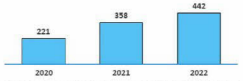
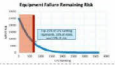
Public Safety
Long Term Incentive Plan (LTIP)
Target Setting

November 23, 2020

Together, Building
a Better California

Evolution of the LTIP metric from units of work completed to amount of risk being reduced

	2020-2022 LTIP Plan	2021-2023 LTIP Plan
System Hardening	▪ **Risk Exposure** – Count of circuit miles system hardening in High Fire Threat Districts (HFTD) and High Fire Risk Areas (HFRA). Goal was ~1,021 circuit miles over 3 years; 235 miles hardened YTD in 2020  	▪ **Risk Exposure** – Count of circuit miles system hardened in the HFTD and HFRA ▪ **Risk Profile** – 80% of system hardening miles have to be high risk miles; High risk miles include – 1) top 20 % of the risk buydown curve, 2) Fire rebuild and, 3) PSPS mitigation miles ▪ **Risk Effectiveness** - Prioritizes higher risk reduction mitigation options (Undergrounding and Line removals) 

Substation Enablement	▪ Number of substations out of possible 64 substations that are "energizable" during a Transmission-Level PSPS event
	▪ 62 high priority substations are now operationally ready within 48 hours (LTIP 3-yr 2.0 target = 50 substations
		▪ Replace the Substation Enablement metric for the 2021-2023 LTIP Period with EVM Risk Reduction Public Safety Metric
		▪ Rational:
		  ▪ 3 Year target has been achieved
		  ▪ Improved weather forecasting capabilities reduces the criticality of number of substations needed to reduce PSPS impact

Enhanced Vegetation Management (EVM)	▪ No metric was established for EVM	▪ **Risk Exposure** – Count of EVM miles worked in the HFTD and HFRA ▪ **Risk Profile** – 80% of EVM miles worked in the top 20% of the HFTD's includes Fire impacted areas ▪ **Risk Effectiveness** – Execute work consistent with defined EVM scope

Risk Model and Risk Quantification

Wildfire Risk Models calculates risk units in CPUC framework

LoRE

- The likelihood of a risk event (LoRE) is the relative frequency of a specific risk event occurring.
- In the case of **wildfire risk**, this is the relative **likelihood of an ignition occurring**.

CoRE

- The consequence of a risk event (CoRE) is the average impact of the risk should it materialize across key outcomes (Safety, Reliability, Financial).
- In the case of wildfire risk, **consequence contains serious injuries, fatalities , property damage**, and impacts to reliability.

Risk = LoRE X CoRE

- Risk is the product of the likelihood and consequence of a risk event.
- This method produces an expected value of impact across the consequence outcomes, and when combined results in a multi-attribute score that can inform risk-based decision making

Methodology

Ignition Model

Likelihood of Ignition

Ignition likelihood was determined based on 2021 modeling predicting ignitions at the circuit protection zone (CPZ)

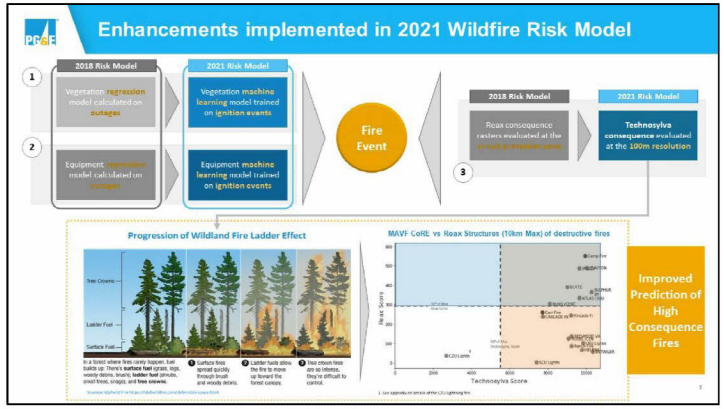
✖

Fire Spread Model

Likelihood of Spread ✖ **Consequence**

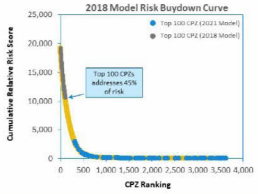
Spread likelihood was determined based on a study conducted by PG&E and Technosylva

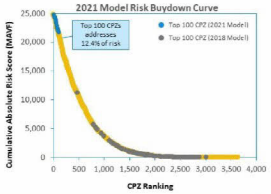
Consequence considerations focused on the potential impact of a wildfire


Enhancements implemented in 2021 Wildfire Risk Model
2018 Risk Model
2021 Risk Model
Vegetation regression model calculated on outages
Vegetation machine learning model trained on ignition events
Equipment regression model calculated on outages
Equipment machine learning model trained on ignition events
Fire Event
2018 Risk Model
2021 Risk Model
Reax consequence rasters evaluated at the 100m resolution
Technosylva consequence evaluated at the 100m resolution
Progression of Wildland Fire Ladder Effect
Tree Crowns
Ladder Fuel
Surface Fuel
MAVF CoRE vs Reax Structures (10km Max) of destructive fires
Risk Score
Technosylva Score
Improved Prediction of High Consequence Fires

Risk models provide risk buydown curves to guide workplan

The risk buydown curve shows ***the amount of risk that can be addressed*** with every subsequent mile within a CPZ that is mitigated. This view shows the relative magnitude of potential projects and can compares impacts of programs with varied effectiveness. The visualization helps to highlight the consolidation of risk by CPZ as you move down the prioritization list.

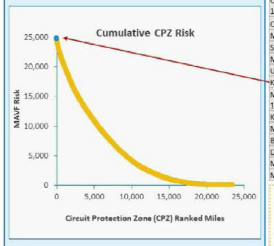




Equipment (Conductor) Risk Buydown curves highlight the significant shift of where the top 100 CPZ's are between the two models primarily as a result of the shift in the consequence model

Project Example

The top 50 riskiest miles represent 1.4% of the system risk.

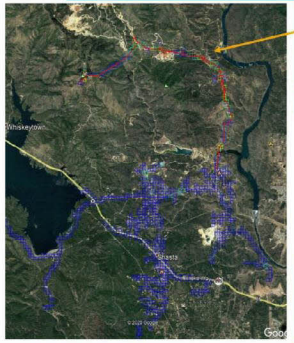


Protection Zone Name	Miles	Cumulative Miles	Mean MAVF Score	Total CPZ MAVF	% total risk reduced (62%)
OREGON TRAIL 1103CUS391	0.02	0.02	3.16	3.16	**0.01%**
CALPINE 1144276-G	0.01	0.03	1.88	1.88	**0.01%**
MARIPOSA 210190130	0.08	0.12	1.69	1.69	**0.02%**
SHEPHERD 2111688294	0.01	0.13	1.44	1.44	**0.02%**
MIDDLETOWN 1103CB	0.05	0.18	1.30	5.20	**0.03%**
UPPER LAKE 1101CB	1.00	1.17	1.26	3.77	**0.04%**
KESWICK 11011586	6.66	7.83	1.25	48.84	**0.17%**
MIDDLETOWN 1102302610	4.21	12.04	0.92	48.56	**0.29%**
KONOCTI 1102965078	5.61	17.65	0.88	51.70	**0.42%**
MARIPOSA 2102241564	0.64	18.29	0.77	10.81	**0.44%**
BUCKS CREEK 1101CB	4.29	22.58	0.73	9.55	**0.47%**
DEL MAR 2109378446	0.09	22.67	0.73	2.19	**0.47%**
MIDDLETOWN 1102CB	0.42	23.08	0.72	8.70	**0.49%**
MIDDLETOWN 1103830	24.80	47.88	0.72	151.83	**0.87%**

Key Takeaways

- Mitigating 25 of the 50 riskiest miles within PG&E's service territory would reduce ~0.5% of PG&E's total wildfire risk.
- Reason it is only 0.5% is because this is across all circuits in HFTD's (~25,000 miles)
- On each project a more granular risk spend efficiency calculation can and will be performed on an NPV basis once the project is fully scoped similar to what is shown on the Keswick 11011586 circuit protection zone

Project Example: Keswick 11011586 Circuit Protection Zone



Keswick 11011586 Circuit Protection Zone

- 6.6 Miles in total, the 100m X 100m squares are the absolute risk values for each section of that protection zone
- The total protection zone absolute risk score is 48.84 risk units (sum of all the 100m squares along the circuit)
- Average risk score of all the squares gives the CPZ mean risk score of 1.25

Keswick (6.6 Miles)	No System Hardening	Overhead Hardening	Under-grounding	50%-50% OH / UG
Total CPZ Risk Reduced After Mitigation	48.84	30.28	48.35	39.32
Total CPZ Residual Risk Value	**48.84**	**18.56**	**0.49**	**9.52**
Overall Miles Mitigated	6.6	6.6	6.6	6.6
OH System Hardening [redacted] /mile)	[redacted]			
UG System Hardening [redacted] /mile)				
Total Capital Cost				
Per Year O&M Spend				
NPV @ 7% discount rate				
$ NPV per unit of risk (RSE)				

Assumptions:

- Discount Rate: **7%**, Cost Escalation / Inflation: **3%** (inline with major project business cases)
- Benefit Duration: **80** years for OH and **60** for UG (inline with capital accounting)
- Routine Veg Tree Count / Mile: **50.76**
- PSPS Cost of Reenergizing [redacted] **/ mile**
- Patrols and Inspections [redacted] **/ mile** for OH and [redacted] **/ mile** for UG

Lead time to scope and complete projects is 12-18 months

System Hardening Project Life Cycle

- 3 months — Preliminary, Field, & Final Scoping
- 2 months — Estimating
- 3 months — Dependencies & Contracts
- 1 month — Approvals & Scheduling
- 2-3 months — Construction & QC
- 2-4 months — Documentation & Closeout

Alternative 1

Focus exclusively on the highest risk area miles, and utilize excess resources to complete HFTD EC tags and other non-hardening capital work

Miles Addressed: 147.7	Highest Risk Area Miles: 147.7	Risk Reduced: 281.3 (1.1%)

Alternative 2

Maximize the amount of system hardening work that can be completed by carrying over all construction ready work for 2021

Miles Addressed: 254.2	Highest Risk Area Miles: 7.2	Risk Reduced: 30.27 (0.1%)

Recommendation

Utilize the 2021 Risk Model to inform prioritization of current scoped work, while maximizing the amount of efficient system hardening that can be completed before wildfire season

Miles Addressed: 306	Highest Risk Area Miles: 147.7	Risk Reduced: 283 (1.2%)

Target Setting

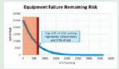
System Hardening

Conditions

Condition 1: 80%[1] of system hardening miles have to be high-risk miles over the three-year period or LTIP is 0

Risk Profile (High Risk Miles defined as)

1. Top 20%[2] of risk buydown curve
2. Fire rebuild miles
3. PSPS mitigation miles



Condition 2: Set minimum percentage of miles mitigated with either Line Removal or Undergrounding over the three-year period or LTIP is 0

Risk Effectiveness

- 10% of Undergrounding or Line Removal work in the System Hardening project portfolio[3]

Risk Exposure

- Count of circuit miles system hardened in the HFTD and HFRA

System Hardening Targets (Risk Miles)

	LTIP 0.5	LTIP 1.0	LTIP 2.0
2021	305	320	350
2022	350	368	403
2023	396	416	455
2021-2023	1,051	1,103	1,209

1. Basis of the 80% is to allow for operational execution considerations including permitting, weather related access, and mob/demob efficiencies
2. Basis of the top 20% correlates to ~70% of the risk on the risk buydown curve
3. Risk reduction effectiveness for Overhead Hardening is estimated at 62% and Undergrounding or Line Removal is estimated at 99%

Enhanced Vegetation Management (EVM)

Conditions

Condition 1: 80%[1] of EVM miles have to be high-risk miles over the three-year period or LTIP is 0

Risk Profile (High Risk Miles defined as)
- Top 20%[2] of risk model buydown curve
- Fire impacted miles

Risk Effectiveness
- Execute work consistent with defined EVM scope
  - Achieve 12' recommended radial clearance
  - Assess strike potential trees including high risk species
  - Remove overhangs above and within 4 feet of power lines
  - Mitigate vegetative fuels under and adjacent to powerlines on targeted basis

Risk Exposure
- Count of EVM miles worked in the HFTD and HFRA

EVM Targets (Risk Miles)

	LTIP 0.5	LTIP 1.0	LTIP 2.0
2021	1,800	1,890	2,070
2022	1,800	1,890	2,070
2023	1,800	1,890	2,070
2021-2023	5,400	5,670	6,210

Note: Targets are based on 12-yr EVM Program pace (2021 – 2032) consistent with the POR. Evaluating viability of 10-yr pace (2021 – 2030).

1. Basis of the 80% is to allow for operational execution considerations including permitting, weather-related access and, customer approvals
2. Basis of the top 20% correlates to ~85% of the risk on the risk buydown curve

The LTIP targets for system hardening are set based on 2021 risk miles and program funding assumptions

Program Funding
- Forecast of [redacted] Wildfire Mitigation capital spend in 2021 consistent with the Settlement for the 2020-2022 GRC. 2022 forecast escalates 2021 by 15% and 2023 forecast escalates 2021 by 30%.

Unit Costs
- Assumes [redacted] per circuit miles of Overhead SH work and [redacted] for Underground work

Program Duration
- Execution of the **13-year** plan focusing on top 20% circuit protection zones by **2032**

System Hardening LTIP Targets

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Targets are miles of system hardening work for specific risk-prioritized work

- The total mileage of the proposed 2021 Project Portfolio was set as the threshold goal (LTIP 0.5) for 2021
- LTIP 0.5 goals in 2022 and 2023 reflect escalation of program funding level
- The target and stretch goals (LTIP 1.0, 2.0) were set as 5% and 15% higher, respectively

[redacted] includes scoping and engineering costs for future system hardening projects beyond 2021 and additional minor capital spend for other Wildfire Mitigation Programs

The LTIP targets for EVM are set based on work to be completed over the remaining twelve years of the program

Program Duration
- Assumes execution of the 12-year Enhanced Vegetation management Plan **(2021-2032)**
- Evaluating viability of 10-year pace (2021-2030)

Program Funding
- Forecast w[redacted] spend on EVM program in 2021, 2022 and 2023 respectively (in alignment with POR)
- 10-year pace will result in incremental forecast of ~$105M per year

Unit Costs
- Assumes [redacted] per miles of EVM work

Enhanced Vegetation Management LTIP Targets

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Detailed Project Level Signoff and Tracking

Wildfire Governance Review

- List of 2021 System Hardening Projects will be formally approved by the Chief Risk Officer.
  - To ensure risk focus and to ensure other factors do not dilute the risk reduction objective
  - Allows judgement to be applied to address 2021 Work plan transition due to a big shift in the risk model
- List of 2021 Enhanced Vegetation Miles (specific location) will also be formally approved by the Chief Risk Officer

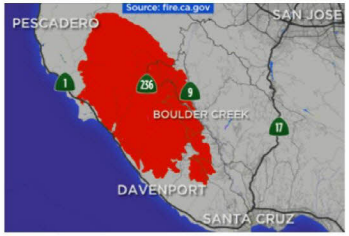
PG&E Board – Risk Committee

- List of 2021 System Hardening Projects and List of 2021 Enhanced Vegetation Miles (specific location) will be provided to the PG&E Board by the Chief Risk Officer
- In 2021 Quarterly Updates regarding progress on both System Hardening and Enhanced Vegetation Management will be submitted to the PG&E Board by the Chief Risk Officer, focusing on
  - Amount of Risk Reduced at the Project Level, from both location of the project / miles on the risk curve and mitigation that was performed (line removal, underground, overhead)
  - Progress being made on developing 2022 plan

Appendix

Review of Work Plans

CZU Lightning Complex Fire Map



Source: CALFIRE

Damage Overview

- **86,509 acres burned**
- **Active for 37 days**
- **1,490 structures destroyed**
- **140 structures damaged**
- **1 injury**
- **1 fatality**

Fire Description and Observations

- The wildfires started at 6:41 AM on August 16, 2020 and were the result of a thunderstorm that produced close to **11,000 bolts of lightning** and started **hundreds of fires** throughout California
- The lightning strikes initially **started fires separately** known as the Warnella Fire near Davenport and the Waddell Fire, near Waddell Creek, as well as three fires on what would become the northern edge of the CZU Complex fire.
- Two days after the fires began, **a change in wind conditions** caused these three northern fires **to rapidly expand and merge**, growing quickly to over 40,000 acres
- The modeling complexity of this wildfire is such that it would **require taking into account the hundreds of fires** that were started rather than treating this as a single wildfire