risk reduction from pre-mitigation risk and dividing by the cost.
[40] SDG&E revised Excel RSE Test Year workpapers, latest "Wildfire-2R" workbook, "Strategic_Undergrounding" tab.

Figure 13. Test year risk reduction due to undergrounding[41]



In other words, according to SDG&E's calculations, the undergrounding of 125 miles of lines in the TY, equivalent to 3.6 percent of the utility HFTD overhead system, will eliminate 30 percent of PSPS risk, and 6 percent of wildfire risk. This is highly unlikely, given that PSPS events can occur across the HFTD.

The reason for the inconsistent PSPS risk reduction result appears to stem primarily from an inappropriate application of a 100 percent mitigation effectiveness factor for undergrounding to *all* expected average PSPS events on the system, rather than an approximation of the PSPS events expected to be experienced by the particular 125 miles that are undergrounded.[42] By applying a 100 percent mitigation effectiveness to the pre-mitigation likelihood of risk event (LoRE) and consequence of risk event (CoRE), the risk reduction is overstated. To better quantify the impact of undergrounding, SDG&E should have assessed the reduction to LoRE from a reasonable assumption for the pre-mitigation LoRE particular to the 125 miles it seeks to underground.

[41] *Ibid.*
[42] The LoRE (likelihood of risk event) is set equal to the "System PSPS average events per year" values. See Excel workpaper "1 Final TY2024 GRC RSE Workpaper - SDGE - Wildfire-2R_60933," tab "Strategic_Undergrounding," "Pre PSPS LoRE" value.

Furthermore, SDG&E should be prioritizing its program, and its spending of ratepayer dollars, based on *wildfire risk,* not PSPS risk, and it cannot do both at once. Indeed, an examination of WiNGS results for the top 30 highest PSPS risk circuits, representing around 500 overhead HFTD circuit miles, shows that PSPS risk and wildfire risk are highly uncorrelated. In other words, the highest risk circuits on a PSPS basis are not necessarily the highest risk circuits on the basis of wildfire risk.

Table 4. PSPS risk rank vs. wildfire risk rank[43]

Circuit ID	PSPS Risk Rank	Wildfire Risk Rank
CB 970	1	398
CB 441	2	454
79-1215F	3	360
CB 972	4	361
CB 442	5	455
221-1230F	6	127
79-676R	7	253
CB 1215	8	456
CB 357	9	48
CB 73	10	399
CB 235	11	400
972-8	12	89
176-1834R	13	60
CB 222	14	401
CB 396	15	457
175-24R	16	342
445-897R	17	314
442-728R	18	6
CB 356	19	458
CB 1250	20	254
222-1370R	21	14
222-1364R	22	3
448-1196F	23	459
CB 350	24	460
CB 237	25	238
393-14R	26	402

[43] TURN-31, AttachQ1a_10493_10492, tab Q1a_sup_2.

CB 217	27	461
1030-23R	28	315
CB 236	29	35
CB 971	30	54

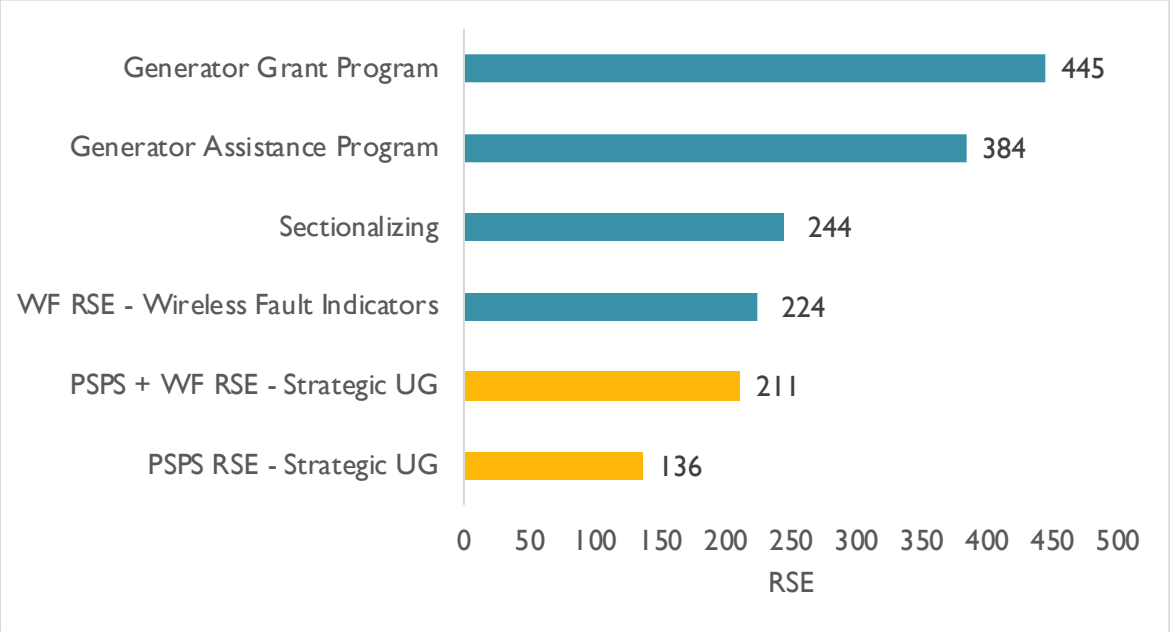
Additionally, as SDG&E acknowledges elsewhere, undergrounding will not always eliminate the PSPS risk of a circuit, even if it is underground, as the deenergization of a given circuit is dependent on switching and "upstream" circuit miles of the system which may still be overhead.[44]

2. Undergrounding is Not a Cost-effective or Necessary Mitigation for PSPS

Combining PSPS and wildfire risk reduction in the undergrounding calculation masks the fact that undergrounding is one of the least cost-effective mitigation measures to mitigate PSPS risk, even according to the utility's overly-optimistic calculations. Other measures, highlighted in the figure below, in addition to improved weather forecasting and incorporating new PSPS thresholds due to the installation of covered conductor, can significantly decrease the likelihood and consequences of PSPS and are much more cost-effective than undergrounding.

[44] As stated in TURN-31, question 1(a)(vi), "Since the PSPS risk on a segment is influenced by the maximum upstream segment PSPS probability, the score after mitigation [risk reduction] is difficult to quantify as it would only be fully realized as mitigations are implanted over time and after all OH risk has been mitigated."

Figure 14. SDG&E RSE results for PSPS risk mitigation alternatives (RSE per $ Million)[45]



3. Undergrounding Costs are Significantly Larger than PSPS Risk Reduction Benefits for Residential Ratepayers

In addition to being largely unnecessary given the availability of cost-effective alternatives (see above) widespread undergrounding is not a viable mitigation measure, particularly for residential ratepayers, due to its high cost compared with the relatively low value of avoiding a PSPS event.[46] This can be seen directly by comparing the value of lost load for the residential class using Lawrence Berkeley National Lab's Interruption Cost Estimate (ICE) calculator.[47] The values and methodology provided in the ICE calculator was recently endorsed by the

[45] As discussed in Section IV the strategic undergrounding RSEs for both PSPS and wildfire are flawed. They are presented here with SDG&E's figures for comparison purposes. Calculated from revised risk Excel workpapers and latest revision to wildfire risk calculations, supporting tabs, "1 Final TY2024 GRC RSE Workpaper - SDGE - Wildfire-2R_60933." These RSEs do not include simply better weather forecasting and isolation of circuits at the most granular level possible, likely the most cost-effective alternative. Wireless fault indicators allow for "potentially faster power restoration which could offset customer reliability impacts caused by wildfire mitigation measures" (SDGE-13, p. JTW-100). While only the wildfire RSE was calculated for this program, it would be even more cost-effective if PSPS risk reduction had been included. RSEs are presented for the program as a whole, across tranches.

[46] This is *relative to the cost of undergrounding,* not that residential ratepayers do not value reliability.

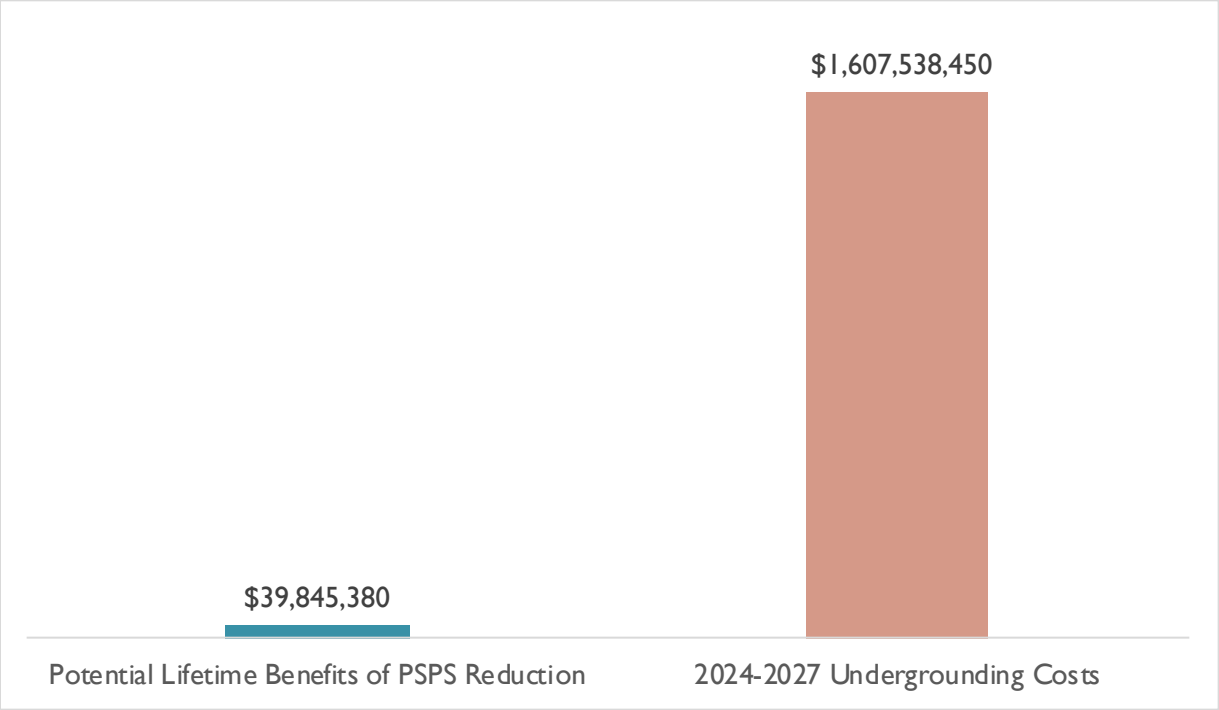
[47] See LBNL, ICE Calculator, https://icecalculator.com/documentation.

Commission for risk modeling purposes.[48] Specifically, I compare the average annual "cost" (or "risk reduction benefit," if the PSPS does not occur) that accrues to residential ratepayers for *all* PSPS events in SDG&E's territory by multiplying the annual average load affected by PSPS from 2015-2021 by the ICE calculator's estimate of the "cost per unserved kWh," for the residential class, adjusted for SDG&E territory specific inputs. The calculation includes the 40-year benefit life of undergrounding, consistent with SDG&E's assumptions.

Potential PSPS risk reduction benefits are overstated here because they are not adjusted for the number of proposed miles of undergrounding, instead, the figures incorporate the economic value of reducing the average amount of PSPS that occurred from 2017-2021 across the entire service territory. Additionally, we assume all PSPS customer outages are residential customers. Costs are understated because they do not include the full revenue requirement and are in 2021 constant dollars rather than nominal dollars.

[48] D.22-12-027, pp. 38-39.

Figure 15. Maximum economic value of PSPS risk reduction benefits for residential ratepayers compared with undergrounding costs[49]



In sum, SDG&E's RSE calculation for strategic undergrounding is flawed due to the inclusion of its PSPS risk reduction calculation. Further, considering there are multiple more cost-effective alternatives for mitigating PSPS risk, and residential ratepayers should never pay for undergrounding as a PSPS risk mitigation strategy, I recommend the Commission compare the benefits and costs of undergrounding to alternatives based on *wildfire risk and wildfire risk reduction cost-effectiveness,* not PSPS which confounds the analysis for the foregoing reasons.

B. SDG&E's Wildfire Risk Tranches are Not Sufficiently Granular

[49] LBNL ICE calculator downloaded from https://icecalculator.com/documentation, updated to include SDG&E territory specific inputs from WMP Excel table 11 (SAIDI and SAIFI including PSPS). Number of residential and non-residential customers from Energy Information Administration, https://www.eia.gov/electricity/data.php, tables 6 and 7. Load based on assumed average residential load of 500 kWh per month, converted to average load per hour, and applied to annual number of PSPS customer hours per year as reported in WMP Excel Table 11 (this also includes commercial and industrial customers so is also overstated).

SDG&E's risk tranches for wildfire – tier 2 and tier 3 – are overly broad, which is directly counter to the RAMP settlement's provisions, signed by SDG&E, that each utility should "strive to achieve as deep a level of granularity as reasonably possible" and "each element (i.e., asset or system) contained in the identified Tranche would be considered to have homogeneous risk profiles."[50] As seen above in the WiNGS model results, risk is heterogeneous across the HFTD, but SDG&E averages this risk across just two HFTD tiers, a highly simplistic representation of its system. SDG&E should utilize its WiNGS model to a greater extent to create significantly more granular tranches and RSE results for its mitigation programs.[51].

C. SDG&E's Risk Spend Efficiency Risk Modeling Significantly Overstates Wildfire Risk

One key assumption that forms the basis of several consequences, including injuries and fatalities from wildfires, is the number of acres SDG&E expects to burn (absent mitigations) given an ignition. The assumption that SDG&E makes is that there will be a catastrophic fire once every 20 years that burns 500,000 acres,[52] an expected value of 25,000 acres per year.[53] This is also the basis for other safety implications including injuries and fatalities.

This is not a realistic modeling assumption. Indeed, it is based on a review of *statewide* fires, not those particular to SDG&E's service territory or the San Diego region.[54] Further, the expected annual number of acres burned, 25,000, is not realistic when compared with actual data for the San Diego region. Putting aside the cause of fires for the moment (the figure includes all sources), annual acres burned in San Diego county have been far less than 25,000 in all years <u>but one</u> since 2008.

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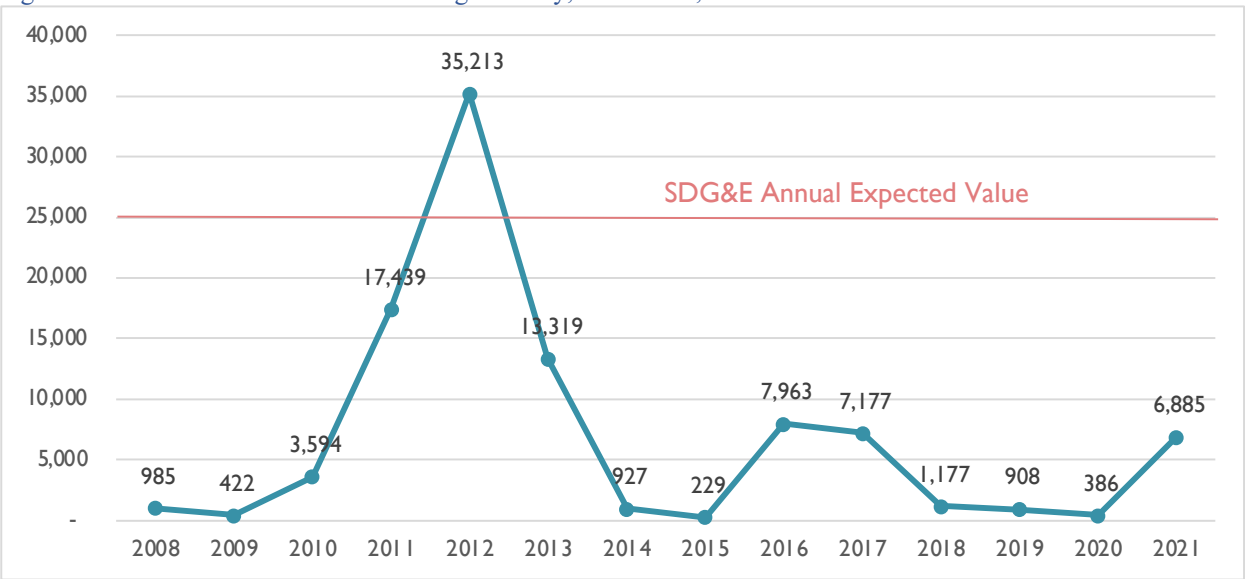
[50] D. 18-12-014, *Settlement Agreement among multiple intervenors, including SDG&E*, Attachment A, Appendix A, p. A-11, row 14.
[51] We are relying on the utility's representations of WiNGS data as it was provided. Our use of it was limited by SDG&E's unwillingness to provide WiNGS inputs and underlying calculations.
[52] See SDG&E RSE Excel workpapers, "Risk Scoring Workpaper" tab.
[53] 1/20 * 500,000 = 25,000.
[54] TURN-31, question 6. Sources provided are for statewide fires; one of the sources is specific to PG&E.

Figure 16. Annual acres burned in San Diego County, 2008-2021, all causes[55]



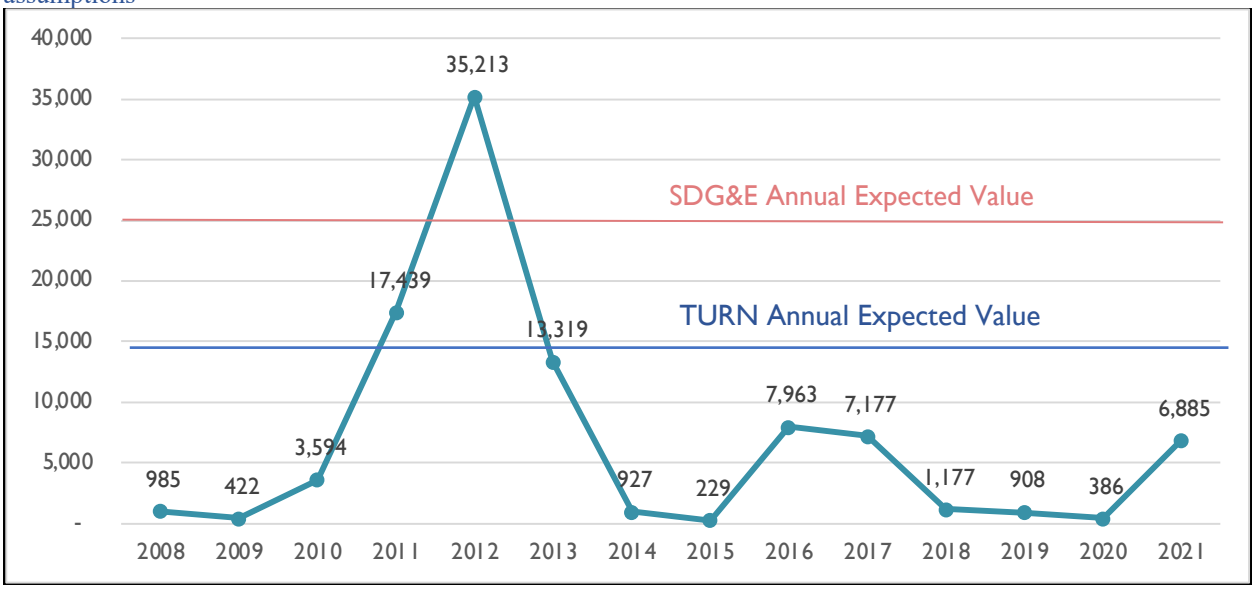
It is not as if recent years have not seen risky wildfire weather, so for SDG&E's value to be this unrepresentative of fire behavior in its service territory demonstrates that this is an unreasonable assumption.

That said, we recognize that the Witch Fire occurred in 2007 due to what was found to be imprudent and unreasonable management of its system by SDG&E.[56] This fire burned nearly 200,000 acres.[57] Therefore, using historical data there is an approximately 1/15 chance of having a 200,000 acre catastrophic fire, resulting in an annual expected value of 13,333 acres burned per year.[58] While this appears to be overly conservative based on recent data for the utility territory, particularly since 2008, "tail events" should be kept in mind for modeling purposes, particularly for modeling of wildfire risk. So we adopt this as a reasonable, but likely conservative estimate to represent both average and catastrophic wildfire years. As shown below, the number of acres

[55] Analyzed from CalFire Redbook Data, CalFire, https://www.fire.ca.gov/our-impact/statistics.
[56] D.17-11-033.
[57] 197,990 acres. See CalFire, https://www.fire.ca.gov/incidents/2007/10/21/witch-fire/.
[58] Using the 1 in 20 year criteria, this equates to a major fire of around 267,000 acres every 20 years: 267,000 * 1/20 = 13,350 annual expected value acres burned.

burned in San Diego County from all causes has been significantly less than this, even in recent years when the state saw relatively high wildfire risk.

Figure 17. Annual acres burned in San Diego County, 2008-2021, all causes, SDG&E vs. TURN acres burned assumptions[59]



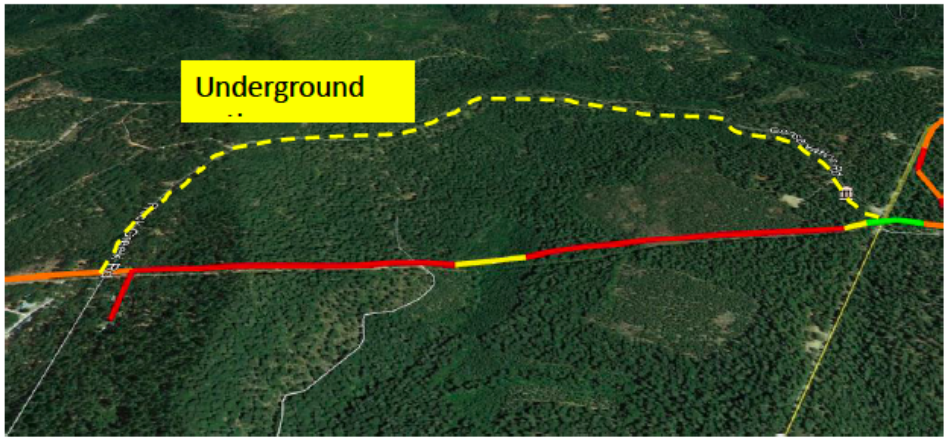
This quantitative assumption affects modified RSE calculations for strategic undergrounding and covered conductor, presented above and in Section V.

D. SDG&E's RSE Calculation Does Not Factor in Overhead to Underground Mileage Factors

One aspect of undergrounding not sufficiently illuminated in SDG&E's testimony is the fact that the unit cost for undergrounding is in dollars per underground miles, not dollars per overhead circuit mile. From a risk perspective, what is important is removal of overhead miles, not how many miles are underground. They differ because, due to challenges with topography, underground miles must go around impediments whereas an overhead line can cross creeks, canyons, and other impediments. An example of this is depicted below.

[59] Analyzed from CalFire Redbook Data, CalFire, https://www.fire.ca.gov/our-impact/statistics.

Figure 18. Underground vs. Overhead Circuit Miles[60]



This has a significant effect on unit costs, and therefore RSEs, and depends on how many more underground miles must be accomplished to replace the same circuits overhead. SDG&E assumes (though provided no data or analysis) that "for every 1 mile of OH conductor there will be 1.2 miles of UG conductor. This is a representative average based on various factors such as feasibility of constructing along the existing easement, additional routing of UG cables required and more."[61] The following shows SDG&E's unit costs assuming a 1.2 conversion ratio.

Table 5. Undergrounding unit costs with overhead to underground ratio

	$2021		$Nominal	
	Dollars per UG Mile	Dollars per OH Mile	Dollars per UG Mile	Dollars per OH Mile
2024	$ 1,938,169	$ 2,325,803	$ 2,157,764	$ 2,589,317
2025	$ 2,389,288	$ 2,867,145	$ 2,693,348	$ 3,232,017
2026	$ 2,336,496	$ 2,803,795	$ 2,677,023	$ 3,212,427
2027	$ 1,933,482	$ 2,320,178	$ 2,262,070	$ 2,714,484

SDG&E admits that it did not factor this conversion ratio into its RSE calculations.[62] This means that either a) it will cost more than modeled to achieve the same risk reduction or b) there will be

[60] A.21-06-021, TURN-154, Question 11b.
[61] TURN-15, question 15a, Excel attachment.
[62] TURN-17, question 6(a)(i). "SDG&E has not incorporated an overhead-to-underground conversion ratio into its risk analysis."

less risk reduction accomplished for the costs modeled. I present a corrected RSE calculation in Section V.

V. When Calculated Correctly, SDG&E's Risk Modeling Demonstrates that the Costs of Undergrounding are Greater than the Benefits

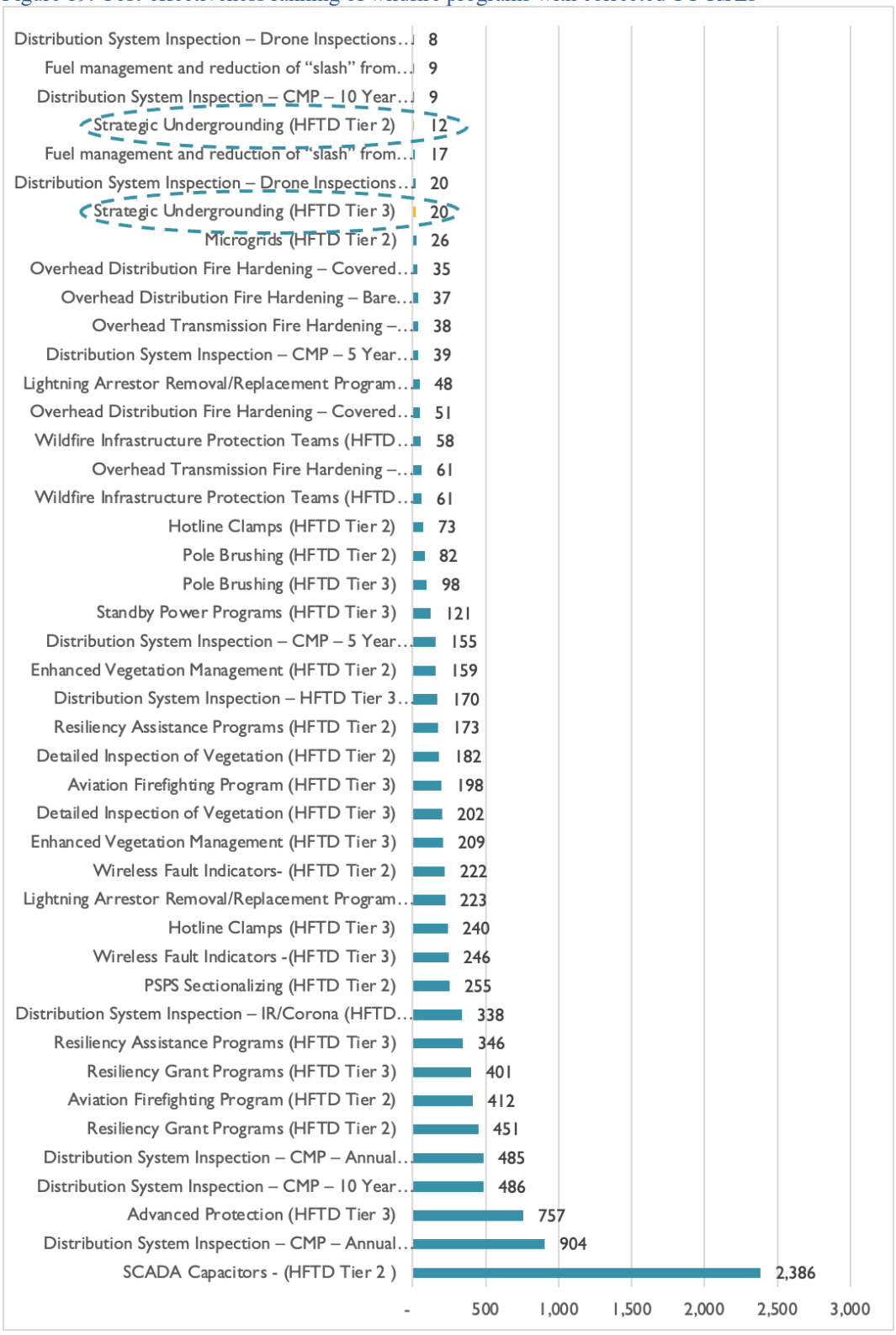
To examine the costs and risk reduction benefits of undergrounding in a more realistic light than as presented by SDG&E, we correct several flaws, discussed above, to calculate a more realistic RSE statistic:

- We remove PSPS risk reduction from the calculation due to the issues noted above, and the fact that undergrounding should be driven by reduction of wildfire risk, not PSPS;
- We reduce the annual expected acres burned in a catastrophic wildfire to a more realistic assumption;
- We incorporate the overhead to underground conversion ratio assumed by SDG&E but not included in its RSE analysis;[63]
- We adjust the discounting and inflation methodology per TURN-4. For the test year, this involves discounting benefits at the Weighted Average Cost of Capital (WACC) and inflating constant 2021 dollars to nominal 2024 dollars.

The following figure shows how the test year RSE compares with other wildfire programs once these changes are accomplished, assuming the same methodology for each mitigation from TURN-4.[64]

[63] This is accomplished by grossing up costs by 20 percent in the RSE calculation.
[64] Cross functional factor (CFF) costs are included in TURN-4 alternative calculations, so we have also included those costs here to accurately compare our adjusted RSEs with TURN-4 values. This did not affect the relative ranking of strategic undergrounding.

Figure 19. Cost-effectiveness ranking of wildfire programs with corrected TY RSEs[65]

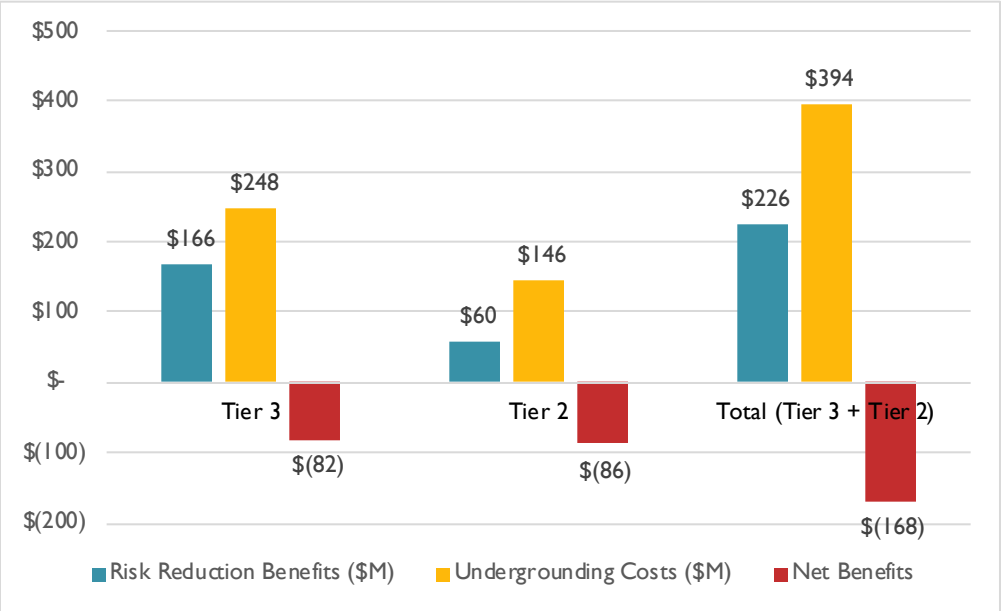


As discussed in TURN-4, the RSE statistic can be translated into a more traditional dollar-denominated benefit-cost ratio through the multi-attribute value function dollar equivalencies and algebraic transformations. This allows for a direct comparison of benefits and costs in dollar terms.

One must be careful in interpreting benefit-cost statistics – indeed, they do not consider *affordability,* only whether the modeled benefits exceed costs. Nevertheless, they can be helpful for examining modeling results in absolute, rather than relative terms, as above. Based on the modifications described above and in TURN-4 to accurately calculate the RSE for strategic undergrounding, namely removing PSPS risk reduction, reducing the number of acres burned in a catastrophic wildfire, adjusting the discount rate to WACC, and adjusting for inflation to match time periods of costs and benefits (risk reduction), costs exceed benefits for all tranches when we convert risk reduction into dollar-denominated units.[66]

[65] Incorporates changes from TURN-4, and modifications to RSE described above. Cross functional factor (CFF) costs are included in TURN-4 alternative calculations, so we have also included those costs here to accurately compare our adjusted RSEs with TURN-4 values.
[66] See TURN-4.

Figure 20. Risk reduction benefits and costs for strategic undergrounding[67]



The strategic undergrounding program for Tier 2, Tier 3, and overall has a benefit-cost ratio (BCR) of .41, .67, and .57, respectively. BCRs less than 1 have costs that are greater than benefits, and are therefore not cost-effective.

SDG&E did not update its post-test year RSE calculations so I do not present the benefits and costs of the strategic undergrounding program for those years. However, using the data currently input into the utility's calculations, the results are very similar to those shown above, even demonstrating slightly worse cost-effectiveness than the TY.[68] This is to be expected as SDG&E prioritizes highest to lowest risk circuits for undergrounding, and it will approach diminishing returns on these investments quickly (see Figure 23).

[67] Calculated with data from Revised Excel Workpapers, "Strategic_Undergrounding" tab, incorporating the changes described above.

[68] RSE may have a slight up-tick in 2027 due to lower assumed unit costs, but these costs should be approached with a degree of skepticism as I have seen no underlying evidence, analysis, or factual data to support them.

VI. Covered Conductor is a More Cost-effective Alternative to Complement Targeted Undergrounding and Other Mitigation Measures

Covered conductor provides significant risk reduction benefits – SDG&E estimates a mitigation effectiveness of about 65 percent[69] - can be deployed more quickly, and is significantly less costly than undergrounding.

As an initial matter, the Commission should recognize that SDG&E's unit cost (dollars per overhead circuit mile) for covered conductor deployment should be significantly less than what the utility has forecast. Even assuming SDG&E's higher unit costs, contrary to SCE's RSE analysis results shown above, an analysis of WiNGS model results at the circuit segment level shows that covered conductor is more cost-effective than undergrounding for every circuit where SDG&E has forecast an undergrounding project.

1. The Commission Should Adopt a Reasonable Unit Cost for Covered Conductor

SDG&E forecasts it will cost the utility around $1 million per mile to deploy covered conductor.[70] These costs are a higher than they should be. This can be seen most directly by comparing with Southern California Edison's (SCE's) actual recorded unit costs for covered conductor deployment, around $629,000 per mile in 2021.[71]

Further, SDG&E's own "traditional hardening" program, described below, is very similar to the covered conductor program, and was accomplished at a cost of $577,000 per circuit mile in 2023, increasing to over $800,000 in 2024 only because the number of miles were reduced in that year.[72] This means there are economies of scale for this program which would apply to a larger-scale covered conductor program as well – which we have proposed here.

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[69] SDGE-13, Appendix C.
[70] TURN-15, question 11a, Excel attachment; TURN-15, question 1, Excel attachment. The attachment states "2024 Increase cost/mile due to reduced mileage target from 3 to 1."
[71] SCE WMP Filing, Excel Table 12, row 30. Subtracts stated deployment of non-WCCP CC deployment.
[72] TURN-15, question 1, Excel attachment.

> Traditional overhead hardening replaces high-risk poles and conductor types with more resilient equipment. These replacements typically include wooden poles with steel poles and small-size bare conductors with larger and stronger-rated bare conductors. Other types of equipment that may also be replaced if attached to the pole in the area targeted for hardening include but are not limited to insulators, crossarms, connectors, guys and anchors, aged and open wire secondary, capacitors, hotline clamps, fuses, switches, and lightning arresters. However, not all the above-mentioned pieces of equipment are installed at each pole location.[73]

When asked why SDG&E's costs are so different from SCE's, SDG&E stated:

> Note that SDG&E's covered conductor program and SCE's covered conductor program do have differences as explained in the Joint IOU Response to Action Statement – Covered Conductor (SDG&E's 2022 WMP Update Attachment H.) Additionally, SCE's service territory and system equipment is different from SDG&E's service territory and system equipment. The number and percentage of poles that need to be replaced to install covered conductor in SCE's service territory may not directly relate to the percentage of poles that need to be replaced to install covered conductor in SDG&E's service territory.[74]

While SDG&E acknowledges a difference between the utility programs, it fails to explain the cost differential to SCE. One difference not mentioned between the programs is that SDG&E replaces wood poles with steel poles, rather than with fire resistant wood poles like SCE. This provides no increase in risk mitigation effectiveness, yet likely represents a significant cost differential, which could not be quantified because SDG&E did not provide the necessary information.[75]

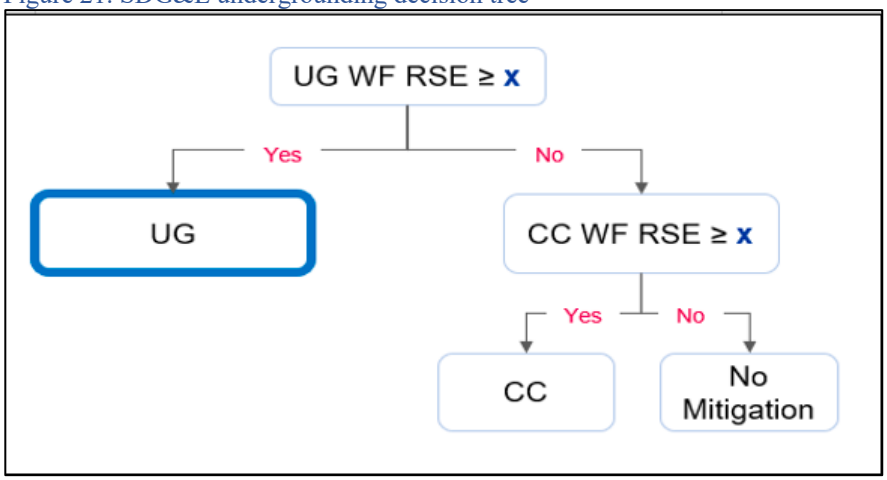
Given the disparity to SCE's covered conductor program as well as costs of SDG&E's own traditional hardening program, unit costs for covered conductor deployment should be set at no greater than $800,000 per circuit mile.[76] As stated, there appears to be economies of scale to the program, so adopting TURN's larger-scale covered conductor program will help drive down costs. Therefore, SDG&E should not be allowed to record expenditures above $800,000.

2. The WiNGS Model Does Not "Identify" Undergrounding as an Optimal Solution; it Demonstrates that Covered Conductor is More Cost-effective

[73] TURN-15, question 9a.
[74] TURN-17, question 8b.
[75] TURN-15, question 10. It is extremely surprising that a utility does not know (or is unwilling to provide) the cost to replace basic assets like poles and wires.
[76] In nominal 2024 dollars.

SDG&E implies that its WiNGS model has somehow "selected" undergrounding as the preferred option for much of the utility's expenditures, per the utility's proposal.[77] We asked numerous questions about the WiNGS model: SDG&E has not provided evidence that undergrounding is the "optimal" solution for the massive number of miles and costs that SDG&E claims. In fact, SDG&E's "decision tree" for how it assessed RSE in the WiNGS model is telling – rather than assessing which mitigation measure would be most cost-effective in the first place the utility asks *first* to see if undergrounding meets a pre-determined threshold, and then if not, looks to covered conductor, rather than assessing what mitigation measure is the most cost-effective.

Figure 21. SDG&E undergrounding decision tree[78]

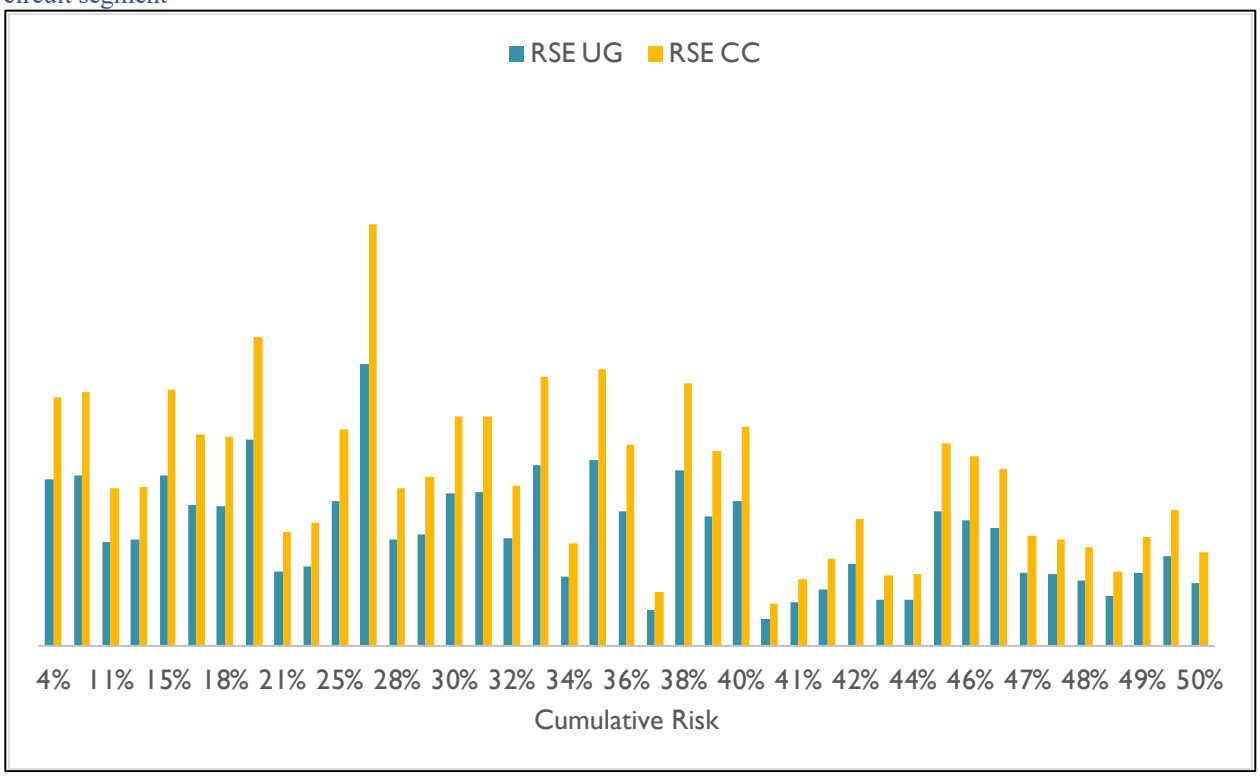


TURN's analysis, shown below, of WiNGS model risk data[79] finds that covered conductor is more cost-effective for reducing wildfire risk on every circuit where SDG&E has selected undergrounding as its preferred mitigation.

[77] See, for instance, SDGE-13, p. JTW-77:22-24. "SDG&E's Wildfire Mitigation Strategy team developed the WiNGS model to specifically tackle the issue of quantifying the impacts of and identify the optimal solutions to target both wildfire risk reduction as well as PSPS reduction."
[78] TURN-31, question 1h.
[79] Unfortunately, SDG&E's non-WiNGS RSE calculations are not sufficiently comparable for the purposes of comparing undergrounding with covered conductor. The number of ignitions before hardening are 50 percent lower for covered conductor, likely because this solution is deployed on much lower-risk circuits. While applicable to SDG&E's proposal, this approach does not allow for a comparison of cost-effectiveness for alternative proposals. Additionally, since WiNGS shows covered conductor is more cost-effective at a more granular level, the results are inconsistent.

On average, according to TURN's analysis of WiNGS model results, covered conductor is around 50 percent more cost-effective than undergrounding, even when assuming SDG&E's proposed unit cost of $1 million per mile. The figure below shows RSE results for the top 50 percent of wildfire risk where SDG&E has planned an undergrounding project.

Figure 22. RSE of undergrounding vs. covered conductor, WiNGS model analysis, sorted by highest to lowest risk circuit segment[80]

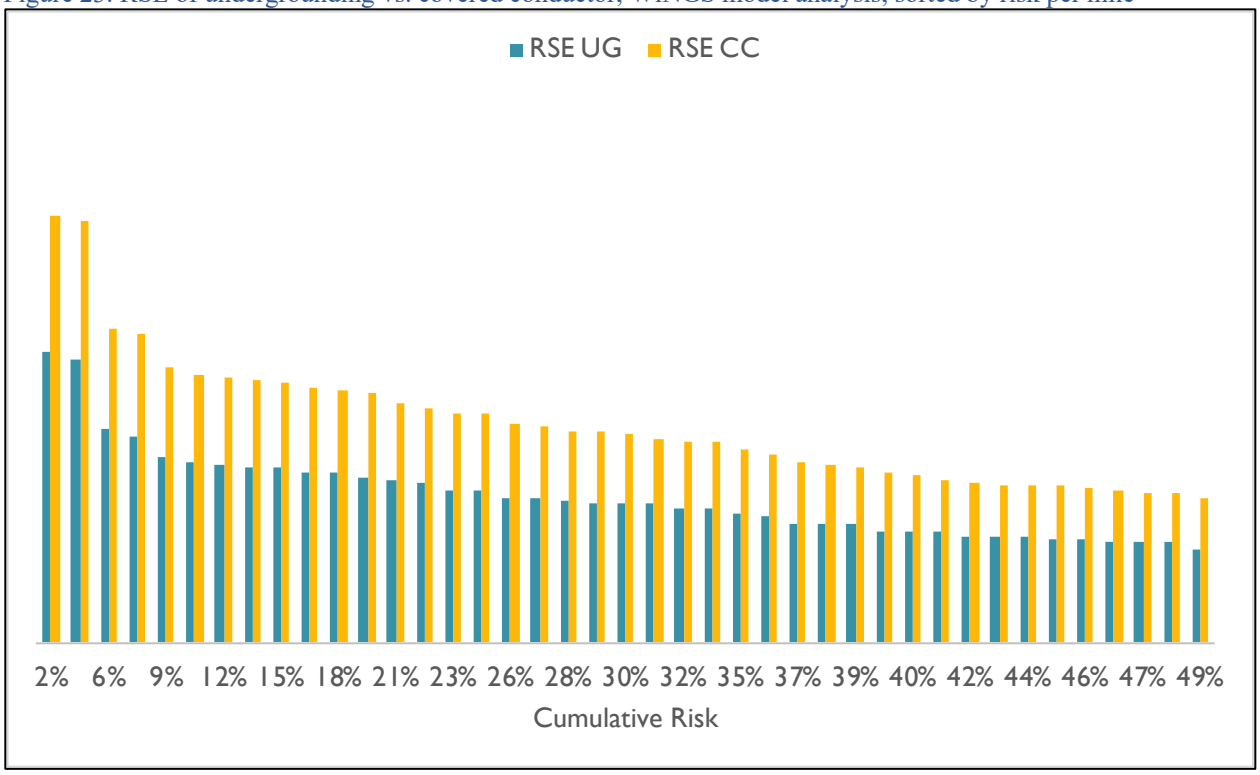


The reason risk reduction and RSEs are not uniform across risk is that circuit segments in the model have very different overhead mileages, ranging from 30 *feet* to 33 miles. Prioritizing circuits based on the highest risk per mile would ideally be the optimal strategy to reduce risk from highest to lowest priority, but may be impractical due to logistical reasons. Nevertheless,

[80] Data from TURN-31, question 1a. Since no years were provided in SDG&E's data set that corresponded to risk, I assume a weighted average (per mile) across years of costs for undergrounding from TURN-15, question 15b. Risk reduction due to undergrounding is provided in the model results. For covered conductor, I assume average unit costs from 2022-2024 provided in TURN-15, Attachment, Q1, though it seems lower unit costs would be realized if TURN's proposal for greater deployment is factored in. I assume SDG&E's mitigation effectiveness of 64.5%, SDGE-13-2R, Appendix C, Table 5.

viewing risk in this manner shows the significant disparity between covered conductor and undergrounding in terms of mitigation effectiveness for the very highest risk circuits, accounting for length.

Figure 23. RSE of undergrounding vs. covered conductor, WiNGS model analysis, sorted by risk per mile[81]



VII. TURN's Recommended Alternative Proposal for Hardening Initiatives Achieves the Majority of the Benefits at a Portion of the Costs.

The preceding sections establish that undergrounding is a significantly less cost-effective approach to wildfire mitigation compared with covered conductor along with other wildfire and

[81] Data from TURN-31, question 1a. Since no years were provided in SDG&E's data set that corresponded to risk, I assume a weighted average (per mile) across years of costs for undergrounding from TURN-15, question 15b. Risk reduction due to undergrounding is provided in the model results. For covered conductor, I assume average unit costs from 2022-2024 provided in TURN-15, Attachment, Q1, though it seems lower unit costs would be realized if TURN's proposal for greater deployment is factored in. I assume SDG&E's mitigation effectiveness of 64.5%, SDGE-13-2R, Appendix C, Table 5.

PSPS risk mitigation strategies. Furthermore, the absolute costs of SDG&E's proposal are unduly burdensome to ratepayers and have not been demonstrated to be reasonable by SDG&E.

While undergrounding is too complex, burdensome, and costly to be the broad-based solution to wildfire mitigation sought by SDG&E, it is appropriate as a strategy to mitigate risk on the very highest-risk circuit miles due to its high mitigation effectiveness.

With a keen eye towards cost-effectiveness, affordability, and absolute risk reduction, TURN believes a scaled down approach to undergrounding and a scaled up approach to covered conductor is appropriate. As we show below, this alternative achieves 78 percent of the risk reduction of SDG&E's proposal for 35 percent of the costs. However, we note that including PSPS both proposals achieve near 100 percent wildfire risk mitigation; TURN's proposal thus may incur slightly higher PSPS risk, though we expect this risk can be mitigated more cost-effectively with other programs and strategies aimed at reducing PSPS frequency and consequence.[82]

Table 6. Undergrounding miles and costs, TURN vs. SDG&E

	2024	2025	2026	2027	Total
	Miles - Undergrounding				
TURN	35	35	35	35	140
SDG&E	125	150	160	170	605
TURN-SDG&E	-90	-115	-125	-135	-465
	Costs - Undergrounding ($M, 2021)				
TURN	$ 82.6	$ 94.7	$ 95.5	$ 96.8	$ 370
SDG&E	$ 295.0	$ 405.8	$ 436.7	$ 470.1	$ 1,607.5
TURN-SDG&E	$ (212.4)	$ (311.1)	$ (341.2)	$ (373.3)	$ (1,238.0)

[82] These include, but are not limited to, better weather forecasting and monitoring, sectionalizing, the generator assistance program, and the generator grant program.

Table 7. Covered Conductor miles and costs, TURN vs. SDG&E

	2024	2025	2026	2027	Total
	Miles - Covered Conductor				
TURN	100	100	100	100	400
SDG&E	60	40	40	40	140
TURN-SDG&E	40	60	60	60	260
	Costs - Covered Conductor ($M, 2021)				
TURN	$ 80.0	$ 80.0	$ 80.0	$ 80.0	$ 320.0
SDG&E	$ 59.8	$ 60.4	$ 63.3	$ 67.2	$ 250.7
TURN-SDG&E	$ 20.2	$ 19.6	$ 16.7	$ 12.8	$ 69.3

Table 8. All hardening miles and costs, TURN vs. SDG&E

	2024	2025	2026	2027	Total
	Total Miles - Hardening (UG + CC)				
TURN	135	135	135	135	540
SDG&E	185	190	200	210	745
TURN-SDG&E	-50	-55	-65	-75	-205
	Total Costs - Hardening ($M, 2021)				
TURN	$ 154.5	$ 166.5	$ 167.4	$ 168.6	$ 657.0
SDG&E	$ 354.8	$ 466.1	$ 500.1	$ 537.3	$ 1,858.3
TURN-SDG&E	$ (200.3)	$ (299.6)	$ (332.7)	$ (368.6)	$ (1,201.2)

In order to compare the benefits and costs of TURN's and SDG&E's respective hardening proposals, we have evaluated the respective risk mitigations of each proposals. However, we wish to note again that these are not the only two programs SDG&E has proposed to mitigate risk. In addition to its $1.9 billion in proposed hardening programs from 2024-2027, SDG&E's programs include an additional $400 million in capital and $700 million in O&M expenditures.[83] It is therefore inaccurate to assume these are the *only* risk reducing programs, and I have not analyzed total risk reduction across all wildfire mitigation programs (nor has SDG&E, to my knowledge).

Using WiNGS data sorted from highest to lowest risk circuit segment, and assuming undergrounding is deployed before covered conductor (i.e. to higher risk circuits) from 2024-

[83] See Figure 2 and SDGE-13, p. JTW-B-8 for O&M expenditures in TY 2024. SDG&E states in TURN-15, question 4d, that "SDG&E does not forecast project-specific Post-Test Year (PTY) costs, except for those identified as PTY capital exceptions." We therefore assume flat O&M costs from the 2024 forecast.

2027, TURN's proposal provides 78 percent of the risk reduction benefits for about $1.2 billion less than SDG&E's proposal. From a statewide perspective, we show that difference of risk reduction between the proposals **is less than 1 percent.**[84] The risk reduction figures include SDG&E's 2022 and 2023 forecast deployment of undergrounding and covered conductor.

Table 9. Difference in risk reduction and cost, TURN vs. SDG&E

	Risk Reduction	Cost ($M, 2021)
TURN	44%	$ 657.0
SDG&E	56%	$ 1,858.3
TURN-SDG&E	-12%	$ (1,201.2)

TURN's proposal thus addresses the vast majority of risk as SDG&E's while saving ratepayers over $1.2 billion. This represents a more than adequate balance between safety and affordability, allowing the Commission to meet its core mandate of passing through only those costs that are just and reasonable.

[84] Since TURN's proposal reduces 12 percent less risk than SDG&E's, and we estimate San Diego's statewide wildfire risk is around 6 percent (at most), this represents a .72 percent difference.