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Exhibit No.: (PG&E-3)
Date: June 30, 2021
Witness(es): Various

PACIFIC GAS AND ELECTRIC COMPANY

2023 GENERAL RATE CASE

EXHIBIT (PG&E-3)

GAS OPERATIONS

WORKPAPERS SUPPORTING

PREPARED TESTIMONY CHAPTERS 6-9

VOLUME 2 OF 4



PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 6, ASSET FAMILY - FACILITIES

TABLE OF CONTENTS

Subject	Page No.
Expense Workpapers	
Recorded and Forecast Expenses by MWC (Nominal Dollars)	WP 6-1
Recorded and Forecast Expenses by MWC (Base Year Dollars)	WP 6-2
Recorded and Forecast Expenses by MAT Code (Nominal Dollars)	WP 6-3
Recorded and Forecast Expenses by MAT Code (Base Year Dollars)	WP 6-4
Summary of Expenses	WP 6-5
GT Routine C&P Expense - JTY	WP 6-6
GT Routine M&C Expense - JTW	WP 6-7
GT Gas Quality Assessment - JT8	WP 6-8
GT Station Over Pressure Protection Enhancements Expense - JTX	WP 6-9
GT FIMP Risk Management - JTL	WP 6-10
GT Engineering Critical Assessment (ECA) Phase 2 Expense - LV2	WP 6-11
GT Engineering Critical Assessment (ECA) Phase 2 Expense - LV2	WP 6-12
GT Station Strength Testing Expense - JTV	WP 6-13
GT Station Strength Testing Expense - JTV	WP 6-14
GD Station OPP Enhancements Expense - FHQ	WP 6-15
GD CNG Stations Expense - GMC	WP 6-16
Project Summaries	
Project Summary GT Gas Quality Assessments MAT JT8	WP 6-17
Project Summary GT Engineering Critical Assessment (ECA) Phase 2 - MAT LV2, MAT 76S	WP 6-19

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 6, ASSET FAMILY - FACILITIES

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Project Summary GT Station Strength Testing - MAT JTV MAT 76V	WP 6-21
Expense Historical and Forecast Walk Workpapers	
Expense Historical Walk by MWC - Transmission	WP 6-24
Expense Forecast Walk by MWC - Transmission	WP 6-25
Expense Historical Walk by MWC - Distribution	WP 6-26
Expense Forecast Walk by MWC - Distribution	WP 6-27
Capital Workpapers	
Capital Expenditures by MWC (Nominal Dollars)	WP 6-28
Forecast Capital Expenditures Summary (Nominal Dollars)	WP 6-29
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million	WP 6-30
Recorded and Forecast Capital Expenditures Details - Other Work Capital – Projects Under \$3 Million	WP 6-31
Summary of Capital Expenditures	WP 6-32
GT Routine C&P Capital- 76N	WP 6-33
GT Electrical Upgrades - Hinkley and Topock - 76P	WP 6-34
GT Electrical Upgrades - Hinkley and Topock - 76P	WP 6-35
GT Compressor Controls Upgrade - 76T	WP 6-36
GT Compressor Controls Upgrade - 76T	WP 6-37
GT Compressor Replacement - 76X	WP 6-38

PACIFIC GAS AND ELECTRIC COMPANY
 2023 GENERAL RATE CASE
 EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
 CHAPTER 6, ASSET FAMILY - FACILITIES

TABLE OF CONTENTS
 (CONTINUED)

Subject	Page No.
GT Compressor Replacement - 76X	WP 6-39
GT Compressor Replacement - 76X	WP 6-40
GT Routine M&C Capital - 75C	WP 6-41
GT Simple Station Rebuilds - 763	WP 6-42
GT Simple Station Rebuilds - 763	WP 6-43
GT Complex Station Rebuilds - 764	WP 6-44
GT Complex Station Rebuilds - 764	WP 6-45
GT Transmission Terminal Upgrades - 765	WP 6-46
GT Transmission Terminal Upgrades - 765	WP 6-47
GT Station Over Pressure Protection Enhancements Capital - 76G	WP 6-48
GT Station Over Pressure Protection Enhancements Capital - 76G	WP 6-49
GT Station Over Pressure Protection Enhancements Capital - 76G	WP 6-50
GT Station Strength Testing Capital - 76V	WP 6-51
GT Physical Security Capital - 76Z	WP 6-52
GT Physical Security Capital - 76Z	WP 6-53
GD Regulator Station Component Replacements - 50L	WP 6-54
GD Regulator Station Rebuilds - 50C	WP 6-55
GD HPR Program - 2K	WP 6-56
GD Station Over Pressure Protection Enhancements Capital - 50N	WP 6-57
GD CNG Stations - 31A	WP 6-58

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 6, ASSET FAMILY - FACILITIES

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Project Summaries	
Project Summary – GT Complex Station Rebuilds Program - 764	WP 6-59
Project Summary GT Terminal Upgrades MAT 765 Brentwood Rebuild	WP 6-62
Project Summary GT Compressor Controls Upgrade MAT 76T	WP 6-64
Project Summary GT Compressor Replacement MAT 76X Los Medanos	WP 6-66
Project Summary GT Compressor Station Retirement MAT 76X Tionesta	WP 6-68
Project Summary GT Station Overpressure Protection Program (OPP) Enhancements MAT 50N, 76G, FHQ, JTX	WP 6-70
Capital Historical and Forecast Walk Workpapers	
Capital Historical Walk by MWC - Transmission	WP 6-73
Capital Forecast Walk by MWC - Transmission	WP 6-74
Capital Historical Walk by MWC - Distribution	WP 6-75
Capital Forecast Walk by MWC - Distribution	WP 6-76
Reasonableness Review Workpapers	
MCOPPMA Capital Summary	WP 6-77
MCOPPMA Capital Details	WP 6-78
CDPMA Expense Summary	WP 6-79
CDPMA Expense Details	WP 6-80

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 6, ASSET FAMILY - FACILITIES

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Supplemental Workpapers	
Reasonableness Review - 2019 GT&S Rebuttal Testimony	WP 6-81
Reasonableness Review - 2019 GT&S Forecast	WP 6-82
Burney Physical Security Upgrade Cost Summary	WP 6-83
Burney Physical Security Upgrade Cost Details	WP 6-84
Storage Facility Above Ground Decommissioning	WP 6-85
M&C Station Rebuild White Paper	WP 6-86
Odor Fade Mitigation Program White Paper	WP 6-99
Deferred Work	
Deferred Work Analysis	WP 6-104

Table 6-1
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 6
Asset Family – Facilities
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	FH	G Dist Preventive Maint	1	374	2,514	1,510	781	3,250	3,529	1,807	
2	GM	Manage Energy Efficiency-NonBA	3,494	3,955	3,631	4,231	3,997	3,870	3,959	4,416	
3	JT	GT Reliability & General Maint	14,973	14,826	18,104	16,480	16,813	23,886	25,147	33,265	
4	LU	GTS Manage Critical Documents-BA	5,650	(1,698)	1,990	588	2,903	4,000	16,500		
5	LV	GTS Station Assessments-BA	8,728	7,916	9,026	11,503	13,990	2,392	2,211	14,032	
6	Total		32,847	25,374	35,264	34,312	38,484	37,399	51,345	53,520	WP 6-5, Line 16

Notes: (A) Line 6, 2022 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 6-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 6
Asset Family – Facilities
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016		2017		2018		2019		2020		2021		2022		2023	
			Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Forecast	Forecast	Forecast	Forecast
1	FH	G Dist Preventive Maint	1	400	2,535	1,509	781	3,182	3,347	1,659								
2	GM	Manage Energy Efficiency-NonBA	3,831	4,229	3,761	4,267	3,997	3,799	3,767	4,072								
3	JT	GT Reliability & General Maint	16,142	15,635	18,416	16,411	16,813	23,626	24,183	31,034								
4	LU	GTS Manage Critical Documts-BA	5,993	(1,815)	1,990	581	2,903	3,988	16,024									
5	LV	GTS Station Assessments-BA	9,249	8,386	9,225	11,499	13,990	2,361	2,119	13,041								
6	Total		35,216	26,836	35,927	34,266	38,484	36,957	49,440	49,805								

Table 6-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 6
Asset Family – Facilities
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	FH	FHQ	GD Over Pressure Protectn Exp.	1	374	2,514	1,510	781	3,250	3,529	1,807	WP 6-5, Line 12
2	FH Total			1	374	2,514	1,510	781	3,250	3,529	1,807	
3	GM	GMC	GD LNG/CNG Station	3,640	3,945	3,626	4,231	3,998	3,859	3,959	4,416	WP 6-5, Line 14
4		#	Not assigned	(146)	9	5		(1)	11			WP 6-5, Line 13
5	GM Total			3,494	3,955	3,631	4,231	3,997	3,870	3,959	4,416	
6	JT	JT7	Phy Security-Exp (Do Not Use)	199	1			11				WP 6-5, Line 1
7		JT8	Gas Quality Assessment - Exp	290	430	520	257	1,113	1,350	1,086	2,000	WP 6-5, Line 2
8		JTL	FIMP Risk Management	1,916	1,802	1,851	2,334	2,625	3,250	2,934	2,527	WP 6-5, Line 3
9		JTV	Station Strength Test Exp C&P				22	(104)	1,000	2,794	12,704	WP 6-5, Line 4
10		JTW	Routine Spend M&C - Expense	3,596	2,794	3,771	3,604	4,759	6,283	6,692	4,506	WP 6-5, Line 5
11		JTX	GT Over Pressure Protection		444	1,075	1,290	588	1,853	1,673	1,102	WP 6-5, Line 6
12		JTY	Routine Spend C&P Expense	8,974	9,354	10,887	8,974	7,821	10,150	9,968	10,426	WP 6-5, Line 7
13	JT Total			14,973	14,826	18,104	16,480	16,813	23,886	25,147	33,265	
14	LU	LU1	Critical Documents - Expense	5,650	(1,698)	1,990	588	2,903	4,000	16,500		WP 6-5, Line 8
15	LU Total			5,650	(1,698)	1,990	588	2,903	4,000	16,500		
16	LV	LV1	Engineering Crtcl Assmnt 1	7,695	7,718	8,322	11,054	9,587				WP 6-5, Line 9
17		LV2	Engineering Crtcl Assmnt 2	1,033	198	704	448	4,403	2,392	2,211	14,032	WP 6-5, Line 10
18	LV Total			8,728	7,916	9,026	11,503	13,990	2,392	2,211	14,032	
19	Total			32,847	25,374	35,264	34,312	38,484	37,399	51,345	53,520	WP 6-5, Line 16

Notes: (A) Line 19, 2022 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 6-4
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 6
Asset Family – Facilities
Expenses by MAT Code
(Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016		2017		2018		2019		2020		2021		2022		2023		
				Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Recorded Adjusted	Forecast
1	FH	FHQ	GD Over Pressure Protectn Exp.	1	400	2,535	1,509	781	3,182	3,347	1,659									
2	FH Total			1	400	2,535	1,509	781	3,182	3,347	1,659									
3	GM	GMC	GD LNG/CNG Station	3,998	4,220	3,755	4,267	3,998	3,789	3,767	4,072									
4		#	Not assigned	(167)	10	5		(1)	10											
5	GM Total			3,831	4,229	3,761	4,267	3,997	3,799	3,767	4,072									
6	JT	JT7	Phy Security-Exp (Do Not Use)	210	1			11												
7		JT8	Gas Quality Assessment - Exp	325	472	544	264	1,113	1,335	1,044	1,864									
8		JTL	FIMP Risk Management	2,057	1,886	1,864	2,311	2,625	3,214	2,819	2,355									
9		JTV	Station Strength Test Exp C&P				23	(104)	989	2,684	11,841									
10		JTW	Routine Spend M&C - Expense	3,897	2,982	3,863	3,613	4,759	6,213	6,429	4,200									
11		JTX	GT Over Pressure Protection		464	1,126	1,285	588	1,832	1,608	1,027									
12		JTY	Routine Spend C&P Expense	9,653	9,831	11,019	8,916	7,821	10,043	9,599	9,747									
13	JT Total			16,142	15,635	18,416	16,411	16,813	23,626	24,183	31,034									
14	LU	LU1	Critical Documents - Expense	5,993	(1,815)	1,990	581	2,903	3,988	16,024										
15	LU Total			5,993	(1,815)	1,990	581	2,903	3,988	16,024										
16	LV	LV1	Engineering Crtcl Assmnt 1	8,174	8,171	8,493	11,033	9,587	2,361	2,119	13,041									
17		LV2	Engineering Crtcl Assmnt 2	1,075	214	732	466	4,403	2,361	2,119	13,041									
18	LV Total			9,249	8,386	9,225	11,499	13,990	2,361	2,119	13,041									
19	Total			35,216	26,836	35,927	34,266	38,484	36,957	49,440	49,805									

Table 6-5
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family Facilities
Summary of Expenses

Gas Transmission Expense													
Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference	Notes
1	Physical Security Expense	JT	JT7	198,903	1,240	-	-	10,901	-	-	-	WP 6-8	1
2	M&C Gas Quality Assessment	JT	JT8	289,579	430,317	519,662	519,662	1,113,088	1,350,002	1,086,231	2,000,001	WP 6-10	
3	FIMP Risk Management	JT	JTL	1,915,568	1,802,469	1,851,316	1,851,316	2,625,085	3,400,302	3,087,871	2,684,784	WP 6-13	
4	Station Strength Testing Expense	JT	JTV	-	-	-	-	(104,381)	1,000,000	2,793,668	12,704,384	WP 6-7	
5	Routine M&C Expense	JT	JTW	3,595,625	2,794,155	3,770,726	3,603,730	4,759,071	6,283,000	6,691,502	4,505,965	WP 6-9	
6	GT Station OPP Enhancements Expense	JT	JTX	-	443,823	1,074,642	1,289,606	587,544	1,853,105	1,673,350	1,101,765	WP 6-9	
7	Routine C&P Expense	JT	JTY	8,973,575	9,354,106	10,887,497	8,973,761	7,821,445	10,000,000	9,814,246	10,267,712	WP 6-6	
8	Critical Documents	LU	LU1	5,650,154	(1,697,525)	1,989,864	587,766	2,903,433	4,000,000	5,250,000	-		2
9	Engineering Critical Assessment (ECA) Phase 1 Expense	LV	LV1	7,694,930	7,718,199	8,321,957	11,054,498	9,586,520	-	-	-		3
10	Engineering Critical Assessment (ECA) Phase 2 Expense	LV	LV2	1,033,019	198,240	704,288	448,358	4,403,102	2,392,424	2,210,999	14,032,389	WP 6-11	
11	Total Expenses			29,351,353	21,045,024	29,119,952	28,570,860	33,705,807	30,278,833	32,607,867	47,297,000		

Notes
 (1) Physical Security Expense (MAT JT7) is centralized under corporate security and is not forecasted under this chapter for 2023 rate case period
 (2) Critical Documents (MAT LU1) program ends in 2022 and not forecasted for 2023 rate case period
 (3) ECA1 (MAT LV1) program ends in 2022 and not forecasted for 2023 GRC period

Gas Distribution Expense													
Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference	Notes
12	GD Station OPP Enhancements Expense	FH	FHQ	1,122	374,239	2,513,786	1,509,790	781,328	3,250,226	3,528,803	1,806,786	WP 6-15	4
13	Natural Gas Fueling Facilities	GM	GM#	(145,748)	9,376	5,131	(177)	(641)	10,542	-	-		
14	CNG Stations Expense	GM	GMC	3,640,122	3,945,457	3,625,620	4,231,252	3,997,685	3,659,409	3,958,555	4,415,918	WP 6-16	
15	Total Expenses			3,495,496	4,329,072	6,144,537	5,740,865	4,778,472	7,120,177	7,487,358	6,225,704		

(4) MAT GM# is used for Natural Gas Fueling Facilities, Other and is not forecasted for 2023 rate case period

Table 6-6
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Routine C&P Expense - MAT JTY

Program: GT Routine Compression and Processing (C&P) Expense, MAT JTY

Program Description

GT Routine C&P Expense program includes a wide assortment of expense projects within the C&P asset family such as equipment leases, service contracts, maintenance agreements, equipment overhauls and other expense-related repairs.

Table 1: GT Routine C&P Expense	2023
Total Expense	\$10,267,713

Table 2, Line 7

	2018	2019	2020
Table 2: Calculation			
GT Routine C&P Expense Recorded	\$ 10,887,497	\$ 8,973,761	\$ 7,821,445
Adjustments for Pleasant Creek Facility	\$ 122,790	\$ 7,789	\$ 20,726
GT Routine C&P Expense Adjusted (unescalated)	\$ 10,764,707	\$ 8,965,972	\$ 7,800,719
Escalation (2023)	1,1435	1,1127	1,0919
GT Routine C&P Expense Recorded (in 2023 \$\$)	\$ 12,309,774	\$ 9,976,101	\$ 8,517,264
Adjusted 3-year Average		\$	\$ 10,267,713

Note #1
Line 2 - Line 3
Line 4 * Line 5
Note #2

Notes:

- #1 Pleasant Creek Storage Facility expected to be decommissioned in 2022. Historical project costs are removed from average calculation for 2023.
- #2 Expense 3-year average (2018-2020)

Table 6-7
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GT Routine M&C Expense - MAT JTW

Program: GT Routine Measurement and Control (M&C) Expense, MAT JTW

Program Description:

GT Routine M&C Expense program includes a wide assortment of expense projects within the M&C asset family such as assessment and repair of valves, actuators, monitors & controllers, electrical circuits, SCADA units, meter repairs, etc.

Table 1: GT Routine M&C Expense	2023
Total Expense	\$4,505,966

Table 2, Line 5

Table 2: Calculation	2018	2019	2020
GT Routine M&C Expense Recorded	\$ 3,770,726	\$ 3,603,730	\$ 4,759,071
Escalation (2023)	1.1435	1.1127	1.0919
GT Routine M&C Expense Recorded (in 2023 \$s)	\$ 4,311,942	\$ 4,009,736	\$ 5,196,221
Adjusted 3-year Average		\$	\$ 4,505,966

Line 2 * Line 3
 Note #1

Notes:

#1 Expense 3-year average (2018-2020)

Table 6-8
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GT Gas Quality Assessment Expense - MAT JT8

Program: GT Gas Quality Assessment Expense, MAT JT8

Program Description:

The GT Gas Quality Assessment program ensures that the quality of the gas delivered into the PG&E system is suitable for transmission and distribution by PG&E and for the end users and meets the California Public Utilities Commission (CPUC) gas quality regulatory requirements. The GT Gas Quality Assessment Expense Program also ensures that natural gas is properly odorized for use in the system. The expense activities in this program are driven by PG&E's Gas Quality Management Plan. In addition to ongoing gas quality initiatives, PG&E is developing targeted odor fade mitigation activities under this program to address the processes and procedures impacting odor fade risk reduction. 2023 GRC forecast includes costs anticipated for projects to support both odor fade and gas quality initiatives.

Table 1: GT Gas Quality Assessment Expense	
Total Cost	2023 \$2,000,000
Total GT Gas Quality Assessment Expense	\$2,000,000

Table 2, Line 9
Line 1

Table 2: Calculation	
Projects	2020
Gas Quality Assessment Recorded	\$1,113,088
Odor Fade Initiative - Review & Update Standards and Procedures (odorization and pipeline conditioning) ^[1]	\$250,000
Odor Fade Initiative - Testing & Research and Technical Support ^[1]	\$250,000
Odor Fade Mitigation - Restoration of Odorant Concentration ^[1]	\$200,000
Total Cost (2020 \$)	\$1,813,088
Escalation (2023)	1,0919
Total Cost (2023 \$) Rounded	\$2,000,000

Line 7 * Line 8

Notes:

#1 Based on the anticipated initiative costs by internal and external subject matter experts.

Table 6-9
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GT Station Overpressure Protection Enhancements Expense - MAT JTX

Program: GT Station Overpressure Protection (OPP) Enhancements Expense, MAT JTX

Program Description:

GT Station OPP program is a mitigation to prevent large overpressure (OP) events due to equipment-related failure at regulator stations. The expense projects related to this program include the following activities:

- Installing pilot filters (sulfur filters) to reduce the likelihood of pilot-operated regulator or monitor failure due to sulfur.
- System planning studies to identify the most effective secondary overpressure protection option for specific stations.
- Developing new design standards for primary Large Volume Customer (LVC) regulation sets.
- Program management for developing and maintaining the master overpressure elimination plan and schedule.
- Pilot studies on new valve technologies for applicability to the PG&E system.

Table 1: GT Station OPP Expense	2023
Total Expense	\$1,101,765

Table 2, Line 5

	2018	2019	2020
GT Station OPP Expense Recorded	\$ 1,074,642	\$ 1,289,606	\$ 587,544
Escalation (2023)	1,1435	1,1127	1,0919
GT Station OPP Expense (in 2023 \$\$)	\$ 1,228,886	\$ 1,434,896	\$ 641,513
Adjusted 3-year Average	\$ 1,101,765		

Line 2 * Line 3
 Note #1

Notes:

#1 Expense 3-year average (2018-2020)

Table 6-10
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT FIMP Risk Management Program -MAT JTL

Program: GT Facilities Integrity Management Program (FIMP) Risk Management Program, MAT JTL

Program Description:

GT FIMP Risk Management Program includes foundational activities that enable PG&E to (1) continuously improve its understanding of risks associated with its M&C and C&P stations and (2) identify appropriate risk mitigations. This program focuses on improving the quality of asset and condition information and contributes to the development of tools that enable easy access to that information. The following activities are included under the program:

- Risk Identification and Assessment: Execution of process safety studies at selected facilities to identify potential safety threats; causal analyses of facility-related events to identify emerging threats and risks;
- Identification and specification of data needs and tools to provide for ongoing asset management decision-making; and continued development of probabilistic risk assessment models to support program evaluation.
- Identification of Risk Mitigation Strategies: Benchmarking studies in order to understand the performance, practices, and technologies of other operators.
- Technical Assessments: Targeted technical assessments (such as pressure vessel inspections, seismic studies, reliability-centered maintenance studies, etc.) to inform prioritization of future activities; and pilot programs to demonstrate and/or test new technology, identify process solutions, and develop work procedures prior to full implementation.

		2023			
1	Total Expense	\$2,526,567			
2	Shared Services Geo Services Forecast Allocation	\$158,217			
3	Total Expense for MAT JTL	\$2,684,784			

Table 1: GT FIMP Risk Management
 Table 2, Line 7
 Note #1

			2018	2019	2020
4	FIMP Risk Management Recorded	\$	1,851,316	\$ 2,333,545	\$ 2,625,085
5	Escalation (2023)		1,1435	1,1127	1,0919
6	FIMP Risk Management Recorded (in 2023 \$s)	\$	2,117,037	\$ 2,596,448	\$ 2,866,216
7	Adjusted 3-year Average			\$	\$ 2,526,567

Line 4 * Line 5
 Note #2

Notes:

- #1 \$158,217 included in the forecast to support Geosciences. Please see Exhibit (PG&E 7), Chapter 10 for more information.
- #2 Expense 3-year average (2018-2020)

Table 6-11
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Engineering Critical Assessment Phase 2 Expense - MAT LV2

Program: GT Engineering Critical Assessment Phase 2 (ECA2) Expense, MAT LV2

Program Description:

GT ECA2 is a program of alternatives to traditional hydrostatic pressure testing. It is intended to mitigate discrepancies remaining after ECA Phase 1 activities that provide the desired reduction in risk to safety and reliability while limiting the risks introduced through the pressure testing of station components. ECA2 addresses this in a manner that is low-risk and minimally disruptive to gas operations by avoiding or limiting system outages, while simultaneously providing the desired reduction in risk to safety and reliability. ECA2 expense forecast includes the following activities:

- 1) Program development and administration.
- 2) Non-destructive examination (NDE).
- 3) Material verification.

Table 1: GT ECA2 Expense		2023 GRC
1	Engineering Critical Assessments Phase 2 Expense (Costs to address station components installed on or before 12/31/1955) ⁽¹⁾	\$13,576,479
2	Escalation (2023)	1,0336
3	Total Engineering Critical Assessments Phase 2 Expense	\$14,032,389

Table 2, Line 7
Note #1

Line 1 * Line 2

Table 2: GT ECA2 Estimate		Unescalated
Engineering Critical Assessments Phase 2 Expense Program		2023
4	ECA2 - Program Development	\$750,000
5	ECA2 - NDE	\$8,550,986
6	ECA2 - Material Verification	\$4,275,493
Total Engineering Critical Assessments Phase 2 Expense (Costs to address station components installed on or before 12/31/1955) ⁽¹⁾		\$13,576,479

From WP 6-12 Table A
From WP 6-12 Table B
From WP 6-12 Table C

Note #1

Notes:

#1 Per 2015 GT&S Final decision D. 16-06-056, Engineering Critical Assessments Phase 2 Balancing Account includes only costs associated with station components installed on or before 12/31/1955.

Table 6-11a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Engineering Critical Assessment Phase 2 - MAT LV2

Program: GT Engineering Critical Assessment Phase 2 (ECA2), MAT LV2

TABLE A : ECA2 Program Development

	Categories	#Stations in Scope for 2023-2026	Fixed Costs ⁽¹⁾	Fixed Costs (Unescalated)		
				2023	2024	2025
1	ECA2 Program Development and Administration	N/A	\$ 1,500,000.00	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000
2	Total ECA2 Program Development		\$	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000
3	ECA2 Program Development (Costs to address station components installed on or before 12/31/1955) ⁽²⁾	50%	\$	\$ 750,000	\$ 750,000	\$ 750,000

Notes:

- [1] Unit cost estimated based on vendors estimates.
- [2] Percentage of station components length (i.e. pipe & fittings length) installed before 1/1/1956 without a TVC test record, as compared to the total length of all components in scope for ECA2 and ST.

TABLE B : ECA2 Non-destructive Examination (NDE) (per CFR § 192.624(c)(3) "Method 3")

	Categories	#Stations in Scope for 2023-2026 ⁽¹⁾⁽²⁾	Unit Cost / Station ⁽³⁾	Total Cost 2023-2026	Allocation (Unescalated) ⁽⁴⁾		
					2023	2024	2025
4	LVC	48	\$ 288,308	\$ 14,318,801	\$ 3,579,700	\$ 3,579,700	\$ 3,579,700
5	Small Stations	40	\$ 935,031	\$ 37,401,242	\$ 9,350,310	\$ 9,350,310	\$ 9,350,310
6	Large Stations	4	\$ 4,171,961	\$ 16,687,845	\$ 4,171,961	\$ 4,171,961	\$ 4,171,961
7	Total ECA2 NDE		\$	\$ 17,101,972	\$ 17,101,972	\$ 17,101,972	\$ 17,101,972
8	ECA2 NDE (Costs to address station components installed on or before 12/31/1955) ⁽⁵⁾	50%	\$	\$ 8,550,986	\$ 8,550,986	\$ 8,550,986	\$ 8,550,986

Notes:

- [1] Count of station in scope for ECA2 estimated based on ECA1 results.
- [2] Pace of program driven by compliance requirement from PHMSA Mega rule and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035).
- [3] Unit costs for ECA2 NDE are based on historical costs of 7 stations in ECA2 scope for 2019-2020.
- [4] Total cost allocated equally over 2023-2026
- [5] Percentage of station components length (i.e. pipe & fittings length) installed before 1/1/1956 without a TVC test record, as compared to the total length of all components in scope for ECA2 and ST.

TABLE C : ECA2 Material Verification (per CFR § 192.607)

	Categories	#Stations in Scope for 2023-2026 ⁽¹⁾⁽²⁾	Unit Cost / Station ⁽³⁾	Total Cost 2023-2026	Allocation (Unescalated) ⁽⁴⁾		
					2023	2024	2025
9	LVC	48	\$ 74,577.09	\$ 3,579,700	\$ 894,925	\$ 894,925	\$ 894,925
10	Small Stations	40	\$ 233,757.76	\$ 9,350,310	\$ 2,337,578	\$ 2,337,578	\$ 2,337,578
11	Large Stations	4	\$ 1,042,990.31	\$ 4,171,961	\$ 1,042,990	\$ 1,042,990	\$ 1,042,990
12	ECA2 Expense Material Verification		\$	\$ 4,275,493	\$ 4,275,493	\$ 4,275,493	\$ 4,275,493

Notes:

- [1] Count of station in scope for ECA2 estimated based on ECA1 results.
- [2] Pace of program driven by compliance requirement from PHMSA Mega rule and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035).
- [3] Unit costs for ECA2 Material Verification costs are based on historical costs of 7 stations in ECA2 scope for 2019-2020.
- [4] Total cost allocated equally over 2023-2026

Table 6-12
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Station Strength Testing Expense - MAT JTV

Program: GT Station Strength Testing Expense, MAT JTV

Program Description:

The GT Station Strength Testing Program will perform station pressure testing when warranted as a result of Engineering Critical Assessment (ECA) Phase 1 and Phase 2 findings. The Station Strength Testing Program forecast includes the following activities:

- 1) Program development and administration.
- 2) Strength testing of station (station piping and components identified as requiring strength testing by ECA Phases 1 and 2).
- 3) Material verification.

Table 1: GT Station Strength Testing Expense	
Station Strength Testing Expense (Costs to address station components installed on or before 12/31/1955) ⁽¹⁾	2023
	\$12,291,621
Escalation (2023)	1,0336
Total Expense	\$12,704,384

Table 2, Line 7
Note #1
Line 1 * Line 2

1
2
3

Table 2: GT Station Strength Testing Program Estimate	
Program Development and Administration	Unescalated
	2023
Strength Testing of Stations	\$750,000
Station Strength Testing - Material Verification (per CFR § 192.607)	\$10,212,000
Total Station Strength Testing Expense (Costs to address station components installed on or before 12/31/1955) ⁽¹⁾	\$1,329,621

From WP 6-14 Table A
From WP 6-14 Table B
From WP 6-14 Table C

Note #1

Notes:

#1 Per 2015 GT&S Final Decision D. 16-06-056, Station Strength Testing Memorandum Account includes only costs associated with station components installed on or before 12/31/1955.

Table 6-12a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Station Strength Testing - MAT JTV

Program: GT Station Strength Testing, MAT JTV

TABLE A : Station Strength Testing Program Development & Administration

Categories	#Stations in Scope for 2023-2033	Fixed Costs ⁽¹⁾	2023	2024	2025	2026
ST Program Development and Administration	N/A	\$1,500,000	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000
ECA2 Program Development (Costs to address station components installed before 1/1/1956)			\$ 750,000	\$ 750,000	\$ 750,000	\$ 750,000
		50%				

Notes:

- (1) Unit cost estimated based on the cost of development & administration of the ECA2 program.
- (2) Percentage of station components length (i.e. pipe & fittings length) installed before 1/1/1956 without a TVC test record, as compared to the total length of all components in scope for ECA2 and ST.

TABLE B : Station Strength Testing

Categories	#Stations in Scope for 2023-2026 ⁽¹⁾⁽²⁾	Unit Cost/ Station ⁽³⁾	Allocation (Unescalated) ⁽⁴⁾			
			2023	2024	2025	2026
LVC	22	\$ 1,213,000	\$ 7,278,000	\$ 7,278,000	\$ 6,065,000	\$ 6,065,000
Complex Stations (Cat A), except the very large ones	8	\$ 2,321,000	\$ 4,642,000	\$ 4,642,000	\$ 4,642,000	\$ 4,642,000
Simple Stations (Cat B)	12	\$ 1,168,000	\$ 3,504,000	\$ 3,504,000	\$ 3,504,000	\$ 3,504,000
Large Stations	2	\$ 5,000,000	\$ 5,000,000	\$ -	\$ -	\$ -
Station Strength Testing			\$ 20,424,000	\$ 20,424,000	\$ 14,211,000	\$ 14,211,000
Station Strength Testing (Costs to address station components installed on or before 12/31/1956)		50%	\$ 10,212,000	\$ 10,212,000	\$ 7,105,500	\$ 7,105,500

Notes:

- (1) Count of station in scope for strength testing estimated based on ECA1 results.
- (2) Pace of program driven by compliance requirement from PHMSA Mega rule and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035).
- (3) Unit cost for station strength test expense for LVC, Cat A, and Cat B stations calculated based on ten Cat B station projects of similar scope between 2016 to 2021 adjusted for complexity and CNG/LNG support needs. Unit cost for large stations calculated based on historical strength testing costs and SME judgement.
- (4) 2023-2026 costs allocated based on number of stations.
- (5) Percentage of station components length (i.e. pipe & fittings length) installed before 1/1/1956 without a TVC test record, as compared to the total length of all components in scope for ECA2 and ST.

TABLE C : Material Verification for Component Part of the Strength Test Scope

Categories	#Stations in Scope for 2023-2026 ⁽¹⁾⁽²⁾	Unit Cost for Material Verification ⁽³⁾	Allocation (Unescalated) ⁽⁴⁾			
			2023	2024	2025	2026
LVC	22	\$ 37,288.54	\$ 223,731.26	\$ 223,731.26	\$ 186,442.72	\$ 186,442.72
Complex Stations (Cat A), except the very large ones	8	\$ 116,878.88	\$ 233,757.76	\$ 233,757.76	\$ 233,757.76	\$ 233,757.76
Simple Stations (Cat B)	12	\$ 116,878.88	\$ 350,636.64	\$ 350,636.64	\$ 350,636.64	\$ 350,636.64
Large Stations	2	\$ 521,495.16	\$ 521,495.16	\$ -	\$ -	\$ -
Material Verification			\$ 1,329,621	\$ 1,329,621	\$ 770,837	\$ 770,837

Notes:

- (1) Count of station in scope for strength testing estimated based on ECA1 results.
- (2) Pace of program driven by compliance requirement from PHMSA Mega rule and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035).
- (3) Unit cost assumed to be half of the unit cost for Material Verification in the ECA2 program.
- (4) 2023-2026 costs allocated based on number of stations.

Table 6-13
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GD Station Overpressure Protection Enhancements Expense - MAT FHQ

Program: GD Station Overpressure Protection (OPP) Enhancements Expense, MAT FHQ

Program Description:

GD Station OPP Enhancements Expense program supports PG&E's overpressure elimination efforts through the following expense activities:

- Installing pilot filters (sulfur filters) to reduce the likelihood of pilot-operated regulator or monitor failure due to sulfur.
- System planning studies to identify the most effective secondary overpressure protection option for specific stations.
- Evaluating and testing modifications to the existing regulation devices on the Low Pressure (LP) Regulator Stations to isolate the station during both over- and under-pressure scenarios.
- Program management for developing and maintaining the master overpressure elimination plan and schedule.
- Pilot studies on new valve technologies for applicability to the PG&E system.

Table 1: GD Station OPP Expense	2023
Total Expense	\$1,806,786

Table 2, Line 5

	2018	2019	2020
Table 2: Calculation			
GD Station OPP Expense Recorded	\$ 2,513,786	\$ 1,509,790	\$ 781,328
Escalation (2023)	1,1467	1,1146	1,0941
GD Station OPP Expense Recorded (in 2023 \$s)	\$ 2,882,640	\$ 1,682,880	\$ 854,837
Adjusted 3-year Average		\$ 1,806,786	

Line 2 * Line 3
 Note #1

Notes:

#1 Expense 3-year average (2018-2020)

Table 6-14
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GD CNG Station Expense Program - MAT GMC

Program: GD Compressed Natural Gas (CNG) Station Expense Program, MAT GMC

Program Description:

Federal and state codes applicable to CNG stations require periodic maintenance to minimize safety risks by confirming the condition and function of a large number of station components. CNG Stations Expense Program consists of maintenance and operating expenditures for CNG stations.

Table 1: CNG Stations Expense	2023
Total Expense	\$4,415,918

Table 2, Line 5

	2018	2019	2020
Table 2: Calculation			
CNG Stations Expense Recorded	\$ 3,625,620	\$ 4,231,252	\$ 3,997,685
Escalation (2023)	1,1467	1,1146	1,0941
CNG Stations Expense Recorded (in 2023 \$s)	\$ 4,157,616	\$ 4,716,344	\$ 4,373,794
Adjusted 3-year Average		\$ 4,415,918	

Line 2 * Line 3
 Note #1

Notes:

#1 Expense 3-year average (2018-2020)

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Gas Quality Assessments Program

Project Title: Gas Quality Assessments

Major Work Categories: JT (MAT JT8)

Planning Order Numbers: Various POs, See Table 1 below

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

The Gas Quality Assessment Program ensures that the quality of the gas delivered into the PG&E system is suitable for transmission and distribution by PG&E and for the end users, and meets CPUC gas quality regulatory requirements. The purpose of the Gas Quality Assessment Program is to address gas quality issues to prevent the creation of solids, liquids, and other debris within the PG&E pipeline system and the capture and removal of such materials, as well as to ensure proper odorization.

Justification

The Gas Quality Assessment Program addresses gas quality issues such as particulate and liquids so that equipment operates correctly, materials do not degrade due to corrosion, and gas entering the PG&E system meets CPUC gas quality regulatory requirements. Gas quality management addresses threats associated with internal corrosion and equipment-related issues. Gas Quality Assessment is a control for two risks: Large Overpressure Event Downstream of Gas Measurement and Control (M&C) Facility risk and Loss of Containment at Gas Measurement and Control or Compression and Processing Facility risk.

Cost

The expense forecast for this program is based on the costs for the various activities included in the scope for ongoing gas quality initiatives and the new activities identified for odor fade initiatives. The estimates were developed by internal and external subject matter experts and then escalated for 2023.

Major Project Spending Estimates

(Thousands of Nominal Dollars)

	Recorded					Forecast				Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023			
EXPENSE											
MAT JT8	290	430	520	257	1,113	1,350	1,086	2,000	7,046	WP 6-5, Line 2	
TOTAL PROJECT COST	290	430	520	257	1,113	1,350	1,086	2,000	7,046		

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Gas Quality Assessments Program**

Benefits

The Code of Federal Regulations (192.625(a)) requires gas operators to maintain an odorant level in natural gas so that a concentration in air of one-fifth of the lower explosive limit is readily detectable by a person with normal sense of smell. Odor Fade Review and Mitigation initiatives under this program evaluates adequacy of procedures to ensure PG&E maintains properly odorized gas during all aspects of its transportation, storage and delivery of natural gas.

The Gas Quality Assessment program also acts complementary to the Station OPP program. Gas quality issues have been identified as one of the common causes of regulator valve failure at both transmission and distribution regulator stations. Sulfur, liquid, or miscellaneous debris in the system increases the risk of a large OP event if they are able to find a way to the regulator valves or the regulator valve pilot tubing. The Gas Quality Assessment program establishes the process and procedures to address specific contaminants at the overall system level and increases the effectiveness of initiatives under the Station OPP program such as sulfur filter installations.

Alternatives Considered

The alternative considered for this program is doing less of the programmatic work at a slower pace. This program provides a significant line of defense against potentially costly damage to Transmission assets and performing less programmatic work would not mitigate the risk in a timely manner.

Table 1. Planning Orders

MAT	List of Planning Orders
JT8	5055619, 5056259, 5056863, 5056864, 5056865, 5056866, 5056867, 5056868, 5056929, 5245102, 5258616, 5271731, 5272373

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Engineering Critical Assessment (ECA) Phase 2 Program

Project Title: Engineering Critical Assessment (ECA) Phase 2

Major Work Categories: LV (MAT LV2), 76 (MAT 76S)

Planning Order Numbers: Various POs, see Table 1 below

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

Engineering Critical Assessments Phase 2 (ECA2) is PG&E's program alternative to traditional strength testing and was originally developed in accordance with the proposed changes set forth in PHMSA's NPRM published on April 8, 2016. The proposed rules were subsequently adopted as part of the latest signification revision to the Code of Federal Regulations, 49 CFR §192, referred to in the industry as the Transmission Mega Rule (part 1). ECA2 encompasses advanced nondestructive technology examination and computations of pipe and components within gas transmission stations.

The activities included in the ECA2 Expense Program are as follows:

- Program development and administration, database/algorithm maintenance, and development of tools.
- Nondestructive examination (NDE), including PHMSA notification requirements and auxiliary expense projects to enable or remediate ECA2.
- Fracture and fatigue modeling and simulations of predicted failure pressure, crack growth, and remaining life; and
- Material Verification: This is new scope of work for 2023 GRC to comply with the requirement to verify material properties and component attributes and the allowance of NDE alternatives to standard laboratory testing to verify material properties introduced in the 10/1/2019 update to the CFR.

Additionally, for this rate case, ECA2 program includes work to comply with the requirements to notify PHMSA. PG&E is not forecasting any ECA2 capital work for 2023 GRC period.

Justification

ECA2 addresses Corrosion, Manufacturing-Related, and Welding/Fabrication-Related threats and is a mitigation for Loss of Containment at Gas Measurement and Control or Compression and Processing Facility risk. It is also an activity specifically designed to limit exposure to risks that would result from the implementation of traditional integrity assessment activities, including hydrostatic pressure-testing (strength testing). The activities and pace of ECA2 are primarily driven by the compliance requirement from PHMSA Mega rule and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035).

Cost

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Engineering Critical Assessment (ECA) Phase 2 Program

2023 GRC period forecast assumes NDE and material verification at 48 LVCs, 40 small stations, and 4 large stations for 2023 GRC period which is the necessary pace to meet the 2035 end date. Unit cost for the performing Nondestructive Examination (NDE) is based on historical data for different factors like lengths of components to examine and types of locations (above ground, in vaults, or buried), adjusted for type of station. The materials verification costs include mobilization, field work, and post-field work costs.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast			Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023		
EXPENSE										
MAT LV2	1,033	198	704	448	4,403	2,392	2,211	14,032	25,421	WP 6-5, Line 10
Expense Total	1,033	198	704	448	4,403	2,392	2,211	14,032	25,421	
CAPITAL										
MAT 76S	19	(152)	8	5	49	252	236	N/A	417	WP 6-32, Line 13
Capital Total	19	(152)	8	5	49	252	236	-	417	
TOTAL PROJECT COST	1,052	46	712	453	4,452	2,644	2,447	14,032	25,838	

Benefits

ECA2 is one of several methods used by gas utilities to reconfirm the structural integrity and safe margin of its natural gas pipeline and components within gas transmission stations. This program allows PG&E to verify the safe operating pressure of the pipeline by establishing a safety margin and minimizing the threat posed by manufacturing defects. In addition, this program reduces operational impacts to the system (NDE tests can be done while the station is in function) and removes environmental concerns related to blowing down pipe which is required for traditional pressure-testing. ECA2 is performed as an alternative to Station Strength testing when there are limitations or when strength testing methods are not possible.

Alternatives Considered

The alternative to ECA Phase 2 is strength-testing of station components. However, strength-testing does not provide the same assessment of component integrity offered by ECA Phase 2 and subjects station components to additional risk. Strength Tests also comes with much higher costs and significant system impacts compared to ECA2. The 2023 GRC pace for ECA2 is based on completion dates mandated by PHMSA Mega rule and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035).

Table 1. Planning Orders

MAT	Planning Order
LV2	5038290, 5038451, 5056954, 5056956, 5056957, 5056958, 5056959, 5056960, 5056961, 5056962, 5247255
76S	5512182, 5524847, 5539768, 5778008, 5793356, 5794643, 5794644, 5794645, 5794646, 5794647, 5794648, 5794649

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Station Strength Testing Program

Project Title: Station Strength Testing

Major Work Categories: JT (MAT JTV), 76 (MAT 76V)

Planning Order Numbers: Various POs, see Table 1 below

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

The Station Strength Testing Program will perform station strength testing when warranted as a result of ECA1 and ECA2 findings. The Station Strength Testing Program is designed to address assets that cannot be assessed via the nondestructive alternative methodology of ECA2, or when the ECA2 assessments would be cost-prohibitive due to the amount of excavations and volume of nondestructive tests to be performed.

The Station Strength Testing Program is a risk mitigation activity that serves a compliance function and addresses multiple integrity threat categories, but it presents risks to station assets. Strength testing within a gas transmission station is more complex and presents more risk than the testing of transmission pipeline assets. However, even with the complexity and risks, there will be some station assets analyzed in ECA1 and ECA2 that cannot be mitigated by either of those programs and, as a result, will require strength testing.

The strength testing expense for stations consists of costs to strength test station piping and components identified as requiring strength testing by ECA1 and ECA2. The number of strength tests and number of station facilities impacted are dependent upon the results of ECA1 and ECA2. The expense and capital projects under this program include projects that will enable strength testing of station components and projects to repair and replace equipment or other components as required to implement the strength testing work. Similar to ECA2, some Material Verification activities due to revision to the Code of Federal Regulations 49 CFR §192 are added to this program's scope. The scope of station facilities includes the Large Volume Customers LVCRs, LVCMS (additional scope as compared to the 2019 GT&S scope), simple and complex M&C facilities, as well as C&P facilities (continuation of the 2019 GT&S scope).

The activities included in the Station Strength Testing Program are as follows:

- Program development and administration (expense only);
- Strength testing of station (expense and capital); and
- Material Verification (expense only).

Justification

The Station Strength Testing Program addresses Corrosion, Manufacturing-Related, and Welding/Fabrication-Related threats and is a mitigation for Loss of Containment at Gas Measurement and Control or Compression and Processing Facility risk. The activities and pace of the Station Strength Testing Program are primarily driven by the compliance requirement from PHMSA Mega rule

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Station Strength Testing Program

and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035). This program is intended to mitigate risk remaining after ECA1 and ECA2 activities.

Cost

The 2023 GRC period forecast assumes 22 LVCs, 8 complex stations, 12 simple stations and 2 large stations which is the necessary pace to meet the 2035 end date (completion date mandated by federal code).

For the station strength test, the costs cover the test planning, mobilization, execution, and limited CNG/LNG support. Costs from ten historical tests of similar scope were used as the basis and adjusted. Materials verification costs include mobilization, field work, and post-field work costs.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT JTV	N/A	N/A	N/A	22	(104)	1,000	2,794	12,704	N/A	N/A	N/A	16,416	WP 6-5, Line 4
Expense Total	-	-	-	22	(104)	1,000	2,794	12,704	-	-	-	16,416	
CAPITAL													
MAT 76V	N/A	N/A	N/A	N/A	(80)	215	142	4,459	4,440	1,700	1,699	12,575	WP 6-32, Line 14
Capital Total	-	-	-	-	(80)	215	142	4,459	4,440	1,700	1,699	12,575	
TOTAL PROJECT COST	-	-	-	22	(184)	1,215	2,936	17,163	4,440	1,700	1,699	28,991	

Benefits

Station Strength Testing is one of several methods used by gas utilities to reconfirm the structural integrity and safe margin of its natural gas pipeline and components within gas transmission stations. This program allows PG&E to verify the safe operating pressure of the pipeline by establishing a safety margin and minimizing the threat posed by manufacturing defects and stress corrosion cracking. Station Strength testing is performed where alternative testing methods, e.g. ECA2, are not possible.

Alternatives Considered

The Station Strength Testing Program is designed to address components that cannot be addressed via other assessments such as ECA 2. As a result, the Station Strength Testing Program is performed as the last-resort alternative. Findings from ECA1 and ECA2 will determine the number of tests required over the duration of the program, and pace is driven by the CFR required deadlines. A slower pace was considered but meeting the prescribed deadlines would not be possible.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Station Strength Testing Program**

Table 1. Planning Orders

MAT	List of Planning Orders
JTV	5056947, 5056963, 5056964, 5056965, 5056966, 5056967, 5056968, 5056969, 5057609, 5262330, 5264532, 5264550, 5264733, 5265614, 5271435, 5271441, 5271935, 5269134, 5268680, 5266933, 5269233, 5269833, 5271253, 5271434, 5271936, 5271937, 5271938, 5271939, 5271940, 5271941, 5271942, 5271943, 5271944, 5271945, 5271946, 5271947, 5267518, 5267533, 5268078, 5268679
76V	5531886, 5531887, 5541807, 5790619, 5791759, 5792781, 5794650, 5794651, 5794652, 5794653, 5794654, 5794655, 5794656, 5794657, 5794958

Table 6-15
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Expense Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC JT	MWC LU	MWC LV	Detailed Description/Explanation
1	2016	29,351	14,973	5,650	8,728	
2			(147)			No material change
3				(7,348)		Decrease due to Critical Documents program accounting adjustment to comply with 2019 GT&S decision
4					(812)	Decrease due to ECA2 program development phase slowing down compared to 2016.
5	2017	21,045	14,826	(1,698)	7,916	
6			3,278			Increase due to in Routine C&P expenses attributable to overhauls and other C&P projects
7				3,687		Increase due to Critical Documents program production phase ramping up.
8					1,110	Increase due to ECA1 program ramping up compared to 2017.
9	2018	29,120	18,104	1,990	9,026	
10			(1,624)			No material change
11				(1,402)		Decrease due to non-recoverable costs associated with the pre-1956 stations completed in 2020 under Critical Documents program and subsequent accounting adjustments.
12					2,477	Increase due to more projects performed under ECA1 program compared to 2018.
13	2019	28,571	16,480	588	11,503	
14			333			No material change
15				2,316		Increase due to recoverable costs associated with the pre-1956 station projects completed for Critical Documents.
16					2,487	Increase due to ECA2 program recoverable costs associated with the pre-1956 stations completed in 2020. The recoverable percentage will vary annually based on station selection and the features that requires ECA 2 activities.
17	2020	33,706	16,813	2,903	13,990	

Note: Total amounts and amounts for each MWC are obtained from WP 6-5 by summing the relevant lines for each MWC.

Table 6-16
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC JT	MWC LU	MWC LV	Detailed Description/Explanation
1	2020	33,706	16,813	2,903	13,990	
2			7,074			Increase in forecast is primarily due to increase in Station Strength Testing program ramping up, and increase in both routine C&P and M&C expense forecasted for the year.
3				1,097		Increase due to more station projects forecasted for Critical Documents.
4					(11,597)	Decrease in costs due to balancing account cap limitations for ECABA and ECA1 program ramping down.
5	2021	30,279	23,886	4,000	2,392	
6			1,260			Increase in forecast is primarily due to increase in Station Strength Testing program ramping up
7				1,250		Increase due to more station projects forecasted for Critical Documents.
8					(181)	No material changes in forecast
9	2022	32,608	25,147	5,250	2,211	
10			8,118			Increase in forecast is primarily due to increase in Station Strength Testing program scope and costs to meet the 49 CFR §192 revisions under Mega Rule.
11				(5,250)		Decrease in costs due to critical Documents program ending in 2022 and no forecasts in 2023.
12					11,821	Increase in forecast is primarily due to increase in ECA2 program scope and costs to meet the 49 CFR §192 revisions under Mega Rule.
13	2023	47,297	33,265	0	14,032	

Note: Total amounts and amounts for each MWC are obtained from WP 6-5 by summing the relevant lines for each MWC.

Table 6-17
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Expense Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC FH	MWC GM	Detailed Description/Explanation
1	2016	3,495	1	3,494	
2			373		Increase due to starting new GD Station OPP expense and program development costs.
3				460	Increase due to slight year over year variations in the mix of projects and asset additions for CNG Stations.
4	2017	4,329	374	3,955	
5			2,140		Increase due to increase in GD Station OPP expense program costs for installation of sulfur filters
6				(324)	Decrease due to slight year over year variations in the mix of projects for CNG Stations.
7	2018	6,145	2,514	3,631	
8			(1,004)		Decrease in GD Station OPP expense program spend due to less sulfur filter installations compared to previous year.
9				600	Decrease due to slight year over year variations in the mix of projects and asset additions for CNG Stations.
10	2019	5,741	1,510	4,231	
11			(728)		Decrease in GD Station OPP expense program spend due to overall Covid 19 delays and resource constraints.
12				(234)	Decrease due to slight year over year variations in the mix of projects for CNG stations.
13	2020	4,778	781	3,997	

Note: Total amounts and amounts for each MWC are obtained from WP 6-5 by summing the relevant lines for each MWC.

Workpaper Table 6-18
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Expense Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC FH	MWC GM	Detailed Description/Explanation
1	2020	4,778	781	3,997	
2			2,469		Increase due to increase in GD Station OPP expense program costs for installation of sulfur filters and system planning efforts.
3				(127)	No material changes in forecast.
4	2021	7,120	3,250	3,870	
5			279		No material changes in forecast.
6				89	No material changes in forecast.
7	2022	7,487	3,529	3,959	
8			(1,722)		Decrease in forecast due to aligning the 2023 GRC forecast for GD expense program at historical 3 year average (2018-2020) level.
9				457	Slight increase in forecast due to aligning 2023 GRC forecast for CNG stations expense program at historical 3 year average (2018-2020) level.
10	2023	6,223	1,807	4,416	

Note: Total amounts and amounts for each MWC are obtained from WP 6-5 by summing the relevant lines for each MWC.

Table 6-19
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 6
 Asset Family – Facilities
 Capital Expenditures by Major Work Category
 (Thousands of Nominal Dollars)

No.	MWC	MWC Description	Capital Expenditures													Reference (A)
			2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast			
1	2K	G Dist Repl/Convert Cust HPR	27,531	37,624	55,089	64,824	47,081	60,946	64,656	17,952	18,433	18,914	19,406			
2	31	NGV - Station Infrastructure	4,265	6,747	4,261	4,304	4,698	4,216	4,321	4,771	4,899	5,027	5,158			
3	50	G Dist Reliability General	28,775	37,826	53,390	61,906	73,700	80,272	83,841	78,629	75,655	77,627	63,599			
4	75	GT Pipeline Reliability	18,833	23,827	9,305	32,942	3,775	20,446	5,596	16,394	16,821	17,259	17,696			
5	76	GT Station Reliability	119,558	115,817	182,382	161,309	122,810	150,422	77,443	210,526	209,517	210,596	210,225			
6		Grand Total	198,962	221,841	304,427	325,285	252,064	316,301	235,857	328,273	325,326	329,423	316,085	WP 6-32, Line 31		

Notes: (A) Line 3, 2016 -2020 Recorded Adjusted values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 6-20
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 6
Asset Family – Facilities
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

Line No.	Description	Capital Expenditures					Reference	
		2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast		2025 Forecast
1	Projects > \$3 Million*	93,767	247,684	230,543	321,247	318,202	322,555	309,051
2	Other Work	31,724	68,617	5,314	7,026	7,124	6,867	7,034
3	Total	125,491	316,301	235,857	328,273	325,326	329,423	316,085

4 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

WP 6-32, Line 31

Table 6-21
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 6
Asset Family – Facilities
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million*
(Thousands of Nominal Dollars)

Line No.	Planning Order	Description	MWC	Operative Date	CWIP	Capital Expenditures						Subtotal	Reference
					2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast		
MWC - 2K G Dist Repl/Convert Cust HPR													
1	5510222	ECON STIM HPR CONVERT MAIN-CC	2K		-	21,331	-	-	-	-	-	21,331	
2	5510274	Econ Stim HPR Convert Distr Reg-SI	2K		-	9,142	-	-	-	-	-	9,142	
3	5510279	ECON STIM HPR REPLACEMENT-CC	2K		-	30,473	-	-	-	-	-	30,473	
4	5542182	2023 GRC High Pressure Regulator	2K		-	-	64,656	17,952	18,433	18,914	19,406	139,361	
5	Total				-	60,946	64,656	17,952	18,433	18,914	19,406	200,307	
MWC - 31 NGV - Station Infrastructure													
6	5500112	LNG/CNG Station Capital	31	7/1/1995	16,399	4,216	-	-	-	-	-	20,615	
7	5542161	2023 GRC CNG/LNG	31		-	-	4,321	4,771	4,899	5,027	5,158	24,177	
8	Total				16,399	4,216	4,321	4,771	4,899	5,027	5,158	44,791	
MWC - 50 G Dist Reliability General													
9	5506993	IMPR RELB/SYS DEPND-G-REGS - CC	50		-	48,725	-	-	-	-	-	48,725	
10	5513880	Impr Rel/Dep Reg Station Components-CC	50		-	13,494	-	-	-	-	-	13,494	
11	5531740	GD OVER PRESSURE PROTECTION-DI	50		-	18,053	-	-	-	-	-	18,053	
12	5542177	2023 GRC GD Over Pressure Protection	50		-	-	18,577	19,796	15,245	15,643	-	69,262	
13	5542183	2023 GRC Impr Rel Dep Gas Reg Component	50		-	-	13,494	10,420	10,699	10,978	11,264	56,855	
14	5542188	2023 GRC Impr Rel/Dep Gas Regulation	50		-	-	51,770	48,413	49,711	51,006	52,335	253,235	
15	Total				-	80,272	83,841	78,629	75,655	77,627	63,599	459,624	
MWC - 75 GT Pipeline Reliability													
16	5531774	75C Routine Spend M&C Balance Bucket	75		-	3,895	-	-	-	-	-	3,895	
17	5759566	Las Vinas - Upgrade M3	75		1,229	3,134	-	-	-	-	-	4,362	
18	5782815	NEW:Fairway Station Valve Control Upgrde	75		706	2,806	-	-	-	-	-	3,511	
19	5793442	2023 GRC Routine M&C Capital (GTL300)	75		-	-	286	839	861	883	905	3,774	
20	5793443	2023 GRC Routine M&C Capital (GTLTRAN)	75		-	-	4,815	14,106	14,474	14,851	15,227	63,474	
21	Total				1,934	9,834	5,102	14,945	15,335	15,734	16,132	79,017	
MWC - 76 GT Station Reliability													
22	5749558	TOPOCK CS CONTROL Upgrd	76	6/30/2014	15,021	3,207	-	-	-	-	-	18,228	
23	5751540	MCD IS- TCS REBUILD FIRE WATER SYSTEM	76		1,926	7,341	-	-	-	-	-	9,267	
24	5757564	30980841 - OAKLAND STATION REBUILD	76		-	4,000	-	-	-	-	-	4,000	
25	5759674	Brentwood	76		1,630	1,800	-	-	-	-	-	3,430	
26	5759679	McD Is MCS K1/K2 Retrofit	76		3,243	850	-	-	-	-	-	4,093	
27	5759687	Hinkley Pond #8 Liner Replacement	76		12,445	2,400	-	-	-	-	-	14,845	
28	5759702	Mcd Is - TCS Extend ESD Boundary	76		2,761	650	-	-	-	-	-	3,411	
29	5759705	Topock Electrical Replace MCC & Conducto	76		3,284	8,359	-	-	-	-	-	11,643	
30	5759706	HinkleyElectrical Replace MCC & Conducto	76		1,146	3,500	-	-	-	-	-	4,646	
31	5762493	Valero Meter Station	76		9,912	120	-	-	-	-	-	10,032	
32	5763298	20th Ave & MLK L108 Station Rebuild	76		5,460	7,151	-	-	-	-	-	12,611	
33	5764879	BUCKEYEE CREEK STATION UPGRADE	76		5,142	16,000	-	-	-	-	-	21,142	
34	5774013	Perform Complex Station Rbls	76		-	6,482	-	-	-	-	-	6,482	
35	5778040	Hinkley K-Units Replace Foundations K-6	76		99	3,207	-	-	-	-	-	3,306	
36	5779930	San Pablo Reg Station	76		3,433	1,188	-	-	-	-	-	4,621	
37	5781407	Enrico ST Phys Security Upgrd	76		682	2,319	-	-	-	-	-	3,002	
38	5782799	Irvington Ph1 Rebuild Outgoing Reg	76		1,418	1,959	-	-	-	-	-	3,377	
39	5782803	MCD IS - TCS Controls Upgrade	76		1,759	1,973	-	-	-	-	-	3,732	
40	5782825	TBD McDonald Island Compressor Purchase	76		4,474	1,740	15,104	-	-	-	-	21,319	
41	5782827	Topock Install P-Unit Fuel Gas BB Valves	76		643	3,094	-	-	-	-	-	3,737	
42	5786062	Brentwood Terminal Cut and Cap	76		275	3,311	-	-	-	-	-	3,586	
43	5788007	NEW Hinkley Retrofit Valve & Actuator Re	76		502	3,967	-	-	-	-	-	4,469	
44	5788013	Topock Repl K-Unit Fuel Gas BB Valves	76		89	4,796	-	-	-	-	-	4,885	
45	5788018	Hinkley Controls Replacement	76		87	3,000	-	-	-	-	-	3,087	
46	5793343	2023 GRC Comp Control Upgrade(GT400LINE)	76		-	-	3,173	3,703	3,799	3,898	3,997	18,570	
47	5793344	2023 GRC Comp Controls Upgrades(GTL300)	76		-	-	2,380	2,777	2,849	2,924	2,998	13,928	
48	5793345	2023 GRC Comp Controls Upgrades(GTLTRAN)	76		-	-	793	926	950	975	999	4,643	
49	5793403	2023 GRC Complex Stn Reblid (GTBALOP)	76		-	-	122	1,434	1,472	1,510	1,548	6,087	
50	5793404	2023 GRC Complex Stn Reblid (GTLTRAN)	76		-	-	2,288	26,897	27,598	28,317	29,033	114,133	
51	5793407	2023 GRC Simple Stn Reblid (GTLTRAN)	76		-	-	3,934	5,076	5,209	5,344	5,480	25,043	
52	5793408	2023 GRC Complex Stn Reblid (GT400LINE)	76		-	-	214	2,510	2,576	2,643	2,710	10,652	
53	5793411	2023 GRC Phys Security Upgd (GTL300)	76		-	-	376	716	735	754	773	3,355	
54	5793412	2023 GRC Physical Security Upgd(GTLTRAN)	76		-	-	3,398	6,466	6,634	6,807	6,980	30,285	
55	5793430	2023 GRC Routine C&P Capital (GSLMPC)	76		-	-	1,012	4,092	4,199	4,308	4,417	18,027	
56	5793431	2023 GRC Routine C&P Capital (GSMCD)	76		-	-	3,035	12,276	12,596	12,924	13,251	54,081	
57	5793432	2023 GRC Routine C&P Capital (GT400LINE)	76		-	-	4,046	16,368	16,794	17,232	17,668	72,108	
58	5793433	2023 GRC Routine C&P Capital (GT401LINE)	76		-	-	1,012	4,092	4,199	4,308	4,417	18,027	
59	5793435	2023 GRC Routine C&P Capital (GTL300)	76		-	-	3,035	12,276	12,596	12,924	13,251	54,081	
60	5793436	2023 GRC Routine C&P Capital (GTLTRAN)	76		-	-	1,012	4,092	4,199	4,308	4,417	18,027	
61	5794562	2023 GRC GT Electrical Upgrade (GTL300)	76		-	-	4,100	5,729	1,000	-	-	10,829	
62	5794567	2023 GRC Comp Controls Upgrades (GSMCD)	76		-	-	2,380	2,777	2,849	2,924	2,998	13,928	
63	5794568	2023 GRC Comp Controls Upgrades (GSLMPC)	76		-	-	793	926	950	975	999	4,643	
64	5794570	2023 GRC Tionesta Retirement (GT400LINE)	76		-	-	-	4,624	4,744	2,372	-	11,740	
65	5794571	2023 GRC Tionesta Retirement (GT401LINE)	76		-	-	-	4,624	4,744	2,372	-	11,740	
66	5794572	2023 GRC LM Compressor Repl (GSLMPC)	76		-	-	-	10,039	10,301	15,451	15,440	51,231	
67	5794622	2023 GRC Complex Stn Reblid (GSSTOR)	76		-	-	61	717	736	755	774	3,044	
68	5794623	2023 GRC Complex Stn Reblid (GT401LINE)	76		-	-	183	2,152	2,208	2,265	2,323	9,131	
69	5794625	2023 GRC Complex Stn Reblid (GTLN300)	76		-	-	305	3,586	3,680	3,776	3,871	15,218	
70	5794626	2023 GRC Complex Stn Reblid (GTL300)	76		-	-	427	5,021	5,152	5,286	5,420	21,305	
71	5794627	2023 GRC Terminal Upgrades (GTBALOP)	76		-	-	1,373	2,853	2,927	3,003	3,079	13,235	
72	5794628	2023 GRC Brentwood Term Reblid (GTBALOP)	76		-	-	5,900	14,570	14,949	14,949	14,938	65,306	
73	5794636	2023 GRC GT Station OPP Cap (GTLTRAN)	76		-	-	11,284	37,337	36,982	37,946	38,906	162,455	
74	5794638	2023 GRC GT Station OPP Cap (GT400LINE)	76		-	-	255	842	834	856	878	3,664	
75	5794641	2023 GRC GT Station OPP Cap (GTL300)	76		-	-	509	1,684	1,668	1,712	1,755	7,329	
76	5794651	2023 GRC Stn Strength Test Cap (GTLTRAN)	76		-	-	120	3,768	3,751	1,437	1,436	10,511	
77	Total				75,434	92,416	72,624	204,949	203,879	205,254	204,755	1,059,311	
78	Grand Total				93,767	247,684	230,543	321,247	318,202	322,555	309,051	1,843,050	

79 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Table 6-22
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 6
Asset Family – Facilities
Recorded and Forecast Capital Expenditures Details - Other Work*
(Thousands of Nominal Dollars)

Line No.	MWC	MWC Description	Capital Expenditures												Reference	
			2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast			
1	2K	G Dist Repl/Convert Cust HPR	23,963	33,746	51,665	57,089	41,724	-	-	-	-	-	-	-	-	-
2	31	NGV - Station Infrastructure	41	136	48	28	59	-	-	-	-	-	-	-	-	-
3	50	G Dist Reliability General	27,524	35,860	50,310	59,321	70,595	-	-	-	-	-	-	-	-	-
4	75	GT Pipeline Reliability	18,802	23,624	9,215	32,418	2,623	10,611	495	1,449	1,487	1,525	1,564	1,564	1,564	1,564
5	76	GT Station Reliability	115,644	111,342	165,355	132,699	81,143	58,006	4,820	5,577	5,638	5,342	5,470	5,470	5,470	5,470
6	Grand Total		185,974	204,709	276,594	281,556	196,145	68,617	5,314	7,026	7,124	6,867	7,034	7,034	7,034	7,034

7 * Excludes projects greater than \$3M

Table 6-23
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family Facilities
Summary of Capital Expenditures

Line No.	Gas Transmission Capital	Description	MWC	MAT	2016		2017		2018		2019		2020		2021		2022		2023		2024		2025		2026		Total 2023-2028	Notes	Reference	
					Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast				Recorded
1		Routine CAP Capital	76	76N	54,360,459	39,253,307	46,102,952	55,547,585	48,718,534	41,800,061	13,150,215	53,185,185	54,381,264	56,003,457	57,420,737	-	-	-	-	-	-	-	-	-	-	-	-	221,200,643		WP 6-33
2		GT Electrical Upgrades - Hinkley and Topock	76	76P	253,692	(19,428)	886,968	3,032,053	11,859,447	4,100,000	5,728,620	1,000,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,728,620		WP 6-34	
3		GT ESD Upgrades	76	76Q	2,942,753	4,467,515	2,335,867	1,023,976	244,689	4,086,548	4,999,996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-35
4		GT Compressor Unit Control Replacements	76	76R	199,471	107,865	4,091,961	2,988,358	1,500,001	2,988,358	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-36
5		GT Station Controls Upgrade	76	76S	2,146,746	1,107,819	1,107,819	6,232,839	1,500,001	1,500,001	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-37
6		GT Station Control Reliability	76	76T	22,860,541	22,895,121	23,002,203	4,397,383	5,701,612	2,346,770	15,104,558	19,286,526	19,286,526	20,095,505	15,639,841	-	-	-	-	-	-	-	-	-	-	-	-	46,091,426		WP 6-38
7		Route M&C Capital	75	76C	18,833,001	23,826,556	9,305,207	32,941,776	3,774,955	20,445,584	5,596,199	16,393,903	16,321,070	17,259,366	17,696,150	-	-	-	-	-	-	-	-	-	-	-	-	68,170,489		WP 6-41
8		Perform Simple Station Rebuilds	76	76C	7,148,718	9,089,556	2,228,021	10,039,779	5,682,010	1,880,111	5,161,361	6,659,233	6,659,233	7,010,785	7,188,205	-	-	-	-	-	-	-	-	-	-	-	-	27,690,970		WP 6-42
9		Perform Complex Station Rebuilds	76	76A	16,624,485	36,208,240	82,469,676	45,235,162	27,081,418	37,214,454	3,600,144	42,317,725	43,420,375	44,551,753	45,679,225	-	-	-	-	-	-	-	-	-	-	-	-	175,969,078		WP 6-44
10		Perform Transmission Terminal Upgrades	76	76S	1,025,211	1,052,153	1,474,122	4,452,840	3,114,431	19,039,611	7,272,351	17,422,306	17,876,269	17,852,537	18,017,623	-	-	-	-	-	-	-	-	-	-	-	-	71,286,735		WP 6-46
11		GT Station Over Pressure Protection Enhancements Capital	76	76S	120,125	(127,775)	115,803	14,747,122	13,988,819	10,059,505	12,590,717	41,660,087	41,264,392	42,339,593	43,411,084	-	-	-	-	-	-	-	-	-	-	-	-	168,675,166		WP 6-48
12		Engineering Critical Assessment (ECA) Phase 1 Capital	76	76S	16,861	(15,150)	8,049	4,666	12,959	262,261	236,206	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-51
13		Physical Security Capital	76	76S	10,241,256	6,355,762	7,875,391	9,857,179	8,830,695	8,451,729	141,880	4,459,508	4,439,848	4,315,078	4,147,374	-	-	-	-	-	-	-	-	-	-	-	-	12,298,471		WP 6-52
14		Physical Security Reliability	76	76A	(0)	981,424	3,274	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-53
15		GT Station Reliability	76	76B	95,870	(204,689)	3,274	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-53
16		GT Station Reliability	76	76E	1,173,314	2,412,388	1,187,153	209,196	(57,383)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-53
17		GT Station Reliability	76	76E	39,450	24,689	6,467	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-53
18		GT Station Reliability	76	76E	(13,048)	2,214	716	17,692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-53
19		GT Station Reliability	76	76H	28,493	(352,214)	(92)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-53
20		GT Station Reliability	76	76I	364,697	(18,408)	4,569	1,183	383	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WP 6-53
21		GT Station Reliability	76	76J	138,390,618	139,843,418	191,687,660	194,251,069	126,584,985	170,867,725	83,039,887	226,920,397	226,338,283	227,655,368	227,921,447	-	-	-	-	-	-	-	-	-	-	-	-	909,035,395		WP 6-53
22		Total Capital Expenditures																												

Notes
(1) ESD Upgrades (MAT 76F) and Unit control (MAT 76T) are combined under one program called compressor Controls upgrade (MAT 76T) and not forecasted separately for 2023 rate case period.
(2) ECA1 and ECA2 capital programs (MAT 76Q and MAT 76S) are not forecasted for 2023 rate case period.
(3) Discontinued MATs and is not forecasted for 2023 rate case period.

Line No.	Gas Distribution Capital	Description	MWC	MAT	2016		2017		2018		2019		2020		2021		2022		2023		2024		2025		2026		Total 2023-2028	Notes	Reference
					Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast	Recorded	Forecast			
25		GD Regulator Station Component Replacements	50	50L	12,946,703	10,491,279	7,976,382	9,908,543	10,024,032	13,483,500	13,483,510	10,420,098	10,699,418	10,978,207	11,264,260	-	-	-	-	-	-	-	-	-	-	-	43,381,983		WP 6-54
26		GD Regulator Station Rebuilds	50	50C	18,670,890	28,773,924	46,556,337	47,068,000	54,505,563	48,725,000	51,769,628	48,413,001	49,710,756	51,006,041	52,335,078	-	-	-	-	-	-	-	-	-	-	-	201,464,876		WP 6-55
27		HPR Program	2K	2K#_2KA_2KB_2KC	27,531,248	37,624,354	55,089,009	64,823,833	47,080,635	60,946,000	64,656,000	17,952,021	18,433,242	18,913,547	19,406,366	-	-	-	-	-	-	-	-	-	-	-	74,705,176		WP 6-56
28		GD Station Over Pressure Protection Enhancements Capital	50	50N	-	-	2,122,269	7,366,662	11,448,842	18,053,690	19,577,331	19,796,391	15,245,288	15,642,526	-	-	-	-	-	-	-	-	-	-	-	-	50,684,205		WP 6-57
29		CNG Stations	31	31A	4,265,164	6,747,097	4,260,677	4,303,891	4,698,195	4,215,735	4,321,128	4,771,350	4,899,250	5,026,909	5,157,891	-	-	-	-	-	-	-	-	-	-	-	19,865,399		WP 6-58
30		Total Capital Expenditures			63,513,995	83,616,644	116,004,714	133,559,950	127,757,266	146,453,725	152,817,797	101,352,561	98,387,954	101,667,229	88,163,695	-	-	-	-	-	-	-	-	-	-	-	390,071,639		
		Total Capital Expenditure																											
31		Total Capital Expenditure	AU	AU	201,704,613	223,280,062	307,692,374	327,782,009	254,342,262	316,300,950	236,857,484	328,273,158	325,326,237	329,422,597	316,085,042	-	-	-	-	-	-	-	-	-	-	-	1,299,107,034		

Table 6-24
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Routine C&P Capital - MAT 76N

Program: GT Routine Compression and Processing (C&P) Capital, MAT 76N

Program Description:

GT Routine C&P Capital Program includes a wide assortment of capital projects within the C&P Asset Family that are unique occurrences and do not qualify for another C&P Capital Program, including compression-related work, station auxiliary, station electrical/instrumentation/control projects, and valve & actuator replacement projects.

	2023	2024	2025	2026
Escalation	1.0261	1.0261	1.0261	1.0253
Total Expense	\$53,195,186	\$54,581,264	\$56,003,458	\$57,420,736

Line 1 * Line 2

1
2

	2018	2019	2020
Routine C&P Capital Recorded	\$ 46,102,952	\$ 55,547,585	\$ 48,719,534
Adjustments for Pleasant Creek Facility	\$ 1,422,278	\$ 58,307	\$ 2,069
Routine Capital C&P Adjusted (unescalated)	\$ 44,680,674	\$ 55,489,279	\$ 48,717,465
Escalation (2023)	1.0841	1.0642	1.0693
Routine C&P Capital Recorded (in 2023 \$s)	\$ 48,437,526	\$ 59,053,024	\$ 52,095,009
Adjusted 3-year Average	\$	\$	\$ 53,195,186

Note #1
Line 3 - Line 4
Line 5 * Line 6
Note #2

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Notes:

- #1 Pleasant Creek Storage Facility expected to be decommissioned in 2022. Historical project costs are removed from average calculation for 2023.
- #2 Capital 3-year average (2018-2020)

Table 6-25
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Electrical Upgrades Hinkley and Topock - MAT 76P

Program: GT Electrical Upgrades Hinkley and Topock, MAT 76P

Program Description:

This program proposes to complete the upgrade of the 480-volt electrical systems at the Hinkley compressor station during the 2023 General Rate Case period. The project scope includes engineering and construction of new Switch Gear (SWG) and Motor Control Center (MCC) sections. Additional aspects of this program include installing new relays, the rewiring of existing cable runs, and the purchase of new starters and relays for the replaced SWGR and MCC sections. A protective device coordination study will be conducted in order to determine how best to configure protective devices in the electrical system to minimize risk while maximizing station availability. The scope of work is assumed to be similar to that of Topock Electrical Upgrade that is currently being performed during the 2019-2022 period. There will be some customizations and scope changes needed specifically for Hinkley which will be evaluated when detailed engineering is performed in 2021.

Table 1: GT Electrical Upgrades Hinkley	2023	2024	2025	2026
Hinkley Electrical Upgrade Forecast	\$5,728,620	\$1,000,000	\$0	\$0
Total Expenditures	\$5,728,620	\$1,000,000	\$0	\$0

Table 2: Capital Expenditures Forecast	Notes	Forecast
3 Unit Cost Based on Topock Electrical Upgrade Project (unescalated)		\$12,200,000
4 Escalation (2023)		1.0693
5 Unit Cost Escalated in 2023\$		\$13,045,817

Allocated Forecast	2020 ^{#1}	2021 ^{#2}	2022 ^{#2}	2023 ^{#3}	2024 ^{#3}	Total Forecast
	\$1,200,000	\$2,117,197	\$3,000,000	\$5,728,620	\$1,000,000	\$13,045,817

Notes:

- #1 Actuals incurred for 2020
- #2 Forecast planned for 2021 and 2022
- #3 2023 GRC Forecast includes allocated \$\$'s for the remainder of the forecast

Table 6-25a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Electrical Upgrades Hinkley and Topock - MAT 76P

Summary of Cost Estimate

Program: GT Electrical Upgrades Hinkley and Topock, MAT 76P

Project Assumptions

The following assumptions are stated to clarify the project description and scope of work based on the Topock Electrical Upgrades Project.

- Electrical upgrade project will replace the switch gear sections (SWGR) and Motor Control Center (MCC) sections at Hinkley.
- The Jacket Water Coolers MCC-7 AND MCC-8 are recently replaced with the electrical building addition, and are not included.
- Approximately 150 drawings will need to be modified with the equipment upgrade.
- The existing station electrical model in Easy Power will be updated to include new equipment.
- Housekeeping pads and other miscellaneous supports will be installed as required.
- Miscellaneous panelboards, switchboards, UPS, DC and emergency systems are not included in the modifications.
- New wiring / cable / conduit to existing loads from new electrical equipment enclosure.
- All MCC's will be Smart MCC's and switchboards will be ARC Flash resistant.

Cost Estimate Summary ^[1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight			\$ 495,588	\$ 495,588
2 Engineering			\$ 1,315,058	\$ 1,315,058
3 Construction	\$ 2,836,688		\$ 4,589,277	\$ 7,425,965
4 Major Equipment				\$ -
5 Materials		\$ 220,935		\$ 220,935
6 Environmental and Permitting			\$ 109,644	\$ 109,644
7 Land Acquisition and permitting				\$ -
8 Other (AFUDC, misc)			\$ 2,632,810	\$ 2,632,810
9 2020 Sub Total	\$ 2,836,688	\$ 220,935	\$ 9,142,377	\$ 12,200,000

[1] Based on detailed estimate developed for the scope and assumptions provided

Table 6-26
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Compressor Controls Upgrade - MAT 76T

Program: GT Compressor Controls Upgrade, MAT 76T

Program Description:

GT Compressor Controls Upgrade program was established to systematically replace and upgrade control systems at PG&E compressor facilities. This program addresses obsolescence of the controls systems (including hardware and software) and improves monitoring and control functionality and reliability to currently available levels. Three types of controls are addressed through this program: compressor unit controls station controls, and associated Emergency Shutdown (ESD) systems. This program will replace outdated unit programmable logic controllers (PLCs), station PLCs, ESD and associated hardware at one compressor and processing station facility. This includes the PLC controllers, communication devices, and input/output (I/O) devices.

Table 1: Capital Expenditures		2023	2024	2025	2026
1	Escalation		1.0261	1.0261	1.0253
2	Unit Cost	\$11,108,293	\$11,397,736	\$11,694,720	\$11,990,678
3	Units	1	1	1	1
4	Total Expenditures	\$11,108,293	\$11,397,736	\$11,694,720	\$11,990,678

2023 Unit Cost from Table 2, Line 15, Escalated
Line 2 * Line 3

Assumptions:

1. Compressor controls upgraded at one (1) station per year.
2. Station facilities that are more complex are more expensive than the typical controls upgrades and the pace when upgrading such facilities will be adjusted to match the forecasted spend per year.
3. Each site has new and custom set of design needed.

Table 2: Program Estimate (in 2020 dollars)

Area Of Work	Estimated Cost in				
	2020\$	2021	2022	2023	
5	Engineering and Design	\$2,726,328	\$2,726,328	\$2,726,328	\$2,726,328
6	Construction	\$3,759,580	\$3,759,580	\$3,759,580	\$3,759,580
7	PM & Oversight	\$1,121,436	\$1,121,436	\$1,121,436	\$1,121,436
8	Equipment, Major	\$0	\$0	\$0	\$0
9	Materials, Commodity	\$1,769,036	\$1,769,036	\$1,769,036	\$1,769,036
10	Environmental and Permitting	\$39,450	\$39,450	\$39,450	\$39,450
11	Land Acquisition and Permitting	\$0	\$0	\$0	\$0
12	Other	\$972,265	\$972,265	\$972,265	\$972,265
13	Total Unescalated	\$10,388,095	\$10,388,095	\$10,388,095	\$10,388,095
14	Escalation	0	1.0091	1.0283	1.0306
15	Total Escalated	\$10,388,095	\$10,482,262	\$10,778,961	\$11,108,293

From WP 6-37

Table 6-26a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Compressor Controls Upgrade - MAT 76T

Summary of Cost Estimate

Program: GT Compressor Controls Upgrade, MAT 76T

Project Assumptions

This program will replace outdated station programmable logic controllers (PLCs) and associated hardware.
 •This includes replacing the PLC controllers, communication devices, and input/output (I/O) devices. The existing PLC system will be removed and replaced in kind with updated hardware.
 •All control and monitoring software will be reprogrammed as necessary, and all drawings will be updated.

Cost Estimate Summary ^[1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight	\$ 376,400		\$ 745,036	\$ 1,121,436
2 Engineering	\$ 1,450,000		\$ 1,276,328	\$ 2,726,328
3 Construction	\$ 759,250		\$ 3,000,330	\$ 3,759,580
4 Major Equipment				\$ -
5 Materials	\$ 10,000	\$ 1,769,036		\$ 1,769,036
6 Environmental and Permitting			\$ 29,450	\$ 29,450
7 Land Acquisition and Permitting				\$ -
8 Other (AFUDC, misc.)			\$ 972,265	\$ 972,265
9 2020 Sub Total	\$ 2,595,650	\$ 1,769,036	\$ 6,023,409	\$ 10,388,095

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-27
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT C&P Compressor Replacements and Retirements - MAT 76X

Program: GT C&P Compressor Replacements and Retirements, MAT 76X

Program Description:

PG&E established the Compressor Replacement Program to manage the replacement of aging compressor units and associated equipment. As part of its asset management process, PG&E prioritizes compressor units and equipment for replacement. The compressor replacement project forecast includes costs to replace an obsolete compressor, replace associated equipment, install a compressor building, and any ancillary systems that must be upgraded to accommodate the new unit. The Compressor Retirement strategy focuses on removal of facilities that are no longer required for system operation and that result in more efficient operation of the gas system. The compressor retirement forecast includes costs for removal of equipment, structures, and piping; and converting the site to a complex regulator station. PG&E is proposing the following two compressor replacement and retirement projects for the 2023 GRC period:

- Los Medanos K-1 Compressor Replacement.
- Tionesta Compressor Station Retirement

Table 1: Capital Expenditures					
	2023	2024	2025	2026	
1 Escalation		1,0261	1,0261	1,0253	
2 Tionesta Retirement	\$ 9,247,790	\$ 9,488,755	\$ 4,744,377	\$ -	Line 7 * Line 1
3 Los Medanos Compressor Retirement	\$ 10,039,166	\$ 10,300,751	\$ 15,451,127	\$ 15,439,841	Line 10 * Line 1
4 Total Expenditures	\$19,286,956	\$19,789,506	\$20,195,504	\$15,439,841	Line 2 + Line 3

Table 2: Tionesta Retirement Forecast			
	Total Forecast	2023	Allocated Forecast
5 Tionesta Station Retirement Costs in 2020 \$\$	\$21,620,540		
6 Escalation (2023)	1,0693		
7 Tionesta Station Retirement Costs in 2023 \$s	\$ 23,119,476	\$ 9,247,790	\$ 4,623,895

Table 3: Los Medanos K-1 Replacement Forecast			
	Total Forecast	2023	Allocated Forecast
8 Los Medanos K-1 Replacement Costs in 2020 \$\$	\$46,941,418		
9 Escalation (2023)	1,0693		
10 Los Medanos K-1 Replacement Costs in 2023 \$s	\$ 50,195,831	\$ 10,039,166	\$ 15,058,749

Notes:

- #1 Based on detailed estimate for the retirement scope and assumptions -- see tab "Tionesta Retirement WP 6-39" for details.
- #2 Total Forecast allocated 40% for 2023 and 2024, 20% for 2025.
- #3 Based on detailed estimate for the compressor replacement scope and assumptions -- see tab "LM Replacement WP 6-40" for details.
- #4 Total Forecast allocated 20% for 2023 and 2024, 30% for 2025 and 2026.

Table 6-27 a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
Tionesta Compressor Station Retirement - GT C&P Compressor Replacements and Retirements - MAT 76X

Summary of Cost Estimate

Project: Tionesta Compressor Station Retirement - GT C&P Compressor Replacements and Retirements, MAT 76X

Project Assumptions

Tionesta Compressor Station Retirement project includes following assumptions and scope of work:
 Scope assumes a single compressor unit will be removed and site converted into a Complex Station facility. Removal and retirement includes removal of all appurtenance / piping, removal of all buildings and shelters, site restoration, etc.

- Demo and removal of the existing compressor station, including (1) compressor unit and all controls, buildings, pipe, foundations and all facilities in conflict with proposed new installation and any facilities outside of proposed station fence.
- Replacement of existing Main Line Valves (MLVs) with automated Remote Control Valves (RCVs)
- Installation of a crossite between L-400 and L-401
- Replacement of existing L-400/401 Tees with pipe
- New Remote Terminal Units (RTUs) for RCVs and Meters
- Control System Field Wiring, programming and integration
- New station SCADA system, site improvements and restoration
- New control building, grounding system, backup power generator

Cost Estimate Summary ^[1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight	\$ 48,000		\$ 952,265	\$ 1,000,265
2 Engineering	\$ 493,400		\$ 724,770	\$ 1,218,170
3 Construction	\$ 5,556,625		\$ 8,962,302	\$ 14,518,927
4 Major Equipment			\$ -	\$ -
5 Materials	\$ -	\$ 2,118,545	\$ -	\$ 2,118,545
6 Environmental and Permitting	\$ 590,000		\$ 102,291	\$ 692,291
7 Land Acquisition and Permitting			\$ 49,826	\$ 49,826
8 Other (AFUDC, misc.)			\$ 2,022,516	\$ 2,022,516
9 2020 Sub Total	\$ 6,688,025	\$ 2,118,545	\$ 12,813,970	\$ 21,620,540

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-27b
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
Los Medanos K-1 Compressor Replacement - GT C&P Compressor Replacements and Retirements - MAT 76X

Summary of Cost Estimate

Project: Los Medanos K-1 Compressor Replacement - GT C&P Compressor Replacements and Retirements, MAT 76X

Project Assumptions

Los Medanos K-1 Compressor Replacement project includes following assumptions and scope of work:
Equipment Upgrades - includes replacing existing compressors with two (2) new ~2500 hp compressors, skid mounted, including suction/discharge filters and Gas/Oil cooler for each compressor. Replace (2) existing 25 hp station instrument air compressors and (1) air dryer.
 Upgrade Compressor building fire suppression system.
 Replace 400 hp backup generator in new building.
Piping Upgrades - includes new suction and discharge piping from existing piping to new compressors, new blowdown piping (4" x 150'), and silencer from new compressor piping.
Civil Upgrades - includes demolishing existing warehouse building and foundation, demolishing existing compressor building and compressor, including wiring and gas piping back to tie-in points, building new warehouse and compressor building.
Controls and Instrumentation Upgrades - includes fire and gas detection in compressor building, integrating into station control system, replacing Emergency Shutdown (ESD) systems, integrating new compressor controls into station control system and control room displays.
Electrical Upgrades - includes installing all control wiring and conduits back to control room, installing utility power and lighting to compressor building and warehouse building, replacing MCC buckets for new loads.

Cost Estimate Summary ^[1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight	\$ 245,315		\$ 1,736,535	\$ 1,981,851
2 Engineering	\$ 1,207,000		\$ 1,306,491	\$ 2,513,491
3 Construction	\$ 11,804,942		\$ 11,921,687	\$ 23,726,628
4 Major Equipment			\$ -	\$ -
5 Materials	\$ 952,508	\$ 7,580,829	\$ -	\$ 7,580,829
6 Environmental and Permitting			\$ 346,856	\$ 1,299,364
7 Land Acquisition and Permitting			\$ 152,414	\$ 152,414
8 Other (AFUDC, misc.)			\$ 9,686,841	\$ 9,686,841
9 2020 Sub Total	\$ 14,209,765	\$ 7,580,829	\$ 25,150,824	\$ 46,941,418

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-28
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Routine M&C Capital - MAT 75C

Program: GT Routine Measurement and Control (M&C) Capital, MAT 75C

Program Description:

Routine M&C Capital program includes a wide assortment of capital projects within the M&C asset family that are unique occurrences that do not qualify for another M&C capital Program. The types of projects included in this program are grounding grids; heating, ventilation, and air conditioning systems; retirements; station electrical/instrumentation/control projects; and valve and actuator replacement projects at M&C stations.

Table 1: Routine Capital M&C	2023	2024	2025	2026
Escalation	1,0261	1,0261	1,0253	1,0253
Total Expense	\$16,393,903	\$16,821,070	\$17,259,368	\$17,696,150

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2

Table 2: Calculation	2018	2019	2020
Routine Capital M&C Recorded	\$ 9,305,207	\$ 32,941,776	\$ 3,774,955
Escalation (2023)	1,0841	1,0642	1,0693
Routine Capital M&C Recorded (in 2023 \$s)	\$ 10,087,610	\$ 35,057,430	\$ 4,036,670
Adjusted 3-year Average	\$ 16,393,903	\$ 16,393,903	\$ 16,393,903

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4
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Line 3 * Line 4
Note #1

Notes:

#1 Capital 3-year average (2018-2020)

Table 6-29
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT M&C Station Rebuilds - Simple Stations - MAT 763

Program: GT M&C Station Rebuilds - Simple Stations, MAT 763

Program Description:

The simple station rebuild program is intended to address station equipment aging and obsolescence of M&C gas transmission stations. Simple gas transmission stations contain only self-contained and pilot-operated pressure regulation and over-protection (OPP) equipment and simple operational metering devices. Stations may also include SCADA Remote Terminal Units (RTUs) or an electronic pressure recorder which monitor operating parameters. Simple transmission stations are located above and below ground and include odorant stations, meter stations, custody transfer stations and dehydrator systems. The project scope includes a complete rebuild of the station (above and below ground) to ensure replacement of older and obsolete equipment and piping, to upgrade configuration to meet current system needs, and to address any outstanding issues with station operations and maintenance (O&M).

	2023	2024	2025	2026
1 Escalation		1,0261	1,0261	1,0253
2 Unit Cost	\$3,329,616	\$3,416,374	\$3,505,392	\$3,594,103
3 Units	2	2	2	2
4 Total Expenditures	\$6,659,232	\$6,832,748	\$7,010,785	\$7,188,207

2023 Unit Cost from Table 2, Line 15, Escalated
Line 2 * Line 3

Assumptions:

- Two (2) simple station rebuilds per year.
- Station facilities that are more complex are more expensive than the typical simple station rebuilds and the pace when upgrading such facilities will be adjusted to match the forecasted spend per year.
- Each site has new and custom set of design needed.

Area Of Work	Estimated Cost in			
	2020\$	2021	2022	2023
5 Engineering and Design	\$519,339	\$519,339	\$519,339	\$519,339
6 Construction	\$1,479,083	\$1,479,083	\$1,479,083	\$1,479,083
7 PM & Oversight	\$220,684	\$220,684	\$220,684	\$220,684
8 Equipment, Major	\$0	\$0	\$0	\$0
9 Materials, Commodity	\$497,000	\$497,000	\$497,000	\$497,000
10 Environmental and Permitting	\$16,652	\$16,652	\$16,652	\$16,652
11 Land Acquisition and Permitting	\$21,286	\$21,286	\$21,286	\$21,286
12 Other	\$359,698	\$359,698	\$359,698	\$359,698
13 Total Unescalated	\$3,113,742	\$3,113,742	\$3,113,742	\$3,113,742
14 Escalation	0	1,0091	1,0283	1,0306
15 Total Escalated	\$3,113,742	\$3,141,968	\$3,230,901	\$3,329,616

From WP 6-43.

Table 6-29a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT M&C Station Rebuilds - Simple Stations - MAT 763

Summary of Cost Estimate

Program: GT M&C Station Rebuilds - Simple Stations, MAT 763

Project Assumptions

The following assumptions are stated to clarify the project description and scope of work: Remove and retire an existing simple gas transmission regulator and meter station. Existing station to be removed has a single inlet and outlet pipes from 10" to 16", undersized regulation, limited SCADA and manual valves. The new station will have a single inlet and outlet pipes from 10" to 16", new regulation, SCADA, manual valves, filters, upgraded electrical and lighting, and fencing. Demolish and remove the existing station, all equipment, pads and piping including existing fencing and gate.

- . Install dual regulator runs in accordance with H-14 standard Rev. 4, 10/17/2019
- . Install fire valve upstream and downstream of regulation
- . Installation of new station steel pipe
- . Install new perimeter fencing
- . Installation of new filters H-14
- . Install SCADA per J-101 standard Rev. 3, 7/17/2019
- . Gravel new station footprint
- . New grounding system
- . Record Drawings and As-built Information
- . Project closeout

Cost Estimate Summary ^[1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight			\$ 220,684	\$ 220,684
2 Engineering	\$ 15,000		\$ 504,339	\$ 519,339
3 Construction	\$ 283,751		\$ 1,195,332	\$ 1,479,083
4 Major Equipment			\$ -	\$ -
5 Materials	\$ 497,000	\$ 497,000	\$ -	\$ 994,000
6 Environmental and Permitting			\$ 16,652	\$ 16,652
7 Land Acquisition and Permitting			\$ 21,286	\$ 21,286
8 Other (AFUDC, misc.)			\$ 359,698	\$ 359,698
9 2020 Sub Total	\$ 298,751	\$ 497,000	\$ 2,317,991	\$ 3,113,742

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-30
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT M&C Station Rebuilds - Complex Stations - MAT 764

Program: GT M&C Station Rebuilds - Complex Stations, MAT 764

Program Description:

The Complex Station Rebuild projects are intended to address station equipment aging and obsolescence of M&C gas transmission stations. Complex gas transmission stations contain valves and equipment that is controller-operated or controlled by an algorithm in either a Programmable Logic Controller (PLC) or Remote Terminal Unit (RTU). Complex stations include Underground Gas Holder Stations and pressure limiting stations. The project scope includes a complete rebuild of the station (above and below ground) to ensure replacement of older and obsolete equipment and piping, to upgrade configuration to meet current system needs, and to address any outstanding issues with station operations and maintenance (O&M).

Table 1: Capital Expenditures		2023	2024	2025	2026
1	Escalation		1,0261	1,0261	1,0253
2	Unit Cost	\$28,211,816	\$28,946,916	\$29,701,170	\$30,452,817
3	Units	1.5	1.5	1.5	1.5
4	Total Expenditures	\$42,317,724	\$43,420,374	\$44,551,755	\$45,679,225

2023 Unit Cost from Table 2, Line 15, Escalated
Line 2 * Line 3

Assumptions:

- Six (6) complex stations to be rebuilt over a 4-year period (1.5 complex station rebuilds per year).
- Station facilities that are more complex are more expensive than the typical complex station rebuilds and the pace when upgrading such facilities will be adjusted to match the forecasted spend per year.
- Each site has new and custom set of design needed.

Table 2: Program Estimate (in 2020 dollars)		Estimated Cost in			
		2020\$	2021	2022	2023
Area Of Work					
5	Engineering and Design	\$3,894,325	\$3,894,325	\$3,894,325	\$3,894,325
6	Construction	\$13,871,500	\$13,871,500	\$13,871,500	\$13,871,500
7	PM & Oversight	\$1,723,208	\$1,723,208	\$1,723,208	\$1,723,208
8	Equipment, Major	\$0	\$0	\$0	\$0
9	Materials, Commodity	\$3,664,174	\$3,664,174	\$3,664,174	\$3,664,174
10	Environmental and Permitting	\$661,488	\$661,488	\$661,488	\$661,488
11	Land Acquisition and Permitting	\$100,029	\$100,029	\$100,029	\$100,029
12	Other	\$2,467,999	\$2,467,999	\$2,467,999	\$2,467,999
13	Total Unescalated	\$26,382,722	\$26,382,722	\$26,382,722	\$26,382,722
14	Escalation	0	1,0091	1,0283	1,0306
15	Total Escalated	\$26,382,722	\$26,621,879	\$27,375,408	\$28,211,816

From WP 6-45.

Table 6-30a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT M&C Station Rebuilds - Complex Stations - MAT 764

Summary of Cost Estimate

Program: GT M&C Station Rebuilds - Complex Stations, MAT 764

Project Assumptions

The following assumptions are stated to clarify the project description and scope of work:

- Replace pressure control and pressure monitor valves.
- Replace Moore Industries electronic controllers with PID control algorithms within new Remote Terminal Unit (RTU) for the control valves.
- Replace and install new pressure transmitters on both regulation runs so as to provide constant and stable signals and reduce signal lag time due to lengthy pressure signal lines.
- Provide redundant pressure control and overpressure protection. Each run will have two regulator valves and a monitor valve.
- Install ultrasonic clamp on meter (non-wetted) and flow computer on both pipelines, upstream of regulation.
- Install isolation ball valves and regulation valves.
- Install independent gas supply system for both (regulators and monitor) control valves. Each control valve shall consist of two filter/dryers, two regulators, and two relief valves.
- Install new blowoffs as necessary.
- Replace existing standby generator with new generator equipped with Automatic Transfer Switch (ATS).
- Retire and remove all old & obsolete piping and equipment from station.
- Perform grounding study that includes AC voltage assessment and recommendations for mitigation of induced AC based on assessment results.
- Install new Total Flow Electronic Flow Computer for the new ultrasonic meters.
- Install foundations and pipe supports.
- Install new conduits, cables and additional grounding as necessary.

Cost Estimate Summary ^[1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight	\$ 386,000		\$ 1,337,208	\$ 1,723,208
2 Engineering	\$ 1,207,050		\$ 2,687,275	\$ 3,894,325
3 Construction	\$ 3,490,142		\$ 10,381,358	\$ 13,871,500
4 Major Equipment			\$ -	\$ -
5 Materials	\$ 3,588,702	\$ 75,472	\$ -	\$ 3,664,174
6 Environmental and Permitting	\$ 499,010		\$ 162,478	\$ 661,488
7 Land Acquisition and Permitting	\$ 46,500		\$ 53,529	\$ 100,029
8 Other (AFUDC, misc.)			\$ 2,467,999	\$ 2,467,999
9 2020 Sub Total	\$ 9,217,404	\$ 75,472	\$ 17,089,846	\$ 26,382,722

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-31
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT M&C Terminal Upgrades - MAT 765

Program: GT M&C Terminal Upgrades, MAT 765

Program Description:

The Terminal Upgrade Program includes upgrades and rebuilds to address station equipment aging and obsolescence. The work to be done during the rate case period is expected to include the following:

- Upgrade and repairs at all three Terminal stations (Brentwood, Antioch and Milpitas)
- Phased approach for rebuilding the Brentwood Terminal

For the upgrade scope, it is anticipated that selected valves, piping, supports and controls will be replaced and repaired. For the phased rebuild at Brentwood, the scope will include piping replacement, valve and control equipment replacements, as well as associated equipment. This program will continue beyond the rate case period to maintain asset health at the Terminal stations.

Table 1: Terminal Upgrade	2023	2024	2025	2026
Escalation		1,0261	1,0261	1,0253
Terminal Upgrade	\$2,852,695	\$2,927,026	\$3,003,294	\$3,079,299
Brentwood Terminal Rebuild	\$14,569,611	\$14,949,243	\$14,949,243	\$14,938,324
Total Capital	\$17,422,306	\$17,876,270	\$17,952,537	\$18,017,622

3-year Average from Table 2, Line 10, Escalated
 Line 1 * Table 3, Line 11
 Line 2 + Line 3

Assumptions:

1. Routine Terminal upgrade forecasted at a 3-year average (2018-2020) .
2. Brentwood Terminal rebuild Phases for 2023 GRC period.

Table 2: Routine Terminal Upgrade Historical Average	2018	2019	2020
Terminal Upgrade Recorded	\$746,419	\$4,452,820	\$3,114,431
Adjustments to Remove Brentwood Rebuild Costs	\$256	\$60,382	\$239,128
Recorded Adjusted Terminal Upgrade	\$746,164	\$4,392,438	\$2,875,303
Escalation (2023)	1,0841	1,0642	1,0693
Terminal Upgrade Recorded (in 2023 \$\$)	\$808,903	\$4,674,538	\$3,074,645
3-year Average (in 2023\$)	\$2,852,695		

Note #1
 Note #2
 Line 5 - Line 6
 Line 7 * Line 8

Table 3: Brentwood Terminal Rebuild Allocated Costs (in 2023 dollars)	Total Forecast			Allocated Forecast	
Brentwood Rebuild Allocated Costs for 2023-2026 (in 2023 \$)	\$	2023	2024	2025	2026
	\$	58,278,443	\$	14,569,611	\$ 14,569,611

Note #3, Note #4

Notes:

- #1 2018-2020 for the entire program under MAT 765 includes both routine Terminal upgrades and Brentwood Rebuild costs.
- #2 Recorded costs for Brentwood Rebuild removed so that the average will reflect only routine upgrade work at all three terminals.
- #3 Brentwood Terminal Rebuild Total Forecast for 2023-2026 based on detailed cost estimate developed for specific scope. Reference WP 6-47.
- #4 Total Brentwood Rebuild Forecast for 2023 GRC period allocated equally over 4 years (2023-2026).

Table 6-31a
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GT M&C Terminal Upgrades - Brentwood Terminal Rebuild Phases 2, 3 and 4 - MAT 765

Summary of Cost Estimate

Project: GT M&C Terminal Upgrades - Brentwood Terminal Rebuild MAT 765

Project Assumptions

The Brentwood Terminal Rebuild Phase for 2023 GRC period will focus on the activities related to engineering and construction. The project includes following assumptions and scope of work:

- **Phase 0 - Site Development/Preparation:** Prior to any disruption of existing gas assets, the new station property will be prepared for construction of the new facility. This work includes site clearing, grading, construction of retaining walls, drainage features, and equipment foundations. The scope of the work includes the entire footprint of the new facility, as well as any areas that may be temporarily needed during construction.
- **Phase 1 - Inlet Header Ring, Power and Communication Systems:** This phase focuses on construction of inlet header ring and the connected regulation systems for L-57B, L-57A, L-2, and L-303S. As described in the feasibility study, this phase does not include any tie-in of the equipment into the gas system. Since this is the first phase of construction of gas assets, it was intended to capture all the work that needed to be completed prior to taking a system clearance. This phase also includes the partial installation of the electric power (including backup power and the Automatic Transfer Switch (ATS)) and control systems; primarily those that support the inlet header and the L-57B/L-57A/L-2/303S metering and regulation systems.
- **Phase 2 - Preliminary Tie-Ins:** This phase consists of the first tie-in operations to the new facility, specifically the tie-in of lines L-57B and L-2. The scope of work also includes the installation of pigging launchers/receivers, as well as the metering equipment for these lines. Upon completion of this phase, these two lines will flow through the new station and utilize its infrastructure (controls/electrical systems). The corresponding metering and regulation systems at the existing facility will be retired.
- **Phase 3 - L-57A Tie-In:** This phase consists of the tie-in for L-57A, similar to Phase 2 for L-57A and L-2. The scope of work includes connection of this line to the inlet header and installation of a pig receiver and metering equipment.
- **Detailed engineering for subsequent phases beyond Phase 3:** The phases after Phase 3 primarily focus on completion of the rest of the facility, notably the second (outlet) header ring, the installation of the filter/separators, and the tie-ins to L-114, L-303, and L-131. The late phases facilitate retirement of the existing facility by replacing the pipeline sections that run through the existing footprint, disconnecting the connections to the retired systems and concluding site restoration activities.

Cost Estimate Summary [1]

Phases and Scope	Cost Estimate in 2020 \$\$
Continuation of Detailed Engineering (90% and IFC for Phases 1,2 and3) and Permitting.	\$3,200,000
New Terminal Site Development (Mobilization, Grading, Retaining Walls, Drainage)	\$11,800,000
Construction of Phases 1, 2 and 3: 1. Install and connect: (Ring Header #1, L-002 System, L-057A System, L-057B System, New IAS Skid and MCC, New ATS (2), General Tray (50%), Electrical Cables (50%), PLC (50%)) 2. Demobilize Yard and trailers. Process physical records and as-builts (New Terminal Site Development Phase)	\$37,200,000
Continuation of Detailed Engineering (90% and IFC for Phases 4, 5, 6 and 7) Process physical records and as-builts (Phases 1, 2 and 3)	\$2,300,000
Total Costs for 2023-2026 (in 2020 \$\$)	\$54,500,000
Escalation (2023)	1,0693
Total Costs for 2023-2026 (in 2023 \$\$)	\$58,278,443

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-32
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Station Over Pressure Protection Enhancements Capital - MAT 76G

Program: GT Station Over Pressure Protection (OPP) Enhancements Capital, MAT 76G

Program Description:

The GT Station OPP Enhancements Program began in 2018 as a mitigation to prevent large Overpressure (OP) events due to equipment-related failure at regulator stations. The primary focus of this program is to install or retrofit GT pilot-operated regulator stations with a secondary OPP device. M&C station assets addressed through this program include Large Volume Customers Regulator Sets (LVCRs), Large Volume Customer Meter Sets (LVCMs), and Simple Stations.

PG&E is proposing the following work for the 2023 GRC period:

* Rebuilding LVCM facilities to H-15 standard (beginning in 2023)

* Retrofitting LVCR, LVCM and Simple Station facilities with secondary OPP device (beginning in 2023)

Table 1: Capital Expenditures		2023	2024	2025	2026
1	LVCR Retrofits	\$ 8,661,567	\$ -	\$ -	\$ -
2	LVCM Rebuilds	\$ 3,164,234	\$ 3,246,683	\$ 3,331,280	\$ 3,415,585
3	LVCM Retrofits (limited to pilot operated facilities)	\$ 22,616,313	\$ 23,205,614	\$ 23,810,270	\$ 24,412,836
4	H-14 Simple Station Retrofits	\$ 7,217,972	\$ 14,812,094	\$ 15,198,045	\$ 15,582,661
5	Total Expenditures	\$41,660,087	\$41,264,391	\$42,339,595	\$43,411,082

Line 7 * Line 17
 Line 8 * Line 14
 Line 9 * Line 17
 Line 10 * Line 17
 Sum of Line 1 : Line 4

Table 2: Station OPP Units Forecast		2023	2024	2025	2026
6	Type of Stations				
7	LVCR Retrofits	18	0	0	0
8	LVCM Rebuilds	2	2	2	2
9	LVCM Retrofits (limited to pilot operated facilities)	47	47	47	47
10	H-14 Simple Station Retrofits	15	30	30	30
11	Total Stations	82	79	79	79

Sum of Line 7 : Line 10

Table 3: LVCM Rebuild Unit Cost Forecast

	Unit Cost	2023	2024	2025	2026
12	Station OPP LVCM Rebuild Unit Cost in 2020 \$s	\$1,479,542			
13	Escalation	1.0693	1.0261	1.0261	1.0253
14	Station OPP LVCM Rebuild Unit Cost (escalated)	\$ 1,582,117	\$ 1,623,342	\$ 1,665,640	\$ 1,707,792

#5

Table 4: Retrofit Unit Cost Forecast (Applicable to LVCR, LVCM and Simple Station Retrofits)

	Unit Cost	2023	2024	2025	2026
15	GT Station OPP Retrofit Unit Cost in 2020 \$s	\$450,000			
16	Escalation	1.0693	1.0261	1.0261	1.0253
17	Station OPP LVC Rebuild Unit Cost (escalated)	\$ 481,198	\$ 493,736	\$ 506,601	\$ 519,422

#6

Notes:

- #1 LVCR facilities are currently being retrofitted during 2019-2022 rate case period. The LVCR retrofit work is expected to end in 2023.
- #2 LVCM facilities that do not conform to the new H-15 design standard will be rebuilt to address OP risk. PG&E will begin addressing LVCM facilities from 2023.
- #3 LVCM facilities that do not require rebuilding will be retrofitted with a Secondary OPP device. PGE will begin retrofitting these facilities from 2023.
- #4 Simple Station facilities that do not require rebuilding will be retrofitted with a Secondary OPP device. PGE will begin retrofitting these facilities in 2023.
- #5 Based on detailed estimate for the rebuild scope and assumptions. See workpaper Station OPP LVC Rebuild WP 6-49 for details.
- #6 Based on detailed estimate for the retrofit scope and assumptions that are applicable to LVCR, LVCM and Simple stations. See Workpaper Station OPP LVC Retro WP 6-50 for details.

Table 6-32a
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Station Over Pressure Protection Enhancements Capital - MAT 76G

Summary of Cost Estimate

Project: GT Station Over Pressure Protection LVCM Rebuild, MAT 76G

Project Assumptions

The following assumptions are stated to clarify the project description and scope of work:
Remove and retire an existing simple gas LVC regulator station. Fabricate and install a new dual run 4" regulator/monitor run with 6" filter per H-15 standard Rev#02b 10/04/2017. Demolish and remove the existing station, all equipment, pads and piping including existing fencing and gate.

- Installation of 70' of new 4" steel pipe
- Installation of 50' of new 2" steel pipe
- Installation new dual run regulator and monitor sets and secondary overpressure protection
- Installation of new 6" filter, electronic pressure recorder (ERX) and telecom
- Installation of new fence and gate
- Gravel new station footprint
- New grounding system
- Record Drawings and As-built Information
- Project closeout

Cost Estimate Summary [1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight	\$ 9,500		\$ 101,853	\$ 111,353
2 Engineering			\$ 60,538	\$ 60,538
3 Construction	\$ 161,710		\$ 817,593	\$ 979,303
4 Major Equipment			\$ -	\$ -
5 Materials	\$ 167,383		\$ -	\$ 167,383
6 Environmental and Permitting	\$ 5,000		\$ 13,084	\$ 18,084
7 Land Acquisition and Permitting			\$ 4,475	\$ 4,475
8 Other (AFUDC, misc.)			\$ 138,405	\$ 138,405
9 2020 Sub Total	\$ 176,210	\$ 167,383	\$ 1,135,948	\$ 1,479,542

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-32b
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GT Station Over Pressure Protection Enhancements Capital - MAT 76G

Summary of Cost Estimate

Project: GT Station Over Pressure Protection Retrofit for LVCR, LVCM and Simple Stations, MAT 76G

Project Assumptions

This summary of proposed work is based on a completed project for Station OPP retrofit project. This scope and unit cost applies to LVCS, LVCR and Simple Stations.

- Replace existing Mooney Monitor with Mooney Monitor with Slam Shut
- Install electronic pressure recorder (ERX)
- Install (2) Token Relief Valves ((1) on regulator set, (1) on meter set)
- Install 1" rigid steel conduit (PVC coated from Slam Shut to ERX Cabinet)
- Install 3/4" rigid steel conduit (from monitor vault to ERX Cabinet)

Cost Estimate Summary ^[1]

	Contractor	Materials	PG&E	Total
1 PM & Oversight			\$ 39,512	\$ 39,512
2 Engineering			\$ 18,963	\$ 18,963
3 Construction	\$ 163,990		\$ 206,346	\$ 370,336
4 Major Equipment			-	\$ -
5 Materials		\$ 5,860		\$ 5,860
6 Environmental and Permitting			\$ 4,127	\$ 4,127
7 Land Acquisition and Permitting			\$ 8,160	\$ 8,160
8 Other (AFUDC, misc.)			\$ 3,042	\$ 3,042
9 2020 Sub Total	\$ 163,990	\$ 5,860	\$ 280,150	\$ 450,000

[1] Based on detailed estimate developed for the scope and assumptions provided.

Table 6-33
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Station Strength Testing Capital - MAT 76V

Program: GT Station Strength Testing Capital, MAT 76V

Program Description:

The Station Strength Testing Program will perform pressure testing of station components when required as a result of ECA Phase 1 and Phase 2 findings. The Strength Testing capital includes the following activities:
 1) Auxiliary capital projects that will enable strength testing of station components through installation or replacement of equipment or other components that is required as a result of the Station Strength Testing work.

2023 GRC Forecast				
	2023	2024	2025	2026
Table 1: Station Strength Testing Capital				
Station Strength Testing Capital (Costs to address station components installed on or before 12/31/1955) ⁽¹⁾	\$4,327,100	\$4,327,100	\$1,657,100	\$1,657,100
Escalation	1,0306	1,0261	1,0261	1,0253
Total Capital	\$4,459,307	\$4,439,849	\$1,700,278	\$1,699,036

Table 2, Line 9, Note #1
 Line 1 * Line 2

Categories	#Stations in Scope for 2023-2026 ⁽²⁾⁽³⁾	Unit Cost/Station ⁽⁴⁾	2023	2024	2025	2026
LVC	22	\$ 340,000	\$ 2,040,000	\$ 2,040,000	\$ 1,700,000	\$ 1,700,000
Complex Stations (Cat A), except the very large ones	8	\$ 461,200	\$ 922,400	\$ 922,400	\$ 922,400	\$ 922,400
Simple Stations (Cat B)	12	\$ 230,600	\$ 691,800	\$ 691,800	\$ 691,800	\$ 691,800
Large Stations	2	\$ 5,000,000	\$ 5,000,000	\$ 5,000,000	\$ -	\$ -
Station Strength Testing Auxiliary Capital Projects			\$ 8,654,200	\$ 8,654,200	\$ 3,314,200	\$ 3,314,200
Station Strength Testing Capital (Costs to address station components installed on or before 12/31/1955) ⁽⁵⁾		50% \$	4,327,100 \$	4,327,100 \$	1,657,100 \$	1,657,100 \$

Notes:

- #1 Per 2015 GT&S Final decision D, 16-06-056, Station Strength Testing Memorandum Account includes only cost to address station components installed before 1/1/1956.
- #2 Pace of program driven by compliance requirement from PHMSA Mega rule and intended deadlines (50% of the pipeline mileage by July 3, 2028, and 100% of the pipeline mileage by July 2, 2035).
- #3 Count of station in scope for strength testing estimated based on ECA1 results.
- #4 Unit cost for station strength test capital for LVC, Cat A and Cat B stations based on 10 Cat B station projects of similar scope between 2016 to 2021. Unit cost for large stations calculated based on historical strength testing costs and SME judgement.
- #5 Percentage of station components length (i.e. pipe & fittings length) installed before 1/1/1956 without a TVC record, as compared to the total length of all components in scope for ECA2 and ST.

Table 6-34
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GT Physical Security Upgrades - MAT 76Z

Program: GT Physical Security Upgrades, MAT 76Z

Program Description:

Physical Security Program implements physical security measures at critical station facilities for both C&P and M&C assets. Mitigations implemented under this program are designed to deter and prevent third party damage. Physical Security Program includes security upgrade for one small and one large station per year for 2023 GRC period. Typical projects under this program include installation of physical access (locks), perimeter barriers (walls or fences), video surveillance technology, intrusion detection and activation, escalated alarm handling, and advanced security barriers around facility equipment.

	2023	2024	2025	2026
Table 1: Capital Expenditures				
Large Stations	\$5,828,553	\$5,980,425	\$6,136,253	\$6,291,543
Small Stations	\$2,860,129	\$2,934,654	\$3,011,120	\$3,087,323
Total Capital	\$8,688,682	\$8,915,078	\$9,147,374	\$9,378,866

Table 2, Line 6 * Table 4, Line 10
Table 3, Line 9 * Table 4, Line 11

Assumptions:

- One (1) Large Station and one (1) Small Station Physical Security Upgrades per year.
- Each site has new and custom set of design needed.

	Forecast	2023	2024	2025	2026
Table 2: Large Stations Unit Cost					
Average Unit Cost in 2020 \$s	\$5,450,663				
Escalation		1.0693	1.02606	1.02606	1.02531
Large Station Escalated Unit Cost		\$5,828,553	\$5,980,425	\$6,136,253	\$6,291,543

WP 6-53 Table 1

	Forecast	2023	2024	2025	2026
Table 3: Small Stations Unit Cost					
Average Unit Cost in 2020 \$s	\$2,674,694				
Escalation		1.0693	1.02606	1.02606	1.02531
Small Station Escalated Unit Cost		\$2,860,129	\$2,934,654	\$3,011,120	\$3,087,323

WP 6-53 Table 2

	2023	2024	2025	2026
Table 4: Large and Small Stations Unit Forecast				
Large Stations	1	1	1	1
Small Stations	1	1	1	1

10
11

Table 6-35
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GD Regulator Station Component Replacements - MAT 50L

Program: GD Regulator Station Component Replacements, MAT 50L

Program Description:

The GD Regulator Station Component Replacements Program focuses on replacing equipment that is obsolete or that has experienced problems, as well as the addition of specific equipment necessary to ensure reliable operation of the station. Component replacement consists of routine work to replace equipment or components when they have exceeded their useful life or are experiencing performance problems. Equipment additions may be required based on the need for filters, bypass valves, fire valves, and other components.

	2023	2024	2025	2026
1 Escalation		1,0268	1,0261	1,0261
2 Unit Cost	\$69,467	\$71,329	\$73,188	\$75,095
3 Units	150	150	150	150
4 Total Expenditures	\$10,420,098	\$10,699,418	\$10,978,207	\$11,264,260

2023 Unit Cost from Table 2, Line 10, Escalated
Line 2 * Line 3

Assumptions:

1. Unit cost forecasted based on 2018-2020 recorded average unit cost.
2. Units forecasted as 150 component replacement units per year.

	2018	2019	2020
5 Total Program Recorded	\$ 7,976,382	\$ 9,968,543	\$ 10,024,032
6 Units Operational	136	164	136
7 Unit Cost	\$ 58,650	\$ 60,784	\$ 73,706
8 Escalation (2023)	1,0929	1,0697	1,0757
9 Unit Cost (in 2023 \$s)	\$ 64,098	\$ 65,022	\$ 79,283
10 3-year Average Unit Cost (Rounded)			\$ 69,467

Line 5 / Line 6
Line 7 * Line 8
Note #1

Notes:

#1 Unit Cost 3-year average (2018-2020)

Table 6-36
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GD Regulator Station Rebuilds - MAT 50C

Program: GD Regulator Station Rebuilds, MAT 50C

Program Description:

The GD Regulator Station rebuild program addresses non-HPR-type District Regulator Stations. This program includes complete rebuild of the distribution regulator stations (above and below ground) to replace old and obsolete equipment and piping, to upgrade configuration to meet current design standards and system operating needs, and to address any issues with station operation and maintenance.

	2023	2024	2025	2026
1 Escalation		1,0268	1,0261	1,0261
2 Unit Cost	\$1,936,520	\$1,988,430	\$2,040,242	\$2,093,403
3 Units	25	25	25	25
4 Total Expenditures	\$48,413,001	\$49,710,756	\$51,006,041	\$52,335,078

2023 Unit Cost from Table 2, Line 10, Escalated
 Line 2 * Line 3

Assumptions:

1. Unit cost forecasted based on 2019 recorded unit cost.
2. 25 regulator station rebuilds per year for 2023-2026.

	2019
5 Total Program Recorded	\$ 47,068,000
6 Units Operational	26
7 Unit Cost	\$ 1,810,308
8 Escalation (2023)	1,0697
9 Unit Cost (in 2023 \$s)	\$ 1,936,520
10 Unit Cost (escalated to 2023)	\$ 1,936,520

Line 5 / Line 6
 Line 7 * Line 8

Table 6-37
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
GD HPR Program - MAT 2K

Program: GD High Pressure Regulator (HPR) Program, MAT 2K

Program Description:

GD HPR program focuses on removal or rebuild of HPR type regulation equipment to address gas leaks and equipment condition, including Atmospheric Corrosion (AC). HPRs can be addressed in several ways, including:

- Removal of the HPR and connection to an existing gas distribution main;
- Rebuild of the HPR;
- Replacement of the HPR with a district regulator station facility; and
- Removal of the HPR and converting the customer service to a non-natural gas alternative.

Table 1: Capital Expenditures	2023	2024	2025	2026
1 Escalation		1,0268	1,0261	1,0261
2 Unit Cost	\$179,520	\$184,332	\$189,135	\$194,064
3 Units	100	100	100	100
4 Total Expenditures	\$17,952,021	\$18,433,242	\$18,913,547	\$19,406,366

2023 Unit Cost from Table 2, Line 10, Escalated
Line 2 * Line 3

Assumptions:

1. Unit cost forecasted based on 2018-2020 recorded average unit cost.
2. Units forecasted 100 HPRs per year for 2023-2026.

Table 2: Unit Cost Calculation	2018	2019	2020
5 Total Program Recorded	\$ 55,089,000	\$ 64,823,676	\$ 47,080,635
6 Units Operational	408	413	227
7 Unit Cost	\$ 135,022	\$ 156,958	\$ 207,404
8 Escalation (2023)	1,0929	1,0697	1,0757
9 Unit Cost (in 2023 \$s)	\$ 147,564	\$ 167,901	\$ 223,096
10 3-year Average Unit Cost (Rounded)	\$	\$	\$ 179,520

Line 5 / Line 6
Line 7 * Line 8
Note #1

Notes:

#1 Unit Cost 3-year average (2018-2020)

Table 6-38
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GD Station Over Pressure Protection Enhancements Capital - MAT 50N

Program: GD Station Over Pressure Protection (OPP) Enhancements Capital, MAT 50N

Program Description:

The specific scope of work to address distribution facilities includes the retrofit of high pressure and low pressure pilot operated GD regulator stations with OPP modifications. These stations are governed by Design Standard H 14.

- High pressure Pilot Operated Regulator Station retrofits: PG&E plans to complete retrofits on the high pressure stations by 2025. PG&E proposes to perform 200 retrofits in 2023 and 150 retrofits in each of 2024 and 2025. These retrofits will include installation of slam shuts or, if required, alternate technologies and relief valves.
- Low pressure Pilot Operated Regulator Station retrofits: PG&E currently has secondary OPP slam shuts installed on its LP stations. For 2023 GRC period, PG&E is not forecasting any capital work for LP stations under this program. However, following the Merrimack Valley, Massachusetts OP event in 2018, PG&E is evaluating enhancing the existing slam shut devices and other alternative upgrade mitigations for LP systems. Modifications to the existing slam shut device on the LP systems to isolate the station during both over and under pressure scenarios and other studies for alternative upgrades for LP stations will be performed under expense program.

Table 1: Capital Expenditures				
	2023	2024	2025	2026
1 Escalation		1,0268	1,0261	1,0261
2 Unit Cost	\$98,982	\$101,635	\$104,284	\$107,001
3 Units	200	150	150	0
4 Total Expenditures	\$19,796,391	\$15,245,288	\$15,642,526	\$0

2023 Unit Cost from Table 2, Line 10, Escalated
 Line 2 * Line 3

Assumptions:

1. Unit cost forecasted based on 2019-2020 recorded average unit cost.
2. Units forecasted as 200 units for 2023 and 150 units for 2024 and 2025.
3. Secondary OPP installations at all GD pilot operated regulator stations will be completed by end of 2025.

Table 2: Unit Cost Calculation				
	2019	2020	Note #1	
5 Total Program Recorded	\$ 7,366,682	\$ 11,480,753		
6 Units Operational	87	115		
7 Unit Cost	\$ 84,675	\$ 99,833		Line 5 / Line 6
8 Escalation (2023)	1,0697	1,0757		
9 Unit Cost (in 2023 \$s)	\$ 90,578	\$ 107,386		Line 7 * Line 8
10 2019-2020 Average Unit Cost (Rounded)		\$ 98,982		

Notes:

- #1 The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

Table 6-39
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 6, Asset Family - Facilities
 GD CNG Station Capital Program - MAT 31A

Program: GD Compressed Natural Gas (CNG) Station Capital Program, MAT 31A

Program Description:

Federal and state codes applicable to CNG stations require periodic maintenance to minimize safety risks by confirming the condition and function of a large number of station components. The capital portion of the program primarily consists of replacement of equipment that is obsolete, has outlived its useful service life, no longer can meet the demands of the station, or is not in acceptable working condition.

Table 1: CNG Stations Capital	2023	2024	2025	2026
ESCALATION	1,0268	1,0268	1,0261	1,0261
Total Expense	\$4,771,350	\$4,899,250	\$5,026,908	\$5,157,891

1

Table 2: Calculation	2018	2019	2020
CNG Stations Capital Recorded	\$ 4,260,677	\$ 4,303,891	\$ 4,698,195
Escalation (2023)	1,0929	1,0697	1,0757
CNG Stations Capital Recorded (in 2023 \$s)	\$ 4,656,436	\$ 4,603,953	\$ 5,053,662
Adjusted 3-year Average		\$ 4,771,350	

Line 2 * Line 3
 Note #1

Notes:

#1 Capital 3-year average (2018-2020).

2

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – GT Complex Station Rebuilds Program

Project Title: GT Complex Station Rebuilds

Major Work Categories: 76 (MAT 764)

Planning Order Numbers: Various POs, see Table 1 below

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): Operative as installed

Project Description

While station maintenance and targeted component replacements can extend reliable operation of the station, station rebuilds are required periodically to address overall station condition and configuration. The station rebuild projects rebuild the station (above and below ground) to replace old and obsolete equipment, valves and piping, upgrade configuration to meet current system needs, and address any outstanding issues with station maintenance and operations.

Transmission Complex Stations have complex control and operations including stations or controller-operated equipment that have either PLCs or RTUs to provide control and data transmission. These stations are generally designed to Design Standard H-19. Other facility types included as complex stations are:

- Pressure limiting or regulator stations; and
- Facilities that contain valves that are PLC, RTU or controller operated.

The frequency of station rebuilds is based on the condition of the station and on the prioritization queue. The criteria for determining the priority of station rebuilds include the following:

- Station condition based on metrics of age, equipment obsolescence (product and parts no longer supported and available), operational issues identified for equipment and station configuration, maintenance status (high level of corrective maintenance); and
- Station configuration modifications required to address changing operational requirements for the station.

Justification

The station rebuilds are mitigation activities for equipment-related threats related to age and obsolescence, maintenance difficulties, configuration, and liquid and debris impacts on equipment operation. Complex Station Rebuilds is a control for two risks: Large Overpressure Event Downstream of Gas Measurement and Control (M&C) Facility risk and Loss of Containment at Gas Measurement and Control or Compression and Processing Facility risk.

Cost

The forecast for this program assumes six complex station rebuilds during the 2023-2026 rate case period which translates to 1.5 complex stations per year. The costs presented are based on a detailed cost estimate developed by PG&E's engineering, construction and cost estimating group.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – GT Complex Station Rebuilds Program

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
CAPITAL														
MAT 764	16,624	36,208	82,470	45,235	27,081	37,214	3,600	42,318	43,420	44,552	45,679	424,401	WP 6-32, Line 9	
TOTAL PROJECT COST	16,624	36,208	82,470	45,235	27,081	37,214	3,600	42,318	43,420	44,552	45,679	424,401		

Benefits

The primary purpose of this program is to improve safety and reliability. The complex station rebuild projects under this program are performed to address aging station condition, equipment obsolescence (product and parts no longer supported and available), operational issues identified for equipment and station configuration, maintenance status (high level of corrective maintenance). With an obsolete and outdated station facility, there is a risk of an extended outage if an equipment failure occurs and replacement parts are not readily available. Timely rebuilding of the complex stations with obsolete equipment provides the benefit of avoiding future potential costs associated with extended outages and costly repairs to other associated equipment.

Alternatives Considered

The alternatives considered for station rebuilds are closely aligned with overall asset management strategy for these facilities, which includes several programs to manage the life cycle and reliability of the facilities and equipment:

- Maintenance programs to effectively inspect and maintain equipment and to monitor the health of the equipment;
- Targeted equipment replacement programs for equipment identified as obsolete or problem equipment; and
- Rebuild of facilities to maintain health of the overall facilities, to address operational and safety needs, and to ensure a rational turnover rate of the transmission facility fleet.

Based on the overall asset condition, various alternatives can be defined from continuation of normal maintenance to targeted projects (component replacements) to facility rebuild. Other factors that influence action at a facility include operational needs or changes at a facility, potential safety concerns related to location of the facility (e.g., located in a heavily trafficked street), and difficulty in performing maintenance. Overall asset management strategy for transmission stations life cycle of the M&C station assets is discussed in the M&C Station rebuild whitepaper. The proposed pace for six complex station rebuilds over the 4-year period (2023-2026) ensures that a large asset population does not build up over time, and thus requiring significant work in a short period of time.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – GT Complex Station Rebuilds Program**

Table 1. Planning Orders

MAT	Planning Order
764	5520640, 5524853, 5526123, 5537702, 5537743, 5738378, 5744023, 5745002, 5746478, 5748183, 5750645, 5751483, 5751894, 5757284, 5757318, 5757324, 5757346, 5757564, 5759099, 5759641, 5759664, 5759701, 5762465, 5762493, 5763298, 5764879, 5765363, 5765655, 5768781, 5774013, 5775651, 5782464, 5782799, 5782811, 5784560, 5792684, 5793403, 5793404, 5793408, 5794622, 5794623, 5794625, 5794626, 5794800, 5794801, 5794802, 5794803

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Brentwood Terminal Rebuild Program

Project Title: Brentwood Terminal Rebuild

Major Work Categories: 76 (MAT 765)

Planning Order Numbers: 5794628

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): Operative as installed

Project Description

PG&E will continue the rebuilding of the Brentwood terminal during the rate case period. For the 2019 GT&S rate case period, PG&E proposed two defined tasks for the Brentwood Terminal: (1) removal of obsolete equipment and piping, and (2) performance of an engineering study to review alternatives for the rebuild and complete preliminary engineering to guide the rebuild activities. PG&E is on track to complete remaining activities by 2022. In addition, PG&E has completed the feasibility study to evaluate various rebuild alternatives which determined the phases for 2023 GRC period.

Since Brentwood Terminal serves as a junction for several major lines in the East Bay Area, construction must be phased in order to limit impact on the surrounding system. The system outages required to remove existing equipment and install new equipment must be relatively short in duration and impact only one or two of the connected pipelines. Removing the entire station from service to complete the rebuild is not an option. The phasing approach divides the scope of work into segments (sub-components of work tasks) which could be easily bundled into construction plans/sequence while minimizing safety, economic, maintenance or operational impacts. The Brentwood Terminal rebuild scope and forecast for 2023 2026 GRC period specifically includes the following phases.

- Phase 0 – Site Development/Preparation: Prior to any disruption of existing gas assets, the new station property will be prepared for construction of the new facility. This work includes site clearing, grading, construction of retaining walls, drainage features, and equipment foundations. The scope of the work includes the entire footprint of the new facility, as well as any areas that may be temporarily needed during construction.
- Phase 1 – Inlet Header Ring, Power and Communication Systems: This phase focuses on construction of inlet header ring and the connected regulation systems for L 57B, L 57A, L 2, and L 303S. As described in the feasibility study, this phase does not include any tie in of the equipment into the gas system. Since this is the first phase of construction of gas assets, it was intended to capture all the work that needed to be completed prior to taking a system clearance. This phase also includes the partial installation of the electric power (including backup power and the ATS) and control systems; primarily those that support the inlet header and the L 57B/57A/2/303S metering and regulation systems.
- Phase 2 – Preliminary Tie Ins: This phase consists of the first tie in operations to the new facility, specifically the tie in of lines L 57B and L 2. The scope of work also includes the installation of pigging launchers/receivers, as well as the metering equipment for these lines. Upon completion of this phase, these two lines will flow through the new station and utilize its infrastructure (controls/electrical systems). The corresponding metering and regulation systems at the existing facility will be retired.
- Phase 3 – L 57A Tie In: This phase consists of the tie in for L 57A, similar to Phase 2 for L 57A and L 2. The scope of work includes connection of this line to the inlet header and installation of a pig receiver and metering equipment.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Brentwood Terminal Rebuild Program

- Detailed engineering for subsequent phases beyond Phase 3: The phases after Phase 3 primarily focus on completion of the rest of the facility, notably the second (outlet) header ring, the installation of the filter/separators, and the tie ins to L 114, L 303, and L 131. The late phases facilitate retirement of the existing facility by replacing the pipeline sections that run through the existing footprint, disconnecting the connections to the retired systems, and concluding site restoration activities.

Justification

The Brentwood terminal is one of the most critical pressure control facilities along PG&E's gas transmission line. The complexity of the facility and equipment obsolescence and age play a crucial role in the reliability of this terminal. While the risk of equipment failure is managed through routine equipment and component upgrades at the Brentwood facility, the rebuild project as planned will significantly improve the reliability of this terminal. The terminal upgrades and rebuilds are mitigation activities for the equipment-related threat related to age and obsolescence, maintenance difficulties, configuration, and liquid and debris impacts on equipment operation.

Cost

Brentwood Rebuild forecast is based on a bottoms-up detailed cost estimate developed by PG&E's engineering, construction and cost-estimating group in collaboration with an engineering firm with experience in project engineering and construction of GT facilities.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
CAPITAL														
MAT 765	-	-	-	-	-	-	5,900	14,570	14,949	14,949	14,938	65,306	WP 6-46, Line 3	
TOTAL PROJECT COST	-	-	-	-	-	-	5,900	14,570	14,949	14,949	14,938	65,306		

Benefits

Brentwood Terminal was originally constructed in 1953 and has gone through numerous partial rebuilds, upgrades, and other modifications. The current system is now overly complex with old and new equipment and pipelines operating at different pressure limits. The station as it exists today faces significant operational challenges and risk of equipment failure. A complete rebuild of Brentwood Terminal will provide PG&E with the opportunity to drastically improve reliability and reduce operational risk by replacing equipment and simplifying the design of the facility.

Alternatives Considered

PG&E reviewed several rebuild alternatives that included factors such as conceptual design (ring header vs. point-to-point configuration), location (greenfield, in-place, and hybrid), and configuration (above or below ground). Based on these considerations, PG&E's study resulted in the selection of the ring-header, below-ground, greenfield alternative as the Brentwood Terminal rebuild approach. The greenfield alternative will be located on PG&E-owned property adjacent to the existing Brentwood Terminal.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – GT Compressor Controls Upgrade Program

Program Title: GT Compressor Controls Upgrade

Major Work Categories: 76 (MAT 76T)

Planning Order Numbers: Various POs, see Table 1 below

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): Operative as installed

Project Description

This program was established to systematically replace and upgrade control systems at PG&E compressor facilities. This program addresses obsolescence of the controls systems (including hardware and software) and improves monitoring and control functionality and reliability to currently available levels. Three types of controls are addressed through this program: compressor unit controls, station controls, and associated Emergency Shutdown (ESD) systems.

Unit Control:

Most compressor units are installed with a PLC that monitors and controls the operation of the compressor unit, ensuring safe and reliable operation. The unit PLC also activates individual unit alarms and initiates an ESD of the unit under prescribed conditions. An associated station PLC works in conjunction with the unit PLCs in a station to synchronize and coordinate proper function of all compressor units.

Station Control:

Each compressor station is integrated with a complex process control system that enables operators to control the downstream pressure of incoming natural gas and eliminate any deviations in normal operation. The station PLC is also responsible for the quick and safe activation of the ESD system in the event of an emergency.

ESD System:

Emergency Shutdown (ESD) systems are important safety response systems installed at all compressor stations and underground gas storage facilities. On detection of an emergency condition, the ESD system is designed to immediately, automatically, and safely stop operation of equipment, isolate the station piping, and safely vent the natural gas within the station to the atmosphere. Upgrades to the obsolete ESD system enable a more robust response to fires and minimize damage and facility outage time. The lifespan of compressor unit and station PLCs is on average 15-20 years.

Justification

The primary manufacturer of the PLCs and I/O interface module currently used at PG&E's transmission compressor stations has announced that they will stop supporting this product soon. This will make obtaining parts for repairs difficult or impossible, and there will be little to no technical support from the manufacturer. Equipment obsolescence, lack of ongoing vendor support and spare parts availability, necessitate these controls upgrades. The threats addressed through Compressor Controls Upgrade Program are equipment-related issues that reduce station reliability and equipment-related lack of

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – GT Compressor Controls Upgrade Program

service and spare parts availability along with technology obsolescence. This program is a control for Loss of Containment at Gas Measurement and Control or Compression and Processing Facility risk.

Cost

The forecast for this program assumes controls upgrade at one station per year. The cost for the upgrade is based on a detailed bottoms-up cost estimate developed for a generic stations upgrade scope for one station.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
CAPITAL													
MAT 76T	2,375	1,505	9,074	11,352	6,169	9,430	9,520	11,108	11,398	11,695	11,991	95,617	WP 6-32, Line 5
TOTAL PROJECT COST	2,375	1,505	9,074	11,352	6,169	9,430	9,520	11,108	11,398	11,695	11,991	95,617	

Benefits

The primary purpose of this program is to improve safety and reliability. The projects under this program addresses obsolete PLCs that are being phased out by the manufacturer and will no longer be supported. With obsolete and outdated PLCs, there is a risk of an extended outage if an equipment failure occurs and replacement parts are not readily available. Timely replacement of the obsolete PLCs provides the benefit of avoiding future potential costs associated with extended outages and costly repairs to other associated equipment.

Alternatives Considered

The alternatives considered are “repair” and “replacement.” The repair alternative was not viable, for several reasons. First, these systems have or are approaching the design lifespan. Second, these systems are obsolete, and lack ongoing vendor support and availability of spare parts.

PG&E also considered slightly increasing or decreasing the pace of compressor controls upgrade at the stations. However, after taking in to account the complexity of the facilities and costs, decided on the pace of one station per year. This proposed pace allows obsolete PLCs to be retained for spare parts for units remaining in operation, minimizes impact on operations, and manages the asset as a whole so that age or condition of these units do not result in a need to replace an unacceptably large number of units at one time.

Table 1. Planning Orders

MAT	Planning Order
76T	5749558, 5759712, 5759713, 5765687, 5772751, 5782803, 5788018, 5793343, 5793344, 5793345, 5793754, 5793755, 5794567, 5794568

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Los Medanos K-1 Compressor Replacement Program

Project Title: Los Medanos K-1 Compressor Replacement

Major Work Categories: 76 (MAT 76X)

Planning Order Numbers: 5794572

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): Operative as installed

Project Description

PG&E maintains a fleet of 41 compressor units installed at stations located on its gas transmission pipeline system and underground gas storage facilities. The asset management strategy for compressor units focuses on life extension, with the overall objective of ensuring safe and reliable operation of the units.

Elements of the compressor replacement strategy include:

- Routine maintenance programs including inspections, periodic overhauls of compressor units (compressors and drivers), and contracted time-based turbine change-outs;
- Targeted overhauls and component replacement or upgrade projects to address specific unit performance issues or problem equipment and systems;
- Unit replacements, typically initiated in response to a specific driver (such as a change in regulatory requirements, or lack of service or spare parts from manufacturers); and
- Unit retirements when applicable, typically initiated by system planning studies and including decommissioning and retirement activities

For the 2023 GRC period, PG&E forecasts one compressor replacement project at the Los Medanos Storage Facility. The compressor replacement study identified Los Medanos K1 to be replaced during the 2017-2020 time frame, but the discussions about the possibility of decommissioning Los Medanos facility delayed the decisions on this compressor replacement. Per the revised Natural Gas Storage Strategy, PG&E has determined that the Los Medanos Storage facility is now required for system operations, and will be replacing this compressor unit during the 2023 rate case period.

Justification

Compressor Replacement initiatives mitigate equipment-related threats and risks that can adversely impact gas system operations through the loss of service, loss of operating flexibility and reliability, and inability to meet evolving industry and environmental regulations.

Los Medanos K-1, a Cooper Bessemer GMVM V-12 (Quad) unit installed in 1981, is considered obsolete. There were few installations of this model compressor, technical support from the OEM is declining, and there has been a notable cost increase in OEM replacement parts.

Compressor Replacement program is a control for Loss of Containment at Gas Measurement and Control or Compression and Processing Facility risk.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Los Medanos K-1 Compressor Replacement Program

Cost

The compressor replacement project forecast includes costs to replace an obsolete compressor, replace associated equipment, install a compressor building, and any ancillary systems that must be upgraded to accommodate the new unit.

The costs presented in this summary are based on detailed bottoms-up cost estimates developed for a specific project scope. Large capital projects typically span over 3-4 years. PG&E's 2023 forecast for this program represents the funds needed to complete the engineering, construction and closeout phases for the identified project. The cost of compressor replacement is spread over a 4-year period with construction occurring in the second and third years.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast							Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
CAPITAL														
MAT 76X (PO 5794572)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10,039	10,301	15,451	15,440	51,231	WP 6-38, Line 3	
TOTAL PROJECT COST	-	-	-	-	-	-	-	10,039	10,301	15,451	15,440	51,231		

Benefits

The primary purpose of this program is to improve safety and reliability. The projects under this program address obsolete units that are being phased-out by the manufacturer and will no longer be supported. With obsolete and outdated units, there is a risk of an extended outage if an equipment failure occurs and replacement parts are not readily available. Timely replacement of the obsolete units provides the benefit of avoiding future potential costs associated with extended outages and costly repairs to other associated equipment.

Alternatives Considered

The alternatives considered are "repair" and "replacement." The repair alternative was not viable, because these systems are obsolete, and lack ongoing vendor support and availability of spare parts.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Tionesta K-1 Compressor Retirement Program

Project Title: Tionesta K-1 Compressor Retirement

Major Work Categories: 76 (MAT 76X)

Planning Order Numbers: Various POs, see Table 1 below

Project Start Date: 1/1/2023

Project Completion Date: 12/31/2025

Operative Date (only applies to Capital): Operative as installed

Project Description

PG&E maintains a fleet of 41 compressor units installed at stations located on its gas transmission pipeline system and underground gas storage facilities. Historically, the asset management strategy for compressor units focuses on life extension, with the overall objective of ensuring safe and reliable operation of the units. However, recent system planning assessments of compression demands on the gas transmission system have identified potential unit for retirement. Therefore, this program has been expanded to include both compressor replacements and retirements.

Elements of the compressor replacement strategy include:

- Routine maintenance programs including inspections, periodic overhauls of compressor units (compressors and drivers), and contracted time-based turbine change-outs;
- Targeted overhauls and component replacement or upgrade projects to address specific unit performance issues or problem equipment and systems;
- Unit replacements, typically initiated in response to a specific driver (such as a change in regulatory requirements, or lack of service or spare parts from manufacturers); and
- Unit retirements when applicable, typically initiated by system planning studies and including decommissioning and retirement activities

PG&E performs system studies that identify the potential for reduced compression capacity. Based on the results of these studies, compressor units or facilities may be identified for retirement and decommissioning. In 2019 GT&S, PG&E forecasted replacing the Tionesta K 1 compressor unit due obsolescence. However, the results of the system planning studies conducted in 2020 have changed the long-term strategy. The study recommends retirement of Tionesta facility in 2025 and will include two major activities: (1) Removal of the Tionesta equipment, structures, and piping; and (2) Conversion of the site to a M&C Complex station facility with remote-controlled, main line valves.

Justification

The compressor retirement strategy focuses on removal of facilities that are no longer required for system operation and that result in more efficient operation of the gas system. The retirements also allow for significant future cost savings as the units will no longer be required to be maintained or replaced.

Together, Compressor Replacement and Retirement initiatives mitigate equipment-related threats and risks that can adversely impact gas system operations through the loss of service, loss of operating flexibility and reliability, and inability to meet evolving industry and environmental regulations.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – Tionesta K-1 Compressor Retirement Program

Cost

Tionesta compressor retirement forecast includes costs for removal of equipment, structures, and piping; and converting the site to a valve lot.

The costs presented in this summary are based on detailed bottoms-up cost estimates developed for a specific project scope. Large capital projects typically span over 3-4 years. PG&E's 2023 forecast for this program represents the funds needed to complete the engineering, construction and closeout phases for the identified project. The cost of retirement is spread over a 3-year period with construction occurring in the second year.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
CAPITAL														
MAT 76X	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9,248	9,489	4,744	N/A		23,481	WP 6-38, Line 2
TOTAL PROJECT COST	-	-	-	-	-	-	-	9,248	9,489	4,744	-		23,481	

Benefits

The Tionesta retirement project reduces the capital investment that otherwise would have been spent on replacing the compressor and ancillary equipment.

Alternatives Considered

The existing turbine/compressor at the Tionesta Station is approximately 50 years old, has a high probability of failure, and has been determined to be at or near the end of its service life. After conducting the preliminary assessment and taking into account the equipment obsolescence, reduced availability of spare parts, lack of manufacturer support, and increased environmental, safety, and reliability risks for older technology, there were only two viable alternatives left – replacing the compressor unit or retiring the compressor station in 2025.

The alternative to replace the compressor will result in significant capital expenditure. In addition, industry forecasts indicate that gas demands will decrease over time. There is an increased risk that the new compressor asset would be stranded if demands decrease in the future. Additional studies were performed to determine the best alternative from an overall system/customer perspective which resulted in the recommended option to retire the unit in 2025.

Table 1. Planning Orders

MAT	Planning Order
76X	5794570, 5794571

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – M&C Station Overpressure Protection (OPP) Enhancements Program

Project Title: M&C Station Overpressure Protection (OPP) Enhancements

Major Work Categories: Capital MWC 50, 76 (MAT 50N, MAT 76G), and Expense MWC FH, JT (MAT FHQ, MAT JTX)

Planning Order Numbers: Various POs, see Table 1 below

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): Multiple projects; operative dates vary by project

Project Description

The M&C Station OPP Enhancements Program began in 2017 as a mitigation to prevent large Overpressure (OP) events due to equipment-related failure at regulator stations. A large OP event is generally defined as a pressure excursion 10 percent greater than the maximum allowable operating pressure. PG&E has performed investigations on large OP events experienced between 2011-present to determine the cause and to define actions to prevent recurrence. These investigations have helped identify some common causes for a number of these OP events, including gas quality, construction-related impacts, and common failure modes in pilot-operated regulator stations. Pilot-operated regulator stations, when compared to other M&C station types, are subject to a higher likelihood of OP events than other station designs. This is primarily because the regulator and monitor (the primary OPP device) installed in many of these stations can fail in the “open” position when affected by contaminants in the system (sulfur, liquids, and other debris).

PG&E’s Station OPP program initiatives address both Gas Transmission and Distribution station assets. GD station assets addressed through this program includes all-pilot operated district regulator stations including High Pressure (HP) and Low Pressure (LP) stations. GT station assets addressed through this program include Large Volume Customers Regulator Sets (LVCRs), Large Volume Customer Meter Set (LVCMs), and Simple Stations. PG&E’s strategic objective includes plans to execute this program over a ten-year period—with the expectation that 50 percent of the pilot operated GD regulator stations and GT LVCRs will be addressed by the end of 2022.

Justification

PG&E continues to benchmark its OPP practices. After the Merrimack Valley, Massachusetts OP event¹ in 2018, PG&E actively collaborated with other operators and contributed to regulatory and industry publications. The lessons learned through the PG&E’s OP Elimination Program have been shared throughout the industry via fact-finding conference calls, industry events, and presentations. PG&E’s practice of installing secondary OPP devices such as slam-shuts is recognized as one of the leading practices in American Gas Association’s (AGA) report “Leading Practices to Reduce the Possibility of a Natural Gas OP Event.”

¹ NTSB, Preliminary Report, Pipeline Over-Pressure of a Columbia Gas of Massachusetts Low-Pressure Natural Gas Distribution System (Sept. 2018)

<<https://www.nts.gov/investigations/AccidentReports/Reports/PLD18MR003-preliminary-report.pdf>> (as of Aug. 17, 2019).

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – M&C Station Overpressure Protection (OPP) Enhancements Program

Additionally, the PIPES Act issued in December 2020 includes new mandates for Pipeline and Hazardous Materials Safety Administration (PHMSA) and requires operators to mitigate common failure mode conditions and have appropriate secondary OPP devices (e.g., slam-shuts, relief valves, etc.) to prevent and mitigate overpressure events². PG&E's OPP program is consistent with this intent and the program was started prior to these requirements.

M&C Station OPP Enhancements expense and capital programs are mitigations for PG&E's RAMP risk and Large Overpressure Event Downstream of Gas Measurement and Control (M&C) Facility risk.

Cost

GT and GD Station OPP Expense (MAT JTX and MAT FHQ):

Both GT and GD Station OPP expense programs are non-unitized programs. For 2023 GRC forecast, both programs are based on a historical 3-year average (2018-2020) and escalated.

GD Station OPP Capital (MAT 50N):

The forecast for this program assumes 200 retrofits and 150 retrofits in each of 2024 and 2025 for high pressure distribution regulator stations. The unit cost for 2023 GRC is based on escalated 2019-2020 average unit costs.

GT Station OPP Capital (MAT 76G):

The forecast for this program assumes 18 retrofits for LVCR in 2023, two rebuilds and 47 retrofits for LVCMs in 2023 and 15 retrofits for Simple Stations in 2023. The unit cost for both rebuilds and retrofits is based on a detailed cost estimate developed by PG&E's engineering, construction and cost estimating group.

Major Project Spending Estimates (Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT JTX	N/A	444	1,075	1,290	588	1,853	1,673	1,102	N/A	N/A	N/A	8,025	WP 6-5, Line 6
MAT FHQ	1	374	2,514	1,510	781	3,250	3,529	1,807	N/A	N/A	N/A	13,766	WP 6-5, Line 12
Expense Total	1	818	3,589	2,800	1,369	5,103	5,202	2,909	-	-	-	21,791	
CAPITAL													
MAT 76G	N/A	413	6,535	14,747	13,987	19,060	12,591	41,660	41,264	42,340	43,411	236,008	WP 6-32, Line 11
MAT 50N	N/A	N/A	2,122	7,367	11,449	18,053	18,577	19,796	15,245	15,643	N/A	108,252	WP 6-32, Line 28
Capital Total	-	413	8,657	22,114	25,436	37,113	31,168	61,456	56,509	57,983	43,411	344,260	
TOTAL PROJECT COST	1	1,231	12,246	24,914	26,805	42,216	36,370	64,365	56,509	57,983	43,411	366,051	

² Consolidated Appropriations Act, 2021, Division R, Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES Act) of 2020, <<https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf>> (as of May 23, 2021).

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 6, ASSET FAMILY- FACILITIES
Project Summary – M&C Station Overpressure Protection (OPP) Enhancements Program

Benefits

The key objective of the program is to reduce risk across the system by reducing and eliminating potential large overpressure events. The Station Over Pressure Enhancements Program identified in this chapter seeks to address the equipment-related potential sources of large overpressure events and is managed by the Measurement & Control asset family. These proposed system improvements reduce the operational risk of large overpressure events throughout the system.

Alternatives Considered

An alternative considered for this program is to address the equipment failures at regulator stations as they occur. This alternative was rejected because it does not provide PG&E the ability to proactively and systematically address equipment-related failures to prevent OP events. Station OPP Enhancement Program provides mitigation measures for the risk of equipment-related failures relative to regulation and operation of the regulation stations that causes OP events.

Table 1. Planning Orders

MAT	List of Planning Orders
FHQ	5046249, 5046251, 5047029, 5047031, 5047033, 5047034, 5047035, 5047036, 5047037, 5047038, 5047039, 5047040, 5047041, 5047042, 5047043, 5047044, 5047045, 5047189, 5055632, 5262386, 5262387
JTX	5055653, 5056946, 5056948, 5056949, 5056950, 5056951, 5056952, 5056953, 5256053, 5265238, 5271614
76G	5528136, 5529763, 5530383, 5530679, 5530680, 5530681, 5530682, 5530683, 5530684, 5530685, 5530686, 5530687, 5530688, 5530689, 5530690, 5530691, 5530692, 5530693, 5530694, 5530695, 5530696, 5530697, 5530698, 5530699, 5530700, 5530701, 5530702, 5531200, 5532419, 5532420, 5533900, 5533912, 5533919, 5533920, 5533921, 5533922, 5533923, 5533924, 5533925, 5533926, 5533927, 5533940, 5533941, 5533942, 5539241, 5540079, 5540080, 5540081, 5540082, 5540083, 5540084, 5540085, 5540086, 5540087, 5540088, 5540089, 5540090, 5540091, 5540092, 5540093, 5540094, 5540095, 5540096, 5540097, 5540098, 5540099, 5540100, 5787138, 5790438, 5794635, 5794636, 5794637, 5794638, 5794639, 5794640, 5794641, 5794642, 5794805
50N	5530368, 5531739, 5531740, 5531741, 5531846, 5531848, 5531849, 5531850, 5531851, 5531852, 5531853, 5531854, 5531855, 5531856, 5531857, 5531858, 5531899, 5531900, 5537885, 5542177

Table 6-40
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Capital Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 75	MWC 76	Detailed Description/Explanation
1	2016	138,391	18,833	119,558	
2			4,994		Increase due to year over year variations in the mix of projects completed for Routine M&C capital program. Routine capital projects typically span over 2-3 years. There is some swing in year over year costs as the project moves through engineering, construction and close out stages.
3				(3,741)	No material changes
4	2017	139,643	23,827	115,817	
5			(14,521)		Decrease due to year over year variations in the mix of projects completed for Routine M&C capital program. Routine capital projects typically span over 2-3 years. There is some swing in year over year costs as the project moves through engineering, construction and close out stages.
6				66,566	Increase due to increase in spending mainly from the following programs * <i>Complex Station Rebuilds MAT 764</i> - Construction scope for some of the large footprint station rebuilds. * <i>GT Station OPP MAT 76G</i> - Increase due to starting new GT Station OPP capital program * <i>Upgrade Station Controls MAT 76T</i> - Increase due to additional scope and units completed for some Station Control projects.
7	2018	191,688	9,305	182,382	
8			23,637		Increase due to year over year variations in the mix of projects completed for Routine M&C capital program.
9				(21,073)	Decrease due to reduction in spend mainly from the following programs * <i>Complex Station Rebuilds MAT 764</i> - Construction scope for some of the large footprint station rebuilds complete which resulted in lower spend compared to previous year * <i>GT Compressor Replacement MAT 76X</i> - Decrease in spend due to completion of majority of construction scope for Burney compressor replacement project
10	2019	194,251	32,942	161,309	
11			(29,167)		Decrease due to overall delays due to Covid-19 and underspending for Routine M&C Capital program. Additionally accounting adjustments related to cancellations and retroactive adjustment for 2019 related to AFUDC reversal resulted in further reductions.
12				(38,499)	Decrease due to overall delays due to Covid-19 and underspending in the following programs. * <i>Complex Station Rebuilds MAT 764</i> - Decrease in spend due to deferral of construction scope of large complex station attributable to Covid-19 delay and resource constraints. * <i>Routine C&P Capital MAT 76N</i> - Decrease due to year over year variations in the mix of projects completed. Routine capital projects consists of routine repair and emergent projects that typically span over 2-3 years. There is some swing in year over year costs as the project moves through engineering, construction and close out stages.
13	2020	126,585	3,775	122,810	

Note: Total amounts and amounts for each MWC are obtained from WP 6-32 by summing the relevant lines for each MWC.

Table 6-41
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Capital Walk by Major Work Category
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 75	MWC 76	Detailed Description/Explanation
1	2020	126,585	3,775	122,810	
2			16,671		Increase due to variations in the mix of projects planned for Routine M&C capital program. Routine capital projects typically span over 2-3 years. There is some swing in year over year costs as the project moves through engineering, construction and close out stages.
3				27,611	Increase due to increase in spending mainly from the following programs * <i>Complex Station Rebuilds MAT 764</i> - Increase due to construction scope for some of the large footprint station rebuilds. Depending on if projects are in engineering, construction or closeout phases in any given year, there is some swing in costs expected compared to previous year. * <i>GT Station OPP MAT 76G</i> - Increase due to ramping up of GT Station OPP capital program LVCR rebuild * <i>GT Electrical Upgrade Hinkley and Topock MAT 76P</i> - Increase due to construction scope of Topock Electrical Upgrade project. Depending on if projects are in engineering, construction or closeout phases in any given year, there is some swing in costs expected compared to previous year.
4	2021	170,867	20,446	150,422	
5			(14,849)		Decrease due to due to variations in the mix of projects planned for Routine M&C capital program. Routine capital projects typically span over 2-3 years. There is some swing in year over year costs as the project moves through engineering, construction and close out stages.
6				(72,978)	Decrease due to decrease in spending mainly from the following programs * <i>Complex Station Rebuilds MAT 764</i> - Completion of construction scope for some of the large footprint station rebuilds. Depending on if projects are in engineering, construction or closeout phases in any given year, there is some swing in costs expected compared to previous year. * <i>GT Station OPP MAT 76G</i> - Decrease due to majority of LVCR rebuilds being complete and the continuation of work only for LVCR Retrofits * <i>Routine C&P Capital 76N</i> - Decrease due to year over year variations in the mix of projects planned. Routine capital projects consists of routine repair and emergent projects that typically span over 2-3 years. There is some swing in year over year costs as the project moves through engineering, construction and close out stages.
7	2022	83,040	5,596	77,443	
8			10,798		Increase in forecast due to aligning 2023 GRC forecast for Routine M&C capital at historical 3 year average (2018-2020) level.
9				133,083	Increase in 2023 GRC forecast due to increase in the following programs * <i>Complex Station Rebuilds MAT 764</i> - Increase in unit cost of complex station rebuilds attributable to scope and complexity of the large facilities. * <i>GT Station OPP MAT 76G</i> - increase in scope due to LVCMs and Simple Station retrofits * <i>Routine C&P Capital 76N</i> - Increase in forecast due to aligning 2023 GRC forecast for Routine C&P capital at historical 3 year average (2018-2020) level. * <i>Terminal Upgrades 765</i> - Increase in forecast due to incremental costs associated with engineering and construction scope identified for various phases of Brentwood Terminal rebuild.
10	2023	226,920	16,394	210,526	
11			427		No material changes. Slight increase due to escalation.
12				(1,009)	Slight decrease due to Hinkley Electrical Upgrade project under MAT 76P completing construction and nearing close out stage in 2024.
13	2024	226,338	16,821	209,517	
14			438		No material changes. Slight increase due to escalation.
15				1,079	No material changes. Slight increase due to escalation between various programs in this MWC.
16	2025	227,855	17,259	210,596	
17			437		No material changes. Slight increase due to escalation.
18				(371)	No material changes. Slight decrease due to lowered escalation rates.
19	2026	227,921	17,696	210,225	

Note: Total amounts and amounts for each MWC are obtained from WP 6-32 by summing the relevant lines for each MWC.

Table 6-42
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Capital Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 2K	MWC 31	MWC 50	Detailed Description/Explanation
1	2016	63,314	27,531	4,265	31,518	
2			10,093			Increase in HPR program costs due to increase in pace and completion of more units compared to previous year.
3				2,482		Increase in CNG Stations program costs due to increasing capital investments on a one-time basis in 2017. This increase reflects the advance purchase of assets that tend to have longer lead-times and are needed for future improvements.
4					7,748	Increase mainly due to increase in Regulator station rebuild (MAT 50C) Program expenditures due to additional scope of work and complexity of some regulator stations rebuilt.
5	2017	83,637	37,624	6,747	39,265	
6			17,465			Increase in HPR program costs due to completion of carryover units from 2017 being completed in 2018, and increased costs driven by higher costs than anticipated, and higher unit costs for jobs with greater difficulty of work.
7				(2,486)		Decrease in CNG Stations program costs due to reduction in spend compared to 2016 which included capital investment increases on a one-time basis.
8					17,390	Increase mainly from increase in Regulator station rebuild (MAT 50C) Program expenditures due to higher unit costs driven by factors such as design changes, station location, construction constraints and local cities requirements.
9	2018	116,005	55,089	4,261	56,655	
10			9,735			Increase in HPR program costs due to completion of carryover units carryover work from 2018 being completed in 2019; and increased costs driven by scope, location and construction constraints for jobs with greater difficulty of work.
11				43		No material changes.
12					7,748	Increase due to increase in spending mainly from the following programs: <i>Regulator Station component Replacements (MAT 50L)</i> : Increase in component replacement projects compared to the previous year. <i>GD Station OPP Capital (MAT 50N)</i> : Increase due to establishing new program and starting Slam shut retrofits units at pilot operated regulator stations to address large OP events.
13	2019	133,531	64,824	4,304	64,403	
14			(17,743)			Decrease in HPR program costs from reduced units due to construction delays caused by COVID-19, such as readiness activities that required field job walks, and delays from bundling coordination with other projects to look at the overall gas system needs to move forward with the best work for the system.
15				394		No material changes. Increase due to escalation.
16					11,575	Increase due to increase in spending mainly from the following programs: <i>GD Regulator Station Rebuild (MAT 50C)</i> : Increase in program costs due to project readiness cost and increases stemming from COVID-19 delays and wildfires resulting in excessive shoring and other rental costs compared to the previous year. <i>GD Station OPP Capital (MAT 50N)</i> : Increase in Slam shut retrofits units at pilot operated regulator stations compared to the previous year.
17	2020	127,757	47,081	4,698	75,978	

Note: Total amounts and amounts for each MWC are obtained from WP 6-32 by summing the relevant lines for each MWC.

Table 6-43
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 6, Asset Family Facilities
Capital Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 2K	MWC 31	MWC 50	Detailed Description/Explanation
1	2020	127,757	47,081	4,698	75,978	
2			13,865			Increase in HPR program costs due to increase in units forecasted compared to the previous year.
3				(482)		No material changes
4					4,294	Increase in program costs for Reg Station Component Replacements (50L) and GD Station OPP capital programs due to increase in units forecasted compared to the previous year.
5	2021	145,434	60,946	4,216	80,272	
6			3,710			Increase in HPR program costs due to increase in units forecasted compared to the previous year and catching upon deferred/delayed units applicable for rate case period.
7				105		No material changes
8					3,569	Increase in Reg Station Rebuild (MAT 50C) and GD Station OPP Capital due to increase in units forecasted compared to the previous year and catching upon deferred/delayed units applicable for rate case period.
9	2022	152,818	64,656	4,321	83,841	
10			(46,704)			Decrease in HPR program forecast due to reduction in units compared to the previous year. Program ramping down in the 2023 GRC rate case period and expected to end in 2026.
11				450		
12					(5,211)	Decrease mainly due to decrease in Reg Station rebuild unit costs and aligning 2023 GRC forecast to 2019 unit cost level.
13	2023	101,353	17,952	4,771	78,629	
14			481			No material changes. Slight increase due to escalation.
15				128		No material changes. Slight increase due to escalation.
16					(2,974)	Decrease mainly due to slight reduction in units for GD Station OPP capital as program ramps down.
17	2024	98,988	18,433	4,899	75,655	
18			480			No material changes. Slight increase due to escalation.
19				128		No material changes. Slight increase due to escalation.
20					1,971	No material changes. Slight increase due to escalation for various program under in MWC.
21	2025	101,567	18,914	5,027	77,627	
22			493			No material changes. Slight increase due to escalation.
23				131		No material changes. Slight increase due to escalation.
24					(14,027)	Decrease mainly due to decrease in GD Station OPP capital completing slam shut retrofits for all the GD pilot operated reg stations.
25	2026	88,164	19,406	5,158	63,599	

Note: Total amounts and amounts for each MWC are obtained from WP 6-32 by summing the relevant lines for each MWC.

Table 6-44
Pacific Gas and Electric Company
Chapter 6, Asset Family Facilities
MCOPMA Capital Summary
(Thousands of Nominal Dollars)

Line No.	Description	MWC	MAT	2019 Recorded	2020 Recorded	2019-2020 Recorded	Reference
1	GT Station Over Pressure Protection Enhancements Capital	76	76G	\$14,756	\$13,988	\$28,744	
2	Total Capital			\$ 14,756	\$ 13,988	\$ 28,744	WP 6-78, Line 7

Table 6-45
Pacific Gas and Electric Company
Chapter 6, Asset Family Facilities
MCOPPPMA Capital Details
(Thousands of Nominal Dollars)

Line No.	Large Volume Customer Regulator (LVCR) Rebuilds				Notes
	Year	2019	2020	Total	
1	# of Units	13	10	23	(1)
2	Average Cost per Unit	\$ 1,117	\$ 1,303	\$ 1,198	
3	MAT 76G - LVCR Rebuilds	\$ 14,519	\$ 13,026	\$ 27,545	(2)
	LVCR Retrofits				
	Year	2019	2020	Total	
4	# of Units	1	2	3	(1)
5	Average Cost per Unit	\$ 237	\$ 481	\$ 400	
6	MAT 76G - LVCR Retrofits	\$ 237	\$ 963	\$ 1,199	(2)
7	MAT 76G - Total	\$ 14,756	\$ 13,988	\$ 28,744	

Notes relating to MCOPPPMA

(1) # of Units are the operational units for the year.

(2) Total Costs for the year includes costs for all projects - operational, engineering and closeout stages.

Table 6-46
 Pacific Gas and Electric Company
 Chapter 6, Asset Family Facilities
 CDPMA Expense Summary
 (Thousands of Nominal Dollars)

Line No.	Name	Station Type	Pilot Phase					Production Phase				Reference
			2015	2016	2017	2018	2019	2020	2015-2020 Total			
1	Total Program Costs	All Stations	\$	2,178	\$5,650	\$4,663	\$11,962	\$14,383	\$10,665	\$	49,501	
2	Critical Docs Shareholder Expense	Stations installed after 12/31/1955 (Not requested for recovery)		\$0		\$6,360	\$9,972	\$13,796	\$7,762		\$37,890	
3	Critical Docs Memorandum Account (CDPMA)	Stations installed before 12/31/1955		\$2,178	\$5,650	(\$1,698)	\$1,990	\$588	\$2,903		\$11,611	WP 6-80, Line 5

Table 6-47
Pacific Gas and Electric Company
Chapter 6, Asset Family Facilities
CDPMA Expense Details
(Thousands of Nominal Dollars)

Line No.	Cost Category	Pilot Program					Production Phase					2015-2020 Total
		2015 Recorded Costs	2016 Recorded Costs	2017 Recorded Costs	2018 Recorded Costs	2019 Recorded Costs	2020 Recorded Costs	2020 Recorded Costs	2015-2020 Total			
1	Labor Internal	\$147	\$199	(\$1,016)	\$121	\$65	\$87					
2	Contracts/ Labor External	\$2,047	\$5,543	(\$691)	\$1,976	\$3,295	\$2,853					
3	Materials	\$0	\$0	(\$0)	\$1	\$0	\$3					
4	Other	(\$17)	(\$92)	\$10	(\$108)	(\$2,773)	(\$39)					
5	MAT LU1 Total	\$ 2,178	\$ 5,650	\$ (1,698)	\$ 1,990	\$ 588	\$ 2,903	\$	\$	\$	\$	11,611

1 proposed plan addresses the known risks and limitations for slam-shut
2 devices and any other solutions it proposes.”⁸⁴

3 Q 86 What is the basis for TURN’s proposed reduction?

4 A 86 TURN claims that “it makes more sense to obtain the benefits of [PG&E’s]
5 planning studies before committing ratepayer funds to a new capital
6 program that, [as PG&E stated], was still evolving when it prepared this rate
7 case and that relies on a strategy, slam-shut devices, for which PG&E’s own
8 white paper identifies significant risks and limitations that need further study.
9 Therefore, TURN recommends that PG&E’s Capital Program be deferred
10 until the next rate case period, when PG&E will have the benefit of the
11 system planning studies it intends to perform in this rate case period.”⁸⁵

12 Q 87 Do you agree with TURN’s recommendations to defer the Station OPP
13 Capital Program until the next rate case period?

14 A 87 No. PG&E disagrees with TURN’s recommendation. PG&E has made
15 significant progress in its OPP Program since the 2019 GT&S filing.
16 After assessing the white paper⁸⁶ with secondary OPP options and
17 recommended actions, PG&E enlisted the services of a third-party
18 consultant,⁸⁷ SPEC Services, to evaluate those options and to develop an
19 overall OPP Program. As stated in a PG&E response to a TURN data
20 request,⁸⁸ the program focus during the 2019-2021 rate case period will be
21 on pilot-operated (H-14) regulator stations through installation of secondary
22 OPP devices, such as slam shuts, and rebuilding the Large Volume
23 Customer (LVC) primary regulation sets with a goal to a goal to address
24 50 percent of the stations over a 5-year period. Based on the evaluation by
25 SPEC Services, and the planning approach developed by PG&E and SPEC,
26 there is a well-defined and justified program for OPP mitigation actions for
27 the 2019-2021 rate case period.

⁸⁴ TURN, Chapter 7, p. 12, lines 19-23.

⁸⁵ TURN, Chapter 7, p. 12, lines 14-21.

⁸⁶ PG&E WP-7-84 to WP 7-109.

⁸⁷ TURN-023, Question 04c.

⁸⁸ TURN-011, Question 09.

From 2019 GT&S Filing

Workpaper Table 7-1
Pacific Gas and Electric Company
2019 Gas Transmission and Storage Rate Case
Workpapers Supporting Chapter 7, Asset Family Facilities
Summary of Expenses and Capital Expenditures
in New Cost Model

Workpaper Table 7-1a
Summary of Expenses

Line No.	Description	2012 Recorded	2013 Recorded	2014 Recorded	2015 Recorded	2016 Recorded	2017 Forecast	2018 Forecast	2019 Forecast
1	Routine Expense Compression and Processing (C&P) Program	5,358,323	5,167,300	8,388,637	6,931,804	7,352,944	13,858,500	11,337,999	11,259,304
2	Routine Expense Measurement and Control (M&C) Program	2,273,310	2,879,561	3,233,221	5,132,090	4,516,022	5,516,851	6,280,999	6,451,226
3	Becker System Upgrades	951,046	1,305,677	-	759,685	304,048	-	-	-
4	Gas Quality Assessment	-	-	118,968	184,879	289,580	1,028,267	1,020,835	1,040,385
5	Station Over Pressure Protection (OPP) Enhancements Expense	-	-	-	-	-	-	1,524,638	1,560,580
6	Critical Documents (Expense)	-	-	236	2,177,720	5,650,154	8,887,480	2,467,130	3,143,120
7	FIMP Risk Management	97,580	1,247,246	1,444,374	1,532,229	1,915,568	2,713,720	2,756,256	2,809,173
8	Engineering Critical Assessment (ECA) Phase 1	-	-	94,400	9,713,887	7,694,931	5,570,000	6,125,819	4,720,324
9	Engineering Critical Assessment (ECA) Phase 2	-	-	425	561,840	1,035,018	1,930,000	1,507,677	1,834,611
10	Station Strength Testing	(21,259)	-	-	-	-	-	507,729	1,014,369
11	Physical Security Expense	42,556	9,640	393,263	779,775	1,394,742	345,359	-	-
12	Station MAOP	-	10,813,773	14,152,425	0	-	-	-	-
13	Total Expenses	8,701,554	21,423,196	28,585,635	27,318,269	29,668,981	32,850,177	33,529,061	33,833,091

Workpaper Table 7-1b
Summary of Capital Expenditures

Line No.	Description	2012 Recorded	2013 Recorded	2014 Recorded	2015 Recorded	2016 Recorded	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast	2021 Forecast	Total 2019-2021
14	Routine Capital Compression and Processing (C&P) Program	43,972,649	52,731,142	27,583,236	30,973,476	54,277,797	42,256,856	41,727,173	38,535,000	39,745,001	40,913,502	119,193,503
15	Install Active Fire Suppression Systems	-	-	-	-	(1,456)	339,190	1,650,000	-	-	-	-
16	Emergency Shutdown Upgrade	8,531	771,954	1,741,181	3,691,270	1,909,673	2,515,737	3,820,000	3,843,224	3,857,436	3,849,956	11,550,616
17	GT Electrical Upgrades - Hinkley and Topock	-	-	-	44,228	224,028	1,065,218	7,000,000	4,269,678	4,285,467	4,277,157	12,832,302
18	Compressor Unit Control Replacements	138,874	5,430,581	8,115,619	2,051,688	199,472	773,990	2,000,000	3,267,768	3,279,852	3,273,492	9,821,112
19	Upgrade Station Controls	(115,197)	-	1,883,224	1,322,632	2,389,177	508,088	5,300,000	2,014,096	2,021,544	2,017,624	6,053,264
20	Compressor Stations	-	-	-	-	-	1,619,333	-	-	-	-	-
21	Station Other	-	-	-	-	-	28,341	-	-	-	-	-
22	Compressor Replacement	433,528	(227,821)	870,009	715,217	22,660,541	30,050,000	12,140,416	21,530,275	20,639,861	22,074,454	64,244,590
23	Compressor Retrofit Projects	-	1,481	1,053,992	1,150,565	364,687	50,000	-	-	-	-	-
24	Routine Capital Measurement and Control (M&C) Program	25,832,564	16,879,157	12,586,743	20,348,064	21,665,888	17,484,268	13,149,206	18,191,793	18,763,015	19,314,649	56,289,457
25	Replace Obsolete Bristol Controllers	249,390	1,256,339	11,130	95,359	96,870	106,510	-	-	-	-	-
26	Becker System Upgrades	228	55	494,762	4,126,078	1,173,324	2,751,294	1,434,175	324,687	-	-	324,687
27	Perform Simple Station Rebuilds	263,777	1,917,429	990,190	8,821,142	7,024,891	5,108,977	5,000,000	6,223,287	6,246,301	6,234,189	18,703,776
28	Perform Complex Station Rebuilds	12,806,040	11,527,362	15,151,270	24,553,238	15,904,130	37,867,249	48,004,415	32,311,392	32,430,877	32,367,989	97,110,258
29	Perform Transmission Terminal Upgrades	622,025	4,024,497	4,192,413	3,212,944	871,028	448,590	350,000	7,436,399	7,543,605	7,621,980	22,601,983
30	Station Over Pressure Protection (OPP) Enhancements	-	-	-	-	-	430,562	3,982,718	6,138,962	6,161,664	6,148,716	18,450,343
31	Engineering Critical Assessment (ECA) Phase 1	-	-	-	-	-	(114,566)	-	-	-	-	-
32	Engineering Critical Assessment (ECA) Phase 2	-	-	-	-	-	(263)	272,091	286,649	575,420	594,815	1,456,885
33	Station Strength Testing Capital	2,743,468	2,116,761	1,095,672	10,229,773	10,236,716	7,503,803	10,310,000	102,376	184,956	9,408,716	543,716
34	Physical Security Capital	446,501	(430,870)	1,707,913	453,814	26,000	-	-	9,392,264	-	-	28,227,976
35	Station Reliability Other	-	-	-	-	-	-	-	-	-	-	-
36	Total Capital Expenditures	87,402,398	95,998,085	77,479,353	111,789,690	138,423,767	150,833,195	157,168,465	153,867,849	155,161,995	158,354,624	467,384,463

Table 6-48
Pacific Gas and Electric Company
Chapter 6, Asset Family Facilities
Burney Physical Security Upgrade Cost Summary
(Thousands of Nominal Dollars)

Line No.	Cost Category	2019 Recorded Costs	2020 Recorded Costs	2019-2020 Total
1	Labor Internal	\$29	\$39	\$68
2	Contracts/ Labor External	\$2,643	\$479	\$3,122
3	Materials	\$4		\$4
4	Other	\$34	\$191	\$225
5	Total Burney Physical Security order costs	\$ 2,710	\$ 709	\$ 3,419

Table 6-49
Pacific Gas and Electric Company
Chapter 6, Asset Family Facilities
Burney Physical Security Upgrade Order Cost Details
(Thousands of Nominal Dollars)

Line No.

Line No.	Planning Order	PO Description	Order	Order Name	CE Mjr Resource Grp	Cost Element	CE Description	2019 Actual	2020 Actual
1									
2	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Contract	PGE1/5007001	Security Services		222
3	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Contract	PGE1/5490000	Contracts	51	19
4	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Contract	PGE1/5490002	Gas Construction Contract	2,383	229
5	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Contract	PGE1/5490003	Engr/Dsgn and Engr, Proc & Constr Contra	206	3
6	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor External	PGE1/5001250	Consulting Services - Other		4
7	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor External	PGE1/5590114	Contractor Activity Charges	4	
8	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor External	PGE1/6603565	IT Analyze, Plan, Mtce, etc. Tier 1	0	1
9	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor External	PGE1/6603566	IT Analyze, Plan, Mtce, etc. Tier 2	0	
10	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor External	PGE1/6603567	IT Analyze, Plan, Mtce, etc. Tier 3		1
11	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor External	PGE1/6608158	Contractor Consultant		
12	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor External	PGE1/6608164	Contractor Specialist/Services		0
13	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/5590101	GAS Activity Charge - Type A		
14	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/5590103	IT Activity Charge - Type A	14	
15	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6010100	Paid Time Off	2	5
16	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6010107	Indirect Labor - Gas	0	7
17	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6010110	Indirect Labor - Cust Care		0
18	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6010111	Indirect Labor - IT	8	2
19	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603001	Construction		11
20	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603005	Analyst Services		2
21	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603006	Design Drafting Services		0
22	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603013	Project Management Services		4
23	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603023	Engineering Services		3
24	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603025	Estimating Services	0	
25	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603076	Management Services		2
26	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603107	Design Drafting Services - Overtime		
27	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603730	Account Services		0
28	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6603855	Analyst Svcs Overtime		1
29	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6608193	Hours - Straight Time	3	4
30	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6608194	Hours - Overtime	2	0
31	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Labor Internal	PGE1/6608195	Hours - Doubletime		0
32	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Materials	PGE1/5300230	Communication & Signaling Equipment	4	
33	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Materials	PGE1/6010000	Material Burden	0	
34	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/5006310	Cash Discount earned		-1
35	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/5091114	Lodging	0	0
36	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/5590030	AFUDC-Borrowed	2	36
37	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/5590031	AFUDC-Equity	3	111
38	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010050	Capitalized A&G	9	10
39	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010112	Building Service Overhead	1	2
40	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010113	IT Device OH	1	1
41	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010115	Operation Mgmt & Support - Gas	0	10
42	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010119	Operation Mgmt & Support - IT	8	1
43	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010120	Benefits OH	6	10
44	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010121	Payroll Taxes OH	3	4
45	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010122	Minor Material OH	1	
46	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010123	Fleet OH	0	7
47	5788478	Burney Security Upgrade	74030169	BURNEY COMP STA UPGRADE SECURITY	Other	PGE1/6010126	Fleet OH - Gas		
48								2,710	709

Table 6-50
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 6, Asset Family - Facilities
Storage Facility Above Ground Decommissioning

Estimated Breakdown for Cost Model

Project: Decommissioning of Above Ground Storage Facilities at Pleasant Creek

Project Description

The Gas storage facilities decommissioning includes the projects to decommission above ground facilities at Pleasant Creek storage fields, as described in Chapter 7. The above ground decommissioning of Pleasant Creek Storage Compression and processing facilities include the costs for the following scope of work.

- Removal of all appurtenance piping for the compressor and gas infrastructure including engine and compressors.
- Removal of dehydration system and appurtenance piping including thermal oxidizers glycol coolers and gas glycol contactors.
- Controlled demolition of site which will include removal of the operations building, pump house, warehouse and all other surrounding buildings or canopies. Break up and removal of foundation and footings and haul off concrete steel. Cleaning demolition and removal of all containers, and pressure vessels. All underground piping related to gas transmission, storage, waste water, glycol, air, engine oil, hydraulic oil and storm water will be demolished.

	2022	2023	2024
Table 1: Above Ground Decommissioning Costs			
Total Decommissioning Expenditures	\$3,121,621	\$6,433,993	\$6,601,640

Table 2: Above Ground Decommissioning Costs for Pleasant Creek Storage C&P Facility

	Pleasant Creek			2024 ⁽¹⁾
	2022 ⁽¹⁾	2023 ⁽¹⁾	2024 ⁽¹⁾	2024 ⁽¹⁾
Contract (Includes Removal)	\$ 10,851,763	\$ 2,170,353	\$ 4,340,705	\$ 4,340,705
Labor Allocations	\$ 2,228,345	\$ 445,669	\$ 891,338	\$ 891,338
AFUDC	\$ -	\$ -	\$ -	\$ -
Facility Specific undefined Scope	\$ 1,962,016	\$ 392,403	\$ 784,806	\$ 784,806
Total Forecast (Unescalated)	\$ 15,042,123	\$ 3,008,425	\$ 6,016,849	\$ 6,016,849
2021 Escalation		1,009	1,009	1,009
2022 Escalation		1,028	1,028	1,028
2023 Escalation			1,031	1,031
2024 Escalation				1,026
Total Forecast (Escalated)	\$ -	\$ 3,121,621	\$ 6,433,993	\$ 6,601,640

Note #2
 Note #3
 Note #4
 Note #5

Notes

- #1 Total project costs allocated over three years. 20% in 2022 for Engineering and 40% in 2023 & 2024 for Construction and Closeout
- #2 Based on detailed estimate developed by cost estimating firm for the scope and assumptions provided.
- #3 Includes PG&E labor costs for Project Management, Engineering, construction and overheads.
- #4 Costs for facility specific undefined scope to account for unknowns and unanticipated costs (such as differing site conditions such as an underground obstruction).
- #5 Forecasts escalated to 2022 and 2023 based on the escalation rates provided.

Measurement & Control Asset Family Station Rebuilds

Background

PG&E Measurement and Control asset family manages a fleet of approximately 5,000 regulation and meter stations of various designs in the transmission and distribution system.

There are approximately 930 gas transmission stations¹ identified in the PG&E Measurement and Control asset family. These include complex stations, simple stations, and large volume customer stations. The various station types include:

- **Complex Stations:** Stations that have complex control and operations. Stations contain controller-operated equipment and devices and have either PLC or RTU to provide control and data transmission. These stations are generally designed to PG&E Gas Design Standard H-19. Other facility types included as complex stations are:
 - Pressure limiting or regulator stations
 - Facilities that contain valves that are PLC, RTU or controller operated.
- **Simple Stations:** Stations that have simple control and operations. Instrumentation and RTU's are installed for monitoring and data transmission only. Gas transmission regulator stations that contain self-contained regulators for control and are generally designed to PG&E Gas Design Standard H-14. Other facility types included as simple stations are:
 - Odorizer, dehydrator, or meter stations
 - Intertie and interconnect facilities
 - Cross-ties with RTU's for monitoring purposes.
- **Large volume customers (LVCs)** are those served by PG&E gas facilities which have the capability of delivering 40,000 standard cubic feet per hour (scfh) or more. Major asset components at facilities that serve large volume customers include regulators, relief valves, meters and station piping. Transmission LVCs are those LVCs that are located upstream of a distribution center.
 - **Large Volume Customer Regulator (LVCR) Sets:** LVCR Sets are pressure regulating sets that control pressure to a transmission line serving a large volume customer. LVCR Sets may include one or more stages of pressure regulation. They are sometimes referred to as customer primary sets.

¹ Based on M&C Station count as of 3/31/2020.

- Large Volume Customer Meter Set (LVCMS): LVCMS are meter set assemblies that serve large volume customers. Meter set assembly (MSA) equipment may include any of the following components: valves, filters, regulators, overpressure protection devices, and other piping and components. LVCMS may or may not contain any regulating equipment.

There are approximately 4,080 gas distribution stations¹ identified in the PG&E Measurement and Control asset family. These include district regulation stations and farm taps.:

- Distribution Regulator Stations: PG&E defines district regulator stations as stations that serve more than two customers (typically hundreds to thousands of customers). These stations typically receive gas from the high-pressure gas transmission pipeline system. Approximately 90 percent of the stations regulate the gas pressure into local distribution systems to a pressure no higher than 60 pounds Per Square Inch Gauge (psig). The remaining 10 percent are a type of district regulator station classified as low-pressure stations that regulate gas pressure into what are called “low-pressure distribution systems” with operating pressures below 1 psig. PG&E uses two general types of natural gas regulators at its district regulator stations:
 - Non-HPR-Type: PG&E refers to pilot-operated regulators as “non-HPR-type” regulators, which are larger in size than HPR-type regulators and are used in district regulator stations serving a large gas demand (e.g., thousands to tens of thousands of customers). These stations are generally designed to PG&E Gas Design Standard H-14 or comparable historical standards.
 - HPR-Type: PG&E refers to spring-operated regulators as “high pressure regulators” (HPRs). These stations are designed and constructed to PG&E Gas Design Standard H-10, or comparable historic standards. HPRs are relatively small in size (90% of station HPRs are 3/4 inch in diameter, or less, and none are greater than 2 inches in diameter); they are used in district regulator stations serving a small gas demand (e.g., as few as three customers up to hundreds of residential customers).
- Farm Taps: PG&E defines a farm tap as a service line that is connected directly from a gathering or transmission line to serve customers other than a large volume customer. A farm tap regulator set is a pressure regulator set that may include multiple stages of pressure regulation that control pressure to a service line. More than one service line downstream of a farm tap regulator means that the farm tap regulator is a district regulator station. A single service line may connect to multiple customers (services). Similar to the lower-capacity district regulator stations, farm taps are typically installed with HPR-type regulators.

The M&C facilities serve both an integrity function (pressure retention) as well as an operability function (to regulate pressure and to measure and monitor flow). These additional operability functions require that the components perform active operations so that the management of these

assets must consider both pressure boundary integrity and operability considerations. PG&E executes an asset management strategy for these stations that includes the following programs to manage the life cycle of the stations and equipment, including:

- Maintenance programs to effectively inspect and maintain equipment and to inform equipment condition.
- Targeted equipment replacement programs for equipment identified as obsolete.
- Rebuild of stations to maintain health of the overall stations, to address operational needs, and to ensure a rational turnover rate of the station fleet.

This strategy has been consistently applied by PG&E over the past several rate case periods.

There are several input streams that provide information on the current health of the Measurement and Control (M&C) facilities, such as:

- Feedback from maintenance and engineering personnel on the performance and condition of stations.
- Feedback from planning and operation relative to operational needs of the stations.
- Evaluation of obsolescence and condition by Facilities Integrity Management personnel, including required upgrades to meet current station design standards.

The results of these inputs are used to inform and develop the overall station rebuild strategy for this rate case submittal (2023 – 2026).

Asset Management Strategy

The aging degradation mechanisms for the station equipment include the following:

- Material degradation due to internal corrosion, external corrosion, and stress corrosion cracking
- Mechanical and control equipment operational performance degradation
- Equipment obsolescence including spare parts availability

For gas pipeline equipment (including stations), internal corrosion is minimized through programs to monitor and control contaminants and liquids in the pipeline system; external corrosion is minimized through cathodic protection programs and degradation is monitored through the leak survey program. Stress corrosion cracking occurs in piping which experiences high stress, harsh environments, and susceptible material. Piping in areas of soil settlement may be subject to stress corrosion cracking and this potential can be reviewed through assessment of site conditions (supports).

Mechanical and control equipment operability may degrade over time. This equipment is subject to malfunction or failure due to number of factors, such as number of operations, internal component failures, and operational wear. These degradation mechanisms are primarily managed through inspection and maintenance programs to identify potential problems and to establish corrective actions. In some cases, parts can be replaced or reworked and the equipment maintains its operability.

Equipment obsolescence is manifested in the maintenance program where equipment may be difficult to maintain, spare parts are no longer available, or equipment parts become incompatible (for examples, new actuators installed on older valves). Equipment obsolescence is managed through asset management programs that typically maintain equipment and replace equipment on time based intervals. Some equipment can be managed through condition-based programs that allow for corrective action based on monitoring equipment condition and performance.

There are three parts to the overall asset management strategy related to the M&C facilities that are described below.

Equipment or Component Level

The equipment or component level strategy is focused on the maintenance and upkeep of the equipment to achieve the expected life (or obsolescence) of the various equipment items. It involves maintenance through the life cycle and replacement when the expected life (or obsolescence) is reached. Equipment becomes obsolete through normal wear with age, when vendors no longer support the equipment, and when equipment performance deteriorates. Equipment aging is typically illustrated in a “bathtub curve” as shown in the Figure 1.

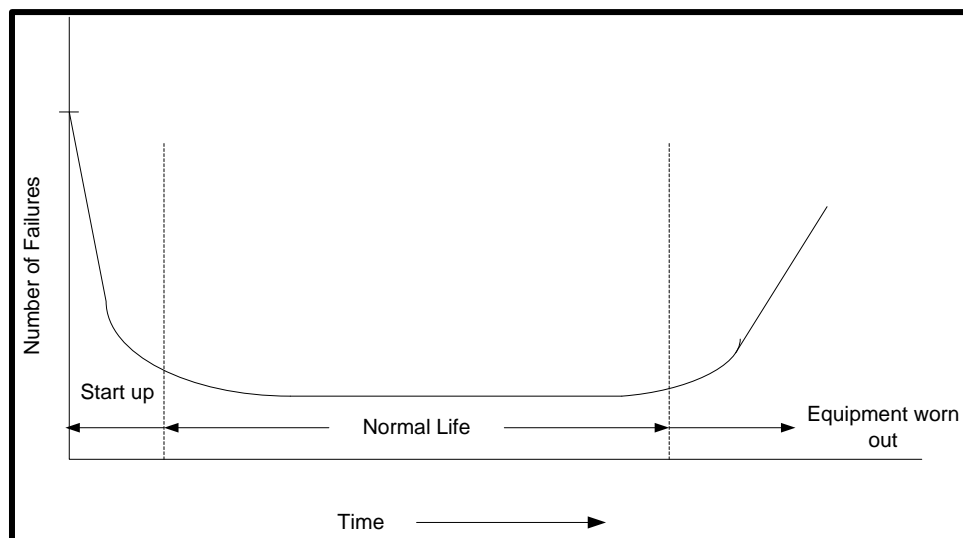


Figure 1: Equipment Life Cycle

As equipment starts up (or breaks in), the probability of failure may be high due to installation problems during its initial operation. After this break-in period, the probability of equipment

failure is relatively low for an extended period of time. Normal maintenance activities are defined to ensure that the equipment remains in operable condition. Following this expected life, the probability of failure increases sharply with time. As the equipment ages and becomes obsolete, the lack of readily available spare parts impacts the ability for normal maintenance to prevent malfunction or mis-operation. The risk of equipment malfunction or mis-operation increases greatly.

Management of the regulation assets during the normal life consists of defined maintenance and parts replacement. Therefore, obsolescence management of equipment is included as a risk mitigation measure to address identified threats and risks. Obsolescence management specifically addresses the threat of equipment failure. When equipment is identified as obsolete, appropriate programs will be identified to address these issues and the replacement of these components. PG&E continually evaluates equipment for issues related to obsolescence, condition and performance through its maintenance and asset management programs.

Facility Level

At the facility level, the types of equipment can be grouped into equipment that has a defined useful life (experience indicates that the equipment has a finite life and requires replacement based on either a time-based replacement or a condition-based replacement) and equipment that has a very long and indeterminate life cycle (experience indicates minimal threats to the equipment and replacement is based on economic or condition-based criteria). Typically, for a facility, the accessible components (valves, actuators, filters, meters), whether above ground or in vaults, have defined life cycles ranging from 10 to 30 years and can be individually replaced during the life of the facility. The inaccessible buried components (valves and piping) have very long life cycles and can be replaced or inspected during major facility rebuilds.

An example of a facility asset management plan is described below.

There will be various replacement intervals for each specific equipment item. The goal is to manage the facility so that the health of the facility remains good and that work is integrated to allow for efficient and cost effective equipment replacement at the facility. The condition health assessment of the components and facility provides the information to define the facility strategy. The example below (Figure 2) shows how this strategy may play out for a set of equipment items at a facility. Items A, B and C have different replacement intervals based on time-based or condition-based strategies. Therefore, effective asset management at the facility includes determining when and how to replace equipment. If Item A represents a meter with an expected life of 20 years prior to obsolescence, this item can be replaced and not require replacement of other items. If Item B represents a pilot-operated regulator, it may have a 30 year life. At some point equipment obsolescence and compatibility becomes an issue. If Item C represents a manual valve, then this may require replacement at 60 years based on lack of replacement parts and obsolescence. Therefore, a strategy may be to replace these items together at 60 years along with other equipment that has reached its useful life. If Item D represents piping, a decision is required whether to replace at this time or wait until a later time based on inspection. This decision will be both economic and condition-based.

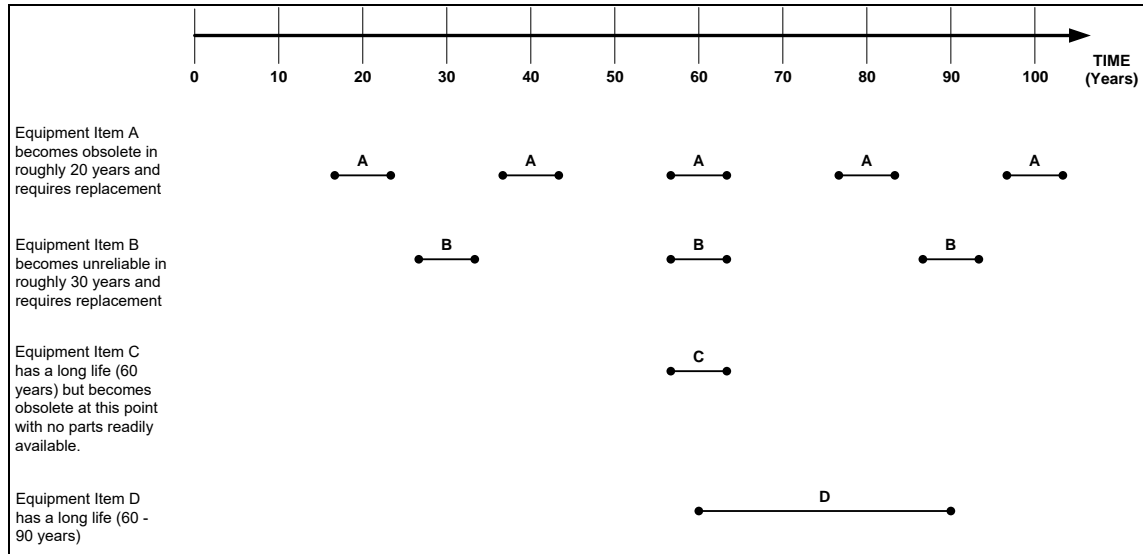


Figure 2: Typical Facility Asset Management

This example provides a basis for specific facility asset management and the specific time frames and decisions must be made on the equipment performance and maintenance data. The facility rebuild may include the following scenarios:

- Major facility rebuild of regulators, meters, valves, filters and other equipment based on equipment obsolescence, functional fit and facility condition, excluding replacement of buried piping. However, the buried piping will be available for inspection and a condition assessment can be performed to validate continued use of this asset.
- Major facility rebuild of regulators, meters, valves, filters and other equipment based on equipment obsolescence, functional fit and facility condition, including replacement of buried piping. An economic analysis may determine that replacement of the piping with the facility rebuild is appropriate from a cost-effectiveness standpoint.

The management of these assets requires a program to systematically rebuild the stations (either in entirety or partially depending on asset condition and performance). Considerations that will factor into this rebuild decision include:

- Equipment age and obsolescence: Maintenance and assessment programs identify issues related to equipment obsolescence, excessive corrective maintenance, and backlog of maintenance activities. These programs capture data on equipment age and identify obsolete equipment (equipment no longer supported, parts are hard to obtain, and the equipment is difficult to maintain).

- **Station configuration:** The current station configuration meets the requirements of the system operation. This is a design and operations related issue that requires additional evaluation.
- **Station location:** The location of a station in a HCA, in a high external threat area (e.g. seismic, flood, etc.), or in a worker safety area may also be considered in reviewing the need for station rebuilds.

Fleet-Level

Managing at a fleet level requires that obsolescence is managed so that there is not a build-up of obsolescence requiring many station rebuilds over a short period of time. The management of these assets requires a program to systematically rebuild the stations (either entirely or partially depending on asset condition as described previously).

Station Rebuild Decision Criteria

The decision criteria for station rebuilds are provided in Figure 3.

As stations are assessed, the following general approach is defined for determining the need for a station rebuild:

- If there is the need for an operational change at a station and the current configuration is not sufficient, then the station is a candidate for a rebuild.
- If the station is located such that there may be safety concerns, then the station is a candidate for a rebuild.
- If the condition of the station is good, then the station remains under existing maintenance and inspection practices.
- If the station condition is poor, then the following factors are considered:
 - It should be noted that age is not typically a single factor used in determining whether a rebuild is required. However, if the condition is poor and the station is greater than 60 years old, this station may be a candidate for a full or partial rebuild. This criterion relates to overall fleet management. Sixty years is a typical time frame used for major overhauls in power plants are typically designed for a 40 life and typically are run for a longer time period (e.g. 60 years). Plants wishing to run for a longer period with existing equipment typically conduct life extension studies to justify extended operation or replacements. Also, many of the key equipment items at the M&C stations may be reaching obsolescence.
 - If the station is less than 60 years in age, then the station is evaluated for specific equipment replacement only. If specific equipment replacement is possible, then the station project will consist of equipment replacement only. If specific

equipment replacement is not possible, then the station is considered for a partial or full rebuild.

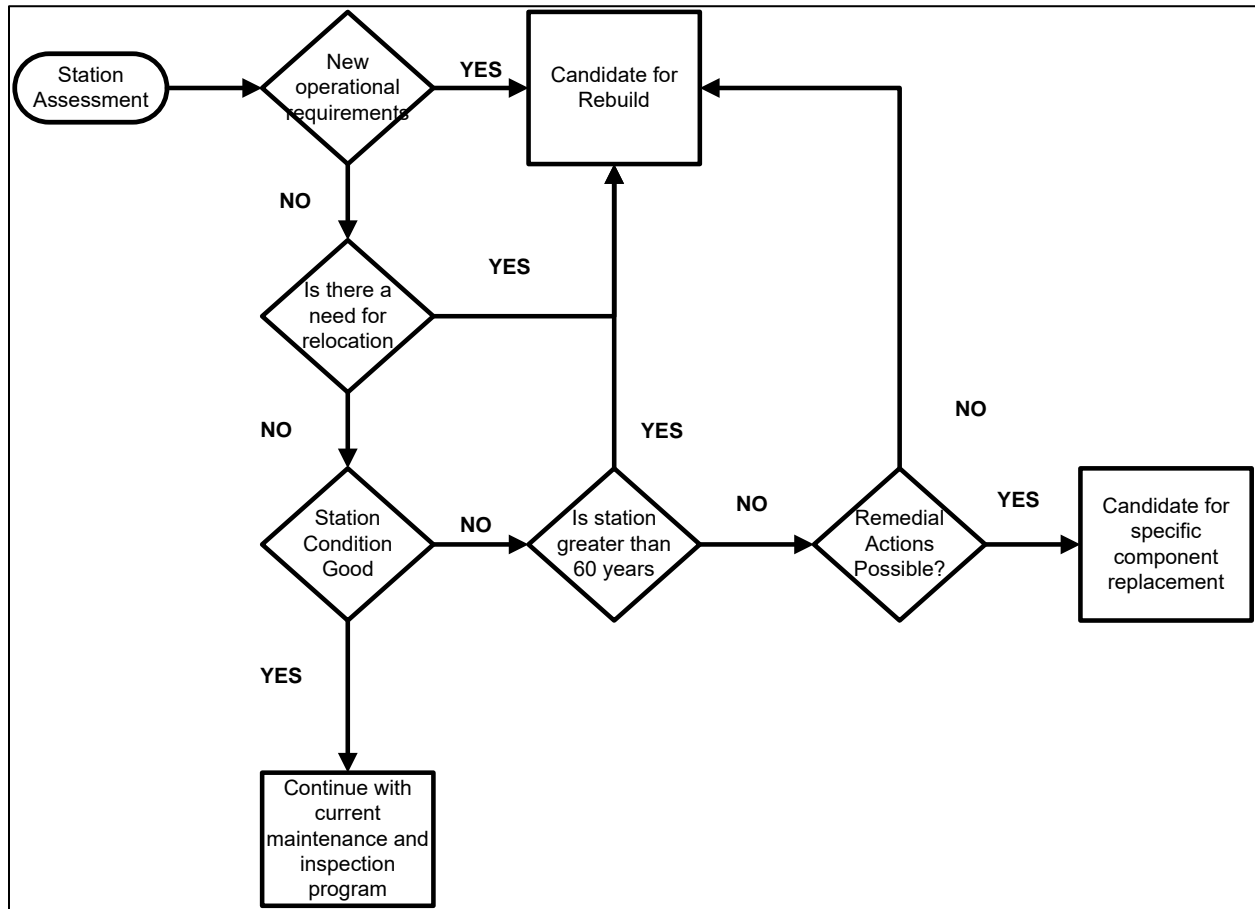


Figure 3: Rebuild Decision Tree

Recommended Station Rebuild Pace

The discussion below describes the recommended pace for the station rebuilds for the various station types.

Transmission Stations

The current aging profile for the complex and simple station aging is shown in the Figures 4 and 5, respectively. It should be noted that the LVC stations are not addressed in this discussion as the LVC rebuilds and retrofits are primarily addressed from the over pressure risk standpoint and included under Station OverPressure Protection Enhancements program.

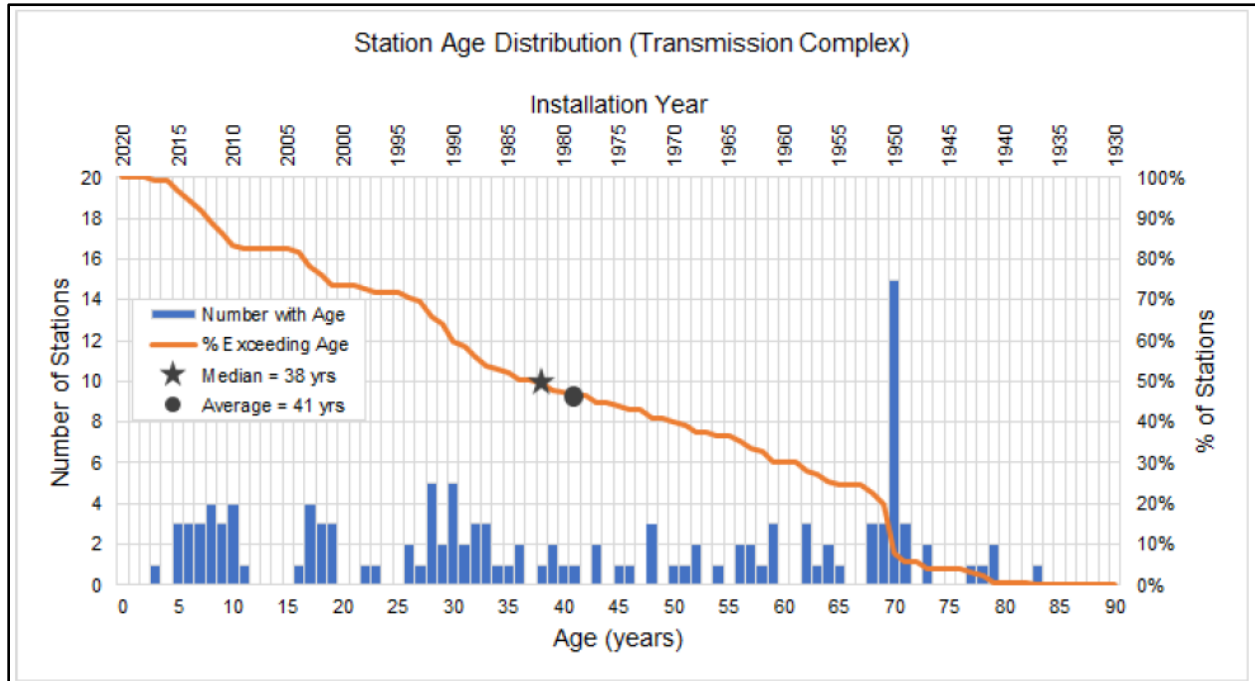


Figure 4: Transmission Complex Station Aging²

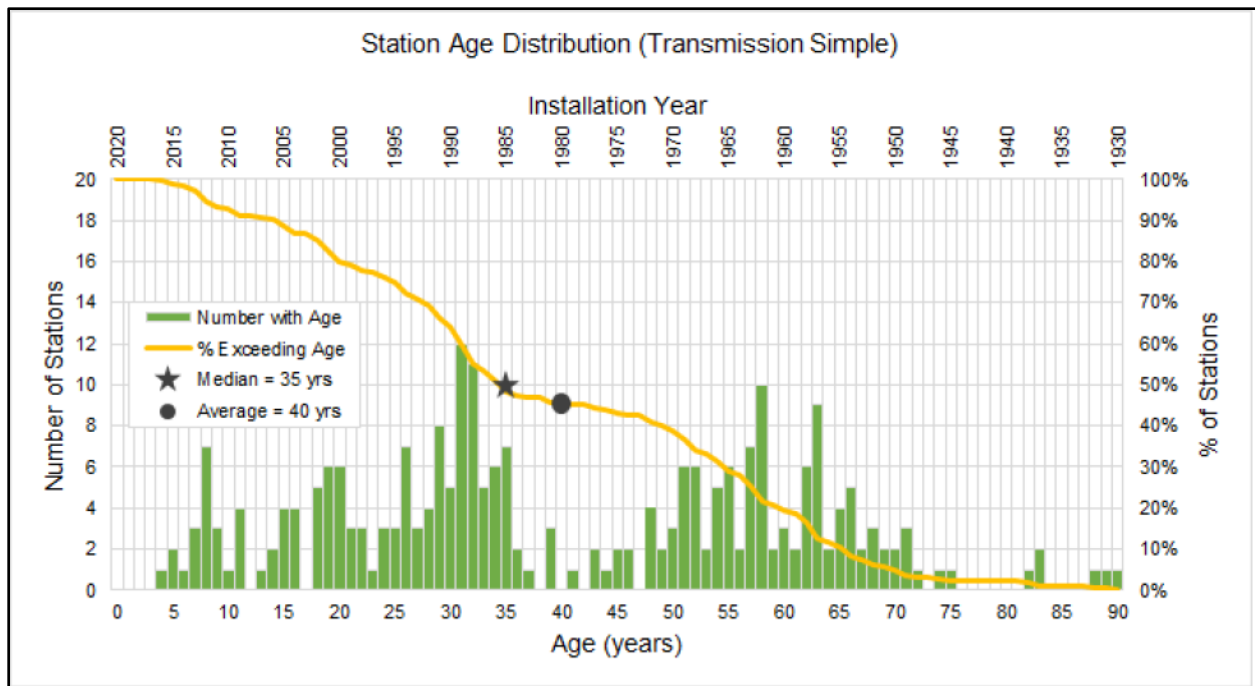


Figure 5: Transmission Simple Station Aging²

The facility rebuild projects and component replacement projects are intended to address facility equipment aging, obsolescence, and operational needs. Managing at a fleet level requires that

² GP-1104 M&C Asset Management Plan, Rev. 7, 08/07/2020.

obsolescence is managed so that there is not a build-up of obsolescence requiring many facility rebuilds over a short period of time.

The projects are intended to be a complete rebuild of the facility to ensure replacement of older and obsolete equipment and piping, to upgrade configuration to meet current system needs, and to address any outstanding issues with facility operations and maintenance. The scope of the facility rebuild will depend on a review of the condition of all facility components, as well as operational and safety issues. The initial pace of facility rebuilds can be targeted based on overall age distribution. However, the final determination of need for a facility rebuild will depend on a review of the condition of all facility components, as well as operational and safety issues.

Based on discussion of the various asset life expectancies as discussed previously, it is reasonable to manage a pool of assets to a replacement age of 60 - 80 years as a targeted pace. The age is based on the expectations of equipment obsolescence and multiple equipment replacements throughout this life cycle. The on-going management of the assets ensures that a large asset population does not build up over time, and thus requiring significant work in a short period of time. Therefore, the pace of facility rebuilds is based on maintaining an overall turnover rate of assets of 60 - 80 years for these transmission stations. The recommended pace of transmission station rebuilds is six complex stations and eight simple stations over this rate case period. This provides a facility turnover rate of about 85 years for the complex stations and about 115 years for the simple stations. The pace of the simple station program is considered appropriate since the median and average age of the stations is less than the 40 year target based on 80 year life and therefore, investments in other parts of the program were prioritized.

District Regulator Facilities (H-14 Type)

The current aging profile of district regulator (non-HPR type) stations is shown in Figure 6 below.

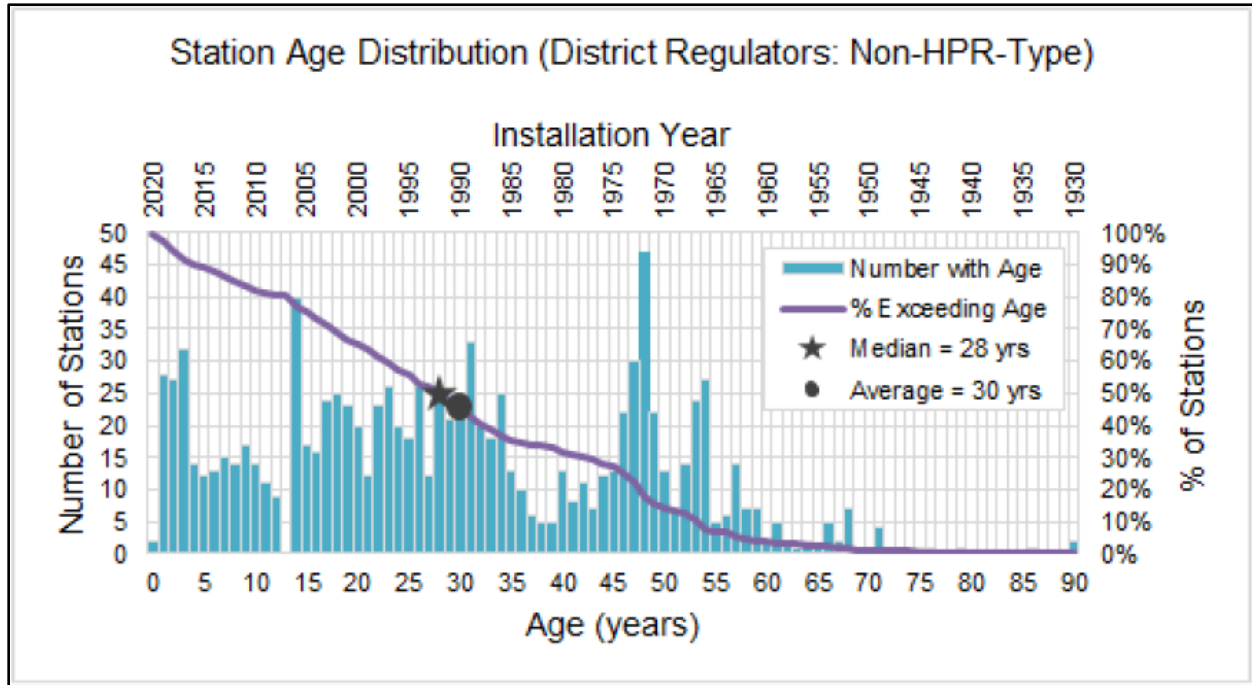


Figure 6: Non-HPR Type District Regulator Station Aging²

The facility rebuild projects and component replacement projects are intended to address facility equipment aging, obsolescence, and operational needs. Managing at a fleet level requires that obsolescence is managed so that there is not a build-up of obsolescence requiring many facility rebuilds over a short period of time.

The projects are intended to be a complete rebuild of the facility to ensure replacement of older and obsolete equipment and piping, to upgrade configuration to meet current system needs, and to address any outstanding issues with facility operations and maintenance. The scope of the facility rebuild will depend on a review of the condition of all facility components, as well as operational and safety issues. The initial pace of facility rebuilds can be targeted based on overall age distribution. However, the final determination of need for a facility rebuild will depend on a review of the condition of all facility components, as well as operational and safety issues. The review process typically consists of reviewing maintenance documents, photos, discussing with the local Gas Distribution Engineering and Design (GDED) engineer and completing a peer review of the issues at the station. The peer review allows multiple groups to discuss the system wide issues that are being addressed. In addition, rebuilds may be initiated for stations to address immediate or specific risks.

Based on discussion of the various asset life expectancies as discussed previously, it is reasonable to manage a pool of assets to a replacement age of 60 years as a targeted pace. The 60-year age is based on the expectations of equipment obsolescence and multiple equipment replacements throughout this life cycle. The on-going management of the assets ensures that a large asset population does not build up over time, and thus requiring significant work in a short period of time. Therefore, the pace of facility rebuilds is based on maintaining an overall

turnover rate of assets of 60 years. The pace of work for this rate case period is 25 station rebuilds per year, which maintains an approximate 60 year turnover rate. This pace of station rebuilds is somewhat reduced from the previous rate case but the current rebuild rate is aligned with the targeted turnover rate.

HPRs (H-10 Type and Farm Taps) Upgrades

The current status of complex and simple station aging is shown in the Figures 7 and 8, respectively.

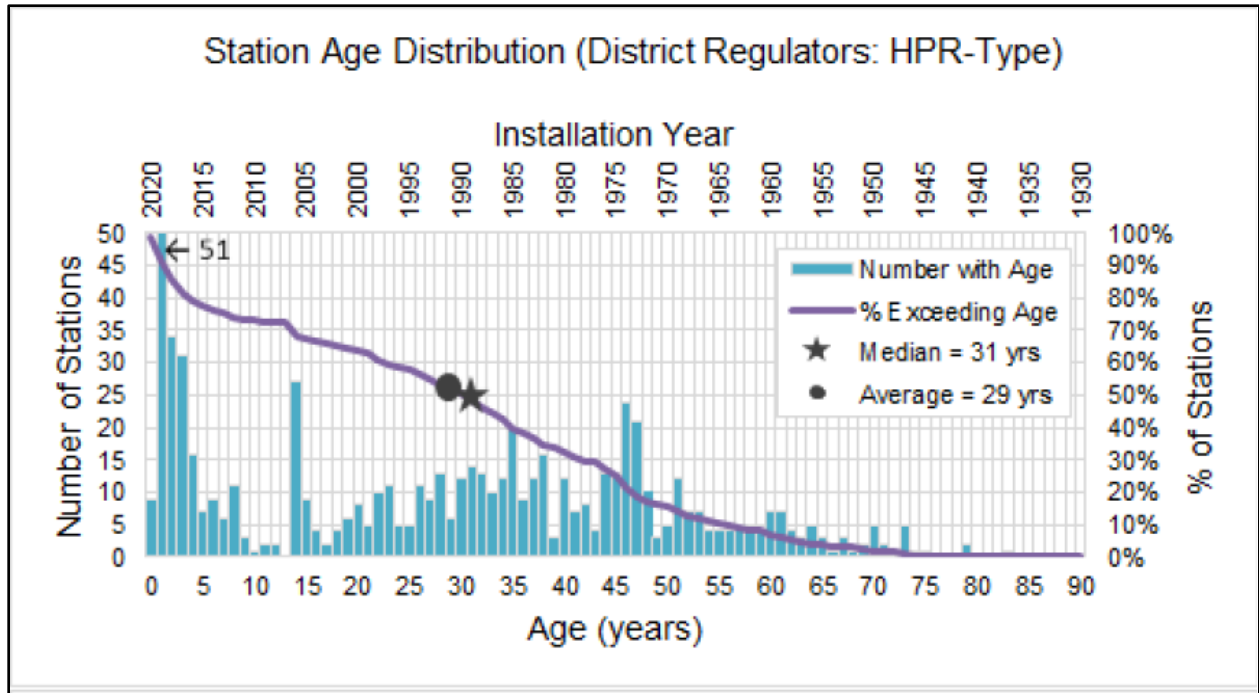


Figure 7: HPR Type District Regulator Station Aging²

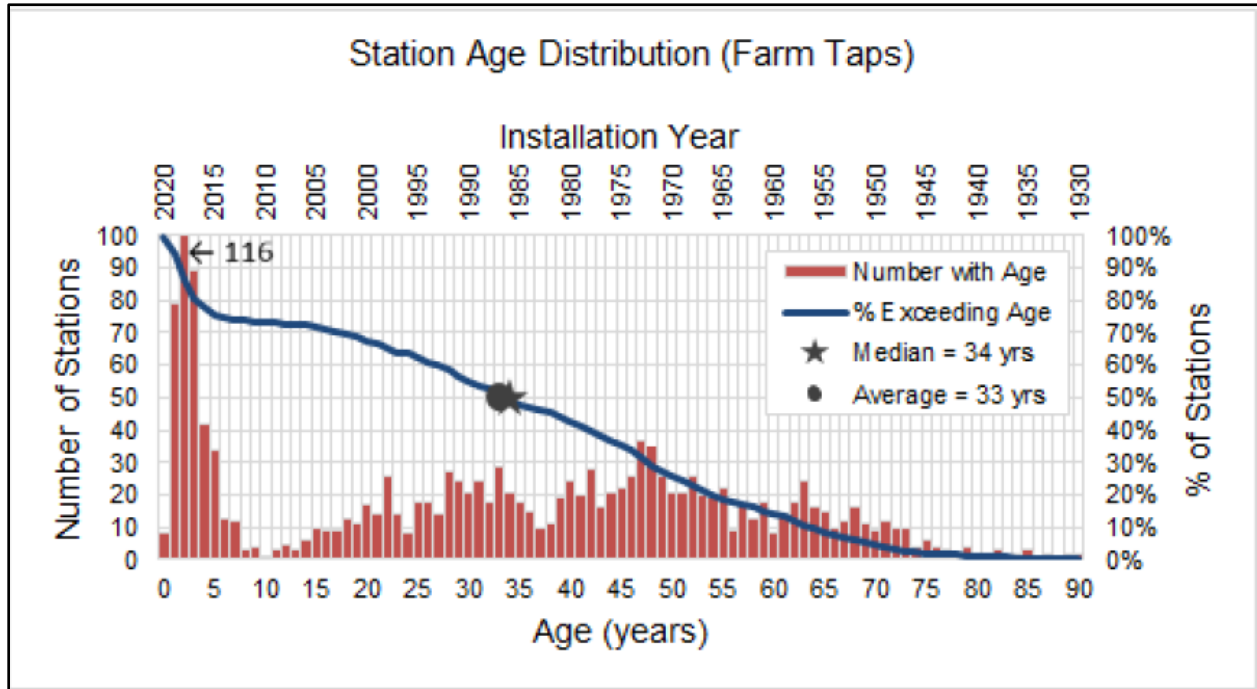


Figure 8: Farm Tap Station Aging²

The approach for the HPRs (H-10 type) is different than the strategy applied to the district regulator (H-14 types) facilities. The strategy for addressing HPRs includes the following options:

- Removal of the HPR and connection to an existing main
- Rebuild of the HPR
- Replacement of the HPR with a district regulator facility
- Conversion by removal and replacement with alternatives, such as propane, electric or solar

PG&E evaluates the alternatives based on location of HPR, location of the main, and potential future system configuration to evaluate an HPR and determine a cost effective approach to continued safe and reliable operation. This approach ensures that HPR's are replaced or rebuilt consistent with system needs to serve these customers.

PG&E is planning to complete the HPR replacement program during this rate case. The pace of replacements is targeted at 100 per year which will effectively complete the program in 2026. In the past, the pace of replacement has been 300-400 replacements per year, but this lower pace for the current rate case period is sufficient to complete the program.

Gas Operations Odor Fade Mitigation Program

Summary of Program Development and Recommendations for Odor Fade Risk Reduction

Prepared by:



SPEC Services, Inc.
10540 Talbert Ave., Suite 100 East
Fountain Valley, CA 92708
714.963.8077 Fax 714.963.0364
www.specservices.com

April 5, 2021

Prepared for: Pacific Gas & Electric

Contents

Purpose..... 3
Background..... 3
Short-Term Plan (2021-2022)..... 4
Long Term Plan (From 2023)..... 4
2023 GRC Plan and Forecast..... 5

Purpose

Address the processes and procedures impacting odor fade risk reduction.

Background

Odor fade is the loss of odorant compounds due to the chemical decomposition reaction and/or physical removal by adsorption and absorption. It is known to occur in newly installed pipelines and in pipelines which have recently been hydrotested. Odorization of natural gas is regulated by Code of Federal Regulations Title 49 §192.625. PG&E odorizes its gas with a 50-50 blend of tertiary butyl mercaptan (TBM) and tetrahydrothiophene (THT). Over a period of 18 months three odor fade events have been identified, resulting in under odorized gas being delivered to customers.

The first identified event occurred on May 14, 2019 as a result of a newly constructed pipeline tie-in for the Tracy Hills subdivision in the city of Tracy California. The low gas odorization was reported to both the gas regulation engineer and the supervisors per PG&E corporate reporting requirements. Ultimately, PG&E personnel took action in shutting off the gas supply to the subdivision, purged the under odorized gas, and performed pipeline conditioning (pickling) activities to restore odorization to the new tie-in.

The second odor fade event occurred in April 2020 and was identified on the Line 301A pipeline, resulting from the extent of condition assessment conducted by PG&E following the completion of 298 hydrostatic strength testing projects. A total of 44 projects were identified for field verification of odorization and two projects were identified to have active odor fade occurring. Line 301A, was confirmed to have insufficient odor intensity. A corrective action plan (CAP) was initiated involving four mitigating actions (Check odor intensity, check odorant levels, inject supplemental odorant, and continue to check odor intensity and odorant levels). Upon completion, Line 301A was found to have marginal odor intensity levels (above 0.6% gas in air) and was identified for additional monitoring. As a result of this additional monitoring, on September 30th, 2020 PG&E identified locations on 301A where odor intensity reads exceeded the 1.0% Gas to Air reading, exceeding the compliance limits defined in CFR 192.625. Gas Operations Emergency Center (OEC) was activated and odor levels were restored to acceptable levels.

The third odor fade event occurred in November 2020 on Line 21F after the completion of initial phases of hydrotesting activities. Odorization levels were registered as unacceptable per PG&E standards and OEC was activated to create an odorization plan. Odorization levels were restored to acceptable levels and the pipeline was returned to normal operation.

Following the initial odor fade event in Tracy, an extent of condition assessment of odor fade within PG&E's pipeline system was carried out. New screening methods were developed to better identify possible odor fade events. In addition to developing new screening methods, PG&E retained Dynamic Risk to conduct a process review and root cause evaluation (RCE) for all three low odor events.

Dynamic Risk conducted a fact-based and method driven RCE that utilized two techniques to ensure a thorough review. The first technique used was an events timeline that chronologically identified incidents of the loss of odorization. The second technique was the barrier-based Systematic Cause Analysis Technique (BSCAT) that utilizes the Bow-Tie method to link all the incidents that led to the loss of odorization. This method aided the reviewer in identifying the pathways that resulted in the incident and analyzes the failed barriers intended to prevent odorization loss. Both techniques helped Dynamic Risk in the analysis of what led to the loss of odorization and it also identified which processes/barriers need to be changed to ensure this failure does not occur again.

The analysis developed both short- and long-term recommendations that address all the identified causes. This included:

- Preventing the occurrence of odor fade
- Validating odorization system design and performance
- Confirming acceptable levels of odorization
- Effective response to low odorization events
- Continuous improvement

Short-Term Plan (2021-2022)

Following a root cause evaluation of the three events, the Odor Fade Mitigation program was developed to address the process and procedures impacting odor fade risk reduction. Current initiatives being developed include:

- Third party odorization of active projects with potential for odor fade based on screening criteria
- Procedure to complete an odor fade project screening and implementation into the project execution process
- Standardization of the monitoring of odorization and the mitigation of odor fade
- Pipeline conditioning and supplemental odorization for odor fade risk reduction
- Portable odorization equipment pilot
- New product approvals for equipment and tools related to pipeline conditioning, monitoring and evaluation of odorant concentration.

Long Term Plan (From 2023)

- Effectiveness reviews of the standards and procedures put in place during the current rate case period
- Update/expansion of standards and procedures related to odorization
- Supplemental odorization projects for locations found to have low TBM concentrations
- Testing and research of additional odorant blends
- Additional SME and troubleshooting support due to an increase in monitoring locations

2023 GRC Plan and Forecast

In the 2023 Rate Case, we are expecting an increase in engagement from Measurement Services for Gas Quality to support the long-term recommendations included above. 2023 GRC forecast for Gas Quality Assessment Program (MAT JT8) includes forecast at the 2020 recorded costs level with incremental forecast included for the activities above. Based on engineering judgement of internal and external Subject Matter Experts PG&E anticipates the incremental costs to be approximately \$700K to support the incremental activities.

The Gas Transmission/deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks listed below.

Check 1: This work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (toplift or imputed) units of work.

Check 3: PG&E did not pay for all units of work during the 2019-2022 period.

Check 4: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service.

Line	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 2			Explanation	Units Comparison		Dollar Comparison					
							Check 1	Check 2a	Check 2b		Check 3	Deferred Work	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast	2019 to 2022 Imputed	Difference	2019 to 2022 Imputed	Difference	
1	6	Capital	75	75C	Routine M&C Capital	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	-	-	-	-
2	6	Capital	76	76X	Compressor Replacements	# of Compressor Unit Replacements	Y	Y	Y	N	N	1.00	1.75	(1)	\$ 27,040,101	\$ 78,472,536	\$ (50,838,435)	
3	6	Capital	76	76F	Emergency Shutdown Upgrade	# of Upgrades	Y	Y	Y	N	N	5.00	7.03	(2)	\$ 5,855,209	\$ 14,099,339	\$ (8,244,130)	
4	6	Capital	76	76A	Perfor m Complex Station Rebuilds	# of Complex Stations Rebuilt	Y	Y	Y	N	N	9.00	10.77	(1.8)	\$ 113,131,178	\$ 116,896,677	\$ (3,765,500)	
5	6	Capital	76	76Z	Physical Security - Capital	# of P/C Upgrades	Y	Y	Y	N	N	9.00	7.18	1.82	\$ 31,705,565	\$ 35,103,440	\$ (3,457,874)	
6	6	Capital	76	76R	Compressor Unit Control Replacements	Non-Unitized	Y	Y	N/A	N/A	N	9.00	7.03	2	\$ 11,982,208	\$ 26,882,200	\$ (15,267,711)	
7	6	Capital	76	76S	GT Terminal Upgrades	Non-Unitized	Y	Y	N/A	N/A	N	-	-	-	\$ 25,766,433	\$ -	\$ (25,766,433)	
8	6	Capital	76	76Q	Engineering Critical Assessment 1 (ECA1) - Capital	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ (50,761)	\$ -	\$ (50,761)	
9	6	Capital	76	76S	Engineering Critical Assessment 2 (ECA2) - Capital	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 542,477	\$ 1,048,966	\$ (506,489)	
10	6	Capital	76	76V	Station Strength - Testing - Capital	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 276,742	\$ 622,510	\$ (345,768)	
11	6	Capital	76	76E	Becker System Upgrades	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 151,813	\$ 324,687	\$ (172,874)	
12	6	Capital	76	76Y	Compressor Retrofit Projects	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 1,566	\$ -	\$ (1,566)	
13	6	Capital	76	76B	Perform Simple Station Rebuilds	# of Simple Stations Rebuilt	Y	Y	Y	Y	Y	6.00	7.18	(1.2)	\$ 22,749,261	\$ 22,746,384	\$ 2,877	
14	6	Capital	76	76P	GT Eject Upgrad-Hinley&Topoek	# of upgrades	Y	Y	Y	Y	Y	1.00	1.72	(0.7)	\$ 19,887,308	\$ 15,289,501	\$ 4,617,806	
15	6	Capital	76	76N	Routine C&P Capital	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 191,217,995	\$ 145,382,783	\$ 45,835,212	
16	6	Capital	76	76T	Upgrade Station Controls	# of P/C Upgrades	Y	Y	N	N	N	5.00	3.32	1	\$ 36,670,161	\$ 7,386,958	\$ 29,283,203	
17	6	Capital	76	76G	GT Station OPR Enhancements Capital	# Rebuilds and Rate cuts	Y	Y	N	N	N	78.00	-	78	\$ 60,384,162	\$ -	\$ (60,384,162)	
18	6	Capital	77	76H	Compressor Stations	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 17,692	\$ -	\$ (17,692)	
19	6	Expense	77	76H	Routine M&C Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 21,337,303	\$ 26,035,952	\$ (4,698,649)	
20	6	Expense	77	J7V	Station Strength Tests	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 3,711,633	\$ 4,108,356	\$ (396,723)	
21	6	Expense	77	J7V	Routine C&P Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 36,609,452	\$ 37,936,759	\$ (1,327,308)	
22	6	Expense	77	J7X	GT Station OPR Enhancements Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 5,403,604	\$ 6,298,209	\$ (894,604)	
23	6	Expense	77	J7B	Gas Quality Assessment - Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 3,806,571	\$ 4,198,799	\$ (392,228)	
24	6	Expense	77	J7L	FIMP Risk Management	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 11,446,802	\$ 11,340,595	\$ 106,208	
25	6	Expense	77	J7J	Physical Security - Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 10,901	\$ -	\$ (10,901)	
26	6	Expense	77	L71	Critical Documents - Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 12,741,199	\$ -	\$ (12,741,199)	
27	6	Expense	77	L71	Engineering Critical Assessment 1 (ECA 1) - Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 20,641,018	\$ 19,141,345	\$ 1,499,673	
28	6	Expense	77	L72	Engineering Critical Assessment 2 (ECA 2) - Expense	Non-Unitized	Y	N	N/A	N/A	N	-	-	-	\$ 9,454,885	\$ 7,439,517	\$ 2,015,368	
29																		
30																		
31																		
32																		

(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 7, ASSET FAMILY – STORAGE

TABLE OF CONTENTS

Subject	Page No.
Expense Workpapers	
Recorded and Forecast Expenses by MWC (Nominal Dollars)	WP 7-1
Recorded and Forecast Expenses by MWC (Base Year Dollars)	WP 7-2
Recorded and Forecast Expenses by MAT Code (Nominal Dollars)	WP 7-3
Recorded and Forecast Expenses by MAT Code (Base Year Dollars)	WP 7-4
Summary of Expenses	WP 7-5
Summary – MAT AH1	WP 7-6
Noise and Temperature Survey Cost Calculation – MAT AH1	WP 7-7
Thru-Tubing (MTD) Survey Cost Calculation – MAT AH1	WP 7-8
Rework Logging Survey Cost Calculation – MAT AH1	WP 7-9
Pressure Testing Cost Calculation – MAT AH1	WP 7-10
Storage Well Rework Reassessment Project Cost Calculator – MAT AH2	WP 7-11
Compiled View – MATs AH3 & AH#	WP 7-12
Engineering and Support – MATs AH3 & AH#	WP 7-13
Non-High Consequence Area (HCA) Hydrotestic Testing Cost Calculator – MAT AH3	WP 7-14
Project Summaries	
Project Summary – AH1 Integrity Assessments	WP 7-15
Project Summary – AH Well Other and Program Support	WP 7-17
Expense Historical and Forecast Walk Workpapers	
Expense Historical Walk by MWC – Storage	WP 7-19
Expense Forecast Walk by MWC – Storage	WP 7-20

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 7, ASSET FAMILY – STORAGE

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Capital Workpapers	
Capital Expenditures by MWC (Nominal Dollars)	WP 7-21
Forecast Capital Expenditures Summary (Nominal Dollars)	WP 7-22
Recorded CWIP and Forecast Capital Expenditures Details – Projects Over \$3 Million	WP 7-23
Recorded and Forecast Capital Expenditures Details - Other Work Capital – Projects Under \$3 Million	WP 7-24
Summary of Capital Expenditures	WP 7-25
Summary – MAT 3L1	WP 7-26
New Storage Well Drilling Project Cost Calculator – MAT 3L1	WP 7-27
Well Drilling Support Equipment – MAT 3L1	WP 7-28
Storage Well Rework and Retrofit to T&P Project Cost Calculator Summary – MAT 3L3	WP 7-29
(Type 2) Storage Well Rework and Retrofit to T&P Project Cost Calculator – MAT 3L3	WP 7-30
(Type 1a) Storage Well Rework and Retrofit to T&P Project Cost Calculator – MAT 3L3	WP 7-31
(Type 1) Storage Well Rework and Retrofit to T&P Project Cost Calculator – MAT 3L3	WP 7-32
Well Controls Monitoring – MAT 3L5	WP 7-33
Project Summaries	
Project Summary – 3L1 Storage Drilling	WP 7-34
Project Summary – 3L3 Well Reworks Retrofits	WP 7-36
Project Summary – 3L5 Well Controls Monitoring	WP 7-38
Capital Historical and Recorded Walk Workpapers	
Capital Historical Walk by MWC – Storage	WP 7-40
Capital Forecast Walk by MWC – Storage	WP 7-41

PACIFIC GAS AND ELECTRIC COMPANY
 2023 GENERAL RATE CASE
 EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
 CHAPTER 7, ASSET FAMILY – STORAGE

TABLE OF CONTENTS
 (CONTINUED)

Subject	Page No.
Reasonableness Review Workpapers	
Gas Storage Balancing Account Expense Summary	WP 7-42
Gas Storage Balancing Account Expense Details	WP 7-43
Gas Storage Balancing Account Capital Summary	WP 7-44
Gas Storage Balancing Account Capital Details	WP 7-45
Supplemental Workpapers	
Gas Storage Well Abandonment Cost Calculator	WP 7-46
PG&E's Typical Storage Well Construction	WP 7-47
NGSS Capacity Alternatives	WP 7-48
Intra-day Inventory Management Service Analysis	WP 7-69
Curtailment In-Lieu of Balancing Analysis	WP 7-75
Deferred Work Workpaper	
Deferred Work Analysis	WP 7-79

Workpaper Table 7-1
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 7
Asset Family – Storage
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	AH	Maint Gas Storage Fac	11,921	6,913	4,013	5,228	5,717	8,352	13,693	10,522	
2	Total		11,921	6,913	4,013	5,228	5,717	8,352	13,693	10,522	WP 7-5 Line 5

Notes: Line 2, 2023 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 7-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 7
Asset Family – Storage
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	AH	Maint Gas Storage Fac	12,807	7,221	4,107	5,211	5,717	8,338	13,290	9,952
2	Total		12,807	7,221	4,107	5,211	5,717	8,338	13,290	9,952

Workpaper 7-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 7
Asset Family – Storage
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	AH	AH1	WELL - Integrity Assessments	10,214	2,590	2,247	3,086	4,064	4,685	5,791	5,627	WP 7-5 Line 2
2		AH2	WELL - Reworks		3,092	(262)	10					WP 7-5 Line 3
3		AH3	WELL - Other	1,017	397	416	881	284	1,867	5,795	2,720	WP 7-5 Line 4
4		AH#	Maintain Gas Storage Facilities Other	689	834	1,612	1,251	1,368	1,800	2,107	2,176	WP 7-5 Line 1
5	AH Total			11,921	6,913	4,013	5,228	5,717	8,352	13,693	10,522	
6	Total			11,921	6,913	4,013	5,228	5,717	8,352	13,693	10,522	WP 7-5 Line 5

Notes: Line 6, 2023 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 7-4
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 7
 Asset Family – Storage
 Expenses by MAT Code
 (Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	AH	AH1	WELL - Integrity Assessments	10,948	2,706	2,252	3,049	4,064	4,677	5,641	5,338
2		AH2	WELL - Reworks		3,196	(259)	10				
3		AH3	WELL - Other	1,083	412	414	864	284	1,864	5,596	2,550
4		AH#	Maintain Gas Storage Facilities Other	775	908	1,699	1,288	1,368	1,797	2,053	2,064
5	AH Total			12,807	7,221	4,107	5,211	5,717	8,338	13,290	9,952
6	Total			12,807	7,221	4,107	5,211	5,717	8,338	13,290	9,952

Workpaper Table 7-5
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 7, Asset Family - Storage
Summary of Expenses

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast (A)	Reference
1	Engineering and Support	AH	AH#	689,421	834,235	1,612,006	1,250,819	1,368,283	1,800,000	2,107,344	2,175,833	2,243,283	2,312,825	2,383,829	WP 7-12 Line 2
2	WELL - Integrity Assessments	AH	AH1	10,214,370	2,590,083	2,247,361	3,086,472	4,064,495	4,685,000	5,790,813	5,638,620	6,250,751	4,380,244	6,120,824	WP 7-6 Line 5
3	WELL - Reworks	AH	AH2	-	3,091,616	(261,595)	9,588	41	-	-	-	-	-	19,834,739	WP 7-11 Line 5
4	WELL - Other	AH	AH3	1,016,799	397,260	415,595	880,660	283,862	1,867,000	5,795,196	2,719,791	6,505,522	8,187,401	7,509,061	WP 7-12 Line 1
5	Total Expenses			11,920,590	6,913,194	4,013,368	5,227,539	5,716,682	8,352,000	13,693,353	10,534,244	14,999,557	14,880,471	35,848,453	

Notes

(A) Forecast expenses shown through 2026 above due to special attrition for this expense program.

Worksheet Table 7-6
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
Summary - MAT AH1

Line No.	Expense Program	MAT	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	Noise and Temperature Surveys	AH1	\$1,503,675	\$1,609,347	\$1,735,349	\$1,788,624	WP 7-7 Line 5
2	Thru-Tubing Casing Inspections	AH1	\$1,107,766	\$1,347,100	\$1,871,941	\$1,773,812	WP 7-8 Line 5
3	Barrier Inspection Surveys (MFL, USIT, Caliper, CBL/GRN)	AH1	\$3,027,180	\$2,823,782	\$0	\$1,737,245	WP 7-9 Line 5
4	Pressure Testing (Post Conversion to T&P)	AH1	\$0	\$470,522	\$772,954	\$821,142	WP 7-10 Line 5
5	Total Expense	AH1	\$5,638,620	\$6,250,751	\$4,380,244	\$6,120,824	WP 7-5 Line 2

Workpaper Table 7-7
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
Noise and Temperature Survey Cost Calculation
MAT AH1

Line
No

	2023	2024	2025	2026	Reference
1					
2	1.08791634	1.121641747	1.156412641	1.191914509	
3	\$14,321	\$14,765	\$15,222	\$15,690	
4	105	109	114	114	
5	\$1,503,675	\$1,609,347	\$1,735,349	\$1,788,624	WP 7-6 Line 1

	Actual 2020 Well Count	Contractor Unit Costs ⁽¹⁾	PG&E Internal Costs ⁽²⁾	2020 Total Cost Estimate	2020 Unit Cost
6					
7	18	\$102,665	\$133,989	\$236,654	
8	6	\$43,275	\$44,663	\$87,938	
9	85	\$462,608	\$647,614	\$1,110,222	
10	<i>Subtotals</i>	<i>109</i>	<i>\$608,548</i>	<i>\$826,266</i>	<i>\$13,163</i>
11			Total 2020 Unit Cost		\$13,163

	Forecast Well Count			
Storage Field	2023	2024	2025	2026
12				
13				
14	18	18	18	18
15	0	0	0	0
16	87	91	96	96
17	Total	105	109	114

18 **NOTES**

19 ⁽¹⁾ Contractor Costs are from quotes provided by the contractor in 2020.

20 ⁽²⁾ PG&E Internal Costs are based on 2020 costs, excluding overhead.

21 ⁽³⁾ The number of wells in 2018 and 2019 accounts for the abandonment of two wells at Los Medanos.

Workpaper Table 7-8
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
Thru-Tubing (MTD) Survey Cost Calculation
MAT AH1

Line
No

	2023	2024	2025	2026	Reference
1					
2	1.08791634	1.121641747	1.156412641	1.191914509	
3	\$28,404	\$29,285	\$30,193	\$31,120	
4	Total Units	39	46	62	57
5	Total	\$1,107,766	\$1,347,100	\$1,871,941	\$1,773,812

WP 7-6 Line 2

	Actual 2020 Well Count	Contractor Unit Costs ⁽¹⁾	PG&E Internal Costs ⁽²⁾	2020 Total Cost Estimate	2020 Unit Cost
6	Storage Field				
7	Los Medanos --- Thru-Tubing	7	\$130,655	\$52,107	\$182,762
8	Pleasant Creek --- Thru-Tubing	1	\$18,665	\$7,444	\$26,109
9	McDonald Island --- Thru-Tubing	32	\$597,280	\$238,203	\$835,483
10	<i>Subtotals</i>	40	\$746,600	\$297,754	\$1,044,354
11	Total 2020 Unit Cost				\$26,109

	Storage Field	Well Inspected ⁽³⁾	2023	2024	2025	2026
12						
13	2023 Wells (LM + PC + McD)	39	\$1,107,766			
14	2024 Wells (LM + PC + McD)	46		\$1,347,100		
15	2025 Wells (LM + PC + McD)	62			\$1,871,941	
16	2026 Wells (LM + PC + McD)	57				\$1,773,812
17	⁽⁴⁾ Total	204	\$1,107,766	\$1,347,100	\$1,871,941	\$1,773,812

18 NOTES

19 ⁽¹⁾ Contractor Costs are from quotes provided by the contractor in 2020.

20 ⁽²⁾ PG&E Internal Costs are based on 2020 costs, excluding overhead allocations.

21 ⁽³⁾ Forecast units, subject to change pending CalGEM approval.

22 ⁽⁴⁾ The costs reflected are vendor specific and may be different should another cost competitive vendor be used.

Workpaper Table 7-9
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
Rework Logging Survey Cost Calculation
MAT AH1

Line
No

	2023	2024	2025	2026	Reference
1					
2	1.08791634	1.121641747	1.156412641	1.191914509	
3	Final Unit Cost (Prior Year Unit Cost * Unit Cost Escalation)	\$144,151	\$148,620	\$153,227	\$157,931
4	Total Units	21	19	0	11
5	Total	\$3,027,180	\$2,823,782	\$0	\$1,737,245

WP 7-6 Line 3

	Actual 2020 Well Count	Contractor Unit Costs ⁽¹⁾	PG&E Internal Costs ⁽²⁾	2020 Total Cost Estimate	2020 Unit Cost
6	Storage Field				
7	Los Medanos --- Rework Logging	3	\$357,801	\$0	\$357,801
8	McDonald Island --- Rework Logging	14	\$1,894,738	\$0	\$1,894,738
9	<i>Subtotals</i>	17	\$2,252,539	\$0	\$2,252,539
10		Total 2020 Unit Cost			\$132,502

	Well Inspected ⁽³⁾	2023	2024	2025	2026
11	Storage Field				
12	2023 Wells (LM + PC + McD)	21	\$3,027,180		
13	2024 Wells (LM + PC + McD)	19		\$2,823,782	
14	2025 Wells (LM + PC + McD)	0		\$0	
15	2026 Wells (LM + PC + McD)	11			\$1,737,245
16	Total	51	\$3,027,180	\$2,823,782	\$0

17 NOTES

18 ⁽¹⁾ Contractor Costs are from quotes provided by the contractor in 2020.

19 ⁽²⁾ PG&E Internal Costs are included in 3L3.

20 ⁽³⁾ Forecast units, subject to change pending CalGEM approval.

Workpaper Table 7-10
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
Pressure Testing Cost Calculation
MAT AH1

Line
No

	2023	2024	2025	2026	Reference	
1						
2	Unit Cost Escalation	1.08791634	1.121641747	1.156412641	1.191914509	
3	Final Unit Cost (Prior Year Unit Cost * Unit Cost Escalation)	\$36,989	\$38,136	\$39,318	\$40,525	
4	Total Units	0	11	17	17	
5	Total	\$0	\$470,522	\$772,954	\$821,142	WP 7-6 Line 4

	2020 Unit Costs (1)	
6	Activity	
7	Pressure testing Casing Annuli	\$21,000
8	Contractor Support	\$2,500
9	Internal Labor (2)	\$10,500
10	<i>Subtotals</i>	<i>\$34,000</i>
11	Total 2020 Unit Cost	\$34,000

Vendor Estimate
WSM Oversight
GPOM, Eng, Clearance Devel, PM

	Storage Field	Well Pressure Tests (3)	2023	2024	2025	2026
12						
13	2023 Wells (LM + PC + McD)	0	\$0			
14	2024 Wells (LM + PC + McD)	11		\$419,494		
15	2025 Wells (LM + PC + McD)	17			\$668,407	
	2026 Wells (LM + PC + McD)	17				\$688,927
	Total	45	\$0	\$419,494	\$668,407	\$688,927

NOTES

- 16 (1) Contractor Costs are from quotes provided by the contractor in 2020.
17 (2) PG&E Internal Costs are based on 2020 costs, excluding overhead allocations.
18 (3) Forecast units, subject to change pending CalGEM approval; assumes 5 year pressure testing cycle post conversion.

Workpaper Table 7-11
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
Storage Well Rework Reassessment Project Cost Calculator
MAT AH2

Line No.	Year	Escalation	Unit Cost	Units ⁽¹⁾	Cost	Reference
1	2020		\$1,512,825			
2	2023	1.08791634	\$1,645,827	0	\$0	
3	2024	1.121641747	\$1,696,848	0	\$0	
4	2025	1.156412641	\$1,749,450	0	\$0	
5	2026	1.191914509	\$1,803,158	11	\$19,834,739	WP 7-5 Line 3

6 ⁽¹⁾ The units noted are based on performing well reworks at Los Medanos and McDonald Island storage fields.

7 STORAGE WELL REWORK & REASSESSMENT:

8 Well Rework (Post T&P Conversion), Assess Condition, Recomplete T&P (10 Rig Days)

	Unit (\$)	Quantity	Unit	Total (\$)	Source of Data
DHSV, Rate Restoration, & Packer Assembly	360,000	1	job	360,000	Vendor Quote
Down Hole Safety Valve					
(E) Liner Retrieval/Fishing					
8-5/8" Packer Assembly					
Pressure Testing x2					
4.5" Steel Tubing	17	5,000	feet	85,000	Vendor Quote
Total for DHSV & Rate Restoration				445,000	

9 Rig & Remaining Rework Cost

Rig	Daily Rate	15	daily	412,500	Vendor Quote
	Mobilization	1	job	50,000	Vendor Quote
	Rig Subtotal			462,500	
Remaining Rework Cost:					
Auxiliary Rig Support Services					
(WSM, fishing, crane, rat holes, PU/LD, guard shack, drill bits, etc)	147,016	1	job	147,016	Vendor Quote
Fluids & Fluid Handling					
Drilling Fluids	70,000	1	job	70,000	Vendor Quote
Fluid transport, storage, and disposal	120,000	1	job	120,000	Vendor Quote
				190,000	
WSM, Engineering and PM Support Services					
Day WSM (Incl. Per Diem/ Mileage)	2,600	15	daily	39,000	Vendor Quote
Night WSM (Incl. Per Diem/ Mileage)	2,600	15	daily	39,000	Vendor Quote
Engineering Support (Above/below ground)	70,000	1	job	70,000	Vendor Quote
Project Management Support	70,000	1	job	70,000	Vendor Quote
Services Subtotal				218,000	
Total for Rig and the remaining Rework Cost				870,500	

DHSV, Rate Restoration, Rig, & Remaining Rework Total	1,315,500
Overhead Allocations	197,325
Total 2020 Unit Cost	1,512,825

15% Overhead allocations were based on internal PG&E standard labor and material factors.

Workpaper Table 7-12
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
MAT AH3 & AH# Engineering & Support

Line No.	Escalation Rates	1.08792	1.12164	1.15641	1.19191	Reference
	MAT	2023	2024	2025	2026	
1	AH3	2,719,791	6,505,522	8,187,401	7,509,061	WP 7-13 Line 1 +
2	AH#	2,175,833	2,243,283	2,312,825	2,383,829	WP 7-14 Line 3
3	Total Costs (\$M)	4,895,624	\$8,748,805.62	\$10,500,226.78	\$9,892,890.42	WP 7-13 Line 2

Worksheet Table 7-13
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
MAT AH3 & AH# Engineering & Support

Line No.	Escalation Rates	1.08792	1.12164	1.15641	1.19191	Reference
	MAT	2023	2024	2025	2026	
1	AH3	\$1,087.92	\$897.31	\$1,156.41	\$953.53	WP 7-12 Line 1
2	AH#	\$2,175.83	\$2,243.28	\$2,312.83	\$2,383.83	WP 7-12 Line 2
3	Total Costs (\$M)	\$3,263.75	\$3,140.60	\$3,469.24	\$3,337.36	

Line No.	Activity	2020 Cost	MAT
4	Wellhead Program Engineering and Contract Support	\$ 70	AH3
5			engineering estimate
6	Isochronal Gas Sampling Program	\$ 200	AH3
7	Well Control School Training(every 2 Years)	\$ 200	AH3
8	Well Control Support & Emergency Preparedness	\$ 130	AH3
9	General Engineering/Integrity Management/R&D Contract Support	\$ 400	AH3
10	Internal Engineering/Integrity Management/Program Support	\$ 2,000	AH#
			engineering estimate

Workpaper Table 7-14
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers

Chapter 7, Asset Family - Storage
MAT AH3 Non-High Consequence Area (HCA) Hydrotestic Testing Cost Calculator

Line No.	Storage Field	Escalation Rates	1.08792	1.12164	1.15641	1.19191	Reference
		MAT	2023	2024	2025	2026	
1	McDonald Island	AH3	\$1.63	\$5.61	\$3.01	\$6.56	
2	Los Medanos	AH3	\$0.00	\$0.00	\$4.02	\$0.00	
3	Total Costs (\$M)		\$1.63	\$5.61	\$7.03	\$6.56	WP 7-12 Line 1

Line No.	Facility	Execution Year	Project Designation (a)	Route(s) (b)	Mile Point 1	Mile Point 2	Est. Hydrotest Costs (\$M)
4	McDonald Island	2023	McD-11	057A-MC79S	0	0.17	1.5
5	McDonald Island	2024	McD-5	057A-MC STUB7134	0	0.42 0	5.0
6	McDonald Island	2025	McD-6	057A-MT	0	0.61	2.6
7	Los Medanos	2025	LM-1	065 065-2	0	0.87 0.29	3.5
8	McDonald Island	2026	McD-7	057A-M10 057A-WT 057A-MD3	0	0.01 0.69 0.29	5.5

Notes

- 9 (a) These projects are part of the 10-year Storage Pipe Plan that is being developed to perform assessments on all pipe at the storage facilities regardless of HCA classification. The planned assessments under the 10-yr Storage Pipe Plan include hydrotest, NT-ILI, ECDA, and pipe replacement. The assessments address the highest risks we have to the pipe and overall to the storage asset family stemming from internal corrosion. The pipe classified as HCA (all 2.5 miles of HCA pipe within storage asset family are located at McDonald Island) are currently assessed under the purview of TIMP per compliance schedule and typically only include ECDA assessment. The remaining miles of pipe would not otherwise normally receive assessments other than a hydrotest at install, if performed.
- 10 (b) As part of this effort, TIMP and FIMP coordinated project bundles at each facility to minimize outages to perform hydrotests in lieu of, or in addition to ECDAs planned for compliance due dates. The projects are prioritized to address the highest risk pipe.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROGRAM SUMMARY – INTEGRITY INSPECTIONS AND SURVEYS**

Program Title: Integrity Inspections and Surveys
Major Work Categories: MWC AH (MAT AH1)
Planning Order Numbers: AH1 – 5055379
Program Start Date: ongoing
Program Completion Date: ongoing
Operative Date (only applies to Capital): Operative as installed

Program Description

This program includes storage wellbore surveys and assessments, including Gamma-Ray Neutron, Cement Bond Log, Noise/Temperature, Magnetic Flux Leakage and Sonic surveys and other similar assessments. Does not include assessments that are completed as part of 3L3 well rework projects. This includes thru-tubing logging and pressure testing not associated with 3L3.

For further details see Exhibit (PG&E-3), Chapter 7, Section B.6.a.

Justification

The driver to this work is implementation of new regulations from the Pipeline and Hazardous Material Safety Administration (PHMSA) at the federal level and from CalGEM (previously DOGGR) at the state level related to the underground natural gas facilities. The work included in this program includes performing inspection surveys and pressure testing on wells at various frequencies and provide information on asset condition. (Exhibit (PG&E-3), Chapter 7, Section B.3.)

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROGRAM SUMMARY – INTEGRITY INSPECTIONS AND SURVEYS**

Cost

Each MAT code had varying forecast methodologies. See Exhibit (PG&E-3), Chapter 7, Section B.6.b.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT AH1	10,214	2,590	2,247	3,086	4,064	4,685	5,791	5,638	6,251	4,380	6,121	55,069	WP 7-5 Line 2
Expense Total	10,214	2,590	2,247	3,086	4,064	4,685	5,791	5,638	6,251	4,380	6,121	55,069	
TOTAL PROJECT COST	10,214	2,590	2,247	3,086	4,064	4,685	5,791	5,638	6,251	4,380	6,121	55,069	

Additional Cost Information:

Please see Exhibit (PG&E-3), WP 7-6 to WP 7-10 for specific details regarding the cost assumptions and forecast for Integrity Inspections and Surveys.

Benefits

These work activities will lead to improved safe operations and reliability of storage well operations and provide valuable asset condition information to inform current and future activities performed on storage wells.

Alternatives Considered

The pace of the performing the assessments is a regulatory compliance requirement. The pace the inspections vary by type; some survey inspection frequency is currently pending regulatory approval by CalGEM and further clarification is pending by PHMSA to inform the re-assessment frequency of direct inspection methods.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROJECT SUMMARY – WELL - OTHER AND PROGRAM SUPPORT**

Program Title: Well Other and Program Support

Major Work Categories: MWC AH (MATs AH3, AH#)

Planning Order Numbers: AH3 - 5055374, AH# - 5057515

Program Start Date: ongoing

Program Completion Date: ongoing

Operative Date (only applies to Capital): Operative as installed

Program Description

Work in this program includes: (1) non-HCA hydrotests; and (2) support and engineering for expense projects, such as integrity management and data analysis software, and gas storage emergency site plans and support.

For further details see Exhibit (PG&E-3), Chapter 7, Section B.7.a.

Justification

The scope of work proposed in this program includes: storage asset family pipeline inspections and replacement at the McDonald Island and Los Medanos storage fields, miscellaneous storage expenses, such as engineering support, integrity management programs, engineering analysis software, emergent and emergency support as required under CalGEM and PHMSA regulations. (Exhibit (PG&E-3), Chapter 7, Section B.3.)

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROJECT SUMMARY – WELL - OTHER AND PROGRAM SUPPORT**

Cost

Each MAT code had varying forecast methodologies. See Exhibit (PG&E-3), Chapter 7, Section B.7.b for details.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT AH3	1,017	397	416	881	284	1,867	5,795	2,720	6,506	8,187	7,509	35,578	WP 7-5 Line 4
MAT AH#	689	834	1,612	1,251	1,368	1,800	2,107	2,176	2,243	2,313	2,384	18,778	WP 7-5 Line 1
Expense Total	1,706	1,231	2,028	2,131	1,652	3,667	7,903	4,896	8,749	10,500	9,893	54,356	
TOTAL PROJECT COST	1,706	1,231	2,028	2,131	1,652	3,667	7,903	4,896	8,749	10,500	9,893	54,356	

Additional Cost Information:

Please see Exhibit (PG&E-3), WP 7-12 to WP 7-14 for specific details regarding the cost assumptions and forecast for Repair and Replace non-Storage Well Assets.

Benefits

The projects included in as part of the storage asset family pipelines will maintain safe operations and mitigate a failure related to the internal corrosion of the transmission lines that transport gas from the wellheads to the facility. Further, the broader program ensure the reliability and integrity of the all the storage assets at the facilities.

Workpaper Table 7-15
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Expense Historical Walk by MWC - Storage
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC AH	Detailed Description/Explanation
1	2016	11,921	11,921	
2			(5,007)	Well unit inspections per year differ as well as cost escalation and response to McDonald Island event generated additional expense in 2016.
3	2017	6,913	6,913	
4			(2,900)	Well unit inspections per year differ as well as cost escalation.
5	2018	4,013	4,013	
6			1,214	Well unit inspections per year differ as well as cost escalation.
7	2019	5,228	5,228	
8			489	Well unit inspections per year differ as well as cost escalation.
9	2020	5,717	5,717	

Note: Total amounts and amounts for each MWC are obtained from WP 7-5 by summing the relevant lines for each MWC.

Workpaper Table 7-16
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Expense Forecast Walk by MWC - Storage
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC AH	Detailed Description/Explanation
1	2020	5,717	5,717	
2			2,635	Well unit inspections per year differ as well as cost escalation.
3	2021	8,352	8,352	
4			5,341	Well unit inspections per year differ as well as cost escalation.
5	2022	13,693	13,693	
6			(3,159)	Well unit inspections per year differ as well as cost escalation. Pipeline inspection work planned.
7	2023	10,534	10,534	

Note: Total amounts and amounts for each MWC are obtained from WP 7-5 by summing the relevant lines for each MWC.

Workpaper Table 7-17
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 7
 Asset Family – Storage
 Capital Expenditures by Major Work Category
 (Thousands of Nominal Dollars)

No.	MWC	MWC Description	Capital Expenditures										Reference (A)	
			2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast		2026 Forecast
1	3L	Gas Trans Storage Wells	24,128	26,634	48,504	71,942	71,786	88,009	86,444	103,223	130,189	40,327	7,249	
2		Grand Total	24,128	26,634	48,504	71,942	71,786	88,009	86,444	103,223	130,189	40,327	7,249	WP 7-25 Line 5

Notes: (A) Line 2, 2023 - 2026 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 7-18
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 7
Asset Family – Storage
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

Line No.	Description	Capital Expenditures						Reference (A)	
		2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast		2026 Forecast
1	Projects > \$3 Million*	2,471	85,815	86,444	103,223	130,189	40,327	7,249	
2	Other Work	3,968	2,194	-	-	-	-	-	
3	Total	6,439	88,009	86,444	103,223	130,189	40,327	7,249	WP 7-25 Line 5

4 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Notes: (A) Line 3, 2023 - 2026 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 7-19
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 7
Asset Family – Storage
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million*
(Thousands of Nominal Dollars)

Line No.	Planning Order	Description	MWC	Operative Date	CWIP 2020 Recorded Adjusted	Capital Expenditures						Subtotal	Reference	
						2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast			
MWC - 3L Gas Trans Storage Wells														
1	5772766	Emergent Wells_2020	3L		-	3,200	-	-	-	-	-	-	3,200	
2	5774270	McD_TCSRep_Res_2021	3L		1,436	17,200	-	-	-	-	-	-	18,636	
3	5782122	McD_PIPE&CONT_Res_2020	3L		329	2,900	-	-	-	-	-	-	3,229	
4	5786332	McD_TC-4S_RW_2021	3L		20	3,200	-	-	-	-	-	-	3,220	
5	5786335	McD_TC-3S_RW_2021	3L		28	3,200	-	-	-	-	-	-	3,228	
6	5786336	McD_WS-3W_RW_2021	3L		14	3,200	-	-	-	-	-	-	3,214	
7	5786337	McD_WS-9W_RW_2020	3L		29	3,209	-	-	-	-	-	-	3,238	
8	5786361	McD_WS-4W_RW_2020	3L		219	3,253	-	-	-	-	-	-	3,472	
9	5786362	McD_WS-18W_RW_2020	3L		69	3,200	-	-	-	-	-	-	3,269	
10	5789948	McD_WS-5W_RW_2021	3L		213	3,200	-	-	-	-	-	-	3,413	
11	5789951	McD_MCD-13_RW_2021	3L		35	3,200	-	-	-	-	-	-	3,235	
12	5789952	McD_TC-8S_RW_2021	3L		32	3,203	-	-	-	-	-	-	3,235	
13	5790261	LM_17D_RW_2021	3L		15	3,200	-	-	-	-	-	-	3,215	
14	5792500	LM-10C Rework 2021	3L		7	3,200	-	-	-	-	-	-	3,207	
15	5792501	LM-16D Rework 2021	3L		7	3,200	-	-	-	-	-	-	3,207	
16	5792502	MCDI TC-11N Rework 2021	3L		9	3,200	-	-	-	-	-	-	3,209	
17	5792503	MCDI TC-6S Rework 2021	3L		2	3,200	-	-	-	-	-	-	3,202	
18	5793478	2023 GRC WELL - Drilling (GSSTOR)	3L	Dec-2023	-	-	-	19,052	46,185	33,237	-	-	98,473	
19	5793485	2023 GRC WELL - Reworks (GSSTOR)	3L		-	-	64,735	82,795	76,424	7,091	7,249	-	238,294	
20	5793489	2023 GRC WELL-Cntrl&Cont Monit (GTLTRAN)	3L		-	-	309	1,376	7,580	-	-	-	9,265	
21	5793491	2023 GRC WELL-Repair & Replace(GTLTRAN)	3L		-	-	21,400	-	-	-	-	-	21,400	
22	5793813	LMAC-1 Rework	3L		6	3,200	-	-	-	-	-	-	3,206	
23	5793819	McD-Pad Improvement_Res_2021	3L		-	3,250	-	-	-	-	-	-	3,250	
24	5793820	McD WS-1E Redrill(need to change to 3L1)	3L		0	4,000	-	-	-	-	-	-	4,000	
25	5793868	McD WS-2W Rework	3L		1	3,200	-	-	-	-	-	-	3,201	
26	5793926	2021 3L1 Gap	3L	Dec-2021	-	4,000	-	-	-	-	-	-	4,000	
27	Total				2,471	85,815	86,444	103,223	130,189	40,327	7,249	-	455,719	
28	Grand Total				2,471	85,815	86,444	103,223	130,189	40,327	7,249	-	455,719	

* Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Workpaper Table 7-20
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 7
 Asset Family – Storage
 Recorded and Forecast Capital Expenditures Details - Other Work*
 (Thousands of Nominal Dollars)

Line No.	MWC	MWC Description	Capital Expenditures										Reference			
			2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast		2026 Forecast		
1	3L	Gas Trans Storage Wells	24,128	26,380	48,284	71,361	67,359	2,194	-	-	-	-	-	-	-	-
2	Grand Total		24,128	26,380	48,284	71,361	67,359	2,194	-	-	-	-	-	-	-	-

3 * Excludes projects greater than \$3M

Workpaper Table 7-21
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 7, Asset Family - Storage
Summary of Capital Expenditures

Gas Storage Capital Expenditures																	
Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference	Notes
1	WELL - Drilling	3L	3L1	-	-	-	-	-	4,980,000	-	19,041,964	46,171,430	33,219,772	-	96,433,166	WP 7-26 Lines 2-5	
2	WELL - Reworks	3L	3L3	21,159,114	24,525,356	33,114,115	62,383,708	50,406,563	60,560,000	64,735,448	82,411,427	76,088,830	7,308,437	7,471,415	173,280,109	WP 7-29 Lines 2-5	
3	WELL - Repair and Replace	3L	3L4	2,102,793	1,997,180	11,576,161	1,110,652	18,798,875	21,300,000	21,400,000	-	-	-	-	-	-	
4	WELL - Conts. &Conts. Monitoring	3L	3L5	866,213	111,742	3,813,513	8,447,405	2,580,723	1,169,000	308,999	1,375,955	7,580,138	-	-	8,956,093	WP 7-33 Line 3	1
5	Total Capital Expenditures			24,128,120	26,634,278	48,503,789	71,941,765	71,786,161	88,009,000	86,444,447	102,829,345	129,840,398	40,528,209	7,471,415	280,669,368		

Notes

(1) 3L4 is used for planned replacement projects and is not forecasted for this rate case period. It may be used should an emergent replacement be necessary or closeout costs that carry over into 2023.

Workpaper Table 7-22
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
New Storage Well Drilling Project Cost Calculator
Summary - MAT 3L1

Line No.	Year	Drilling Costs Ref WP 7-28	Ancillary Costs Ref WP 7-27	Total Cost	Reference
1	2020	-	-		
2	2023	\$19,041,964	\$0	\$19,041,964	WP 7-25 Line 1
3	2024	\$25,975,777	\$20,195,653	\$46,171,430	WP 7-25 Line 1
4	2025	\$33,219,772	\$0	\$33,219,772	WP 7-25 Line 1
5	2026	\$0	\$0	\$0	WP 7-25 Line 1

Workpaper Table 7-23
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
New Storage Well Drilling Project Cost Calculator
MAT 3L1

Line No.	Year	Escalation	Unit Cost	Units ⁽¹⁾	Cost	Reference
1	2020		\$5,996,937			
2	2023	1.058427157	\$6,347,321	3	\$19,041,964	WP 7-26 Line 2
3	2024	1.082876825	\$6,493,944	4	\$25,975,777	WP 7-26 Line 3
4	2025	1.107891279	\$6,643,954	5	\$33,219,772	WP 7-26 Line 4
5	2026	1.132597255	\$6,792,115	0	\$0	WP 7-26 Line 5

6 ⁽¹⁾ The costs reflected are restricted to the wellbore and do not include associated pipeline or auxiliary processing equipment

7 STORAGE WELL NEW WELL DRILLING:

8 WELLHEAD INSTALL, DRILLING AND WELLBORE COMPLETION, DOWNHOLE SAFETY VALVE, TUBING & PACKER INSTALLATION (35 Rig Days)

Line No.	Description	Unit (\$)	Quantity	Unit	Total (\$)	Source of Data
9	Wellhead & Flow Arm					
10	Wellhead Replacement	320,000	1	wellhead	320,000	Vendor Quote
11	4.5" Steel Pipe (~80')	30,000	1	per well	30,000	Vendor Quote
12	Flow arm fabrication	60,000	1	job	60,000	GTGC Labor
13	As-builing	80,000	1	job	80,000	Internal Labor
14	Total for Wellhead & Flow Arm				490,000	
15						
16						
17	Well Completion, DHSV, T&P Install	790,000	1	job	790,000	Vendor Quote
18	Down Hole Safety Valve					
19	9-5/8" Packer Assembly					
20	Liner Assembly					
21	Pressure Testing x2					
22	Gravel Packing/Filtration					
23	5 1/2" or 7" Steel Tubing	35	6,000	feet	210,000	Vendor Quote
24						
25	Total for DHSV & Rate Restoration				1,000,000	
26						
27						
28	Cementing & Production Casing String					
29	9-5/8" Steel Casing	35	6,000	feet	210,000	Vendor Quote
30	13"-3/8" Steel Casing	50	1,000	feet	50,000	Vendor Quote
31	Cement Blends	236,000	1	per well	236,000	Vendor Quote
32	Remedial Squeezes	25,000	1	per well	25,000	Vendor Quote
33	Total for Cementing & Production Casing				471,000	
34						
35	Rig Drilling & Remaining Cost					
36	Rig	30,000	15	daily	450,000	Vendor Quote
37	Drilling Rig Daily Rate	100,000	1	job	100,000	Vendor Quote
38	Rework Rig Daily Rate	27,500	20	daily	550,000	Vendor Quote
39	Rework Mobilization	50,000	1	job	50,000	Vendor Quote
40	Rig Subtotal				1,150,000	
41	Remaining Rework Cost:					
42	Auxiliary Rig Support Services	565,228	1	job	565,228	Vendor Quote
43	(WSM, fishing, crane, rat holes, PU/LD, guard shack, drill bits, etc)					
44	Openhole and integrity logging for wellbore and casing					
45	Fluids & Fluid Handling	189,000	1	job	189,000	Vendor Quote
46	Drilling Fluids	300,000	1	job	300,000	Vendor Quote
47	Fluid transport, storage, and disposal					
48	WSM, Engineering and PM support	2,600	35	daily	91,000	Vendor Quote
49	Day WSM (Incl. Per Diem/ Mileage)	2,600	35	daily	91,000	Vendor Quote
50	Night WSM (Incl. Per Diem/ Mileage)	235,000	1	job	235,000	*subject to internal overhead adjustments
51	Engineering Support (Above/below ground)	125,000	1	job	125,000	*subject to internal overhead adjustments
52	Project management Support					
53	External Consultants/Services Subtotal					
54						
55	Total for Rig and the remaining Rework Cost				542,000	
56						
57						
58						
59						
60						
61						
62	DHSV, Rate Restoration, Rig, & Remaining Rework Total				5,214,728	
63	Overhead Allocations				782,209	15% Overhead allocations were based on internal PG&E standard labor and material factors.
64	Total 2020 Unit Cost				5,996,937	
65						

Workpaper Table 7-24
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
MAT 3L1 Well Drilling - Support Equipment

Line No.	Escalation Rates	1.05843	2023	1.08288	2024	1.10789	2025	1.13260	2026	Reference
1	MAT		-		\$ 6,750,000		-		-	
2	Pipe		-		\$ 500,000		-		-	
3	Trench Dewatering		-		\$ 1,200,000		-		-	
4	ILI Configuration/Pigability		-		\$ 5,000,000		-		-	
5	Existing Platform Upgrades		-		\$ 5,200,000		-		-	
6	Pad Build Out		-		\$ 20,195,653		-		-	WP 7-26 Line 3
	3L1 Escalated Total Costs (\$M)		\$0		\$20,195,653		\$0		\$0	

Line No.	Support Equipment for Wells off Platform	Component	Length (ft) /Unit	Cost	Total	Year	estimate
7		Pipe	4500	\$ 1,500	\$ 6,750,000	2024	engineering estimate
8		Trench Dewatering	10	\$ 50,000	\$ 500,000	2024	engineering estimate
9		ILI Configuration/Pigability	1	\$ 1,200,000	\$ 1,200,000	2024	engineering estimate
10		Existing Platform Upgrades	1	\$ 5,000,000	\$ 5,000,000	2024	engineering estimate
11		Pad Build Out	1	\$ 5,200,000	\$ 5,200,000	2024	engineering estimate

Workpaper Table 7-25
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
(Type 2) Storage Well Rework and Retrofit to T&P Project Cost Calculator
MAT 3L3

Line No.	Year	Escalation	Average Unit Cost	Units ⁽¹⁾	Pad Improvement/ Site Prep for Well Work	Cost	Reference
1	2020		\$3,298,355				
2	2023	1.058427157	\$3,491,068	23	\$2,116,854	\$82,411,427	WP 7-25 Line 2
3	2024	1.082876825	\$3,571,712	21	\$1,082,877	\$76,088,830	WP 7-25 Line 2
4	2025	1.107891279	\$3,654,219	2	\$0	\$7,308,437	WP 7-25 Line 2
5	2026	1.132597255	\$3,735,708	2	\$0	\$7,471,415	WP 7-25 Line 2

⁽¹⁾ The units noted are based on performing well reworks at Los Medanos and McDonald Island storage fields. 2 emergent wells are factored into the count for each year. Well Pad Improvement work is included to allow for work to be executed and sites to be accessed by construction equipment.

Line No.	Year	Facility		Emergent	Total Well Units ⁽²⁾
		McDonald Island	Los Medanos		
9					
10	2023	17	4	2	23
11	2024	15	4	2	21
12	2025	0	0	2	2
13	2026	0	0	2	2

⁽²⁾The units projected are based on the January 15, 2021 Revised Implementation Plan submitted to CalGEM for approval. The units are subject to change based on feedback or revised guidance mandated by the agency.

Line No.	Unit Cost Calculator	Reference
18		
19	Type 2 Well Unit Cost	\$4,274,591 WP 7-30 Line 63
20	Type 1a Well Unit Cost	\$3,145,360 WP 7-31 Line 57
21	Type 1 Well Unit Cost	\$2,475,113 WP 7-32 Line 53
22	Average Unit Cost	\$3,298,355

Workpaper Table 7-26
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
(Type 2) Storage Well Rework and Retrofit to T&P Project Cost Calculator
MAT 3L3

Line No.	Year	Escalation	Well Unit Cost
1	2020		\$4,274,591
2	2023	1.058427157	\$4,524,344
3	2024	1.082876825	\$4,628,856
4	2025	1.107891279	\$4,735,783
5	2026	1.132597255	\$4,841,390

Line No.	STORAGE WELL REWORK, TYPE 2:	Unit (\$)	Quantity	Unit	Total (\$)	Source of Data
9	Wellhead & Flow Arm					
10	Wellhead Replacement	280,000	1	wellhead	280,000	Vendor Quote
11	4.5" Steel Pipe (~80')	30,000	1	per well	30,000	Vendor Quote
12	Flow arm fabrication	60,000	1	job	60,000	GTGC Labor
13	As-builtting	80,000	1	job	80,000	Internal Labor
14	Total for Wellhead & Flow Arm				450,000	
15						
16	DHSV, Rate Restoration, & Packer Assembly					
17	Down Hole Safety Valve	900,000	1	job	900,000	Vendor Quote
18	(E) Liner Retrieval/Fishing					
19	7" Packer Assembly					
20	Slim-Pak Liner Assembly					
21	Pressure Testing x2					
22	Cement Cleanout/Casing Scraping					
23	Underreaming					
24	Gravel Packing/Filtration					
25	4.5" Steel Tubing	17	5,000	feet	85,000	Vendor Quote
26						
27	Total for DHSV & Rate Restoration				985,000	
28						
29	Remedial Cementing & Inner String					
30	7" Steel Casing (Inner String)	35	5,000	feet	175,000	Vendor Quote
31	Float Equip / Centralizer	85,000	1	per well	85,000	Vendor Quote
32	Cement Blend	100,000	1	per well	100,000	Vendor Quote
33	Remedial Cement Squeeze Job	25,000	1	job	25,000	Vendor Quote
34	Total for Wellhead & Flow Arm				285,000	
35						
36	Rig & Remaining Rework Cost					
37	Rig	27,500	35	daily	962,500	Vendor Quote
38	Daily Rate Mobilization	50,000	1	job	50,000	Vendor Quote
39	Rig Subtotal				1,012,500	
40						
41	Remaining Rework Cost:					
42	Auxiliary Rig Support Services					
43	(WSM, fishing, crane, rat holes, PU/ LD, guard shack, drill bits, etc)	235,936	1	job	235,936	Vendor Quote
44						
45	Integrity logging for newly placed inner string					
46						
47	Fluids & Fluid Handling					
48	Drilling Fluids	70,000	1	job	70,000	Vendor Quote
49	Fluid transport, storage, and disposal	120,000	1	job	120,000	Vendor Quote
50						
51	WSM, Engineering and PM Support Services					
52	Day WSM (Incl. Per Diem/ Mileage)	2,600	35	daily	91,000	Vendor Quote
53	Night WSM (Incl. Per Diem/ Mileage)	2,600	35	daily	91,000	Vendor Quote
54	Engineering Support (Above/below ground)	125,000	1	job	125,000	*subject to internal overhead adjustments
55	Project Management Support	125,000	1	job	125,000	*subject to internal overhead adjustments
56	Services Subtotal				432,000	
57						
58	Total for Rig and the remaining Rework Cost				1,997,036	
59						
60						
61	DHSV, Rate Restoration, Rig, & Remaining Rework Total				3,717,036	
62	Overhead Allocations				557,555	15% Overhead allocations were based on internal PG&E standard labor and material factors.
63	Total 2020 Unit Cost				4,274,591	WP 7-29 Line 19
64						

Workpaper Table 7-27
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7. Asset Family - Storage
(Type 1a) Storage Well Rework and Retrofit to T&P Project Cost Calculator
MAT 3L3

Year	Escalation	Unit Cost
2020		\$3,145,360
2023	1.058427157	\$3,329,135
2024	1.082876825	\$3,406,038
2025	1.107891279	\$3,484,717
2026	1.132597255	\$3,562,427

Line No.	Year	Escalation	Unit Cost	Unit (\$)	Quantity	Unit	Total (\$)	Source of Data
6	STORAGE WELL REWORK, TYPE 1a:							
7	WELLHEAD REPLACEMENT, DOWNHOLE SAFETY VALVE REPLACEMENT and RATE RESTORATION, TUBING & PACKER CONVERSION (20 Rig Days)							
8	Wellhead & Flow Arm							
10			Wellhead Replacement	280,000	1	wellhead	280,000	Vendor Quote
11			4.5" Steel Pipe (~80')	30,000	1	per well	30,000	Vendor Quote
12			Flow arm fabrication	60,000	1	job	60,000	GTGC Labor
13			As-building	80,000	1	job	80,000	Internal Labor
14			Total for Wellhead & Flow Arm				450,000	
15								
16			DHSV, Rate Restoration, & Packer Assembly	750,000	1	job	750,000	Vendor Quote
17			Down Hole Safety Valve					
18			(E) Liner Retrieval /Fishing					
19			8-5/8" Packer Assembly					
20			8-5/8" Liner Assembly					
21			Pressure Testing x2					
22			Underreaming					
23			Gravel Packing/Filtration					
24			4.5" Steel Tubing	17	5,000	feet	85,000	Vendor Quote
25								
26			Total for DHSV & Rate Restoration				835,000	
27								
28			Rig & Remaining Rework Cost					
29			Rig	27,500	20	daily	550,000	Vendor Quote
30			Daily Rate	50,000	1	job	50,000	Vendor Quote
31			Mobilization				600,000	
32			Rig Subtotal					
33			Remaining Rework Cost:					
34			Auxiliary Rig Support Services	216,096	1	job	216,096	Vendor Quote
35			(WSM, fishing, crane, rat holes, PU/ LD, guard shack, drill bits, etc)					
36								
37			Wireline Services (Chemical Cut, Perforation, freepoint/backoff)	90,000	1	job	90,000	Vendor Quote
38							306,096	
39			Fluids & Fluid Handling	70,000	1	job	70,000	Vendor Quote
40			Drilling Fluids	120,000	1	job	120,000	Vendor Quote
41			Fluid transport, storage, and disposal				190,000	
42			WSM, Engineering and PM Support Services	2,600	20	daily	52,000	Vendor Quote
43			Day WSM (Incl. Per Diem/ Mileage)	2,600	20	daily	52,000	Vendor Quote
44			Night WSM (Incl. Per Diem/ Mileage)	125,000	1	job	125,000	*subject to internal overhead adjustments
45			Engineering Support (Above/below ground)	125,000	1	job	125,000	*subject to internal overhead adjustments
46			Project Management Support				354,000	
47			Services Subtotal					
48								
49								
50			Total for Rig and the remaining Rework Cost				1,450,096	
51								
52								
53								
54								
55			DHSV, Rate Restoration, Rig, & Remaining Rework Total				2,735,096	
56			Overhead Allocations				410,264	15% Overhead allocations were based on internal PG&E standard labor and material factors.
57			Total 2020 Unit Cost				3,145,360	WP 7-29 Line 20
58								

Workpaper Table 7-28
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
(Type 1) Storage Well Rework and Retrofit to T&P Project Cost Calculator
MAT 3L3

Year	Escalation	Unit Cost
2020		\$2,475,113
2023	1.058427157	\$2,619,727
2024	1.082876825	\$2,680,242
2025	1.107891279	\$2,742,156
2026	1.132597255	\$2,803,306

Line No.	Year	Escalation	Unit Cost	Unit	Quantity	Unit (\$)	Unit	Total (\$)	Source of Data
6	STORAGE WELL REWORK, TYPE 1:								
7	WELLHEAD REPLACEMENT, DOWNHOLE SAFETY VALVE REPLACEMENT, TUBING & PACKER CONVERSION (17 Rig Days)								
8	Wellhead & Flow Arm								
9			280,000	wellhead	1	280,000		280,000	Vendor Quote
10			30,000	per well	1	30,000		30,000	Vendor Quote
11			60,000	job	1	60,000		60,000	GTGC Labor
12			80,000	job	1	80,000		80,000	Internal Labor
13									
14								450,000	
15									
16			360,000	job	1	360,000		360,000	Vendor Quote
17									
18									
19									
20									
21			17	feet	5,000	85,000		85,000	Vendor Quote
22									
23								445,000	
24									
25									
26									
27			27,500	daily	17	467,500		467,500	Vendor Quote
28			50,000	job	1	50,000		50,000	Vendor Quote
29								517,500	
30									
31			181,372	job	1	181,372		181,372	Vendor Quote
32									
33									
34									
35			30,000	job	1	30,000		30,000	Vendor Quote
36								211,372	
37									
38			70,000	job	1	70,000		70,000	Vendor Quote
39			120,000	job	1	120,000		120,000	Vendor Quote
40								190,000	
41									
42			2,600	daily	17	44,200		44,200	Vendor Quote
43			2,600	daily	17	44,200		44,200	Vendor Quote
44			125,000	job	1	125,000		125,000	*subject to internal overhead adjustments
45			125,000	job	1	125,000		125,000	*subject to internal overhead adjustments
46								338,400	
47									
48								1,257,272	
49									
50									
51								2,152,272	
52								322,841	15% Overhead allocations were based on internal PG&E standard labor and material factors.
53								2,475,113	WP 7-29 Line 21
54									

Workpaper Table 7-29
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
MAT 3L5 Well Controls Monitoring

Line No.

Escalation Rates	1.05843	1.08288	1.10789	1.13260
MAT	2023	2024	2025	2026
3L5 Escalated Total Costs (\$M)	\$1,375.96	\$7,580.14	\$0.00	\$0.00

WP 7-25 Line 4

Activity	2023	2023	2023	2023
Remote Well Controls Operation and Monitoring (closeout costs)	\$ 300	\$ -	\$ -	\$ -
Los Medanos Controls Replacement Engineering and Design	\$ 1,000			
Los Medanos Controls Replacement Installation		\$ 7,000	\$ -	\$ -

engineering estimate

engineering estimate

engineering estimate

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROJECT SUMMARY – WELL DRILLING**

Program Title: Well Drilling

Major Work Categories: MWC 3L (MAT 3L1)

Planning Order Numbers: 3L1 - 5793478

Program Start Date: ongoing

Program Completion Date: ongoing

Operative Date (only applies to Capital): Operative as installed

Program Description

All work required to drill wells or redrill (replace) wells, including installation and cementing of production tubing, gravel pack completion, tubing and packer installation, wellhead components and any ancillary or surface equipment required.

PG&E anticipates drilling 3 additional wells at McDonald Island in 2023 and potentially up to 9 wells 2024-2025.

For further details see Exhibit (PG&E-3), Chapter 7, Section B.8.a

Justification

The driver to perform this work is implementation of new regulations from the Pipeline and Hazardous Material Safety Administration (PHMSA) at the federal level and from CalGEM (previously DOGGR) at the state level related to the underground natural gas facilities. Drilling of new wells offsets the withdrawal and injection capacity lost by converting wells to tubing and packer in alignment with the CalGEM construction standard and are required to maintain deliverability requirements. Drilling of new wells offsets the residual outage impacts from wells being unavailable due to the frequency of inspection required per the regulations. Additional wells may also be required should integrity inspections require permanent abandonment of existing wells. (Exhibit (PG&E-3), Chapter 7, Section B.3.)

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROJECT SUMMARY – WELL DRILLING**

Cost

Each MAT code had varying forecast methodologies. See Exhibit (PG&E-3) Chapter 7, Section B.8.b for details.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
CAPITAL														
MAT 3L1	-	-	-	-	-	4,980	-	19,042	46,171	33,220			103,413	WP 7-25 Line 1
Capital Total	-	-	-	-	-	4,980	-	19,042	46,171	33,220	-		103,413	
TOTAL PROJECT COST	-	-	-	-	-	4,980	-	19,042	46,171	33,220	-		103,413	

Additional Cost Information:

Please see Exhibit (PG&E-3), WP 7-26 to WP 7-28 for specific details regarding the cost assumptions and forecast for Drilling New Wells.

Benefits

Additional wells provide reliability benefits as discussed in Chapter 7 testimony.

Alternatives Considered

Alternatives considered are discussed in detail in WP 7-48 as part of the NGSS.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROGRAM SUMMARY – WELL REWORKS AND RETROFITS**

Program Title: Well Reworks and Retrofits

Major Work Categories: MWC 3L (MAT 3L3), AH (MAT AH2)

Planning Order Numbers: 5793485

Program Start Date: ongoing

Program Completion Date: ongoing

Operative Date (only applies to Capital): Operative as installed

Program Description

This program includes: retrofit, repair, or assessment of the storage well to (a) mitigate single point of failure, i.e. tubing and packer(T&P); (b) assess the condition of a well; or (c) perform corrective work. All work required for gas storage well reworks, including installation of downhole safety valves, installation or replacement of packer, replacement of gravel pack, tubing and casing tubular, wellhead components, and replacing rework equipment. PG&E's approach couples the well conversion with the well casing assessment as it is the most efficient way to conduct the work and mitigates risk by not having to perform similar activity. The pace of this work is currently pending CalGEM approval.

For further details see Exhibit (PG&E-3), Chapter 7, Section B.5.a.

Justification

The driver to this work is implementation of new regulations from the Pipeline and Hazardous Material Safety Administration (PHMSA) at the federal level and from CalGEM (previously DOGGR) at the state level related to the underground natural gas facilities. (Exhibit (PG&E-3), Chapter 7, Section B.3.)

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROGRAM SUMMARY – WELL REWORKS AND RETROFITS**

Cost

Each MAT code had varying forecast methodologies. See Exhibit (PG&E-3), Chapter 7, Section B.5.b.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
CAPITAL														
MAT 3L3	21,159	24,525	33,114	62,384	50,407	60,560	64,735	82,411	76,089	7,308	7,471	490,163	WP 7-25 Line 2	
Capital Total	21,159	24,525	33,114	62,384	50,407	60,560	64,735	82,411	76,089	7,308	7,471	490,163		
EXPENSE														
MAT AH2	-	3,092	(262)	10	0	-	-	-	-	-	-	19,835	22,675	WP 7-5 Line 3
Expense Total	-	3,092	(262)	10	0	-	-	-	-	-	-	19,835	22,675	
TOTAL PROJECT COST	21,159	27,617	32,853	62,393	50,407	60,560	64,735	82,411	76,089	7,308	7,471	512,838		

Additional Cost Information:

Please see Exhibit (PG&E-3), WP 7-11, WP 7-29 to WP 7-32 for specific details regarding the cost assumptions and forecast for Drilling New Wells.

Benefits

These work activities aid in maintaining the reliability of storage operations and safety related to the well assets.

Alternatives Considered

The pace that is proposed to perform this work allows PG&E to meet the regulatory requirements while maintaining deliverability requirements and mitigating risks related to overly frequent repeat intervention activities. Additionally, coupling the conversion work and the inspection activity is the most efficient means to meet the dual barrier CalGEM construction standard and inform on well casing condition. PG&E is awaiting review and approval by CalGEM of PG&E's risk-based, alternative schedule as opposed to the default regulation of performing inspection activity at a reoccurring 24-month frequency that would significantly impact PG&E's ability to meet deliverability needs with extensive well outages. The default 24-month frequency would incur exponentially greater costs to perform the same work and would require half of PG&E's wells to be inspected every other year and would render it nearly impossible to provide a storage service at this pace.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROGRAM SUMMARY – RISK CONTROL AND MITIGATION**

Program Title: Risk Control and Mitigation

Major Work Categories: MWC 3L (MAT 3L5)

Planning Order Numbers: 3L5 – 5793489

Program Start Date: ongoing

Program Completion Date: ongoing

Operative Date (only applies to Capital): Operative as installed

Program Description

This program includes the installation of monitoring and control devices such as equipment for annular monitoring, injection measurement and replacement of well controls and valves for injection and withdrawal operation. Costs for overflow protection are included here.

For further details see Exhibit (PG&E-3), Chapter 7, Section B.9.a.

Justification

The driver to this work is associated with the retention of the Los Medanos facility and the need to replace the well control systems at the Los Medanos well pad due to obsolescence. (Exhibit (PG&E-3), Chapter 7, Section B.9.a).

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 7, ASSET FAMILY – STORAGE
PROGRAM SUMMARY – RISK CONTROL AND MITIGATION**

Cost

Each MAT code had varying forecast methodologies. See Exhibit (PG&E-3) Chapter 7, Section B.9.b for details.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
CAPITAL													
MAT 3L5	866	112	3,814	8,447	2,581	1,169	309	1,376	7,580	-	-	26,254	WP 7-25 Line 4
Capital Total	866	112	3,814	8,447	2,581	1,169	309	1,376	7,580	-	-	26,254	
TOTAL PROJECT COST	866	112	3,814	8,447	2,581	1,169	309	1,376	7,580	-	-	26,254	

Additional Cost Information:

Please see Exhibit (PG&E-3), WP 7-33 for specific details regarding the cost assumptions and forecast for Risk Controls and Mitigation.

Benefits

The equipment replacement will maintain reliability and safe operations of the wells and reservoir.

Alternatives Considered

Replacement of the controls is required with the retention of Los Medanos under the scenarios discussed in Exhibit (PG&E-3) WP 7-48 as part of the NGSS.

**Workpaper Table 7-30
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Capital Recorded Walk by MWC - Storage
(Thousands of Nominal Dollars)**

Line No.	Year	Amount	MWC 3L	Detailed Description/Explanation
1	2016	24,128	24,128	
2			2,506	Well unit inspections per year differ as well as cost escalation.
3	2017	26,634	26,634	
4			21,870	Well unit inspections per year differ as well as cost escalation.
5	2018	48,504	48,504	
6			23,438	Well unit inspections per year differ as well as cost escalation.
7	2019	71,942	71,942	
8			(156)	Well unit inspections per year differ as well as cost escalation.
9	2020	71,786	71,786	

Note: Total amounts and amounts for each MWC are obtained from WP 7-25 by summing the relevant lines for each MWC.

Workpaper Table 7-31
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Capital Walk by Major Work Category
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 3L	Detailed Description/Explanation
1	2020	71,786	71,786	
2			16,223	Well unit inspections per year differ as well as cost escalation.
3	2021	88,009	88,009	
4			(1,565)	Well unit inspections per year differ as well as cost escalation.
5	2022	86,444	86,444	
6			16,385	Well unit inspections per year differ as well as cost escalation. Wells are planned for drilling.
7	2023	102,829	102,829	
8			27,011	Well unit inspections per year differ as well as cost escalation. Wells are planned for potential drilling.
9	2024	129,840	129,840	
10			(89,312)	Well unit inspections per year differ as well as cost escalation, major conversion activity completed in 2024 and reinspections are not yet planned to occur in this year. Wells are planned for potential drilling.
11	2025	40,528	40,528	
12			(33,057)	Well unit inspections per year differ as well as cost escalation. Reinspections are planned to potentially begin based on a 7-year reinspection cycle pending PHMSA FAQs publication clarifying.
13	2026	7,471	7,471	

Note: Total amounts and amounts for each MWC are obtained from WP 7-25 by summing the relevant lines for each MWC.

Workpaper Table 7-32
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Gas Storage Balancing Account Expense Summary
(Thousands of Nominal Dollars)

Line No.	Description	MWC	MAT	2019 Recorded	2020 Recorded	2019-2020 Recorded	Reference
1	WELL - Integrity Assessments	AH	AH1	\$3,086	\$4,064	\$7,151	WP 7-43, Line 6
2	WELL - Reworks	AH	AH2	\$10	\$0	\$10	WP 7-43, Line 8
3	WELL - Other	AH	AH3	\$881	\$284	\$1,165	WP 7-43, Line 12
4	Engineering & Support	AH	AH#	\$1,251	\$1,368	\$2,619	WP 7-43, Line 14
5	Total Expenses			\$ 5,228	\$ 5,717	\$ 10,945	

Workpaper Table 7-33
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Gas Storage Balancing Account Expense Details
(Thousands of Nominal Dollars)□

Line No.	Description	MAT	2019 Recorded	2020 Recorded	2019-2020 Recorded
1	Noise/Temperature	AH1	\$978	\$436	\$1,414
2	Specialty Logging	AH1	\$191	\$200	\$392
3	Storage Wellbore Surveys & Assessments	AH1	\$0	\$2,211	\$2,211
4	Thru-Tubing	AH1	\$1,890	\$1,217	\$3,107
5	Well-Other	AH1	27	1	28
6		Total AH1	\$3,086	\$4,064	\$7,151
7	Misc Closeout	AH2	\$10	\$0	\$10
8		Total AH2	\$10	\$0	\$10
9	CARB O&G	AH3	\$0	\$0	\$0
10	Emergency Response Planning	AH3	\$85	\$110	\$196
11	Engineering & Support	AH3	\$795	\$174	\$969
12		Total AH3	\$881	\$284	\$1,165
13	Engineering & Program Support	#	\$1,251	\$1,368	\$2,619
14		Total AH#	\$1,251	\$1,368	\$2,619
15	Total Expenses		\$5,228	\$5,717	\$10,945

Workpaper Table 7-34
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Gas Storage Balancing Account Capital Summary
(Thousands of Nominal Dollars)□

Line No.	Description	MWC	MAT	2019 Recorded	2020 Recorded	2019-2020 Recorded	Reference
1	WELL - Reworks	3L	3L3	\$62,384	\$50,407	\$112,790	WP 7-46, Line 41
2	WELL - Repair and Replace	3L	3L4	\$1,111	\$18,799	\$19,910	WP 7-43, Line 45
3	WELL - Cntrls & Conds Monitrng	3L	3L5	\$8,447	\$2,581	\$11,028	WP 7-43, Line 49
4	Total Capital			\$ 71,942	\$ 71,786	\$ 143,728	

Workpaper Table 7-35
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 7, Asset Family - Storage
Gas Storage Balancing Account Capital Details
(Thousands of Nominal Dollars)

Line No.	Description	MAT	2019 Recorded	2020 Recorded	2019-2020 Recorded
1	2019 Well Tild-1 Rework (P&A)	3L3	\$3,597	\$634	\$4,230
2	2019 Well LM-15C Rework	3L3	\$2,047	\$110	\$2,157
3	2019 Well LM-4B Rework (P&A)	3L3	\$2,071	\$501	\$2,571
4	2019 Well PC 4-1 Rework (P&A)	3L3	\$2,206	\$310	\$2,516
5	2019 Well Rob-1 Rework (P&A)	3L3	\$644	\$672	\$1,316
6	2019 Well TC-12S Rework	3L3	\$1,910	\$148	\$2,058
7	2019 Well TC-2S Rework	3L3	\$5,688	\$385	\$6,073
8	2019 Well TC-7S Rework	3L3	\$2,194	\$170	\$2,364
9	2019 Well WS-11E Rework	3L3	\$2,221	-\$64	\$2,158
10	2019 Well WS-14E Rework	3L3	\$5,549	-\$773	\$4,777
11	2019 Well WS-6E Rework	3L3	\$6,762	-\$1,840	\$4,922
12	2019 Well WS-7W Rework	3L3	\$4,229	\$286	\$4,514
13	2019 Well WS-8E Rework	3L3	\$5,155	\$676	\$5,832
14	2019 Well Zuck-1 Rework	3L3	\$6,087	-\$8	\$6,079
15	2019 Well Zuck-3 Rework	3L3	\$3,195	\$792	\$3,987
16	2020 Well LM-11C Rework	3L3	\$0	\$1,533	\$1,533
17	2020 Well LM-1A Rework	3L3	\$0	\$1,304	\$1,304
18	2020 Well LM-20D Rework	3L3	\$0	\$1,505	\$1,505
19	2020 Well McD-10 Rework	3L3	\$224	\$438	\$662
20	2020 Well McD-11 Rework	3L3	\$223	\$2,421	\$2,645
21	2020 Well McD-12 Rework	3L3	\$0	\$2,966	\$2,966
22	2020 Well Rob-2 Rework	3L3	\$153	\$1,180	\$1,334
23	2020 Well TC-10S Rework	3L3	\$0	\$3,283	\$3,283
24	2020 Well TC-12N Rework	3L3	\$13	\$2,631	\$2,644
25	2020 Well WS-11W Rework	3L3	\$0	\$4,876	\$4,876
26	2020 Well WS-12E Rework	3L3	\$19	\$2,908	\$2,927
27	2020 Well WS-13E Rework	3L3	\$3	\$1,946	\$1,949
28	2020 Well WS-16W Rework	3L3	\$13	\$3,538	\$3,551
29	2020 Well WS-1AE Rework	3L3	\$64	\$2,505	\$2,568
30	2020 Well WS-1E Rework	3L3	\$421	\$2,105	\$2,526
31	2020 Well WS-4E Rework	3L3	\$22	\$2,408	\$2,430
32	2020 Well WS-5E Rework	3L3	\$44	\$1,933	\$1,977
33	2020 Well WS-7E Rework	3L3	\$19	\$1,807	\$1,827
34	2020 Well WS-9E Rework	3L3	\$26	\$1,564	\$1,590
35	2020 Well ZuckHenn-1	3L3	\$24	\$1,593	\$1,616
36	2021 Rework Design	3L3	\$22	\$1,393	\$1,415
37	New Well Locations	3L3	\$59	\$141	\$200
38	Pad Improvement	3L3	\$3,556	-\$262	\$3,294
39	Rework Closeout	3L3	\$3,886	\$2,688	\$6,574
40	Rework Support Equipment	3L3	\$38	\$2	\$40
41	Total 3L3		\$62,384	\$50,407	\$112,790
42	Component Replacement (valve, tank, control)	3L4	\$208	\$173	\$380
43	Turner Cut Pipe Replacement	3L4	\$91	\$1,327	\$1,418
44	Whiskey Slough Pipe Replacement	3L4	\$812	\$17,299	\$18,111
45	Total 3L4		\$1,111	\$18,799	\$19,910
46	CARB O&G	3L5	\$3,085	\$847	\$3,931
47	CalGEM/DOGGR SCADA Install	3L5	\$4,268	\$1,472	\$5,741
48	Component Install/Replacement	3L5	\$1,094	\$262	\$1,356
49	Total 3L5		\$8,447	\$2,581	\$11,028
50	Total Capital		\$ 71,942	\$ 71,786	\$ 143,728

Workpaper Table 7-36
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers
Chapter 7, Asset Family - Storage
Gas Storage Well Abandonment Cost Calculator

This workpaper is provided in support of the below ground decommissioning costs as shown in the NGSS Update testimony.

Line No.	Year	Escalation	Unit Cost	Units	Costs
1	2020	1.0000	\$2,092,422	-	\$0
2	2021	1.0038	\$2,100,373	-	\$0
3	2022	1.0300	\$2,155,193	-	\$0
4	2023	1.0584	\$2,214,676	3	\$6,644,029
5	2024	1.0829	\$2,265,835	3	\$6,797,506
6	2025	1.1079	\$2,318,176	-	\$0
7	2026	1.1326	\$2,369,871	-	\$0

9 Note: The units in 2023 and 2024 represent 6 wells at Pleasant Creek; the units are shown as split Pleasant Creek between 2 years as the planned abandonment year is dependent on pace and recovery of remaining cushion gas.

Line No.	ABANDON WELL: (avg based on historic P&A, ranges from 8-30 days of rig time, 24hrs/day/7days)	Unit (\$)	Quantity	Unit	Total (\$)	Source of Data
10	Cement	110,975	1	job	110,975	Vendor Quote
11	Rig	378,658	1	job	378,658	Vendor Quote
12	Turnkey Rate	0	1	job	0	Vendor Quote
13	Fork lift	2,600	1	job	2,600	Vendor Quote
14	Environment measure	46,191	1	job	46,191	Vendor Quote
15	Misc.	48,014	1	job	48,014	Vendor Quote
16	Additional Equipment (Power Swivel; Mud Pit; Etc.)				48,014	Vendor Quote
17	Rig Subtotal				475,463	
18	Mud System/Transportation	33,672	1	job	33,672	Engineering estimate
19	Mud system	81,525	1	job	81,525	Engineering estimate
20	Delivery/Disposal Transportation				115,197	
21	Mud System/Transportation Subtotal					
22	External Consultants/Services	235	321	hours	75,435	Vendor Quote
23	Day / Safety Consultants	98,947	1	job	98,947	Vendor Quote
24	Engineering Consultants	94,878	1	job	94,878	Vendor Quote
25	Misc.- Contractors, Security, Materials etc.				269,260	
26	External Consultants/Services Subtotal					
27	Internal Labors/Admin.	55	1,124	hours	61,820	*subject to internal overhead adjustments
28	General Construction (Site Prep/Site Restoration)	112	427	hours	47,824	*subject to internal overhead adjustments
29	Reservoir Engineering	112	475	hours	53,200	*subject to internal overhead adjustments
30	Gas Transmission Engineering / Project Management Support	55	992	hours	54,560	*subject to internal overhead adjustments
31	Field Personnel	24,776	1	job	24,776	
32	Misc.				242,180	
33	Internal Labors/Admin. Subtotal					
34	Tubing pickup and lay down service	79,091	1	job	79,091	Engineering estimate
35	Integrity baseline (Cement Bond Logging/Magnetic Flux Leakage/Caliper/Gamma Ray Neutron	267,367	1	job	267,367	Engineering estimate
36	Integrity Press tests (Bridge Plugs; Pumping Services; Etc.)	240,756	1	job	240,756	Engineering estimate
37	Total for Rig and the remaining Rework Cost				1,800,289	
38	Overhead Allocations				292,133	Overhead allocations were based on internal PG&E standard labor and material factors.
39	Total 2020 Unit Cost				2,092,422	

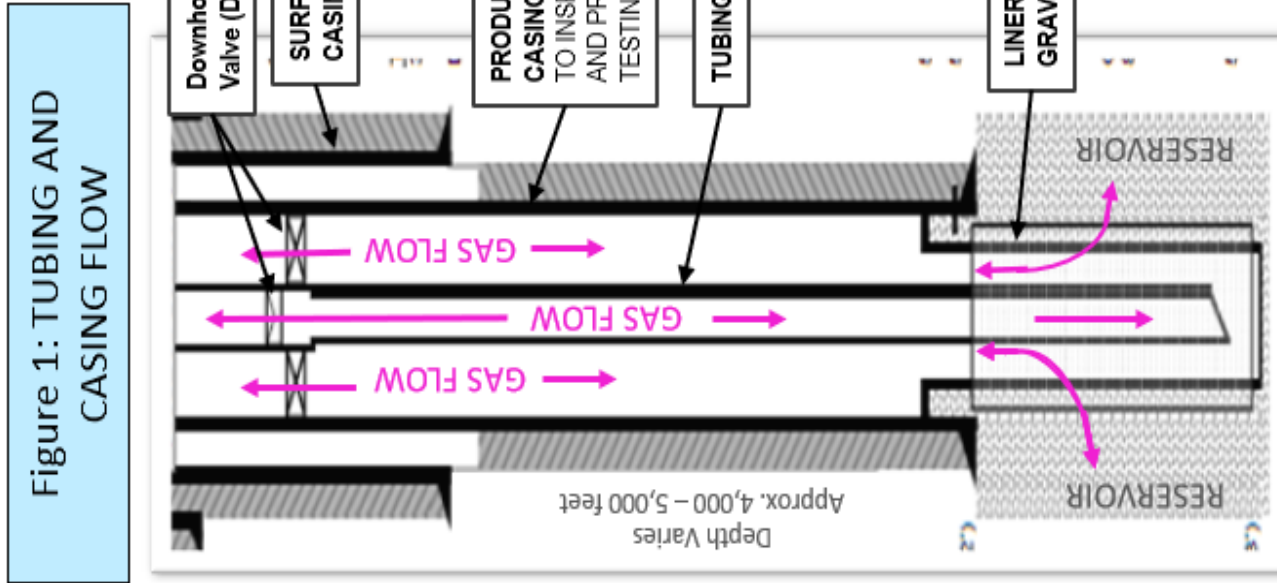


Figure 1: TUBING AND CASING FLOW

Figure 2: TUBING & PACKER, TUBING ONLY FLOW (Type 1 and Type 1a)

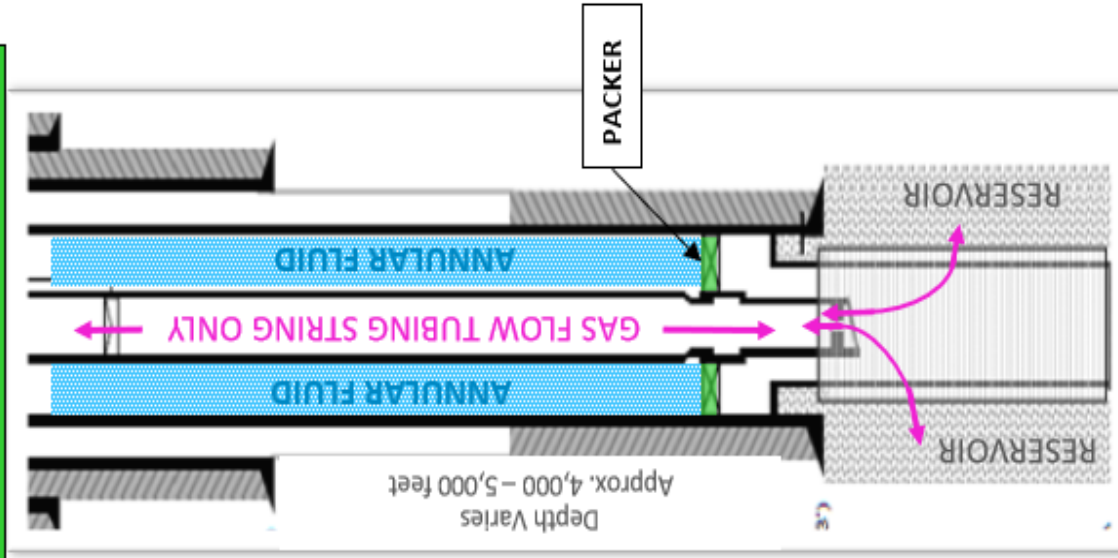
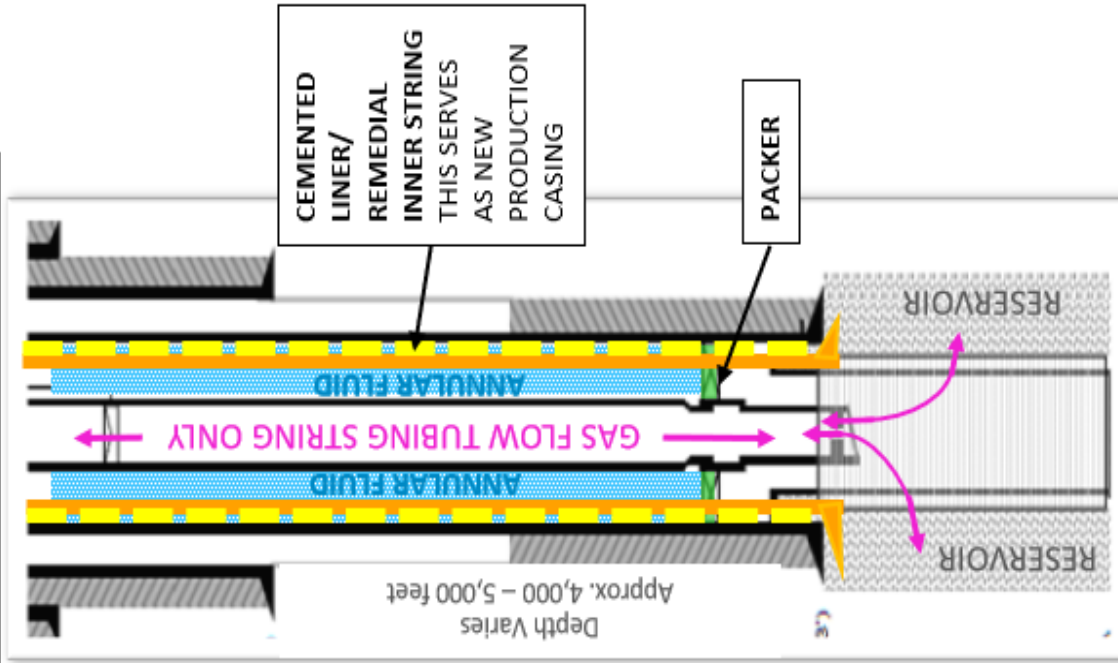


Figure 3: TUBING & PACKER, TUBING ONLY FLOW (Type 2)



Line No.

- 1 **Figure 1** shows PG&E's traditional well configuration that includes gas flow in both the tubing and casing annuli. The production casing is subject to inspection under CalGEM regulations and in order to perform direct inspections and pressure tests in this configuration a rig is required to remove the tubing string, downhole safety valves, and any other downhole equipment installed.
- 2
- 3
- 4 **Figure 2** shows the converted state to meet dual barrier construction requirements per CalGEM regulations, Section 1726.5. Gas flow is restricted to a smaller diameter tubing string only and the casing-tubing annulus space is sealed off with a packer element and fluid. This configuration is the same for both type 1 and type 1a configurations, where type 1a has a new gravel pack and liner installed during the conversion and rework activity.
- 5
- 6
- 7 **Figure 3** shows the converted state of the well in a type 2 configuration. In this type, a new inner string liner is cemented in and the existing production casing is no longer considered a barrier. The new liner is subject to inspection and pressure testing requirements after installation.
- 8

Updated Natural Gas Storage Strategy Peak Day Supply Standard Capacity Shortfall Alternatives Analysis Report

	<u>Table of Contents</u>	<u>Page</u>
1.	Executive Summary	2
2.	Problem Statement	2
	a. 2019 GT&S Rate Case Capacity Forecast.....	2
	b. Updated Supply and Demand Forecasts.....	4
	c. Regulatory Developments Impacting Capacity.....	6
3.	Assumptions for Alternatives Analysis	10
	a. Cross-Compression.....	10
	b. Drilling Costs and Well Pads	11
	c. Well Conversions and Inspection Costs.....	13
	d. Compressor.....	13
	e. Well Controls Replacement.....	13
	f. Security Upgrades	14
	g. Pipeline Expansion.....	14
4.	Analysis of Alternatives	14
	a. Description and Analysis of Alternatives	14
	(1) Alternative A	14
	(2) Alternative B	15
	(3) Alternative C	16
	b. Operational Considerations.....	18
	(1) McDonald Island: Flooding	18
	(2) McDonald Island: Platform Failures.....	18
	(3) McDonald Island: L57A.....	18
	(4) Los Medanos: Areas of Consequence.....	20
	(5) Los Medanos: Supply Diversity	20
	(6) Los Medanos: Resource Management.....	20
5.	Recommendation	21

1. Executive Summary

This report provides a summary and analysis of the capital and operating expenses needed to meet the natural gas storage strategy (NGSS) Peak Day Supply Standard described in Exhibit (PG&E-3), Chapter 7, Section D of the 2023 General Rate Case (GRC) proceeding.

Due to changes in California Department of Conservation, Geological Energy Management (CalGEM)¹ regulations, drilling 11 new wells at McDonald Island as proposed in the 2019 Gas Transmission and Storage (GT&S) Rate Case² no longer satisfies the updated NGSS Peak Day Supply Standards capacity shortfall identified in Exhibit (PG&E-3), Chapter 7, Section D.2 (NGSS Capacity Shortfall). Therefore, PG&E explored three alternatives to find the best alternative to meet this capacity shortfall.

- Alternative A: Drill 3 wells at McDonald Island; restore Gill Ranch capacity by drilling 3 new wells; retain the Los Medanos gas storage facilities; and install cross-compression equipment.
- Alternative B: Drill 16 wells at McDonald Island; restore Gill Ranch capacity by drilling 3 new wells; and install cross-compression equipment.
- Alternative C: Install a new 36 mile, 36-inch pipeline; drill 2 wells at McDonald Island; restore Gill Ranch capacity by drilling 3 new wells; and install cross-compression equipment.

Based on the Economic Analysis Software Package (EASOP) analysis and a detailed review of non-monetary considerations among the three alternatives, it is recommended that PG&E pursue Alternative A as the most cost-effective and manageable solution to meet the NGSS Capacity Shortfall.

2. Problem Statement

a. 2019 GT&S Rate Case Capacity Forecast

In the 2019 GT&S Rate Case, PG&E proposed to eliminate its commodity price service for natural gas storage and to move to a reliability-only focused storage strategy. PG&E made this proposal as a part of the Natural Gas Storage Strategy presented in that proceeding (2019 NGSS). After a thorough review of the 2019 NGSS, the California Public Utilities Commission (CPUC or Commission) determined that PG&E's proposal to focus on a reliability-only storage strategy was "just and reasonable" and thus adopted

¹ CalGEM was previously known as the California Department of Conversation's Division of Oil, Gas and Geothermal Resources or DOGGR.

² The 2019 GT&S Rate Case, which was Application 17-11-009, is referred to in this analysis as the 2019 GT&S Rate Case and Decision (D.) 19-09-025 is referred to as the 2019 GT&S Rate Case Decision.

the 2019 NGSS.³ In the 2019 NGSS, PG&E proposed a Peak Day Supply Standard.⁴ The Peak Day Supply Standard defined a minimum volume of supply that should be available to provide PG&E's service territory with adequate supply quantity and diversity to ensure safe and reliable service and an efficient natural gas market for PG&E customers.

The 2019 NGSS Peak Day Supply Standard was based on a 1-day-in-10-year cold-weather customer demand event, as shown in Figure 1 below. Based on the *2018 California Gas Report* (from the biennium Marquette Design Day study) the 1-day-in-10-year, Core peak day demand was forecasted to be 2,493 million standard cubic feet per day (MMscf/d). The electric generation, industrial, and off-system demands resulted in a total system demand of 4,066 MMscf/d, to which a balancing service of 300 MMscf/d and a reserve service of 250 MMscf/d were added for a total requirement of 4,616 MMscf/d.⁵

Responding to the total customer demand of 4,066 MMscf/d, PG&E overlaid the backbone pipeline capacity assumption of 95% pipeline use and the Redwood path constraint of 2,700 MMscf/d south of Delevan compressor station to derive the required supply volume that needs to be provided by PG&E storage fields, McDonald Island, and PG&E's 25% of Gill Ranch. This resulted in the PG&E storage requirement of 307 MMscf/d for the Core and 550 MMscf/d for the Inventory Management and Reserve Services for a total of 857 MMscf/d.⁶ This is reflected in Figure 1 below.

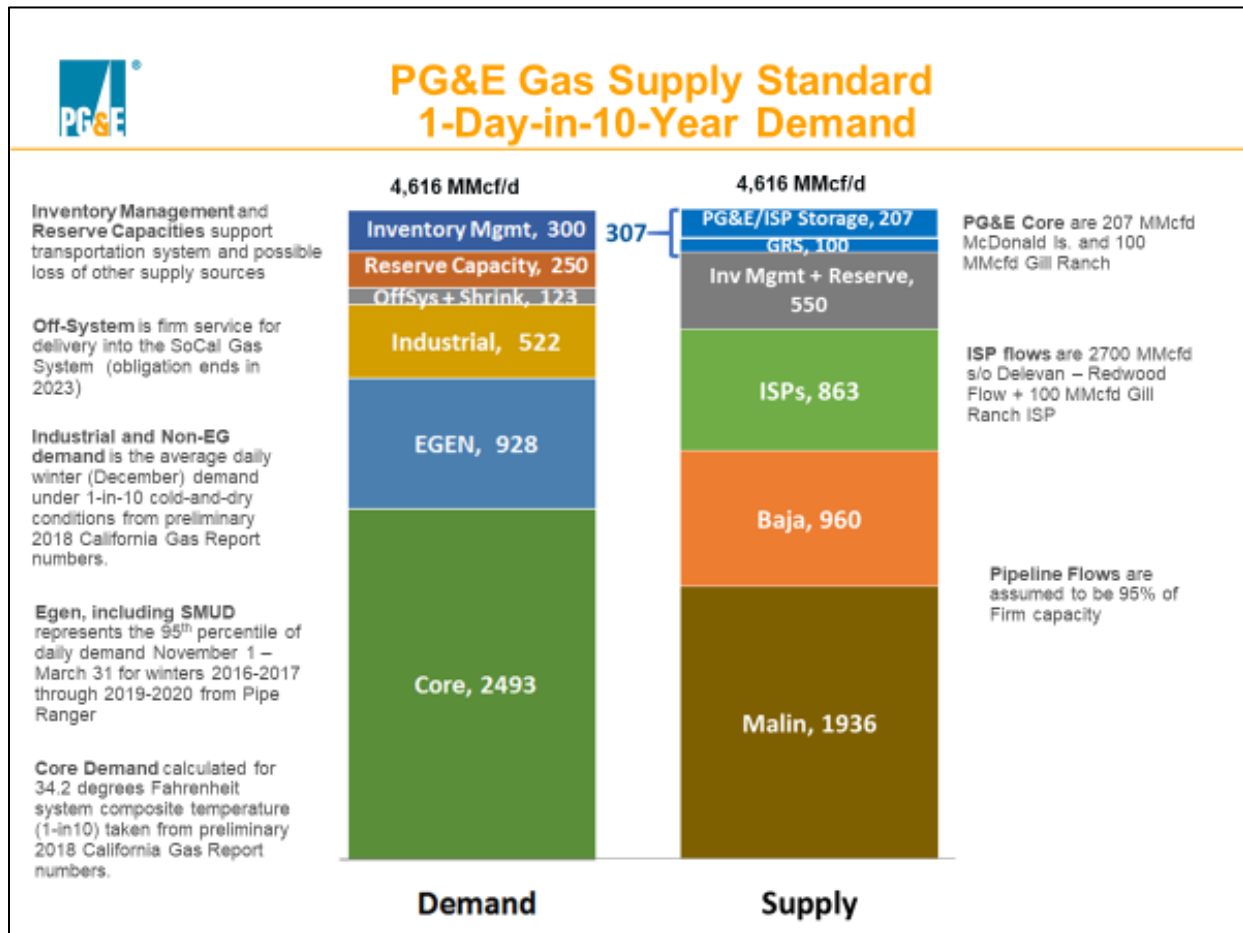
³ D.19-09-025, p. 28.

⁴ In the 2019 GT&S Rate Case, the Peak Day Supply Standard was referred to as the Reliability Standard or the Reliability Supply Standard. Because the standard addresses the supply needs on a peak day, for clarity in this report we are referring to it as the Peak Day Supply Standard.

⁵ D.19-09-025, p. 24, Table 1.

⁶ D.19-09-025, p. 82, Table 6

Figure 1: PG&E Gas Supply Standard 1-Day-in-10-Year Demand



To meet the 857 MMscf/d need identified in the 2019 NGSS analysis described above, PG&E estimated that Gill Ranch could provide 100 MMscf/d and the remaining 757 MMscf/d would be provided from McDonald Island.⁷ However, in order to provide 757 MMscf/d from McDonald Island, 11 additional wells were required at the facility.⁸

b. Updated Supply and Demand Forecasts

Since the 2019 NGSS was first proposed in 2017, some of the underlying supply assumptions have changed and need to be updated including:

1. Originally, for McDonald Island, PG&E assumed that tubing and packer conversions would result in an average of 40% reduction of well capacity after conversion. Furthermore, adjacent well impacts from the conversions were

⁷ D.19-09-025, p. 82, Table 5.

⁸ D.19-09-025, p. 58.

not anticipated to be significant due to a significantly longer period before the well had to be reinspected, ranging up to 15 years.

- a. CalGEM is now indicating a much shorter reinspection period (2–3 years) which will significantly impact the availability of wells at McDonald Island.
2. Originally, PG&E's 25% of Gill Ranch post-conversion withdrawal capacity was assumed to be 100 MMscf/d.
 - a. Currently, the Gill Ranch conversion impact appears to be more significant, reducing withdrawal down to 60 MMscf/d over time.
3. Originally, PG&E assumed that the firm pipeline capacities would remain constant (Redwood path at 2,038 MMscf/d and Baja path at 1,010 MMscf/d) without considering specific pipeline outages or pipeline pressure reduction and de-rates.
 - a. Currently, Baja path firm capacity has dropped to 960 MMscf/d due to PLS2B station's maximum allowable operating pressure (MAOP) de-rate and the Hinkley and Topock compression limitations.

In addition to these changes to the supply forecast, some of the demand assumptions originally used in the 2019 NGSS have changed as well:

1. Originally, the general belief was that climate change would result in a 1-day-in-10-year temperature rising.
 - a. Currently, temperature data from 2018 to 2019 indicates colder-than-normal average temperatures, but the 1-day-in-90-year abnormal peak day (APD) and 1-day-in-10-year probability projections indicate slight cooling of peak day temperatures. Years 2018 and 2019 were colder than normal, which typically increases base load and heat load factors used in the temperature and demand projections. This resulted in increasing the 1-day-in-10-year Core Gas demands and projected future demand growth.
2. Originally, PG&E assumed that renewable electric generation would result in a reduction of gas-fired electric generation demand.
 - b. Currently, data indicates that electric generation annual throughput may be lower but peak day demands are still high due to market economics driving electric generation into the PG&E service territory.

An updated Peak Day Supply Standard analysis is presented in Exhibit (PG&E-3), Chapter 7, Section D. As a result of the changes described above, this updated analysis indicates that there will be a capacity shortfall in every year starting in 2021 and that the capacity shortfall will grow significantly starting in 2023.

c. Regulatory Developments Impacting Capacity

In addition to the changes in supply and demand forecasts described in Section 2.b above, PG&E currently expects that the overall withdrawal capacity will decrease year over year as wells are converted to tubing and packer through 2024. Individual well deliverability is related to reservoir characteristics and relative field development. Following the conversion to tubing and packer, well deliverabilities are expected to decrease on average 40% at McDonald Island and Gill Ranch and 25% at Los Medanos.

Further, the overall outlook compared to the deliverability requirements, with the increased uncertainty associated with CalGEM's proposal on re-assessment intervals, poses an increased risk of capacity shortfalls. The scenario shown in Figures 2 and 3 below demonstrates the impact to well deliverability, assuming CalGEM asserts that two inspections at a frequency of 24 months must occur following the inception of the regulations for the implementation plan. Figure 2 assumes execution to PG&E's 2019 Implementation Plan submitted to CalGEM in March 2019 and excluding Los Medanos and Figure 3 assumes execution to PG&E's 2019 Implementation Plan submitted to CalGEM in March 2019 with Los Medanos.⁹

⁹ Consistent with CalGEM's regulations, on March 29, 2019, PG&E submitted its Underground Storage Risk and Integrity Management Plan (R&IMP) and accompanying field specific Well Risk Evaluation and Construction Standard Implementation Plan (2019 Implementation Plan).

**Figure 2: 2019 Implementation Plan Well Withdrawal Capacity
(With 24 Month Re-inspection without Los Medanos)**

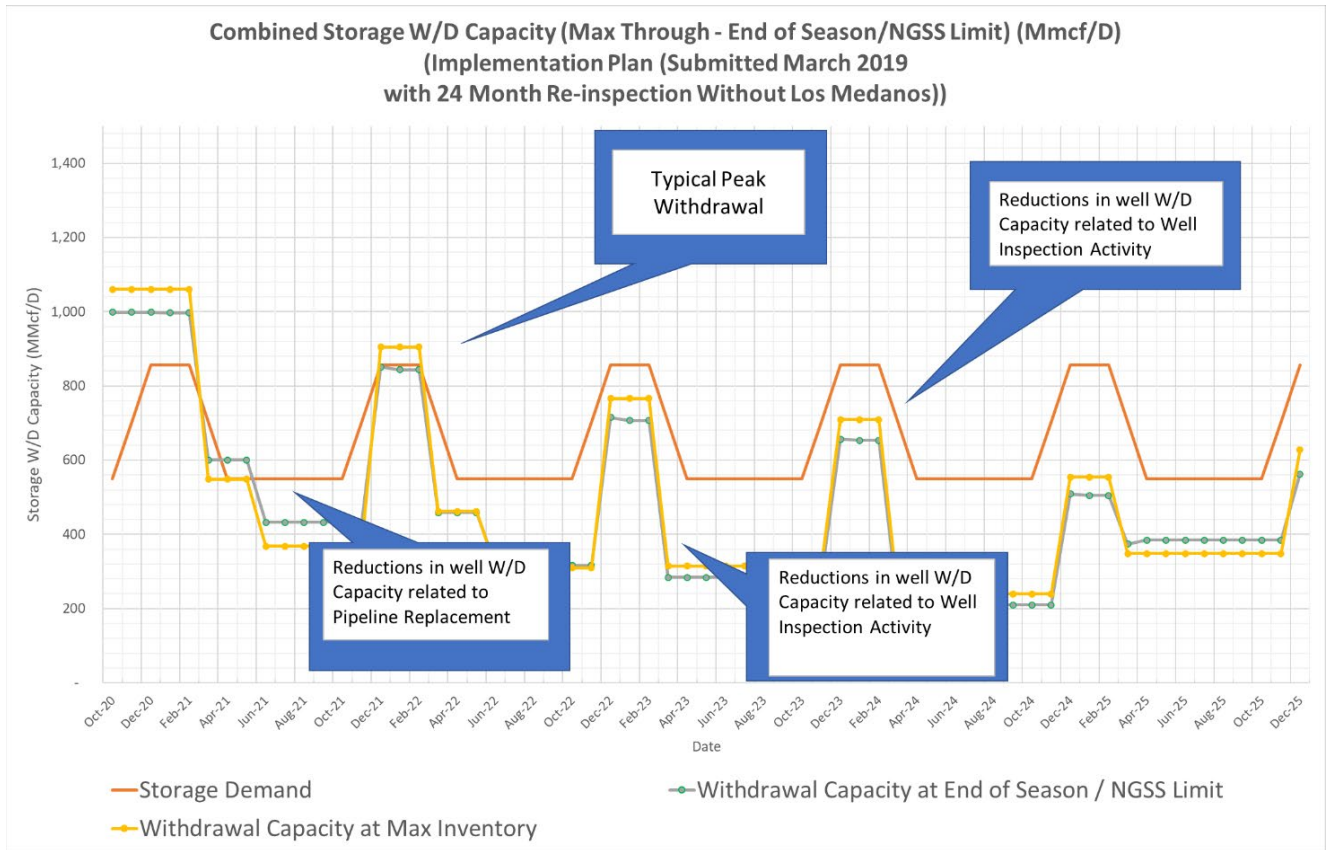
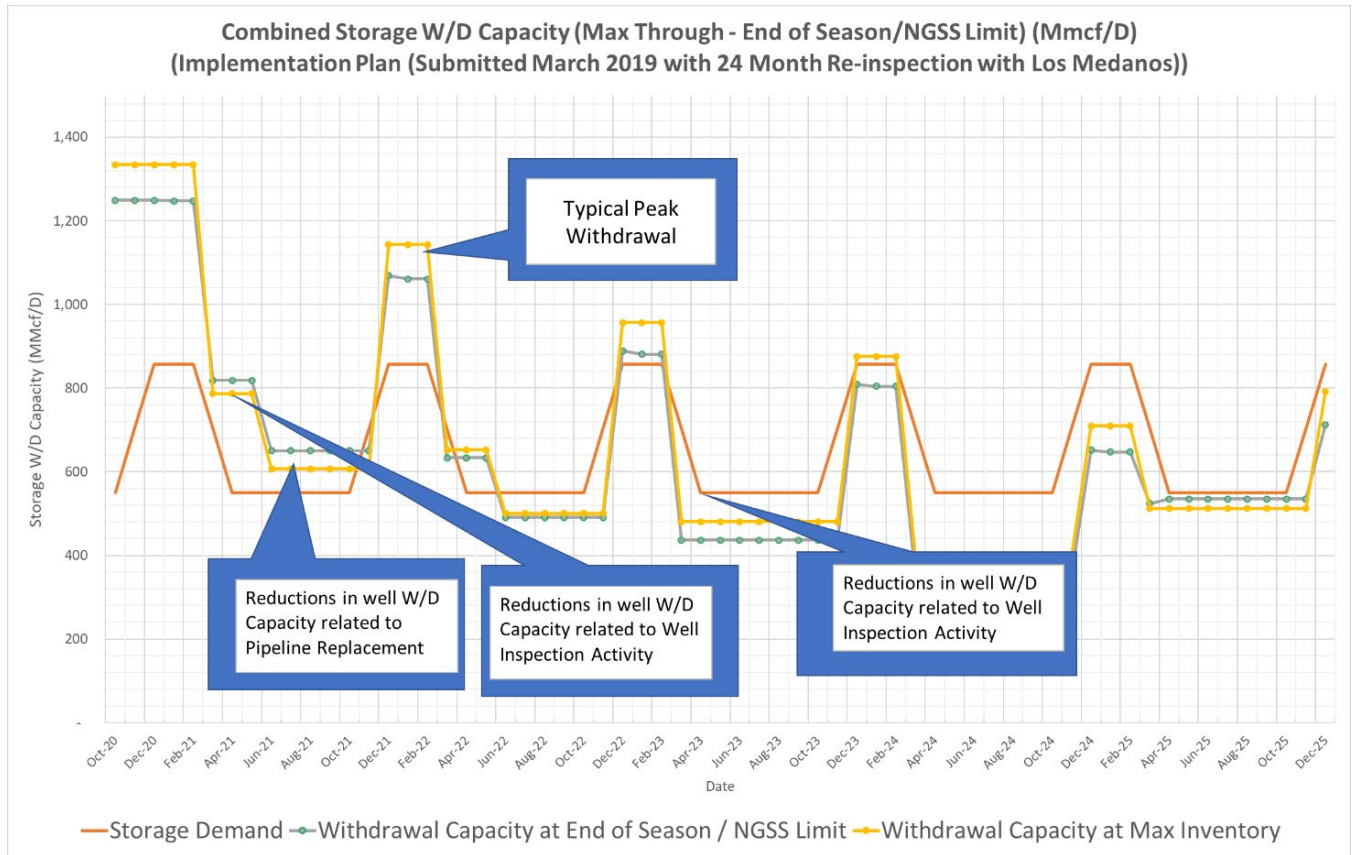
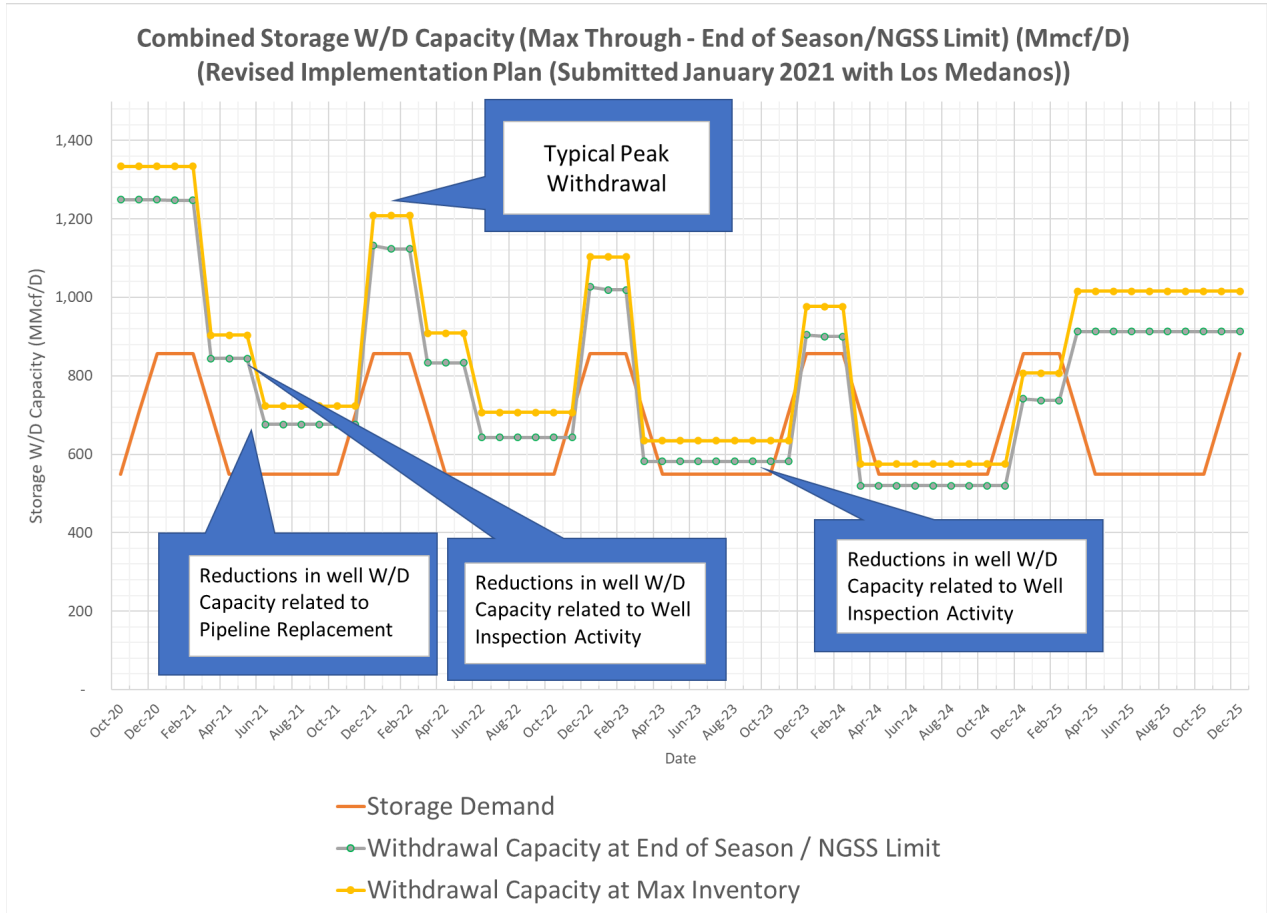


Figure 3: Implementation Plan Well W/D Capacity (With 24 Month Re-inspection and Los Medanos)



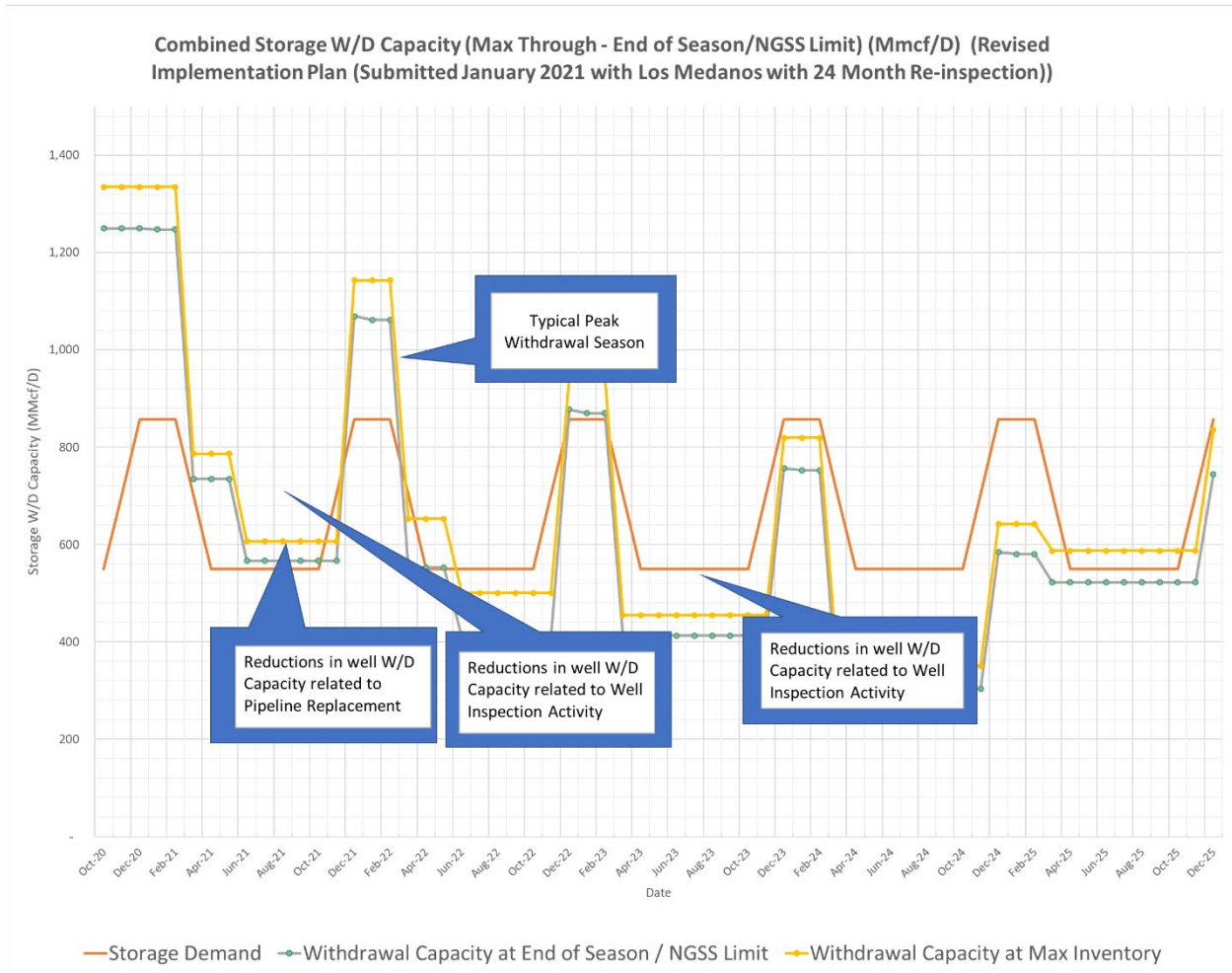
On December 1, 2020, CalGEM indicated that the 2019 Implementation Plan was unsatisfactory and required PG&E to submit an accelerated inspection schedule to CalGEM for review and approval by January 15, 2021. On January 15, 2021, PG&E submitted a revised implementation plan (2021 Revised Implementation Plan) to CalGEM for review and approval. The 2021 Revised Implementation Plan continues to balance the pace of both direct casing thickness inspections and pressure testing and accelerates the integrity inspection work significantly at CalGEM's direction. Figure 4 below reflects the 2021 Revised Implementation Plan and includes Los Medanos.

Figure 4. 2021 Revised Implementation Plan Well W/D Capacity (With Los Medanos)



Finally, should CalGEM still require a 24-month reassessment, the outlook that includes the Los Medanos gas storage facilities is shown in Figure 5. The figure excludes concurrent station outages.

Figure 5: 2021 Revised Implementation Plan Well W/D Capacity (With Los Medanos and 24 Month Re-inspection)



3. Assumptions for Alternatives Analysis

In order to address the NGSS Capacity Shortfall described above in Section 2 and in Exhibit (PG&E-3), Chapter 7, Section D, we performed an alternatives analysis to identify the most cost-effective and reasonable option. Our alternatives analysis included the following assumptions.

a. Cross-Compression

A well is prioritized and selected to be reworked over based on risk analysis and/or emergent corrective need (for example, a faulty downhole safety valve). Following the well rework, a well requires a cleanup cycle to remove residual liquids that aid in well control during the intervention from the near wellbore reservoir sand. These liquids are collected via temporary piping and separators to reduce exposure of the permanent station equipment to excess liquids and sands.

Specific to McDonald Island, the facility piping configuration and layout restricts when cleanup (that is, continuous withdrawal of gas from the reservoir for a prolonged period, approximately 35 days) can occur. This means wells worked early in the season (March–August) cannot go through a cleanup period until continuous withdrawal from the facility can be accommodated. The facility is greatly impacted in terms of deliverability when multiple wells are reworked in a given year because those wells typically do not come back into service until the following early spring in the year following rework.

Cross-compression offers an alternative that facilitates the cleanup cycle for an individual well by allowing the well to be cleaned up and withdrawn regardless of ongoing concurrent station and field operations. The withdrawn gas can be stripped of free liquids and then injected into an adjacent well back into the reservoir. This returns well deliverability nearly a year earlier and cumulatively can make up for about 90 MMscf/d that would have otherwise been unavailable. Equipment required for cross-compression includes:

1. Separators and Dryer Skids to condition gas
2. Flow Control system to allow for multiple wells to cleanup
3. Cross Compression Trailer with Recirculation
4. Power Generation Unit for Cross Compressors
5. Cleanup pipe and flex hoses to connect the system,

The cost of a cross-compression upgrade is estimated at \$7.5 million every 10 years.

b. Drilling Costs and Well Pads

In addition to the well drilling costs identified in the 2019 GT&S Rate Case for McDonald Island, the cost to drill new wells at McDonald Island also needs to account for the following:

- Road improvements
- Pad development at identified surface locations
- Pipeline extension
- Surface facilities required for processing
- Upgrades to centralized processing facility for additional capacity

The existing platform has limited locations where new wells can be efficiently routed through the existing processing on the platform. The Turner Cut platform currently has three available surface well locations that could be connected into processing

equipment on the platforms. As such, pipelines to these new locations are being included as part of the in-field pipeline replacement projects targeted to be completed in fall of 2022 in anticipation of new wells being drilled. However, there are several considerations that play into the number of new wells needed. Some of these include:

- The amount of capacity mitigation required, which frequently changes pending the outcome of CalGEM regulations
- Resulting individual well productivity of new wells
- Interference at bottom-hole locations of other wells

If PG&E drills more than three wells and does not use the slots at the Whiskey Slough platform, a new well pad will need to be built for these wells south of the compressor station. Depending on the number of wells installed, the well pad will change in size and may require additional modifications to existing pipelines and processing equipment.

For purposes of this report, a bottom-up cost estimate was generated for the drilling of new non-platform wells by applying PG&E's existing rate structure and using vendors currently working for PG&E. This estimate is broken into a drilling portion to drill the well to its total depth and a completions portion to make the well suitable for use, based on expected time to complete each operation. Therefore, as the number of wells increases, so does the cost per well. Overhead costs have then been layered in at 15%.

PG&E used McDonald Island's drilling costs at existing platforms as a proxy for Gill Ranch's new wells.

Figure 6: Drilling Costs

Scenario	Cost per well	Total
1 Well TC	\$ 7.05	\$ 7.05
2x Wells TC	\$ 7.05	\$ 14.10
3x Wells TC	\$ 7.05	\$ 21.16
3x Wells TC, 1x Well New Pad	\$ 7.22	\$ 28.88
3x Wells TC, 2x Well New Pad	\$ 7.97	\$ 39.83
3x Wells TC, 3x Well New Pad	\$ 8.46	\$ 50.78
3x Wells TC, 4x Well New Pad	\$ 10.67	\$ 74.72
3x Wells TC, 5x Well New Pad	\$ 10.68	\$ 85.48
3x Wells TC, 6x Well New Pad	\$ 10.68	\$ 96.16
3x Wells TC, 7x Well New Pad	\$ 10.70	\$ 106.95
3x Wells TC, 8x Well New Pad	\$ 10.68	\$ 117.44
3x Wells TC, 9x Well New Pad	\$ 10.68	\$ 128.20
3x Wells TC, 10x Well New Pad	\$ 10.68	\$ 138.88
3x Wells TC, 11x Well New Pad	\$ 10.68	\$ 149.56
3x Wells TC, 12x Well New Pad	\$ 10.68	\$ 160.25
3x Wells TC, 13x Well New Pad	\$ 10.88	\$ 174.15

c. Well Conversions and Inspection Costs

Current construction of most wells at PG&E gas storage facilities requires retrofit or conversion to a dual barrier construction standard, typically achieved by tubing and packer. While each well project design and execution can drastically differ, the typical design includes the following, provided the existing production casing is found to have integrity:

- A new premium, gas-tight, threaded tubing string that reaches the depth of the well
- A new packer element that seals the annulus between the active tubing string and the existing production casing
- A new downhole safety valve, where needed
- Gravel pack replacement, where needed
- A new, multi-bowl wellhead

The cost estimate of this work is assumed to be an average well with a gravel pack, taking 17 days with a rig mobilized for 24 hours a day. The estimated cost of this capital upgrade is \$3.1 million per well.

d. Compressor

The Los Medanos gas storage facilities use a Cooper-Bessemer Quad engine-compressor that was installed in 1979. Prior to the plans to decommission the facility, PG&E had already planned to replace the compressor due to obsolescence and poor reliability. The compressor is a unique model with very few remaining in operation, so future availability of spare parts is a significant risk. To keep the facility reliable for the long term, the compressor needs to be replaced. A 2017 feasibility study found that replacing the single compressor with two smaller compressors was the most cost-effective alternative to replace the existing injection capacity.

In addition to replacing the compressor, various other parts of the compressor station will need to be replaced to accommodate the new configuration as well as replacing components and systems that are at the end of their useful life. The estimated cost of this capital upgrade is \$52 million.

e. Well Controls Replacement

The control systems on the Los Medanos well pads are in need of replacement due to age and obsolescence. Much of the wiring and electrical equipment is original from the 1979 installation. The programmable logic controllers (PLCs) were installed in the 1990s, but typically have a 10- to 15-year life and are now obsolete. The estimated cost of replacement is \$10 million for the facility.

f. Security Upgrades

Due to the location and criticality of the Los Medanos gas storage facilities, it was previously recommended to upgrade the site security systems. This work was deferred due to the plans to close the facility but is now recommended to proceed. Based on other facilities that have had similar upgrades in 2020, it is estimated that the upgrades will cost \$10 million.

g. Pipeline Expansion

Installing a new 36-mile, 36-inch outer diameter pipeline from Delevan compressor station to Buckeye pressure limiting station to increase Redwood capacity is estimated to cost \$409 million or \$11.4 million per mile.

4. Analysis of Alternatives

a. Description and Analysis of Alternatives

(1) Alternative A

Alternative A proposes drilling 3 wells in 2023–2024 at McDonald Island at a cost of \$8.8 million per well for a total of \$26.4 million in capital. The three wells will be drilled at Turner Cut station that would not require incremental capital for pads and piping. Completed wells will bring an estimated incremental 45 MMscf/d of withdrawal on non-reassessment years and 22 MMscf/d on reassessment years. The reduction is based on our proposed well inspection plans submitted by PG&E to CalGEM and pending approval.

Three new wells at Gill Ranch will also need to be drilled to bring PG&E's portion of withdrawal back to 100 MMscf/d. Due to the formation of the Gill Ranch field, no additional padding or piping costs are thought to be needed. The cost per well is \$8.8 million, for a total of \$26.4 million.

In order to restore the Los Medanos gas storage facilities, 12 wells will need to be converted to tubing and packers at a cost of \$3.1 million per well for a total of \$37.5 million, \$52 million for compressor replacement, \$10 million for security upgrades, and \$10 million for well controls. This will result in an estimated 184 MMscf/d of withdrawal and 60 MMscf/d of injection, the only alternative that includes incremental injection. As such, this alternative also assumes that the difference between maximum and firm capacities can be used to generate additional revenue or offset maintenance costs and outages. PG&E assumed that the 150 MMscf/d can be used for this purpose, at an average of \$0.10 per dekatherm, to generate \$1.5 million per year.

Cross-compression will also be installed in 2022 at a cost of \$15 million for a 20-year period and will reduce impacts caused by well cleanups by an estimated 90 MMscf/d.¹⁰

Below is an analysis of the net present value (NPV) of Alternative A.

Alternative A - 3 Wells @McD, CC,3 Wells @GRS, Restore LM										
Project Expenditures Over 20 Years (2022-2041) in \$000 *										
Year	Description	Cost	Esc%	Type	Life	Salvage%		Escalated	NPV	
						Input	Calcd			
2022	Cross Compression (CC)	7,500	2.5	gast	55	0		0	7,880	-7,639
2022	Convert 4 wells(LM)	12,500	2.5	gast	55	0		0	13,133	-12,732
2023	Convert 4 wells(LM)	12,500	2.5	gast	55	0		0	13,461	-12,183
2023	3New Wells (GRS)	26,446	2.5	gast	55	0		0	28,480	-25,775
2024	Compressor Upgrade(LM)	51,691	2.5	gast	55	0		0	57,057	-48,189
2024	Convert 4 wells(LM)	12,500	2.5	gast	55	0		0	13,798	-11,653
2024	3. New Wells (McD)	26,446	2.5	gast	55	0		0	29,192	-24,654
2024	Controls (LM)	10,000	2.5	gast	55	0		0	11,038	-9,323
2025	Security Upgrades (LM)	10,000	2.5	gast	55	0		0	11,314	-8,914
2032	Cross Compression: Replacement (CC)	7,500	2.5	gast	55	0		0	10,087	-4,789
* Life and salvage fields ignored when expenditure is an expense (type exp or atx).									195,439	-165,851
Operating Expenses (+) and Revenues (-) Over 20 Years (2022-2041) in \$000										
Year	a	b	c	d	Description	Esc%	NPV			
2022	19,879				a. Exp1	2.5	-166,103			
2023	17,196				b. Decomm	2.5	-23,412			
2024	22,544						-189,515			
2025	8,815									
2026	11,939									
2027	15,065									
2028	15,068									
2029	24,446									
2030	24,450									
2031	15,079									
2032	8,829									
2033	11,954									
2034	15,079									
2035	15,079									
2036	24,454									
2037	24,454									
2038	15,079	21,600								
2039	8,829	21,600								
2040	11,954	21,600								
2041	15,079									
Total NPV (\$000)							-355,366			

(2) Alternative B

Alternative B proposes drilling 16 wells in 2023–2024 at McDonald Island at a cost of \$13.6 million per well for a total of \$218 million in capital. Three wells can be drilled at Turner Cut station, but 11 will be drilled at a new site that would require incremental capital for pads and piping per well. However, it is not known if it is feasible to drill more than 12 wells at McDonald Island without further geological analysis.

¹⁰ At a cost of \$167,000 per MMscf/d, cross-compression is the lowest-cost capacity replacement option. Thus, it is common to all three alternatives.

Completed wells will bring an estimated incremental 240 MMscf/d of withdrawal on non-reassessment years and 120 MMscf/d on reassessment years. The reduction is based on PG&E’s proposed well inspection plans submitted to CalGEM and pending approval.

Three new wells at Gill Ranch will also need to be drilled to bring PG&E’s portion of withdrawal back to 100 MMscf/d. Due to the formation of the Gill Ranch field, no additional padding or piping costs are thought to be needed. The cost per well is \$8.8 million per well, for a total of \$26.4 million.

Cross-compression will also be installed in 2022 at a cost of \$15 million for a 20-year period. Cross-compression will reduce impacts caused by cleanups by an estimated 90 MMscf/d.

Below is an analysis of the NPV of Alternative B.

Alternative B - 16 Wells @McD, CC,3 Wells @GRS,									
Project Expenditures Over 20 Years (2022-2041) in \$000 *									
Year	Description	Cost	Esc%	Type	Life	Input	Salvage% Calcd	Escalated Cost	NPV
2022	Cross Compression (CC)	7,500	2.5	gast	55	0		7,880	-7,639
2023	3New Wells (GRS)	26,446	2.5	gast	55	0		28,480	-25,775
2024	3. New Wells (McD)	40,816	2.5	gast	55	0		45,053	-38,051
2025	13. New Wells (McD)	176,870	2.5	gast	55	0		200,112	-157,670
2032	Cross Compression: Replacement (CC)	7,500	2.5	gast	55	0		10,087	-4,789
								291,611	-233,923
* Life and salvage fields ignored when expenditure is an expense (type exp or atx).									
Operating Expenses (+) and Revenues (-) Over 20 Years (2022-2041) in \$000									
Year	a	b	c	d	Description	Esc%	NPV		
2022	350				a. Exp1	2.5	-111,729		
2023	1,342				b. Decomm	2.5	-41,621		
2024	2,340	21,600							
2025	6,668	21,600							
2026	6,667	21,600							
2027	6,669								
2028	6,671								
2029	36,362								
2030	36,366								
2031	6,682								
2032	6,682								
2033	6,682								
2034	6,682								
2035	6,682								
2036	36,370								
2037	36,370								
2038	6,682								
2039	6,682								
2040	6,682								
2041	6,682								
								Total NPV (\$000)	-387,273

(3) Alternative C

Alternative C proposes installing a 36-mile, 36-inch outer diameter pipeline between Delevan and Buckeye to increase Independent Storage Provider (ISP) withdrawal by 215 MMscf/d. At a cost of \$409 million to install, or \$1.9 million per MMscf/d of capacity

replacement, building a pipeline is the most expensive capacity replacement alternative available.

This alternative also involves drilling 2 wells in 2023–2024 at McDonald Island at a cost of \$8.8 million per well for a total of \$17.6 million in capital. The two wells will be drilled at Turner Cut station that would not require incremental capital for pads and piping. Completed wells will bring an estimated incremental 30 MMscf/d of withdrawal on non-reassessment years and 15 MMscf/d on reassessment years. The reduction is based on PG&E’s proposed well inspection plans submitted to CalGEM and pending approval.

Three new wells at Gill Ranch will also need to be drilled to bring PG&E’s portion of withdrawal back to 100 MMscf/d. Due to the formation of the Gill Ranch field, no additional padding or piping costs are thought to be needed. The cost per well is \$8.8 million per well, for a total of \$26.4 million.

Cross-compression will also be installed in 2022 at a cost of \$15 million for a 20-year period. Cross-compression will reduce impacts caused by cleanups by an estimated 90 MMscf/d.

Below is an analysis of the NPV of Alternative C.

Alternative C - 2 Wells @McD, CC,3 Wells @GRS, Pipeline Expansion									
Project Expenditures Over 20 Years (2022-2041) in \$000 *									
Year	Description	Cost	Esc%	Type	Life	Salvage%		Escalated Cost	NPV
						Input	Calcd		
2022	Cross Compression (CC)	7,500	2.5	gast	55	0		7,880	-7,639
2023	3New Wells (GRS)	26,446	2.5	gast	55	0		28,480	-25,775
2024	2. New Wells (McD)	17,631	2.5	gast	55	0		19,461	-16,436
2025	Pipeline Expansion	408,954	2.5	gast	55	0		462,694	-364,560
2032	Cross Compression: Replacement (CC)	7,500	2.5	gast	55	0		10,087	-4,789
								528,601	-419,199
* Life and salvage fields ignored when expenditure is an expense (type exp or atx).									
Operating Expenses (+) and Revenues (-) Over 20 Years (2022-2041) in \$000									
Year	a	b	c	d	Description	Esc%	NPV		
2022	350				a. Exp1	2.5	-39,012		
2023	1,342				b. Decomm	2.5	-41,621		
2024	2,006	21,600							
2025	2,459	21,600							
2026	2,458	21,600							
2027	2,459								
2028	2,462								
2029	10,278								
2030	10,281								
2031	2,473								
2032	4,973								
2033	2,473								
2034	2,473								
2035	2,473								
2036	10,285								
2037	10,285								
2038	2,473								
2039	4,973								
2040	2,473								
2041	2,473								
								Total NPV (\$000)	-499,831

b. Operational Considerations

In addition to financial impacts, our analysis also considered operational issues.

(1) McDonald Island: Flooding

A 1985 study of flooding risk at McDonald Island conducted by Dames & Moore found that “due to the potential for seismic instability, or liquefaction, the levees will probably have at least a 50% chance of failure in the next 50 years, even with extensive levee modifications.” Subsequent reviews of this finding, as recently as 2017 by Infraterra, have not disagreed with this estimate. Although the facility was able to be operated while under floodwaters in 1982, this is no longer considered viable due to changes in the facility equipment and operating requirements since that time. A study is currently underway to evaluate the scope and cost of upgrades to make the facility safe to operate under floodwaters, but it is not clear whether this will be feasible or practical.

(2) McDonald Island: Platform Failures

Most of the equipment at McDonald Island is installed on platforms to protect from flooding. This concentrates a lot of equipment in a relatively small space, which increases the risk of collateral damage if there is a major equipment failure such as the filter-separator failure that occurred at Turner Cut in 1993. This failure reduced the facility withdrawal capacity by nearly half for one year while the platform equipment was rebuilt. The risk of failures and associated damage exists at all facilities, but the risk is increased at McDonald Island due to the proximity of the equipment.

(3) McDonald Island: L57A

Because retaining the Los Medanos gas storage field is one of the alternatives being considered, the value of restoring Line 57A for McDonald Island storage field was reevaluated. Line 57A is parallel to Line 57B between Palm Tract and Brentwood terminal and has been under pressure reduction since 2011. The restoration was deemed appropriate when McDonald Island was to be the sole PG&E-operated storage field as in Alternative B and C. Alternative A includes retaining Los Medanos, which increases supply diversity with two storage fields and challenges the need for Line 57A.

Line 57A can transport ~300 MMscf/d of withdrawal and ~193 MMscf/d of injection capacity at 722 pounds per square inch gauge (psig) Maximum Allowable Operating Pressure (MAOP) for McDonald Island. This is sufficient withdrawal capacity for pipeline balancing and most injection requirements. Currently, Line 57A is under conditional reduction of pressure (CROP) at 200 psig, which does not provide any withdrawal or injection capacity. Restoring Line 57A to 722 psig MAOP was estimated to cost approximately \$9.5 million more than maintaining the pipeline at 200 psig, but it is critical to maintain the pipeline capacity reliability for McDonald Island.

Currently, Lines 57B and 57C provide the only path for gas into or out of McDonald Island. Line 57B connects McDonald Island to Line 401 at Bixler Road PLS and Bay Area Loop at the Brentwood terminal. Line 57C partially parallels Line 57B from

McDonald Island to Palm Tract PLS, providing redundancy and reliability for this section.

- **If a pressure reduction or outage** occurs on Line 57B between Palm Tract and Bixler Road PLS, then there will be no way to transport gas to or from McDonald Island with Line 57A at a reduced pressure.
- **If Line 57A is restored**, then Line 57B will have a parallel pipeline from Palm Tract PLS to Brentwood terminal and an alternative gas flow path in the event of pressure reduction or outage on Line 57B between Palm Tract and Bixler Road PLS.

Table 1 below shows the withdrawal capacities and costs if Line 57B between Palm Tract and Bixler Road PLS were to go out of service, limiting McDonald Island capacity. In all alternatives with or without Los Medanos, Line 57A is needed to maintain sufficient pipeline-balancing requirements.

- **Alternative A with Los Medanos** has the most withdrawal capacity of 256 MMscf/d without Line 57A and McDonald Island, but there is still a 44 MMscf/d shortfall of pipeline-balancing withdrawal requirements.
- **Alternatives B–C without Los Medanos** mostly rely on McDonald Island for storage capacity and benefit most from Line 57A being restored.

Assuming pipeline balancing is first priority, the remaining capacity over 300 MMscf/d with Line 57A may be used to partially fulfill Core's obligations.

- **For Alternative A with Los Medanos**, approximately 256 MMscf/d may be used to fulfill Core's obligations.
- **For Alternatives B–C without Los Medanos**, minimal withdrawal capacity of 15-100 MMscf/d may be used to fulfill Core's 153–307 MMscf/d withdrawal obligations.

Line 57A does not fully help any of the alternatives have sufficient capacity for Core, but it still increases capacity and improves the supply reliability.

Due to the shortfall in capacity without McDonald Island, it is recommended to restore Line 57A to 722 psig to improve reliability of the pipeline system. Although its significance is lessened with Los Medanos, Line 57A is still needed to fulfill pipeline-balancing requirements and help maintain some Core obligations if Line 57B between Palm Tract and Bixler Road PLSs are unavailable.

Table 1: Withdrawal capacity and costs if Line 57B between Palm Tract and Bixler Road PLSs were to go out of service, limiting capacity for McDonald Island

	Withdrawal Capacity With Line 57A Restored (MMscf/d)	Withdrawal Capacity Without Line 57A Restored (MMscf/d)	Pipeline Balancing Withdrawal Capacity Shortfall Without Line 57A Restored (MMscf/d)
Alternative A	556	256	44
Alternative B	400	100	200
Alternative C	369 (additional 215 MMscf/d Redwood pipeline capacity also available)	69 (additional 215 MMscf/d Redwood pipeline capacity also available)	231

(4) Los Medanos: Areas of Consequence

The Los Medanos gas storage facilities are located near large residential neighborhoods which, in a situation where there was an uncontrolled release of gas, could create safety and other community impact issues similar to the situation at Aliso Canyon.

(5) Los Medanos: Supply Diversity

Los Medanos withdrawal can also be used to support the East Bay system under certain circumstances including:

- If the Antioch feed is lost, PG&E mitigates this loss by withdrawing gas from Los Medanos into the Standard Pacific Pipeline Company, Pipeline 3 (StanPac 3 or SP3) near Concord during periods of inordinate demand.
- If the Herrmann feed is lost, PG&E mitigates this loss by withdrawing gas from Los Medanos to keep the upstream Los Medanos PLS pressure higher, enabling PG&E ample differential pressure to maintain the highest possible pressure for gas flowing out of the regulation station, moving west toward elevated pressure delivery points (e.g., Chevron, Air Liquid, and Crockett Cogeneration).

(6) Los Medanos: Resource Management

McDonald Island and Los Medanos use compression, processing, and wellhead equipment that is somewhat unique to PG&E's gas assets. Other compressor stations receive pipeline-quality gas, but storage facilities must condition the gas as it exits the storage field before it can enter the gas pipeline system. Due to the unique operating requirements, equipment, and well-related activities, only storage gas pipeline operations and maintenance (GPOM) personnel have the knowledge to execute storage-related GPOM activities. Currently both storage facilities frequently share resources with each other.

5. Recommendation

To meet forecasted NGSS Capacity Shortfall, we recommend choosing Alternative A, which involves the following:

- Drilling three new wells at McDonald Island
- Drilling three new wells at Gill Ranch
- Installing cross-compression equipment
- Retaining the Los Medanos gas storage facilities

We support this option for three reasons:

- **Cost Effectiveness:** Retaining Los Medanos is \$30 million and \$145 million less on an NPV basis than Alternatives B and C for the same winter withdrawal capacity. In addition, Alternative A is also the only scenario that includes incremental injection

Alternatives		NPV
A.	3 Wells @McD, CC,3 Wells @GRS, Restore LM	-355,366
B.	16 Wells @McD, CC,3 Wells @GRS,	-387,273
C.	2 Wells @McD, CC,3 Wells @GRS, Pipeline Expansion	-499,831

- **Reservoir and Construction Constraints and Supply Diversity:** Alternative B, which calls for drilling 16 new wells at McDonald Island, has construction constraints. At above 12 wells, an additional feasibility analysis will need to be undertaken and the performance of additional wells cannot be guaranteed. Furthermore, supply diversity (i.e., retaining both McDonald Island and Los Medanos) reduces risks associated with unforeseen facility-specific events.
- **Scalability and Market Impacts:** Retaining Los Medanos will give PG&E the most flexibility in terms of building or removing future capacity. If changes in capacity is needed in the future, additional wells at McDonald Island or Los Medanos can be drilled or plugged and abandoned at the individual well level. In Alternative B, if additional capacity is needed then drilling additional may not be feasible at least without significant diminishing returns. The only option left with would be reinstating Los Medanos, thus seeing capacity increase in increments of 150 to 180 mmscf/d as opposed to 15 or 20 mmscf/d. The pipeline replacement alternative is scalable; however, aside from the high costs pipeline capacity could be considered as a day-of solution and one that is impacted by market forces beyond the control of PG&E.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE WORKPAPER SUPPORTING CHAPTER 7
NATURAL GAS STORAGE STRATEGY
INTRA-DAY INVENTORY MANAGEMENT SERVICE ANALYSIS

A. Objective

The purpose of this workpaper is to update the 2019 Gas Transmission and Storage (GT&S) Rate Case Natural Gas Storage Strategy (NGSS) Inventory Management Service Analysis to include more recent operating data and confirm the level of storage resources necessary to manage system operating requirements. The 2019 GT&S Rate Case NGSS Inventory Management Service Analysis was performed using six winters of data. This analysis was updated to include four recent winters and ten summers to determine if the current 300 million cubic feet per day (MMcf/d) withdrawal and 200 MMcf/d injection is still recommended.

B. Recommendation

Based on this updated analysis, we recommend continuing to provide 300 MMcf/d withdrawal and 200 MMcf/d injection for inventory management. These capacities will: (1) deliver an adequate level of balancing to avoid significant intra-day and inter-day inventory swings¹, (2) minimize the risk of low pressure events, and (3) provide necessary operating security.

C. Analysis Approach

Under the 2019 GT&S Rate Case decision, Pacific Gas and Electric Company's (PG&E) storage assets were significantly reduced and the reliance on Independent Storage Providers (ISP) storage was increased. This changed PG&E's system balancing capabilities. The original analysis focused on minimizing demand-driven pipeline inventory level drops during the peak morning hours in the winter. The analysis was updated to include the afternoon and evening peak demands in the summer. Such inventory drops increase the risk of system low pressure events,

¹ Intra-day inventory swings are those occurring within the same day. Inter-day inventory swings are those that occurred on the prior day.

which can propagate to the local transmission system and cause potential customer outages. Changes in PG&E's gas transmission system inventory levels are driven by intra-day and inter-day demands as well as the accumulation of other dynamics that are difficult to predict, such as forecast errors and unplanned equipment outages described in Section D.

D. Inventory Imbalance Drivers Uncertainties

There are a number of uncertainties which impact intra-day and inter-day demand on the gas transmission system including:

- Specific customer demands, hourly use profiles, and forecast errors;
- Weather patterns, hourly temperature patterns, and forecast errors;
- Gas supply delivery profiles and equipment interruptions;
- Market drivers; and
- Other imbalances including, but not limited to: Core operating imbalance, shrinkage imbalance, Operating Balancing Agreement imbalances.

E. System Balancing Goals

The objective of system balancing is to manage intra-day and inter-day system supply-demand imbalances and their associated impacts on system inventory, such that:

- 1) Anticipated system inventory levels are maintained +/- 200 MMcf of start-of-day system inventory levels (e.g. a range between 4,000-4,400 MMcf) and,
- 2) The risks of cascading day-to-day inventory impacts are minimized and,
- 3) Adequate capabilities are provided to return the end-of-day inventory levels to start-of-day levels and,
- 4) Day after day inventory degradation is avoided.

F. Analysis

Part I – Ideal Scenario

Develop an ideal scenario balancing model that removes all identifiable uncertainties (perfect supply-demand balance). Focus on managing the intra-day hourly customer demand changes and their impact on system inventory levels.

Assumptions

- Added actual historical hourly customer demand data from Telvent for the recent four years (December 2016-February 2020) to the 2019 GT&S Rate Case NGSS Inventory Management Service Analysis, which consists of six years (December 2010-February 2016) of actual hourly customer demand data. Also, added actual historical hourly customer demand data for summer months (June 2011 – September 2020). Use actual historical hourly customer winter and summer demands for the last 10 years.
- Assume that daily supplies equal daily demands.
- Assume that balancing (withdrawal/injection) would be provided at 1/24th (300 MMcf/d = 12.5 MMcf/h) the daily capability as necessary. In the 300/200 scenario, approximately 9 hours of withdrawal and 13 hours of injection.

Inventory_x = Start of Hour system inventory level.

Δ Demand_x = Hourly customer demand change (Average daily demand – Actual Hr. demand.)

Balancing_x = Applied level of balancing 1/24th of daily rate (example:
300 MMcf/d = 12.5 MMcfh WD/INJ)

Inventory₁ = Start of gas day inventory (i.e. 4,200 MMcf)

Inventory₂ = **Inventory₁** + **Δ Demand₁** + **Balancing₁**

Inventory₃ = **Inventory₂** + **Δ Demand₂** + **Balancing₂**

Inventory₄ = **Inventory₃** + **Δ Demand₃** + **Balancing₃**

...

Inventory₂₄ = **Inventory₂₃** + **Δ Demand₂₃** + **Balancing₂₃**

- Compare the theoretical hourly inventory level with various levels of balancing to the target inventory range and determine the number of occurrences where the inventory level drops below the target range.

Part II – Intra-day with Daily Imbalances

Perform a more realistic analysis using the “ideal” scenario and adding the daily imbalances to identify the increased risk associated with expected levels of intra-day customer supply demand imbalances.

During the Gas Day, there are many unpredictable factors that create differences between the actual supply and demands on any given day, as described in Section D. Because it is difficult to predict the magnitude of these imbalances to analyze the impacts, we applied the actual historical daily imbalances that occurred on the day and re-evaluated the percent of time and number of days per season when inventory levels dropped below minimum inventory target levels.

Assumptions

- Same data used in Part I above.
- Combine the historical hourly customer imbalances with 1/24th of the recorded customer daily imbalances for the last 10 years in winter and summer.

Imbalance _x = Historical hourly supply/demand imbalance (1/24th of the historical daily imbalance)

Inventory₁ = **Start of gas day inventory (i.e. 4,200 MMcf)**

Inventory₂ = **Inventory**₁ + **Δ Demand**₁ + **Imbalance**₁ + **Balancing**₁

...

Inventory₂₄ = **Inventory**₂₃ + **Δ Demand**₂₃ + **Imbalance**₂₃ + **Balancing**₂₃

Part III – Inter-day with Daily Imbalances

Perform sensitivity testing of inter-day imbalances impacting the start-of-day inventory levels from Part II to identify the change in risk associated with lower start-of-day inventory levels.

The factors that drive intra-day imbalances also drive inter-day (prior day) imbalances. The main difference is that inter-day (prior day) imbalances impact start-of-day system inventory levels. To test the impact of prior day imbalances, we re-evaluated the scenarios, assuming the start-of-day inventory levels were lower than the target start-of-day inventory level, first by 50 MMcf, and then by 100 MMcf.

G. Conclusion

The results of the analysis using 2010 to 2020 customer summer and winter usage data indicate that the current level of Inventory Management resources (300/200 MMcfd) are required to provide an adequate level of balancing to avoid significant intra-day inventory swings and minimize the risk of low pressure events.

The results indicate that in situations where the start-of-day system inventory level is lower than the target inventory by as little as -50 MMcf, the risk of low pressure days would be approximately 8 and 10 days per winter and summer season respectively; this increases to 26 and 18 days respectively at the -100 MMcf level. The results for the winter season are reflected in Table 1 and the results for the summer season in Table 2 below.

Due to the unpredictability of the various imbalance drivers outlined in Section D above, the ability to reliably manage the start-of-day inventory level places a significant risk to system operations at the current 300/200 MMcfd level, such that, any reduction in Inventory Management capability would significantly increase the system risk to an unacceptable level.

**TABLE 1
WINTER ALTERNATIVE SCENARIO: DAYS AT RISK VS. BALANCING SCENARIOS**

Scenario	(A)	(B)	(C)		(D)		(E)		(F)	
	Withdrawal (MMcf/d)	Injection (MMcf/d)	Part I		Part II		Part III		Part III	
			Ideal Model Days at Risk in Season		Intra-day with Daily Imbalances Days at Risk in Season		Inter-day with Daily Imbalances Starting Inventory (50) MMcf Days at Risk in Season		Inter-day with Daily Imbalances Starting Inventory (100) MMcf Days at Risk in Season	
			%	#	%	#	%	#	%	#
1	400	400	0.0%	0.0	0.4%	0.4	3.9%	3.5	19.5%	17.6
2	300	300	0.0%	0.0	1.8%	1.6	8.0%	7.2	28.3%	25.6
3	300	200	0.0%	0.0	2.0%	1.8	8.4%	7.6	29.1%	26.3
4	200	200	0.5%	0.4	3.5%	3.1	14.9%	13.5	39.2%	35.4
5	100	100	2.3%	2.0	7.9%	7.1	25.4%	23.0	51.5%	46.5
6	-	-	7.8%	7.0	15.3%	13.8	37.2%	33.6	66.6%	60.2

TABLE 2
SUMMER ALTERNATIVE SCENARIO: DAYS AT RISK VS. BALANCING SCENARIOS

Scenario	(A)	(B)	(C)		(D)		(E)		(F)	
	Withdrawal (MMcf/d)	Injection (MMcf/d)	Part I		Part II		Part III		Part III	
			Ideal Model Days at Risk in Season		Intra-day with Daily Imbalances Days at Risk in Season		Inter-day with Daily Imbalances Starting Inventory (50) MMcf Days at Risk in Season		Inter-day with Daily Imbalances Starting Inventory (100) MMcf Days at Risk in Season	
			%	#	%	#	%	#	%	#
1	400	400	0.0%	0.0	0.9%	1.1	2.5%	3.1	6.0%	7.4
2	300	300	0.0%	0.0	2.4%	2.9	5.4%	6.5	10.1%	12.3
3	300	200	0.0%	0.0	3.8%	4.6	7.9%	9.7	14.6%	17.8
4	200	200	0.0%	0.0	4.9%	6.0	9.3%	11.3	17.5%	21.4
5	100	100	0.1%	0.1	10.7%	13.0	19.8%	24.1	34.2%	41.8
6	-	-	1.9%	2.3	15.8%	19.3	29.6%	36.1	46.9%	57.2

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE WORKPAPER SUPPORTING CHAPTER 7
NATURAL GAS STORAGE STRATEGY
CURTAILMENT IN-LIEU OF BALANCING ANALYSIS

Objective

This workpaper assesses the feasibility of using curtailments to reduce the amount of balancing required on the system. One of the key factors to consider is whether the need for balancing can be determined in advance to give time for curtailments to be implemented.

Recommendation

Due to the challenges in predicting when high levels of balancing will be required, any balancing process that uses curtailments will need to be very conservative to fully protect the natural gas transmission system. Although a conservation approach will protect the overall reliability and safety of the natural gas transmission system, it may also result in unnecessary curtailments that significantly impact customers. For these reasons, PG&E recommends the continued use of storage resources to meet system balancing requirements rather than relying on curtailments to do so.

Analysis Approach

This analysis uses a similar approach as an overall system balancing analysis. Supplies on the system are assumed to enter the system at a flat rate for the day (1/24th each hour). Historical hourly demands were used to determine the theoretical system pack/draft each hour. The actual daily imbalances were also used to adjust the hourly pack/draft volumes (1/24th applied to each hour). Based on the hourly draft volumes, the maximum cumulative draft volume was calculated for each day. Days with high cumulative draft volumes would generally need more balancing resources. These cumulative draft volumes were then trended against sendout, temperature, core demand, industrial demand, and electric generation demand to see how well the draft volume correlated with these variables.

Results

Figures 1 to 5 below contain the resulting trends. These are based on historical data from 12/1/10 to 9/1/20 for the summer (Apr – Sept) and winter (Dec – Feb) months. There is significant scatter in all the charts, which indicates that it would be very difficult to predict when curtailments would be required to support balancing needs.

Figure 1: Summer and Winter Draft Volume v. Sendout

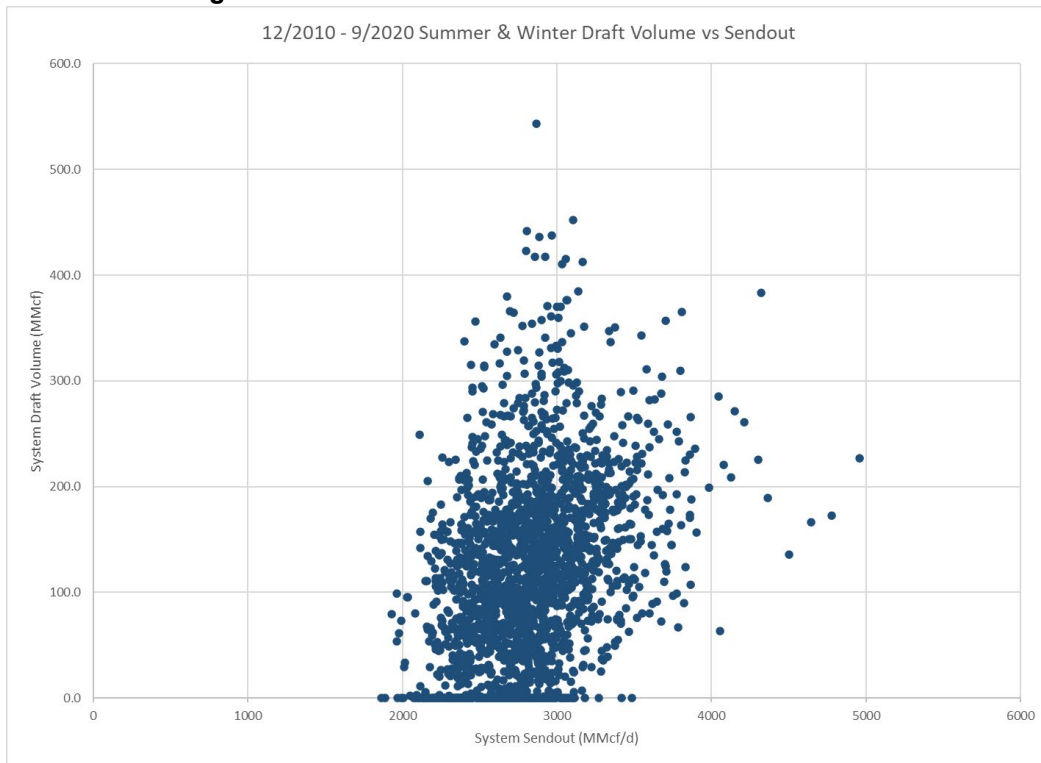


Figure 2: Summer and Winter Draft Volume v. Temperature

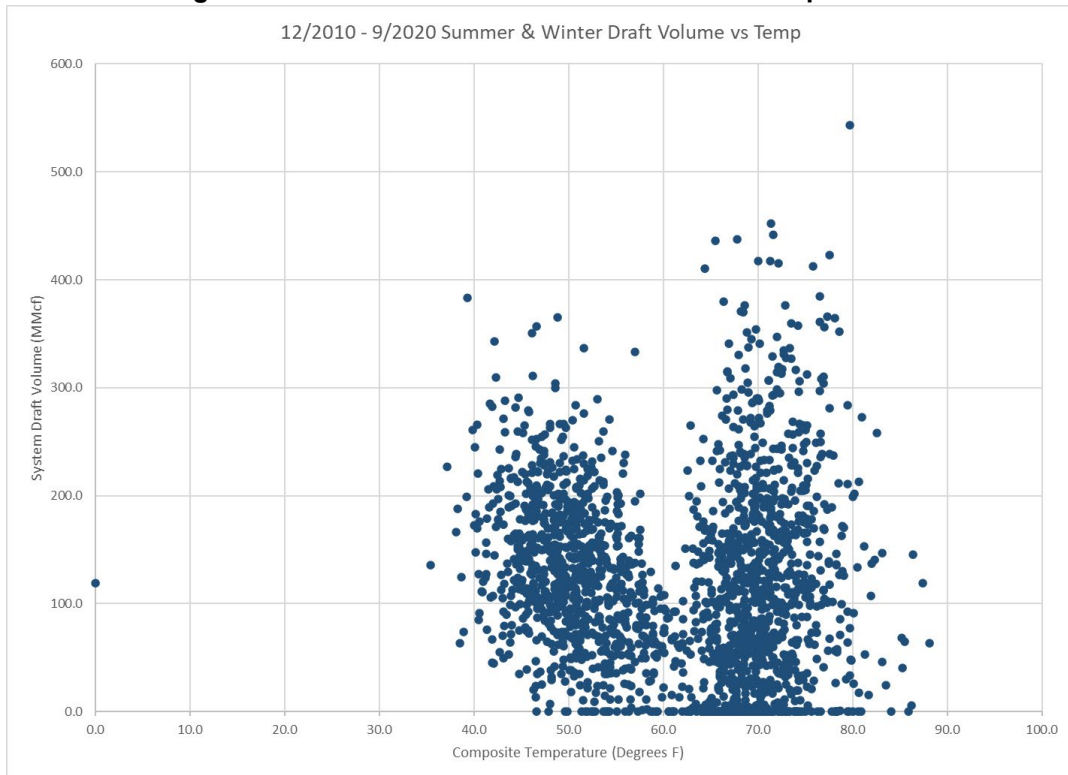


Figure 3: Summer and Winter Draft Volume v. Core Demand

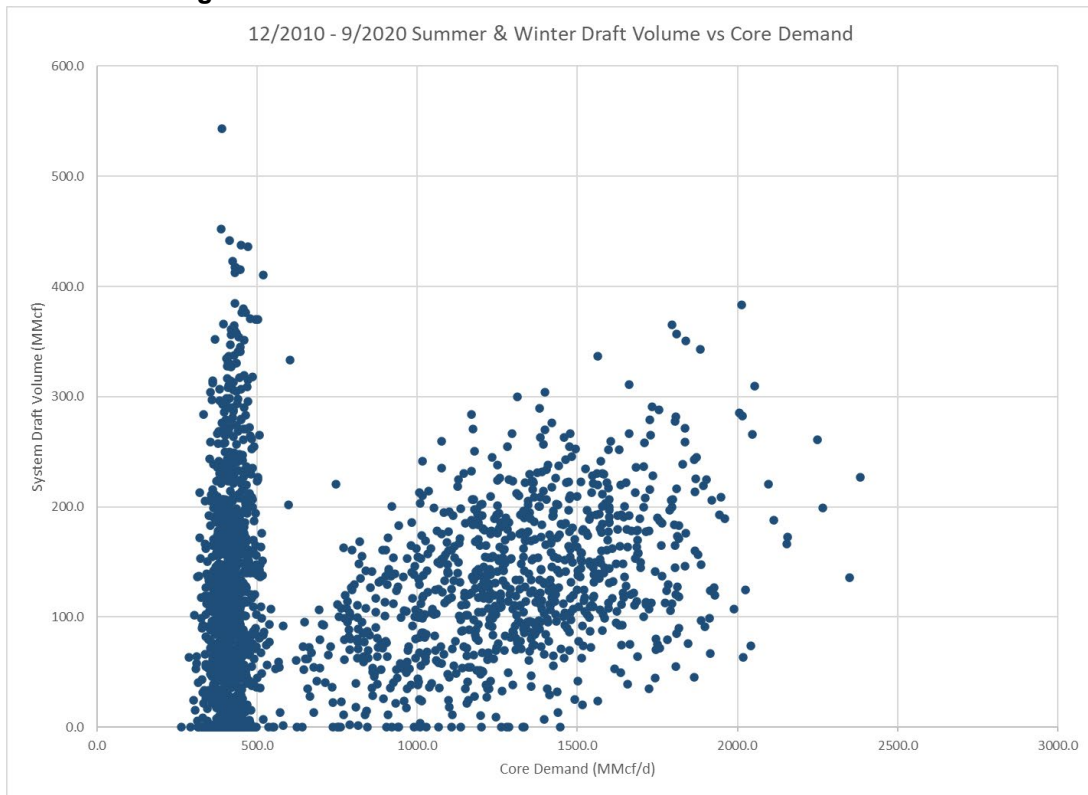


Figure 4: Summer and Winter Draft Volume v. Industrial Demand

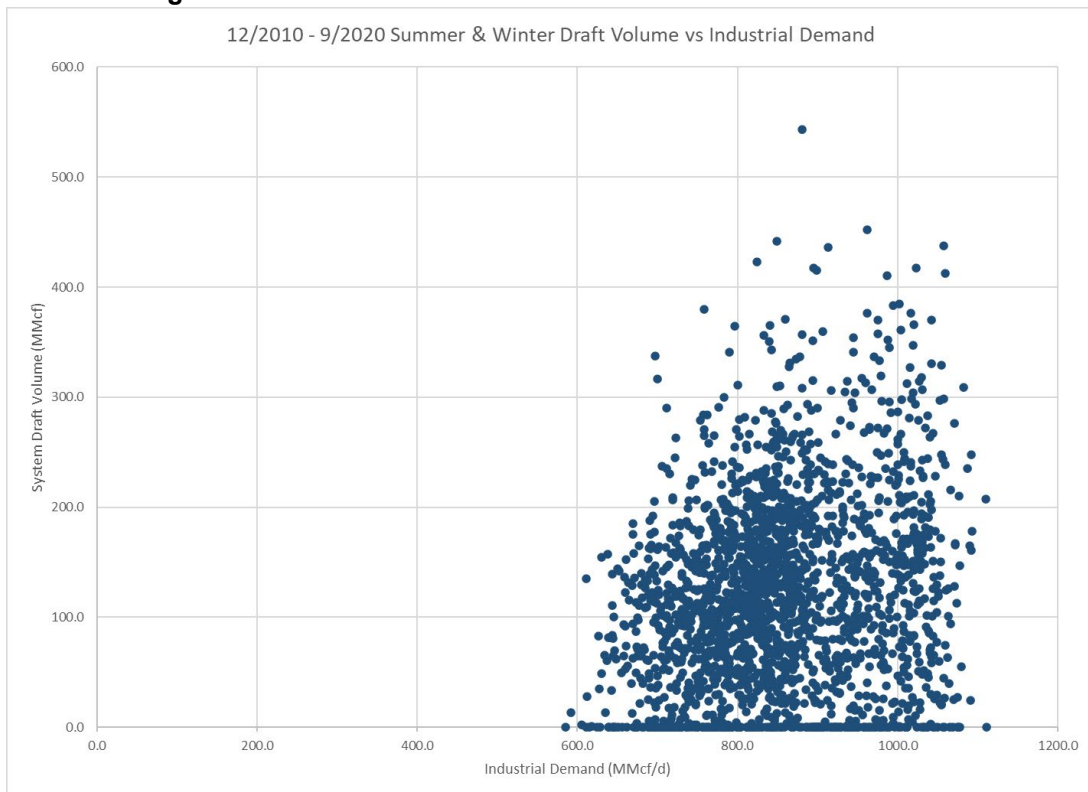
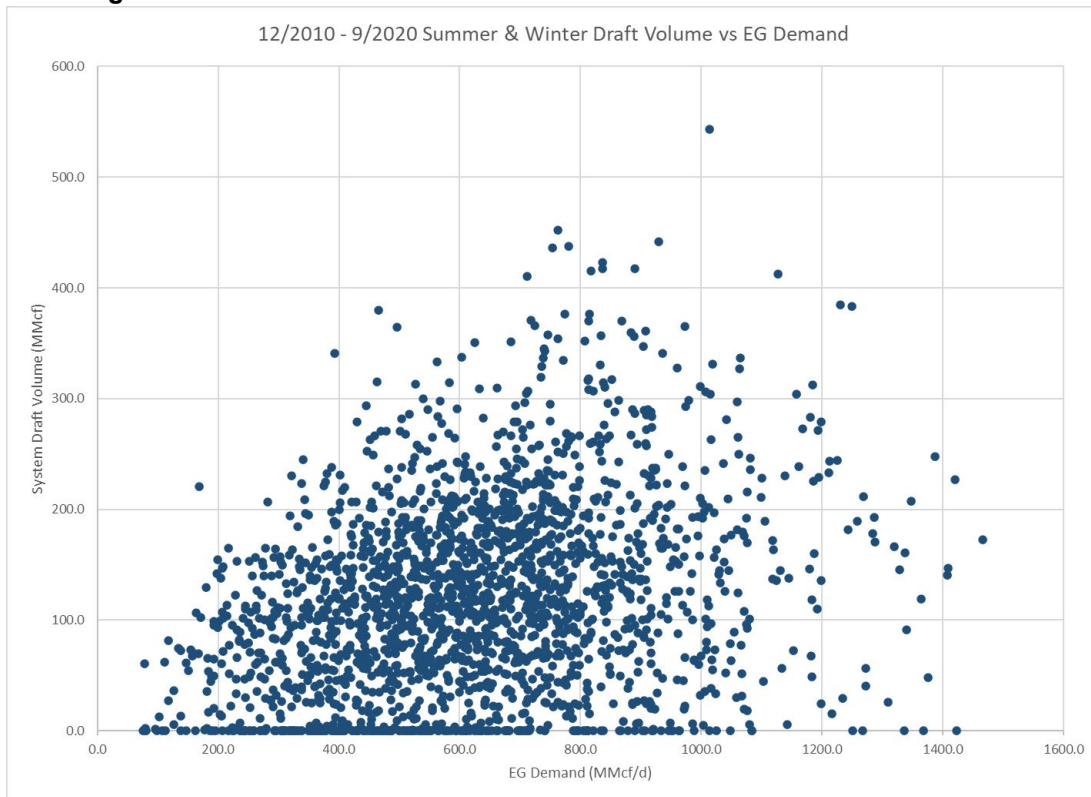


Figure 5: Summer and Winter Draft Volume v. Electric Generation Demand

Conclusion

Based on the degree of scatter in the plots, it is not possible to forecast the need for balancing accurately enough to use curtailments as a balancing resource. To ensure the gas system is protected, a conservative approach would need to be implemented, which would result in numerous unnecessary curtailments. Due to the inability to forecast the need for balancing and significant reliability impacts, PG&E does not consider curtailments as a feasible alternative to storage balancing resources.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 8, GAS OPERATIONS AND MAINTENANCE

TABLE OF CONTENTS

Subject	Page No.
Expense Workpapers	
Recorded and Forecast Expenses by MWC (Nominal Dollars)	WP 8-1
Recorded and Forecast Expenses by MWC (Base Year Dollars)	WP 8-2
Recorded and Forecast Expenses by MAT Code (Nominal Dollars)	WP 8-3
Recorded and Forecast Expenses by MAT Code (Base Year Dollars)	WP 8-6
Summary of Expenses	WP 8-9
Distribution Damage Prevention – MATs DFA, DFB, DF#, and JQC Forecast Calculator	WP 8-11
Distribution Pipeline Preventative and Corrective Maintenance – MATs FHB, FHC, FHG, FHO, FHP, and FH# Forecast Calculator	WP 8-13
Distribution Pipeline Preventative and Corrective Maintenance – MATs FIB, FIC, and FIF Forecast Calculator	WP 8-15
Customer Demand, Compliance, and Emergency Response Programs (Field Service) – MWC DD Forecast Calculator	WP 8-16
Customer Demand, Compliance, and Emergency Response Programs (Field Service) – MAT HYI Regulator Replacements Forecast Calculator	WP 8-17
Distribution Maintenance and Construction Programs – MATs FHA, FHE, FHI, and FHJ Forecast Calculator	WP 8-19
Distribution Maintenance and Construction Programs – MATs EXB and 27A Meter Protection Program and Relocation of Meter Sets Forecast Calculator	WP 8-21
Distribution Pipeline Markers and Distribution Patrols – MAT FHR Forecast Calculator	WP 8-22
Transmission Damage Prevention – MATs DFA and DFB Forecast Calculator	WP 8-23
Transmission Pipeline Patrol – MATs JOF and JOV Forecast Calculator	WP 8-24
Transmission Pipeline Preventative and Corrective Maintenance – MATs JO1, JO2, JOG, JOH, JOI, JOJ, JOK, JOL, JOM, JON, JOO, JOX, and JOY Forecast Calculator	WP 8-25

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 8, GAS OPERATIONS AND MAINTENANCE

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Station Maintenance - MATs JPA, JPB, JPC, JPD, JPE, JPG, JPH, JPI, JPK, JPL, JPN, JPO, JPP Forecast Calculator	WP 8-27
Right-Of-Way (ROW) Maintenance – MATs JOS, JOT, and JTO Forecast Calculator	WP 8-28
ROW Maintenance – MAT JTK Vegetation Management Forecast Calculator	WP 8-29
Transmission Permits and Fees - MAT JTH Forecast Calculator	WP 8-30
Project Summaries	
Project Summary - Damage Prevention (Distribution and Transmission)	WP 8-31
Project Summary - Distribution Pipeline Preventative and Corrective Maintenance	WP 8-35
Project Summary - Customer Demand, Compliance, and Emergency Response Programs (Field Service)	WP 8-38
Project Summary - Distribution Maintenance and Construction Programs	WP 8-41
Project Summary - Distribution Pipeline Markers and Distribution Patrols	WP 8-44
Project Summary - Transmission Pipeline Patrol	WP 8-46
Project Summary - Transmission Pipeline Preventative and Corrective Maintenance	WP 8-48
Project Summary - Station Maintenance	WP 8-51
Project Summary - Right-of-Way (ROW) Maintenance	WP 8-54
Expense Historical and Forecast Walk Workpapers	
Expense Recorded Walk by MWC - Distribution	WP 8-57
Expense Forecast Walk by MWC - Distribution	WP 8-58
Expense Recorded Walk by MWC - Transmission	WP 8-59
Expense Forecast Walk by MWC – Transmission	WP 8-60

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 8, GAS OPERATIONS AND MAINTENANCE

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Capital Workpapers	
Capital Expenditures by MWC (Nominal Dollars)	WP 8-61
Forecast Capital Expenditures Summary (Nominal Dollars)	WP 8-62
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million	WP 8-63
Recorded and Forecast Capital Expenditures Details - Other Work Capital – Projects Under \$3 Million	WP 8-64
Summary of Capital Expenditures	WP 8-65
Customer Demand, Compliance, and Emergency Response Programs (Field Service) – MAT 74A Regulator Replacements Forecast Calculator	WP 8-66
Distribution Maintenance and Construction Programs – MATs EXB and 27A Meter Protection Program and Relocation of Meter Sets Forecast Calculator	WP 8-21
Capital Historical and Forecast Walk Workpapers	
Capital Recorded Walk by MWC - Distribution	WP 8-67
Capital Forecast Walk by MWC - Distribution	WP 8-68
Supplemental Workpapers	
Gas Meter Protection Program Final Progress Report, April 2021	WP 8-69
Deferred Work Workpapers	
Deferred Work Analysis	WP 8-75

Workpaper Table 8-1
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8
Gas Operations and Maintenance
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	DD	Provide Field Service	44,752	41,649	40,728	52,601	50,203	56,787	56,040	57,922	
2	DF	G&E T&D Locate and Mark	39,242	39,483	46,435	53,160	38,566	50,622	77,634	89,310	
3	EX	G Dist Meter Protection	880	239	369	8,479	11,485	7,938	8,046	35,425	
4	FH	G Dist Preventive Maint	13,414	14,334	22,140	24,914	28,009	28,117	26,094	30,379	
5	FI	G Dist Corrective Maint	5,245	5,003	2,596	3,558	4,089	9,107	4,147	4,286	
6	HY	Change/Maint Used Gas Meters	2,973	3,008	4,161	2,714	2,182	2,319	2,212	919	
7	JO	GT Pipeline Maintenance	16,344	18,868	13,156	16,757	18,778	17,929	20,153	20,773	
8	JP	GT Station Maintenance	17,900	15,002	14,291	18,058	17,671	19,881	18,283	18,898	
9	JQ	G Dist Integrity Mgt (Non Bal)	1,879	2,261	1,166	2,843	3,371	3,384	3,468	5,302	
10	JT	GT Reliability & General Maint	8,980	9,938	13,547	17,546	21,324	17,267	24,379	24,736	
11	JU	Gas Distrib Leak Srvy & Repair	115								
12	Total		151,724	149,785	158,589	200,630	195,678	213,351	240,456	287,950	WP 8-10, Line 80

Notes: (A) Line 12 values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 8-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8
Gas Operations and Maintenance
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016		2017		2018		2019		2020		2021		2022		2023	
			Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Forecast	Forecast	Forecast	Forecast
1	DD	Provide Field Service	50,692		45,756		43,317		54,203		50,203		55,159		52,594		52,520	
2	DF	G&E T&D Locate and Mark	43,315		42,547		48,361		53,890		38,566		49,387		73,203		81,438	
3	EX	G Dist Meter Protection	944		259		384		8,364		11,485		7,713		7,556		32,144	
4	FH	G Dist Preventive Maint	14,922		15,514		22,986		25,257		28,009		27,531		24,749		27,898	
5	FI	G Dist Corrective Maint	5,783		5,363		2,695		3,597		4,089		8,867		3,904		3,901	
6	HY	Change/Maint Used Gas Meters	3,371		3,304		4,426		2,797		2,182		2,252		2,076		833	
7	JO	GT Pipeline Maintenance	17,970		20,208		13,809		16,979		18,778		17,584		19,155		19,117	
8	JP	GT Station Maintenance	19,819		16,203		14,899		18,289		17,671		19,524		17,390		17,406	
9	JQ	G Dist Integrity Mgt (Non Bal)	2,005		2,350		1,183		2,899		3,371		3,298		3,269		4,832	
10	JT	GT Reliability & General Maint	9,522		10,292		13,525		17,264		21,324		17,074		23,424		23,056	
11	JU	Gas Distrib Leak Srvy & Repair		126														
12	Total		168,469		161,796		165,585		203,539		195,678		208,389		227,320		263,145	

Workpaper Table 8-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8
Gas Operations and Maintenance
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	DD	DDA	Field Services: Other	1,347	246	9	1,116	309				WP 8-9, Line 1
2		DDD	Pilot Relight	11,782	11,483	10,525	10,773	9,876	12,026	11,748	12,142	WP 8-9, Line 7
3		DDE	Appliance Adj's	846	1,033	913	1,030	801	1,137	1,113	1,150	WP 8-9, Line 2
4		DDF	Gas Furnigation Activity	2,799	2,868	3,105	3,066	3,087	3,531	3,470	3,587	WP 8-9, Line 3
5		DDG	Gas Leaks & Emergencies	17,572	16,697	17,540	28,120	29,425	30,424	30,311	31,329	WP 8-9, Line 4
6		DDK	Gas Start	5,402	4,730	4,745	4,412	3,794	5,041	4,964	5,130	WP 8-9, Line 5
7		DDL	Gas Stop	5,004	4,593	3,891	4,083	2,912	4,629	4,435	4,584	WP 8-9, Line 6
8		DD#	Field Services: Other									WP 8-9, Line 8
9	DD Total			44,752	41,649	40,728	52,601	50,203	56,787	56,040	57,922	
10	DF	DFA	Locate and Mark	25,405	27,968	37,168	46,591	29,789	42,298	68,667	79,238	WP 8-9, Line 9, WP 8-10, Line 34
11		DFB	Locate and Mark - Standby	12,391	10,778	8,496	5,058	6,118	6,282	6,875	7,910	WP 8-9, Line 10, WP 8-10, Line 35
12		DF#	Locate and Mark Other	1,447	836	771	1,511	2,658	2,042	2,092	2,162	WP 8-9, Line 11, WP 8-10, Line 36
13	DF Total			39,242	39,483	46,435	53,160	38,566	50,622	77,634	89,310	
14	EX	EXA	MPP Inspections	6	217	2	8,450	11,471	7,938	8,046	35,425	WP 8-9, Line 14
15		EXB	MPP Protections	873	22	8	28	13				WP 8-9, Line 12
16		EXC	MPP - Service Valves	1	22	8	28	13				WP 8-9, Line 13
17	EX Total			880	239	369	8,479	11,485	7,938	8,046	35,425	
18	FH	FHA	Maint-Prev-G Mains	1,412	1,486	1,362	1,750	1,516	916	2,157	2,783	WP 8-9, Line 15
19		FHB	Maint-Prev-G Reg Sta	3,512	3,384	4,090	4,046	4,143	4,850	4,661	4,802	WP 8-9, Line 16
20		FHC	Maint-Prev-G Farm Tap	217	238	300	692	102	410	395	409	WP 8-9, Line 22
21		FHE	Maint-Prev-G Svcs	2,590	2,957	4,121	4,600	4,870	8,747	5,864	4,686	WP 8-9, Line 17
22		FHG	Maint-Prev-G Main Vlv	983	1,018	1,056	1,103	1,613	1,737	2,127	2,506	WP 8-9, Line 18
23		FHI	Maint-Corr G Svc Valves	1,102	1,698	6,500	7,321	5,447	4,245	4,088	8,057	WP 8-9, Line 19
24		FHJ	Gas Non-Recurring Projects	537	1,754	2,498	2,980	7,801	4,673	3,636	3,758	WP 8-9, Line 21
25		FHO	PM SCADA	265	393	698	864	1,062	1,012	1,303	1,453	WP 8-9, Line 24
26		FHP	CM SCADA	351	303	371	378	638	623	727	752	WP 8-9, Line 23
27		FH#	Preventative Maintenance, Other	2,444	1,104	1,144	1,179	816	903	1,135	1,173	WP 8-9, Line 20
28	FH Total			13,414	14,334	22,140	24,914	28,009	28,117	26,094	30,379	
29	FI	FIB	Maint-Corr-G Reg Genl	4,279	4,294	2,021	2,365	3,241	7,836	2,819	2,913	WP 8-9, Line 26
30		FIC	Maint-Corr-G Farm Tap	201	155	221	919	427	663	951	983	WP 8-9, Line 28
31		FIF	Maint-Corr-G Main Vlv	765	553	354	273	378	608	378	390	WP 8-9, Line 27
32	FI Total			5,245	5,003	2,596	3,558	4,089	9,107	4,147	4,286	
33	HY	HYI	G Meter Atmospheric Corrosion	2,570	2,998	4,156	2,714	2,182	2,319	2,212	919	WP 8-9, Line 29
34		HY#	Meter Set Atmospheric Corrosion Remediation-other	402	9	5						WP 8-9, Line 30
35	HY Total			2,973	3,008	4,161	2,714	2,182	2,319	2,212	919	

Workpaper Table 8-3
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Gas Operations and Maintenance
 Expenses by MAT Code
 (Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
36	JO	JO1	PM Scada Maintenance	564	164	186	174	328	358	334	345	WP 8-10, Line 52
37		JO2	CM Scada Maintenance	337	198	140	226	307	382	240	248	WP 8-10, Line 53
38		JOF	Requird Ground Pipeline Patrol	1,097	1,006	858	863	975	939	1,000	1,033	WP 8-10, Line 38
39		JOG	PM G Regulator General	1,314	1,987	2,029	2,091	2,855	3,516	3,761	3,887	WP 8-10, Line 39
40		JOH	PM Gas Pipeline Valve Manual	974	1,124	1,216	1,185	1,314	1,571	1,420	1,468	WP 8-10, Line 40
41		JOI	PM Gas Pipeline Valve Automate	159	8	43	32	30	33	38	39	WP 8-10, Line 49
42		JOJ	Gas Holders Maintenance	177	80	81	145	111	201	121	125	WP 8-10, Line 45
43		JOK	Oper Transmission Pipelines	1,001	874	908	1,107	1,008	689	705	728	WP 8-10, Line 41
44		JOL	Oper Transmission Regl Station	2,649	2,250	2,292	1,967	439	483	464	479	WP 8-10, Line 42
45		JOM	CM G Regl Genl	414	903	826	1,014	1,139	1,225	1,069	1,105	WP 8-10, Line 43
46		JON	CM Gas Pipeline Valve Manual	665	1,015	1,129	730	663	776	912	942	WP 8-10, Line 44
47		JOO	CM Gas Pipeline Valve Automate	23	203	246	194	151	193	213	220	WP 8-10, Line 48
48		JOS	Pipeline Marker Maintenance	65	4,574	(431)	1,577	2,265	1,002	1,700	1,756	WP 8-10, Line 47
49		JOT	Vegetation Management	104	6	433	797	699	298	1,429	1,477	WP 8-10, Line 46
50		JOV	Requird Aerial Pipeline Patrol	5,629	3,779	2,376	3,627	4,203	4,277	4,602	4,700	WP 8-10, Line 50
51		JOX	PM Meter Maintenance	550	586	616	834	1,824	1,828	1,870	1,933	WP 8-10, Line 54
52		JOY	CM Meter Maintenance	113	102	188	156	428	158	276	285	WP 8-10, Line 37
53		JO#	Gas Transmission Pipeline Maintenance	509	11	21	38	39				WP 8-10, Line 51
54		JO Total		16,344	18,868	13,156	16,757	18,778	17,929	20,153	20,773	
55	JP	JPA	PM StorCompStat Piping Assets	697	655	594	1,009	1,010	959	937	968	WP 8-10, Line 65
56		JPB	CM StorCompStat Piping Assets	159	289	140	239	886	1,450	450	465	WP 8-10, Line 59
57		JPC	PM StorCompStat GasProcess	833	1,109	1,489	1,826	1,791	1,942	1,835	1,897	WP 8-10, Line 63
58		JPD	PM StorCompStat GasCompressor	1,125	1,022	1,191	1,788	1,843	1,954	1,730	1,788	WP 8-10, Line 52
59		JPE	PM StorCompStat Support	1,747	1,772	1,684	1,477	1,710	2,015	2,172	2,245	WP 8-10, Line 64
60		JPF	PM StorCompStat Other	526	62	62						WP 8-10, Line 67
61		JPG	CM StorCompStat GasProcess	944	448	939	824	850	992	941	973	WP 8-10, Line 57
62		JPH	CM StorCompStat GasCompress	1,251	1,094	934	2,743	1,848	1,902	1,980	2,046	WP 8-10, Line 56
63		JPI	CM StorCompStat Support	(173)	940	1,594	1,601	852	1,580	1,462	1,511	WP 8-10, Line 58
64		JPJ	CM StorCompStat Other	1,558	348	(8)						WP 8-10, Line 61
65		JPK	PM Power Units	167	92	104	137	129	176	133	138	WP 8-10, Line 66
66		JPL	CM Power Units	189	233	280	303	152	195	265	274	WP 8-10, Line 60
67		JPN	Station Operations	6,358	5,851	4,838	5,377	5,817	5,518	5,762	5,955	WP 8-10, Line 55
68		JPO	PM Storage Wells	1,966	933	432	394	511	635	539	557	WP 8-10, Line 69
69		JPP	CM Storage Wells	132	124	24	46	73	563	77	79	WP 8-10, Line 70
70		JP#	PM station maintenance	421	28	55	295	200				WP 8-10, Line 68
71		JP Total		17,900	15,002	14,291	18,058	17,671	19,881	18,263	18,898	

Workpaper Table 8-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8
Gas Operations and Maintenance
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
72	JQ	JQC	Mark and Locate Program	1,879	2,261	1,166	2,843	3,371	3,384	3,468	5,302	WP 8-9, Line 31
73	JQ Total			1,879	2,261	1,166	2,843	3,371	3,384	3,468	5,302	
74	JT	JTF	Station Compress Overhaul_Insp	59	1	3						WP 8-10, Line 73
75		JTG	Storage Well	138								WP 8-10, Line 76
76		JTH	Permits & Fees Projects	6,015	6,753	6,917	6,652	6,926	6,289	7,377	7,625	WP 8-10, Line 71
77		JTI	Becker System Upgrades- Expnse	22								WP 8-10, Line 77
78		JTJ	GT Information Technology			2						WP 8-10, Line 72
79		JTK	Vegetation Manage Project	2,635	3,119	6,323	10,314	13,821	10,008	15,819	15,888	WP 8-10, Line 74
80		JTO	Encroachments Structures & ROW	111	26	302	580	577	970	1,183	1,223	WP 8-10, Line 75
81		JT#	GT Reliability & General Maintenance		39							WP 8-10, Line 78
82	JT Total			8,980	9,938	13,547	17,546	21,324	17,267	24,379	24,736	
83	JU	JU#	Leak Management Balancing Account	115								WP 8-9, Line 32
84	JU Total			115								
85	Total			151,724	149,785	158,589	200,630	195,678	213,351	240,456	287,950	WP 8-10, Line 80

Notes: (A) Line 85 values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Worksheet Table 8-4
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Gas Operations and Maintenance
 Expenses by MAT Code
 (Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	DD	DDA	Field Services: Other	1,527	268	9	1,140	309			
2		DDD	Pilot Relight	13,347	12,619	11,194	11,097	9,876	11,681	11,025	11,010
3		DDE	Appliance Adj's	959	1,135	972	1,062	801	1,104	1,045	1,043
4		DDF	Gas Fumigation Activity	3,171	3,151	3,302	3,159	3,087	3,429	3,257	3,252
5		DDG	Gas Leaks & Emergencies	19,901	18,340	18,652	28,995	29,425	29,552	28,447	28,407
6		DDK	Gas Start	6,118	5,196	5,048	4,545	3,794	4,896	4,658	4,652
7		DDL	Gas Stop	5,669	5,047	4,140	4,206	2,912	4,496	4,162	4,157
8		DD#	Field Services: Other								
9	DD Total			50,692	45,756	43,317	54,203	50,203	55,159	52,594	52,520
10	DF	DFA	Locate and Mark	28,467	30,423	39,063	47,391	29,789	41,166	64,597	72,056
11		DFB	Locate and Mark - Standby	13,305	11,254	8,525	4,992	6,118	6,235	6,639	7,417
12		DF#	Locate and Mark Other	1,543	870	773	1,508	2,658	1,986	1,967	1,965
13	DF Total			43,315	42,547	48,361	53,890	38,566	49,387	73,203	81,438
14	EX	EXA	MPP Inspections	6		2	1	1			
15		EXB	MPP Protections	937	235	374	8,335	11,471	7,713	7,556	32,144
16		EXC	MPP - Service Valves	1	23	28	9	13			
17	EX Total			944	259	384	8,364	11,485	7,713	7,556	32,144
18	FH	FHA	Maint-Prev-G Mains	1,558	1,601	1,420	1,778	1,516	897	2,046	2,556
19		FHB	Maint-Prev-G Reg Sta	3,962	3,704	4,327	4,143	4,143	4,749	4,420	4,410
20		FHC	Maint-Prev-G Farm Tap	246	262	319	711	102	401	375	375
21		FHE	Maint-Prev-G Svcs	2,852	3,172	4,246	4,627	4,870	8,565	5,562	4,304
22		FHG	Maint-Prev-G Main Viv	1,106	1,115	1,122	1,135	1,613	1,701	2,017	2,302
23		FHI	Maint-Corr G Svc Valves	1,233	1,837	6,666	7,408	5,447	4,156	3,877	7,399
24		FHJ	Gas Non-Recurring Projects	589	1,859	2,539	2,970	7,801	4,575	3,449	3,451
25		FHO	PM SCADA	300	430	742	890	1,062	991	1,236	1,334
26		FHP	CM SCADA	388	329	391	383	638	610	690	690
27		FH#	Preventative Maintenance, Other	2,689	1,205	1,215	1,213	816	884	1,076	1,077
28	FH Total			14,922	15,514	22,986	25,257	28,009	27,531	24,749	27,898
29	FI	FIB	Maint-Corr-G Reg Genl	4,718	4,604	2,100	2,394	3,241	7,629	2,654	2,652
30		FIC	Maint-Corr-G Farm Tap	223	168	229	928	427	646	895	894
31		FIF	Maint-Corr-G Main Viv	842	591	366	276	421	592	356	355
32	FI Total			5,783	5,363	2,695	3,597	4,089	8,867	3,904	3,901

Worksheet Table 8-4
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Gas Operations and Maintenance
 Expenses by MAT Code
 (Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
33	HY	HYI	G Meter Atmospheric Corrosion	2,919	3,294	4,421	2,797	2,182	2,252	2,076	833
34		HY#	Meter Set Atmospheric Corrosion Remediation-other	452	10	5					
35	HY Total			3,371	3,304	4,426	2,797	2,182	2,252	2,076	833
36	JO	JO1	PM Scada Maintenance	636	179	198	178	328	351	317	318
37		JO2	CM Scada Maintenance	378	215	147	231	307	375	228	229
38		JOJ	Require Ground Pipeline Patrol	1,235	1,100	906	886	975	921	950	951
39		JOG	PM G Regulator General	1,481	2,174	2,154	2,147	2,855	3,448	3,575	3,577
40		JOH	PM Gas Pipeline Valve Manual	1,095	1,230	1,289	1,218	1,314	1,540	1,350	1,351
41		JOI	PM Gas Pipeline Valve Automate	180	8	45	33	30	33	36	36
42		JOJ	Gas Holders Maintenance	195	85	84	146	111	197	115	115
43		JOK	Oper Transmission Pipelines	1,124	956	958	1,134	1,008	676	670	670
44		JOL	Oper Transmission Regl Station	2,967	2,460	2,418	2,010	439	474	441	441
45		JOM	CM G Regl Genl	459	979	862	1,029	1,139	1,201	1,016	1,017
46		JON	CM Gas Pipeline Valve Manual	727	1,083	1,148	731	663	761	867	867
47		JOO	CM Gas Pipeline Valve Automate	26	219	259	195	151	189	203	203
48		JOS	Pipeline Marker Maintenance	73	4,741	(420)	1,555	2,265	983	1,616	1,616
49		JOT	Vegetation Management	110	7	432	785	699	293	1,359	1,360
50		JOV	Require Aerial Pipeline Patrol	5,969	4,013	2,466	3,650	4,203	4,194	4,374	4,326
51		JOX	PM Meter Maintenance	620	638	648	855	1,824	1,792	1,777	1,778
52		JOY	CM Meter Maintenance	126	110	194	158	428	155	262	262
53		JO#	Gas Transmission Pipeline Maintenance	570	12	22	39	39			
54	JO Total			17,970	20,208	13,809	16,979	18,778	17,584	19,155	19,117
55	JP	JPA	PM StorCompStat Piping Assets	780	713	628	1,032	1,010	941	891	892
56		JPB	CM StorCompStat Piping Assets	173	308	146	241	886	1,423	428	428
57		JPC	PM StorCompStat GasProcess	912	1,181	1,518	1,820	1,791	1,906	1,746	1,747
58		JPD	PM StorCompStat GasCompressor	1,247	1,084	1,216	1,776	1,843	1,917	1,645	1,647
59		JPE	PM StorCompStat Support	1,933	1,927	1,766	1,510	1,710	1,977	2,066	2,068
60		JPF	PM StorCompStat Other	584	68						
61		JPG	CM StorCompStat GasProcess	1,025	481	961	829	850	973	895	896
62		JPH	CM StorCompStat GasCompress	1,373	1,159	960	2,740	1,848	1,867	1,883	1,885
63		JPI	CM StorCompStat Support	(198)	1,007	1,626	1,609	852	1,551	1,391	1,392
64		JPJ	CM StorCompStat Other	1,730	373	(8)					
65		JPK	PM Power Units	186	100	110	140	129	173	127	127
66		JPL	CM Power Units	210	249	289	303	152	191	252	253
67		JPN	Station Operations	7,109	6,383	5,145	5,534	5,817	5,430	5,480	5,485
68		JPO	PM Storage Wells	2,133	1,004	459	405	511	623	513	513
69		JPJ	CM Storage Wells	148	134	25	47	73	552	73	73
70		JP#	PM station maintenance	473	31	58	303	200			
71	JP Total			19,819	16,203	14,899	18,289	17,671	19,524	17,390	17,406

Worksheet Table 8-4
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Gas Operations and Maintenance
 Expenses by MAT Code
 (Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016		2017		2018		2019		2020		2021		2022		2023			
				Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted
72	JQ	JQC	Mark and Locate Program	2,005		2,350		1,183		2,899		3,371		3,298		3,269		4,832			
73	JQ Total			2,005		2,350		1,183		2,899		3,371		3,298		3,269		4,832			
74	JT	JTF	Station Compress Overhaul_ Insp	63		1		3													
75		JTG	Storage Well	156																	
76		JTH	Permits & Fees Projects	6,359		6,972		6,871		6,524		6,926		6,219		7,088		7,107			
77		JTI	Becker System Upgrades- Expsn	24																	
78		JTJ	GT Information Technology					2													
79		JTK	Vegetation Manage Project	2,799		3,251		6,346		10,163		13,821		9,896		15,199		14,809			
80		JTO	Encroachments Structures & ROW	121		27		303		577		577		959		1,137		1,140			
81		JT#	GT Reliability & General Maintenance			41															
82	JT Total			9,522		10,292		13,525		17,264		21,324		17,074		23,424		23,056			
83	JU	JU#	Leak Management Balancing Account	126																	
84	JU Total			126																	
85	Total			168,469		161,796		165,585		203,539		195,678		208,389		227,320		263,145			

Workpaper Table 8-5
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 8, Gas Operations and Maintenance
Summary of Expenses

Line No.	Gas Distribution Expense Description	MWC	MAT	2018 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	Reference	Notes
1	Field Services: Other	DD	DDA	1,346,812	245,949	1,116,325	300,784	-	-	1,150,384	WP 8-16, Line 4	1
2	Appliance Adis	DD	DDE	846,259	1,032,921	913,200	800,614	1,136,536	1,113,008	3,596,785	WP 8-16, Line 4	
3	Gas Flammability Activity	DD	DDF	2,798,872	2,867,639	3,104,744	3,086,702	3,530,628	3,470,251	31,328,611	WP 8-16, Line 6	
4	Gas Leaks & Emergencies	DD	DDG	17,572,401	16,696,949	28,120,018	29,424,529	30,424,323	30,310,749	4,130,264	WP 8-16, Line 7	
5	Gas Start	DD	DDK	5,401,782	4,729,532	4,411,553	3,794,276	5,040,533	4,963,582	4,584,103	WP 8-16, Line 8	
6	Gas Stop	DD	DDL	5,004,002	4,592,802	3,891,257	2,911,851	4,629,063	4,435,138	12,142,154	WP 8-16, Line 3	
7	Pilot Relight	DD	DDD	11,782,340	11,482,974	10,524,800	9,875,723	12,026,187	11,747,657	-		
8	Field Services: Other	DD	DD#	-	-	354	152	-	-	-		2
9	Locate and Mark	DF	DFA	24,394,156	26,839,047	36,047,971	29,084,542	40,914,699	67,066,360	77,435,704	WP 8-11, Line 3	
10	Locate and Mark - Standby	DF	DFB	3,881,667	2,229,952	204,553	292,624	2,042,100	2,091,999	451,268	WP 8-11, Line 4	
11	Locate and Mark Other	DF	DF#	1,388,436	836,394	770,688	2,658,411	2,042,100	2,091,999	2,162,250	WP 8-11, Line 5	
12	MPP Protections	EX	EXB	873,228	217,469	358,495	11,471,054	7,937,588	8,046,206	35,442,143	WP 8-21, Line 3	
13	MPP - Service Valves	EX	EXC	751	21,605	8,362	13,180	-	-	-		3
14	MPP Inspections	EX	EXA	5,539	294	493	915	-	-	-		4
15	Maint-Prev-G Mains	FH	FHA	1,412,223	1,485,541	1,749,846	1,515,701	916,166	2,157,099	2,782,827	WP 8-13, Line 3	
16	Maint-Prev-G Reg Sta	FH	FHB	3,511,655	3,384,181	4,089,587	4,143,404	4,850,353	4,660,626	4,994,254	WP 8-13, Line 4	
17	Maint-Prev-G Svs	FH	FHC	2,590,020	2,957,149	4,121,311	4,969,706	8,747,108	5,864,399	4,686,349	WP 8-13, Line 5	
18	Maint-Prev-G Main Vlv	FH	FHD	983,129	1,018,326	1,056,417	1,103,068	1,737,410	2,127,012	2,422,464	WP 8-13, Line 6	
19	Maint-Corr-G Svs/Valves	FH	FHE	1,102,178	1,697,705	6,699,879	7,131,956	4,244,628	4,089,136	8,057,367	WP 8-13, Line 7	
20	Preventative Maintenance, Other	FH	FHF	2,444,458	1,103,753	1,170,346	816,195	609,038	1,134,983	1,173,015	WP 8-13, Line 8	
21	Gas Non-Recurring Projects	FH	FHJ	537,235	1,753,631	2,498,346	7,801,212	4,672,625	3,655,953	3,756,121	WP 8-13, Line 9	
22	Oil SCADA	FH	FHK	217,458	236,143	300,165	691,685	410,011	955,340	468,623	WP 8-13, Line 10	
23	Oil SCADA	FH	FHL	350,536	303,130	370,649	637,760	623,437	727,230	751,065	WP 8-13, Line 11	
24	Distribution Pipeline Markers	FH	FHM	264,669	382,610	697,635	1,062,445	1,012,287	1,305,258	1,452,617	WP 8-13, Line 12	
25	Maint-Corr-G Reg Gert	FH	FHN	4,278,853	4,294,337	16,856	141,560	-	-	1,792,373	WP 8-13, Line 13	
26	Maint-Corr-G Main Vlv	FI	FIB	765,420	553,483	353,955	1,903,280	7,835,565	72,502	390,316	WP 8-15, Line 3	
27	G Meter Atmospheric Corrosion	FI	FIF	200,588	155,396	220,972	420,804	603,322	377,628	919,078	WP 8-15, Line 4	
28	Meter Set Atmospheric Corrosion	HY	FIC	2,570,210	2,988,325	4,155,591	2,182,201	2,319,206	2,212,397	919,078	WP 8-15, Line 5	
29	Dig in Reduction Team	HY	FID	402,423	9,376	5,131	(322)	-	-	-		5
30	Leak Management Balancing Account	JQ	JQC	1,852,238	2,228,790	1,149,527	3,229,465	3,384,415	3,395,286	3,509,272	WP 8-11, Line 6	
31		JQ	JQJ	114,646	-	-	-	-	-	-		6
32		JQ	JQJ	114,646	-	-	-	-	-	-		
33	Total Expenses			98,421,034	96,400,210	108,182,837	129,814,402	151,033,944	169,621,293	213,767,438		

Notes:
 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.
 (1) DDA is used for field services - other and does not have a forecast.
 (2) DD# captured other costs under MWC DD and is not used for forecasting.
 (3) EXC was previously used for meter protection/service valves, however, will no longer be used. Refer to MAT FHI.
 (4) EXA was previously used for meter inspections, however, it will no longer be used.
 (5) HY# captured other costs under MWC HY and is not used for forecasting.
 (6) JQ# captured other costs under MWC JQ and is no longer used.

Workpaper Table 8-5
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 8, Gas Operations and Maintenance
Summary of Expenses

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	Reference	Notes
34	Locate and Mark	DF	DFA	1,029,001	1,119,967	1,119,967	910,561	704,154	1,383,459	1,560,579	1,802,010	WP 8-23, Line 3	
35	Damage prevention- other activities	DF	DFB	9,008,865	8,548,264	8,291,931	4,765,631	6,095,991	5,857,351	6,459,284	7,458,584	WP 8-23, Line 4	
36	CM Meter Maintenance	DF	DFJ	58,073	-	-	-	-	-	-	-	WP 8-25, Line 14	
37	CM Meter Maintenance	DF	DFJ	113,203	101,688	187,720	156,000	427,542	158,129	275,751	285,018	WP 8-24, Line 4	
38	Require Ground Pipeline Patrol	JO	JOJ	1,096,554	1,006,019	857,868	862,766	938,668	862,766	999,667	1,033,237	WP 8-24, Line 4	
39	PM G Regulator General	JO	JOJ	1,313,922	1,987,489	2,029,214	2,090,828	2,855,216	3,515,980	3,760,903	3,887,271	WP 8-25, Line 5	
40	PM Gas Pipeline Valve Manual	JO	JOH	1,123,807	1,215,600	1,185,346	1,313,828	1,570,511	1,420,049	1,402,049	1,467,763	WP 8-25, Line 6	
41	Oper Transmission Pipelines	JO	JOH	974,016	874,453	731,007	1,107,383	1,007,618	688,308	704,520	728,190	WP 8-25, Line 8	
42	Oper Transmission Regl Station	JO	JOH	2,649,340	2,249,662	2,291,567	1,967,033	438,825	483,076	463,551	479,130	WP 8-25, Line 9	
43	CM G Regl Genl	JO	JOM	413,958	902,675	1,013,713	1,138,915	1,388,915	1,224,897	1,069,280	1,105,207	WP 8-25, Line 11	
44	CM Gas Pipeline Valve Manual	JO	JON	664,522	1,014,713	1,128,943	730,407	662,563	776,310	911,734	942,365	WP 8-25, Line 12	
45	Gas Holders Maintenance	JO	JOJ	176,932	80,318	81,357	145,179	111,113	200,551	121,224	125,300	WP 8-25, Line 16	
46	Vegetation Management	JO	JOT	103,993	6,338	433,321	796,929	699,444	298,485	1,429,450	1,477,452	WP 8-28, Line 5	
47	Pipeline Marker Maintenance	JO	JOS	4,753,503	(431,277)	1,577,117	2,265,299	1,699,871	1,002,340	1,699,871	1,756,632	WP 8-28, Line 6	
48	CM Gas Pipeline Valve Automate	JO	JOJ	23,238	202,897	245,772	193,842	150,774	193,215	213,285	220,450	WP 8-25, Line 13	
49	PM Gas Pipeline Valve Automate	JO	JOJ	159,333	7,532	42,902	32,319	29,964	33,296	37,969	39,249	WP 8-25, Line 7	
50	Require Aerial Pipeline Patrol	JO	JOV	5,628,976	3,778,642	2,376,068	3,626,796	4,203,026	4,276,710	4,602,128	4,700,326	WP 8-24, Line 5	
51	Gas Transmission Pipeline Maintenance	JO	JOH	508,756	11,440	21,238	38,130	38,719	-	-	-	WP 8-25, Line 4	
52	PM Scada Maintenance	JO	JOI	564,429	163,522	186,144	173,617	328,170	357,842	333,964	345,188	WP 8-25, Line 10	
53	CM Scada Maintenance	JO	JOJ	337,216	197,744	139,769	226,132	307,409	382,233	240,316	248,390	WP 8-25, Line 10	
54	PM Meter Maintenance	JO	JOX	585,949	585,949	616,294	833,639	1,824,273	1,869,681	1,869,681	1,932,502	WP 8-25, Line 8	
55	Station Operations	JP	JPN	6,351,804	5,844,796	4,742,024	5,280,549	5,742,971	5,517,880	5,761,732	5,955,326	WP 8-27, Line 19	
56	CM StorCompStat GasCompress	JP	JPH	1,250,841	1,094,123	934,274	2,743,155	1,847,963	1,902,212	1,979,598	2,046,112	WP 8-27, Line 14	
57	CM StorCompStat GasProcess	JP	JPG	(173,469)	940,437	1,593,943	1,600,572	852,316	991,551	941,118	972,739	WP 8-27, Line 14	
58	CM StorCompStat Support	JP	JPI	158,582	289,176	140,404	238,980	886,419	1,450,294	449,657	464,765	WP 8-27, Line 12	
59	CM StorCompStat Piping Assets	JP	JPB	188,551	233,363	279,896	303,220	151,624	194,835	265,418	274,336	WP 8-27, Line 16	
60	CM Power Units	JP	JPL	1,557,861	347,631	(6,312)	-	-	-	-	-	WP 8-27, Line 7	
61	CM StorCompStat Other	JP	JPJ	1,124,621	1,022,321	1,191,481	1,787,558	1,842,668	1,720,678	1,825,678	1,781,795	WP 8-27, Line 7	
62	PM StorCompStat GasCompress	JP	JPD	833,000	1,108,753	1,489,360	1,826,455	1,791,450	1,942,312	1,835,454	1,897,125	WP 8-27, Line 6	
63	CM StorCompStat GasProcess	JP	JPC	1,748,908	1,772,430	1,683,962	1,477,038	1,709,688	2,014,966	2,172,364	2,245,356	WP 8-27, Line 6	
64	PM StorCompStat Support	JP	JPE	697,434	654,759	593,880	1,008,748	1,010,311	959,327	936,739	968,213	WP 8-27, Line 5	
65	PM Power Units	JP	JPA	167,413	92,260	104,236	137,469	-	176,287	133,103	137,575	WP 8-27, Line 9	
66	PM StorCompStat Other	JP	JPF	526,310	62,559	-	-	-	-	-	-	WP 8-27, Line 9	
67	CM Station Maintenance	JP	JP#	421,339	28,268	56,086	205,145	200,260	-	-	-	WP 8-27, Line 10	
68	PM Storage Wells	JP	JPO	1,965,748	933,266	431,745	393,575	510,519	634,650	539,286	557,406	WP 8-27, Line 10	
69	CM Storage Wells	JP	JPP	6,014,671	6,753,209	6,917,476	6,651,603	6,925,031	6,286,642	7,376,672	7,624,328	WP 8-30, Line 3	
70	Permits & Fees Projects	JP	JPT	-	2,040	466	-	-	-	-	-	WP 8-27, Line 17	
71	GT Information Technology	JT	JTH	-	2,040	-	-	-	-	-	-	WP 8-30, Line 3	
72	Station Compress Overhaul Insp	JT	JTI	59,464	1,083	2,759	39	-	-	-	-	WP 8-23, Line 32	
73	Vegetation Manage Project	JT	JTF	2,635,192	3,118,540	6,323,021	10,313,825	13,821,344	10,007,569	15,819,295	15,888,054	WP 8-23, Line 4	
74	Encroachments Structures & ROW	JT	JTK	110,810	25,914	302,205	580,235	576,599	969,720	1,183,271	1,223,006	WP 8-23, Line 4	
75	Storage Well	JT	JTL	137,925	(32)	(20)	(34)	-	-	-	-		
76	Becker System Upgrades- Expense	JT	JTM	22,020	-	-	-	-	-	-	-		
77	GT Reliability & General Maintenance	JT	JTN	-	-	-	-	-	-	-	-		
78	GT Reliability & General Maintenance	JT	JTO	-	-	-	-	-	-	-	-		
79	Total Expenses			53,295,304	53,378,700	50,133,512	57,941,608	64,499,493	62,317,100	70,835,766	73,666,481		

Notes:
 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.
 (7) DFL captures other Damage Prevention costs under MWC DF, and is not used for transmission forecasting.
 (8) JO# captures cost under MWC JO and is not used for forecasting.
 (9) JPJ was previously used for preventative maintenance on storage compressor stations and is no longer in use. These costs are now captured as part of MAT JPI.
 (10) JPF was previously used for preventative maintenance on storage compressor stations and is no longer in use. These costs are now captured as part of MAT JPI.
 (11) JPH captures other station preventative and corrective maintenance costs under MWC JP, and is not used for forecasting.
 (12) JTI was previously used for GT information technology and is no longer in use.
 (13) JTF was previously used for station compression overhaul inspections and is no longer in use. Refer to MAT JTY.
 (14) JTG was previously used for storage wells and is no longer in use. Refer to MAT JTY.
 (15) JTI included expense related costs for Becker control updates are is no longer in use.
 (16) JTH captures other transmission reliability and general maintenance costs under MWC JT, and is not used for forecasting.

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
80	Total Expenses	All	All	151,716,338	149,778,909	158,316,349	200,072,615	194,313,895	213,351,044	240,457,059	267,433,919

**Workpaper Table 8-6
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 8, Operations and Maintenance
Distribution Damage Prevention
MATs DFA, DFB, DF#, and JQC Forecast Calculator**

Line No.

Forecast Summary Table - Gas Distribution

Description	2023 Units	2023 Unit Cost	2023 Forecast	Notes
Locate and Mark (DFA)	902,783	\$86	\$77,435,704	Units: Line 22, Unit Cost: Line 16
Standby Governance (DFB)	655	\$689	\$451,268	Units: Line 48, Unit Cost: Line 49
Other Damage Prevention Activities (DF#)	N/A	N/A	\$2,162,250	Line 75
Dig In Reduction Team (DIRT) (JQC)	N/A	N/A	\$3,509,272	Line 86

Notes:
(a) MATs DF# and JQC are non-unitized.

Locate and Mark (DFA) Unit and Unit Cost Forecast Detail

	2021 Forecast	2022 Forecast	2023 Forecast	Notes
Forecast	\$39,824,187	\$67,106,380	\$77,435,704	Line 34
Units	723,318	808,084	902,783	Line 22
Unit Cost	\$55	\$83	\$86	Line 14 + Line 15
Job Time (in minutes)	45	45	45	Line 24 + Line 29

	2017 Recorded ^(a)	2018 Recorded	2019 Recorded Adjusted ^(b)	2020 Recorded ^(a)	2021 Forecast	2022 Forecast	2023 Forecast	Notes
Base Recorded/Forecast	\$27,340,172	\$36,047,970	\$45,820,868	\$53,987,034	\$47,217,844	\$54,508,939	\$62,941,785	Forecast: Line 22 * Line 23
Units ^(c)	549,856	579,530	647,445	592,990	723,318	808,084	902,783	2019 Units * Line 92
Unit Cost (Escalated to 2021 \$)	\$55	\$67	\$74	\$93	\$65	\$67	\$70	2017-2019 unit costs: (Line 21 + Line 22) * Line 91 2021-2023 base unit cost: (2017-2019 Average) * Line 91
Job Time (in minutes)	33	35	37	47	35	35	35	2017-2019 Job Time Average
Fiber Optic Forecast				\$408,827	\$418,803	\$432,758	\$447,290	(d)
Job Time Forecast					\$10,537,540	\$12,164,663	\$14,046,630	(Line 29 + 60) * Line 30 * Line 22
Job Time Increase (in minutes per ticket)					10	10	10	(e)
Billable Hourly Rate (per hour)					\$88	\$91	\$94	(f)
OII Adjustment				(\$24,943,431)	(\$18,350,000)			(g)
Total	\$28,943,603	\$39,824,187	\$67,106,380	\$77,435,704				Line 21 + Line 26 + Line 28

Notes:
(a) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(b) The 2019 recorded costs reflect adjustments to move cost costs incorrectly captured under MAT DFA to MAT DFB.
(c) A 99% Distribution and 1% Transmission split has been applied to tickets based on a statistical sample of tickets. See Exhibit (PG&E-3), WP 8-23 for more information.
(d) Prior to April 2020, Fiber Optic work was recorded to IT. The 2020 recorded costs are escalated using the escalation factors in Line 91.
(e) Due to the new Ticket Management System (Locate App) as well as updates to the Locate and Mark Field Guide and field procedures, job times have increased from 35 minutes (3-year average for 2017-2019) to 47 minutes (in 2020). The forecast rounded the job time increase down to 10 minutes.
(f) The billable hourly rate is based on a 2018-2019 average labor rate including overheads.
(g) Shareholder funded spend as required by the Presiding Officer's Decision (D.20-02-036) adopting the Locate and Mark OII settlement with modifications in Appendix A.

Standby Governance (MAT DFB) Unit and Unit Cost Forecast Detail

	2021 Forecast	2022 Forecast	2023 Forecast	Notes
Forecast	\$383,646	\$415,406	\$451,268	Line 60
Units	537	593	655	Line 53 + Line 57
Unit Cost	\$714	\$701	\$689	Line 47 + Line 48

	2017 Recorded ^(a)	2018 Recorded	2019 Recorded Adjusted ^(b)	2020 Recorded ^(b)	2021 Forecast	2022 Forecast	2023 Forecast	Notes
Base Forecast	\$1,728,828	\$204,553	\$151,710	\$163,384	\$156,710	\$180,908	\$208,895	2021-2023 forecast: Line 53 * Line 54
Units ^(c)	5,026	943	427	297	477	533	595	2019 Units * Line 92
Unit Cost (Escalated to 2021 \$)	\$382	\$233	\$371	\$564	\$329	\$339	\$351	2017-2019 unit costs: (Line 52 + Line 53) * Line 91 2021-2023 base unit cost: (2017-2019 Average) * Line 91
Regulator Station Forecast					\$226,936	\$234,498	\$242,373	Line 57 * Line 58
Units					60	60	60	(d)
Unit Cost					\$ 3,782	\$ 3,908	\$ 4,040	(d)
Total	\$ 383,646	\$ 415,406	\$ 451,268					Line 52 + Line 56

Notes:
(a) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(b) The 2019 recorded adjusted costs reflect adjustments to move cost costs incorrectly captured under MAT DFA to MAT DFB.
(c) A 99% Distribution and 1% Transmission split has been applied to tickets based on a statistical sample of tickets. See Exhibit (PG&E-3), WP 8-23 for more information.
(d) The Regulator Station unit forecast assumes 5 standbys per month (5 x 12 = 60 per year). The unit cost forecast assumes each job will take approximately 19 hours to complete and uses historic contract labor costs.

Workpaper Table 8-6
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 8, Operations and Maintenance
Distribution Damage Prevention
MATs DFA, DFB, DF#, and JQC Forecast Calculator

Line No.

Other Damage Prevention Activities (MAT DF#) Forecast Detail

	2020 Recorded ^(a)	2021 Forecast	2022 Forecast	2023 Forecast
Dig Alert	\$ 71,168	\$ 72,905	\$ 75,334	\$ 77,863
Dig Safe Board - 2020	\$ 712,921	\$ 730,319	\$ 754,653	\$ 779,994
Dig Safe Board - 2019 ^(b)	\$ 577,997	\$ -	\$ -	\$ -
USA North 811	\$ 1,192,226	\$ 1,221,319	\$ 1,262,013	\$ 1,304,392
Total	\$ 2,554,312	\$ 2,024,542	\$ 2,091,999	\$ 2,162,250

Notes:

(a) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

(b) 2019 Dig Safe Board Fees were paid in 2020.

DIRT (MAT JQC) Forecast Detail

	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
Irth Solutions Inc.	\$ 21,961	\$ -	\$ -	\$ -
The ACT 1 Group Inc.	\$ 439,953	\$ 450,689	\$ 465,706	\$ 481,345
Internal Labor	\$ 2,767,551	\$ 2,835,086	\$ 2,929,550	\$ 3,027,927
Total	\$ 3,229,465	\$ 3,285,775	\$ 3,395,256	\$ 3,509,272

Escalation Factors

	2018	2019	2020	2021	2022	2023
Escalation Factors ^(a)	3.38%	2.88%	1.88%	2.44%	3.33%	3.36%
Unit Escalation ^(b)	-	-	-	12%	12%	12%

Notes:

(a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

(b) See Exhibit (PG&E-3), WP 8-24 for more information.

WP Table 8 - 7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Distribution Pipeline Preventative and Corrective Maintenance
MATs FHB, FHC, FHG, FHO, FHP, and FH# Forecast Calculator

Line No.

Forecast Summary Table			
MAT	Program Description	2023 Forecast ^(a)	Notes
Preventative Maintenance (PM)			
FHB ^(b)	PM Regulator Station	\$ 4,994,254	Line 24
FHC ^(b)	PM Farm Tap	\$ 408,623	Line 28
FHG ^(b)	PM Valve	\$ 2,422,464	Line 34
FHO	PM SCADA	\$ 1,452,817	Line 39
Corrective Maintenance (CM)			
FHP	CM SCADA	\$ 751,665	Line 44
PM and CM			
FH#	PM and CM, Other	\$ 1,173,015	Line 48

Notes:

- (a) The forecasts for these MATs are non-utilized.
 - (b) Line 4 and Line 6 2023 Forecast values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata.
- These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Forecast Details by MAT

MAT	Program Description	2018 Recorded (Nominal \$)	2018 Recorded (Escalated to 2020 \$)	2019 Recorded (Nominal \$)	2019 Recorded (Escalated to 2020 \$)	2020 Recorded (Nominal \$)	2020 Recorded (Escalated to 2020 \$)	2018-2020 Average (In 2020 \$)	Forecast Base	2021 Forecast Adders ^(a)	2022 Forecast Adders ^(a)	2023 Forecast Adders ^(a)	Notes
FHB ^(b)	PM Regulator Station	\$ 3,940,256	\$ 4,129,946	\$ 3,812,325	\$ 3,883,996	\$ 3,796,678	\$ 3,936,873	\$ 3,936,873	\$ 672,068	\$ 679,391	\$ 687,005	\$ 687,005	Adders: Sum of Lines 20-22
									Vegetation Management ^(c)	\$ 473,780	\$ 474,500	\$ 475,230	Line 79
									Meter Set Assembly Pilot Flexible Element	\$ 180,000	\$ 185,994	\$ 192,243	Line 65
									New Regulator Station Maintenance	\$ 18,288	\$ 18,897	\$ 19,532	Line 71
									Escalation Factor	1.0244	1.0333	1.0336	(d)
									Forecast Total ^(g)	\$ 4,705,001	\$ 4,846,620	\$ 4,994,254	Base Forecast (Line 19) + Line 23 + Adders (Line 19)
FHC ^(b)	PM Farm Tap	\$ 300,165	\$ 314,616	\$ 690,471	\$ 703,452	\$ 102,391	\$ 373,486	\$ 373,486	N/A	N/A	N/A	N/A	(d)
									Escalation Factor	1.0244	1.0333	1.0336	(d)
									Forecast Total	\$ 382,599	\$ 395,340	\$ 408,623	Base Forecast (Line 26) + Line 27
FHG ^(b)	PM Valve	\$ 1,056,417	\$ 1,107,275	\$ 1,103,068	\$ 1,123,806	\$ 1,383,654	\$ 1,204,911	\$ 1,204,911	\$ 699,438	\$ 770,569	\$ 1,104,196	\$ 1,104,196	Adders: Sum of Lines 31-32
									Curb Valve Maintenance	\$ 662,400	\$ 684,458	\$ 955,856	Line 90
									New Emergency Valve Maintenance	\$ 37,038	\$ 86,111	\$ 148,341	Line 101
									Escalation Factor	1.0244	1.0333	1.0336	(d)
									Forecast Total ^(g)	\$ 1,933,749	\$ 2,045,983	\$ 2,422,464	Base Forecast (Line 30) + Line 33 + Adders (Line 30)
FHO	PM SCADA	\$ 697,635	\$ 731,220	\$ 864,243	\$ 880,491	\$ 1,062,445	N/A ^(h)	\$ 1,062,445	\$ 73,856	\$ 178,647	\$ 290,420	\$ 290,420	Line 37
									New SCADA Maintenance	\$ 73,856	\$ 178,647	\$ 290,420	Line 114
									Escalation Factor	1.0244	1.0333	1.0336	(d)
									Forecast Total	\$ 1,162,224	\$ 1,303,258	\$ 1,452,817	Base Forecast (Line 36) + Line 38 + Adder (Line 36)
FHP ^(b)	CM SCADA	\$ 370,649	\$ 388,493	\$ 377,965	\$ 385,071	\$ 638,221	N/A ^(h)	\$ 638,221	\$ 50,000	\$ 51,665	\$ 53,401	\$ 53,401	Line 42
									Additional SCADA Work	\$ 50,000	\$ 51,665	\$ 53,401	(i)
									Escalation Factor	1.0244	1.0333	1.0336	(d)
									Forecast Total	\$ 703,794	\$ 727,230	\$ 751,665	Base Forecast (Line 41) + Line 43 + Adders (Line 41)
FH#	PM and CM, Other	\$ 1,143,673	\$ 1,198,731	\$ 1,179,348	\$ 1,201,520	\$ 816,195	\$ 1,072,149	\$ 1,072,149	N/A	N/A	N/A	N/A	(d)
									Escalation Factor	1.0244	1.0333	1.0336	(d)
									Forecast Total	\$ 1,098,309	\$ 1,134,883	\$ 1,173,015	Base Forecast (Line 46) + Line 47

Notes:

- (a) See Tables below for forecast adders methodology. The adders are with reference to the base forecast and reflect full value amounts (not incremental year-over-year adders).
- (b) The vegetation management adders are presented as approximate \$475,000 per year, however, the net increase in vegetation management costs if you take the vegetation management costs recorded in years 2018-2020 into consideration, is approximately \$200,000.
- (c) Adjusted PM Regulator Station (MAT FHB) recorded costs for 2018-2020 to remove vegetation management costs. The base forecast was adjusted because costs expected to increase in 2021 and beyond based on contracts to perform the work.
- (d) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.
- (e) Line 24 2023 Forecast Total values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.
- (f) The recorded costs reflected in this workpaper may vary from the Results of Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
- (g) Line 34 2023 Forecast Total values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.
- (h) The forecast base for most MATs is a 3-year average (2018-2020). SCADA PM and CM (MATs FHO and FHP) uses 2020 recorded as the foundation of the 2023 forecast because 2020 data gives a better view of the programs moving forward.
- (i) Accounts for additional SCADA work that is expected to be performed by Gas Pipeline Operations and Maintenance (e.g. ERX relocations, some expense replacement/repairs of assets, and minor expense removals of ancillary equipment). Based on an estimate of 10 relocations per year at \$5,000 each.
- (j) Adjusted PM Valve (MAT FHG) recorded costs for 2020 to remove curb valve maintenance costs.

WP Table 8 - 7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Distribution Pipeline Preventative and Corrective Maintenance
MATs FHB, FHC, FHG, FHO, FHP, and FH# Forecast Calculator

Line No.

Forecast Adders
PM Regulator Station (MAT FHB) Forecast Adders

	# of stations	# of hours per station	Hours	Labor Rate	Total	Notes
Meter Set Assembly						
Pilot Flexible Element	483	6	2,898	62.11	\$ 180,000	Line 21

New Regulator Station Maintenance	2021	2022	2023	Notes
Volume	135	135	135	(a)
Cost \$	135	\$ 140	\$ 145	(b)
Total \$	18,288	\$ 18,897	\$ 19,532	Line 69 * Line 70

- Notes:
 (a) Volume forecast assumes 10 Regulator Stations per year with an average of 13.5 components per Regulator Station.
 (b) Cost based on a 3-year average of costs (2018-2020) excluding vegetation management costs with escalation. See Exhibit (PG&E-3) Chapter 2 Workpapers for escalation factors.

Vegetation Management Adder

Square Feet	First Time Visit Costs (a)	Labor/Support (b)	Mowing Costs (c)	Herbicide Application Costs (d)	2021	2022	2023	Notes
739,977	\$100,000	\$300,000	\$50,000	\$23,780	\$473,780	\$474,500	\$475,230	Sum of (a)-(d)

- Notes:
 (a) This is for any facility that needs to be added to the program; the first visit can include additional activity in order to bring the site up to speed (for example clearing access roads or additional space to support project or coatings).
 (b) Labor and support overhead costs for program management and professional Services support which includes Pest Control Advisors and Quality Assurance Auditors and Contractor Safety Inspectors. This also includes costs of maintaining the database.
 (c) This is for fuels reduction program (FRP) which involves mowing facilities for weed abatement compliance.
 (d) This is a contractor cost for herbicide application.

PM Valve (MAT FHG) Forecast Adders

	Volume	First Time Maintenance Costs (a)	Subsequent Maintenance Costs (b)	Total	Total with escalation	Note
Curb Valve Maintenance	2,300	\$ 662,400	\$ 248,400	\$ 910,800	\$ 955,856	Line 31

- Notes:
 (a) First time maintenance performed on valves 3 years after installation. The forecast assumes a four hour job time (includes travel, locating valve and records, and maintenance) per valve at a labor rate of \$72/hr.
 (b) Subsequent maintenance performed on valves every 3 years. The forecast assumes a 1.5 hour job time per valve at a labor rate of \$72/hr.

New emergency valve maintenance	2021	2022	2023	Notes
Volume	200	250	300	(a)
Cost \$	185	\$ 191	\$ 198	(b)
Adder amount (incremental value year over year increase amount)	\$ 37,038	\$ 47,839	\$ 59,336	Line 97 * Line 98
Escalation Factor	1.0244	1.0333	1.0336	(b)
Full value adder amount (added with reference to base forecast amount)	\$ 37,038	\$ 86,111	\$ 148,341	(c)

- Notes:
 (a) Volume includes maintenance of 100 new safe operation valves per year.
 (b) Cost based on a 3-year average of costs (2018-2020) with escalation. See Exhibit (PG&E-3) Chapter 2 Workpapers for escalation factors.
 (c) This is full value adder amount. The adders are with reference to the base forecast and are full value amounts (not incremental year-over-year adders).

PM SCADA (MAT FHO) Forecast Adder

New SCADA Maintenance	2021	2022	2023	Notes
Volume	474	636	636	(a)
Cost \$	156	\$ 161	\$ 166	(b)
Adder amount (incremental value year over year increase amount)	\$ 73,856	\$ 102,332	\$ 105,770	Line 110 * Line 111
Escalation	1.0244	1.0333	1.0336	(b)
Full value adder amount (i.e. added with reference to base forecast)	\$ 73,856	\$ 178,647	\$ 290,420	(c)

- Notes:
 (a) Volume based on new remote terminal units and deactivations with an average of 5.39 components assumed per functional location.
 (b) Cost based on 2020 recorded costs with escalation. See Exhibit (PG&E-3) Chapter 2 Workpapers for escalation factors.
 (c) This is full value adder amount. The adders are with reference to the base forecast and are full value amounts (not incremental year-over-year adders).

**WP Table 8-8
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Distribution Pipeline Preventative and Corrective Maintenance
MATs FIB, FIC, and FIF Forecast Calculator**

Line No.

Forecast Summary Table

MAT	Program Description	2023 Forecast ^(a)	Notes
FIB ^(b)	Corrective Maintenance (CM) Regulator Station	\$ 2,272,418	Line 18
FIC	CM Farm Tap	\$ 982,613	Line 24
FIF	CM Valve	\$ 390,317	Line 28

Notes:

- (a) The forecasts for these MATs are non-unionized.
- (b) Line 3 2023 Forecast values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Forecast Details by MAT

MAT	Program Description	2018 Recorded (Nominal \$)	2018 Recorded (Escalated to 2020 \$)	2019 Recorded (Nominal \$)	2019 Recorded (Escalated to 2020 \$)	2020 Recorded (Nominal \$)	2018-2020 Average (In 2020 \$)	Forecast Base	2021 Forecast Adders ^(a)	2022 Forecast Adders ^(a)	2023 Forecast Adders ^(a)	Notes		
FIB ^(b)	CM Regulator Station	\$ 2,020,711	\$ 2,117,990	\$ 1,907,441	\$ 1,943,301	\$ 1,950,788	\$ 2,004,026	\$ 2,004,026	\$ 734,770	\$ 77,260	\$ 79,856	Sum of Lines 15-16		
										Unvented regulators	\$ 660,000	\$ -	\$ -	(b)
										Material traceability ^(c)	\$ 74,770	\$ 77,260	\$ 79,856	Line 41
										Escalation Factor	1.0244	1.0333	1.0336	(d)
										Forecast Total ^(e)	\$ 2,787,694	\$ 2,198,547	\$ 2,272,418	Line 14 * Line 17 + Line 14 Adder
FIC	CM Farm Tap	\$ 220,972	\$ 231,610	\$ 919,348	\$ 936,632	\$ 427,239	\$ 531,827	\$ 531,827	\$ 375,230	\$ 387,725	\$ 400,753	Sum of Lines 21-22		
										Overpressure elimination effort	\$ 200,000	\$ 206,660	\$ 213,604	Line 51
										Material traceability ^(c)	\$ 175,230	\$ 181,065	\$ 187,149	Line 42
										Escalation Factor	1.0244	1.0333	1.0336	(c)
										Forecast Total	\$ 920,034	\$ 950,671	\$ 982,613	Line 20 * Line 23 + Line 20 Adder
FIF	CM Valve	\$ 353,955	\$ 370,994	\$ 273,324	\$ 278,463	\$ 420,804	\$ 356,754	\$ 356,754	N/A	N/A	N/A			
										Escalation Factor	1.0244	1.0333	1.0336	(c)
								Forecast Total	\$ 365,459	\$ 377,628	\$ 390,317	Line 26 * Line 27		

Notes:

- (a) See Tables below for forecast adders methodology. The adders are with reference to the base forecast and are full value amounts (not incremental year-over-year adders).
- (b) This is not included in the 2023 forecast.
- (c) This is for the pressure verification/testing of components at regulator stations to test the reliability of the equipment. The costs are split between MATs FIB and FIC, see table below.
- (d) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.
- (e) Line 18 2023 Forecast Total values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.
- (f) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

Forecast Adders

Pressure Verifications (Material Traceability)

MAT	Program Description	# of stations / farm taps	% Split	2021 Adder	2022 Adder	2023 Adder	Notes
FIB	CM Regulator Station	780	30%	\$ 74,770	\$ 77,260	\$ 79,856	(a), (b)
FIC	CM Farm Tap	1828	70%	\$ 175,230	\$ 181,065	\$ 187,149	
Total		2608	100%	\$ 250,000	\$ 258,325	\$ 267,005	

Notes:

- (a) This is for the pressure verification/testing of components at the regulator stations, including High Pressure Regulators (HPRs) and farm taps.
- (b) Costs are split between MATs FIB and FIC as this work is related to regulator stations (including HPRs and farm taps). The split is based on number of regulator stations and farm taps being maintained (total of 2,608 stations of which 1,828 are farm taps and 780 are regulator stations).

Overpressure Elimination Effort

MAT	Program Description	2021 Adder	2022 Adder	2023 Adder	Note
FIC	CM Farm Tap	\$ 200,000	\$ 206,660	\$ 213,604	(a)

Notes:

- (a) Costs for farm tap modifications needed for maintenance.

Workpaper Table 8-9
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Customer Demand, Compliance and Emergency Response Programs (Field Service)
MWC DD - Forecast Calculator

Line No.

1 **Forecast Summary Table**

MAT	Description	Unit Cost (Escalated to 2023)	2023 Unit Forecast	2023 Forecast Total	Notes
DDD	Pilot Relight	\$ 87	138,946	\$ 12,142,154	Unit Cost: Line 12, Units: Line 24
DDE	Appliance Adjs	\$ 95	12,142	\$ 1,150,384	Unit Cost: Line 13, Units: Line 25
DDF	Gas Fumigation Activity	\$ 105	34,152	\$ 3,586,785	Unit Cost: Line 14, Units: Line 26
DDG	Gas Leaks & Emergencies	\$ 195	160,514	\$ 31,328,611	Unit Cost: Line 15, Units: Line 27
DDK	Gas Start	\$ 113	45,509	\$ 5,130,264	Unit Cost: Line 16, Units: Line 28
DDL	Gas Stop	\$ 59	77,877	\$ 4,584,103	Unit Cost: Line 17, Units: Line 29

10 **Unit Cost Forecast**

MAT Code	Description	2019 Recorded \$	2019 Recorded Units	2019 Unit Cost (Unescalated)	Unit Cost (Escalated to 2023 \$) ^(a)
DDD	Pilot Relight	\$ 10,773,107	137,413	\$ 78	\$ 87
DDE	Appliance Adjs	\$ 1,030,449	12,123	\$ 85	\$ 95
DDF	Gas Fumigation Activity	\$ 3,066,175	32,542	\$ 94	\$ 105
DDG	Gas Leaks & Emergencies	\$ 28,120,018	160,592	\$ 175	\$ 195
DDK	Gas Start	\$ 4,411,553	43,620	\$ 101	\$ 113
DDL	Gas Stop	\$ 4,083,304	77,322	\$ 53	\$ 59

Notes:

(a) 2019 unit cost * Line 33 escalation rates.

22 **Unit Forecast**

MAT	Description	2018 Recorded Units	2019 Recorded Units	Average (2018-2019)
DDD	Pilot Relights	140,479	137,413	138,946
DDE	Appliance Adjs	12,161	12,123	12,142
DDF	Gas Fumigation Activity	35,762	32,542	34,152
DDG	Gas Leaks & Emergencies	160,436	160,592	160,514
DDK	Gas Start	47,398	43,620	45,509
DDL	Gas Stop	78,431	77,322	77,877

Escalation Rates ^(a)	2019	2020	2021	2022	2023
	2.88%	1.88%	2.44%	3.33%	3.36%

Notes:

(a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Workpaper Review 8-10
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Customer Demand, Compliance and Emergency Response Programs (Field Service)
MAT HYI - Regulator Replacements Forecast Calculator

Line No.

1 **Forecast Summary Table**

	2023 Forecast	Notes	
2			
3	Unit Cost	\$ 57	Line 12
4	Unit	16,077	Line 32
5	Total	\$ 919,078	Line 3 * Line 4

6

7 **Unit Cost Calculation**

	2019 Recorded	Notes	
8			
9	Recorded Costs	\$2,714,285	
10	Recorded Units	52,923	
11	Unit Cost	\$51	Line 9 ÷ Line 10
12	Unit Cost (escalated to 2023 \$)	\$57	(a)

13

14 Notes:

15 (a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

16

17 **Unit Calculation**

18

19 **Forecast of Repairs 2020 - 2023 ^(a)**

Year	Volume	Notes	
20			
21	2020 YE Pending	61,891	Line 62
22	2021 Forecast Finds	15,452	Line 73
23	<i>Sub Total</i>	77,343	Line 21 + Line 22
24	2021 Repair Forecast	40,000	(b)
25	2021 YE Pending	37,343	Line 23 - Line 24
26	2022 Forecast Finds	16,077	Line 74
27	<i>Sub Total</i>	53,420	Line 25 + Line 26
28	2022 Repair Forecast	40,000	(b)
29	2022 YE Pending	13,420	Line 27 - Line 28
30	2023 Forecast Finds	16,077	Line 75
31	<i>Sub Total</i>	29,497	Line 29 + Line 30
32	2023 Repair Forecast	16,077	Line 46
33	2023 YE Pending	13,420	Line 31 - Line 32

34

35 Notes:

36 (a) This table shows a small volume in the system at the end of each year. This provides for bundling opportunities, routing and efficiencies, while enabling PG&E to stay ahead of survey cycle.

37 (b) Forecast volume held consistent with 2020 GRC forecast.

Workpaper Review 8-10
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Customer Demand, Compliance and Emergency Response Programs (Field Service)
MAT HYI - Regulator Replacements Forecast Calculator

Line No.

38

39

Historic and Projected Find Rates

40

Year	Total Services	Total Finds ^(a)	% Find Rate ^(b)
2017	1,031,136	30,942	3.00%
2018	1,238,404	25,867	2.09%
2019	1,032,232	10,204	0.99%
2020	1,669,524	10,447	0.63%
2021	1,308,833	15,452	1.18%
2022	1,361,716	16,077	1.18%
2023	1,361,716	16,077	1.18%

48

Notes:

49

(a) Finds as identified in the Inspect Application of AOC Tool as used by Leak Survey.

50

(b) The % Find Rate is Total Services ÷ Total Finds. For 2021 and beyond, the Find Rate is based on the 3-year average from 2018-2020. See table below.

51

3-year Average (2018-2020)		
Services	Finds	% Find Rate
3,940,160	46,518	1.18%

52

53

54

55

56

AC Meter Repairs Remaining (as of 12/31/2020)

57

	Total in Asset Management Plan (AMP)	Completed	Remaining ^(a)	Notes
AC Remediation				
AC Meter / AC Riser Found 2017	22,919	22,261	658	
AC Meter / AC Riser Found 2018	25,346	17,838	7,508	
AC Meter / AC Riser Found 2019	49,136	23,530	25,606	
AC Meter / AC Riser Found 2020	34,325	6,206	28,119	
Total	131,726	69,835	61,891	Sum of Lines 58-61

62

63

Notes:

64

(a) Data through 12/31/2020. Remaining units may include Can't Get In locations (CGIs) that require additional attempts to remediate.

65

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67

AC Meter Remediation Pending Volumes

68

Year Pending Units Found ^(a)	Volume	Due	Est. Completion
2017 Units	658	2020	2020
2018 Units	7,508	2021	2021
2019 Units	25,606	2022	2021
2020 Units	28,119	2023	2022
2021 Units	15,452	2024	2023
2022 Units	16,077	2025	2024
2023 Units	16,077	2026	2024

76

77

Notes:

78

(a) Data for historic pending from AMP system, future work is estimated.

Workpaper Table 8-11
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 8, Operations and Maintenance
Distribution Maintenance and Construction Programs
MATs FHA, FHE, FHI, and FHJ Forecast Calculator

Forecast Summary					
MAT	Description	Units	Unit Cost	2023 Forecast	Notes
FHA	Routine Maintenance on Mains	605	\$ 4,600	\$ 2,782,827	Units: Line 20, Unit Cost: Line 13
FHE	Routine Maintenance on Services	2,606	\$ 1,798	\$ 4,686,349	Units: Line 31, Unit Cost: Line 24
FHI	Service Valve Replacement	32,345	\$ 249	\$ 8,057,367	Units: Line 47, Unit Cost: Line 39
FHJ ^(a)	Non-Recurring Projects	n/a	n/a	\$ 3,758,121	Line 57

Notes:
(a) MAT FHJ is non-unitized.

Routine Maintenance on Mains (MAT FHA) Forecast Details

Unit Cost Forecast	2020 Recorded \$^(a)	2020 Recorded Units	2020 Unit Cost (unescalated)	Escalation Factor^(b)	2020 Unit Cost (escalated to 2023 \$)
MAT FHA	\$ 1,516,151	368	\$4,119	1.0375	\$ 4,600

Notes:
(a) 2020 recorded costs were chosen for the unit cost forecast to capture costs for plastic joint replacement work which began in 2020. The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(b) A unique escalation factor was used to account for annual labor rate increases.

Unit Forecast	2018 Recorded Units	2019 Recorded Units	2018-2019 Average	Plastic Joint Replacement Units	Total
MAT FHA	508	691	600	5	605

Routine Maintenance on Services (MAT FHE) Forecast Details

Unit Cost Forecast	2019 Recorded \$^(a)	2020 Recorded \$ Adjusted^(a)	2019-2020 Recorded \$ Total	2019-2020 Recorded Units Total	2019-2020 Unit Cost (2020 \$)	Escalation Factor^(b)	2020 Unit Cost (escalated to 2023 \$)
MAT FHE	\$ 4,611,322	\$ 3,061,565	7,672,888	4,765	\$1,610	1.0375	\$1,798

Notes:
(a) The 2019 and 2020 recorded adjusted spend excludes copper services costs.
(b) A unique escalation rate was used to account for annual labor increases.

Unit Forecast	2018 Recorded Units	2019 Recorded Units	2018-2019 Average^(a) (Forecast Base)	Incremental New Finds^(b)	2023 Unit Forecast Total
MAT FHE	2,024	2,156	2,090	516	2,606

Notes:
(a) The forecast base is a two-year average of service replacements completed by M&C. This excludes service replacements created by the AOC tool that are identified through AC Inspection and Leak Survey.
(b) This work is identified through AC inspection, leak survey inspection and abnormal operating conditions identified in the field by other PG&E employees. The new finds were estimated using the expected find rate per thousand inspections, using the 2021 inspection forecast. For additional information on AC inspections and leak survey, see Exhibit (PG&E-3), Chapter 10.

AC Inspections performed by Leak Survey	Divided by 1000 Services	Find Rate	New Finds
1,342,650	1,343	0.38	516

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Workpaper Table 8-11
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 8, Operations and Maintenance
Distribution Maintenance and Construction Programs
MATs FHA, FHE, FHI, and FHJ Forecast Calculator

Line No.

Service Valve Replacement (MAT FHI) Unit Cost Forecast							
Unit Cost Forecast	2019 Recorded \$	2020 Recorded \$ ^(a)	2019-2020 Recorded \$ Total	2019 Recorded Units	2019-2020 Recorded Units Total	2019-2020 Unit Cost (2020 \$)	2020 Unit Cost (escalated to 2023 \$)
MAT FHI	\$ 7,321,356	\$ 5,447,457	\$ 12,768,813	27,580	57,243	\$223	\$249

Notes:

- (a) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
- (b) A unique escalation rate was used to account for annual labor increases.

Service Valve Replacement (MAT FHI) Unit Forecast

Unit Forecast	2018 Recorded Units	2019 Recorded Units	2018-2019 Average ^(a) (Base Forecast)	New Finds ^(b)	Existing Locations ^(c)	Emergent Field Service Finds ^(d)	Total	Divided by 1000 services	Find Rate	New Finds
MAT FHI	4,038	3,062	3,550	5,303	7,392	16,100	32,345	1,342,650	3,949	5303

Notes:

- (a) The Base Forecast is based on a two year historic average of service replacements completed by M&C. This excludes service replacements created by the AOC tool that are identified through AC inspection and Leak Survey.
- (b) This work is identified through AC inspection, leak survey inspection and abnormal operating conditions identified in the field by other PG&E employees. The new finds were estimated using the expected find rate per thousand inspections, using the 2021 inspection forecast. For additional information on AC inspections and leak survey, see Exhibit (PG&E-3), Chapter 10.
- (c) Existing AOC backlog locations. PG&E forecasts addressing the existing backlog locations by 2026.
- (d) Emergent field services finds based on a two year historic average (2018-2019) of services replacements completed by Gas Service Representatives (GSRs).

Non-Recurring Projects (MAT FHJ) Forecast

2020 Recorded Adjusted \$	Escalation Factor	2020 Recorded Adjusted (escalated to 2023 \$)
MAT FHJ \$ 3,434,964	1.0244 (2021) 1.0333 (2022) 1.0336 (2023)	\$ 3,758,121

Notes:

- (a) 2020 recorded adjusted excludes copper services verifications that are not expected to continue into 2023.

Workpaper Table 8-12
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 8, Operations and Maintenance
Distribution Maintenance and Construction Programs
MATs EXB and 27A Meter Protection Program and Relocation of Meter Sets Forecast Calculator

Line No.

Forecast Summary

MAT	Description	2023 Unit Forecast	2023 Unit Cost Forecast	2023 Forecast	2024 Forecast ^(a)	2025 Forecast ^(a)	2026 Forecast ^(a)	Notes
EXB	Meter Protection (Bollards)	43,193	\$ 821	\$ 35,442,143				Units: Line 25, Unit Cost: Line 16
27A	Relocation of Meter Sets	250	\$ 29,640	\$ 7,410,003	\$ 7,608,591	\$ 7,807,175	\$ 8,010,942	Units: Line 45, Unit Cost: Line 38

Notes:

(a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Meter Protection (MAT EXB) Forecast Detail**Unit Cost Forecast**

Unit	Unit Cost ^(b) (Unescalated)	Escalation Factors ^(c)	Unit Cost (Escalated to 2023 \$)	2023 Unit Forecast	2023 Forecast
Non-CGI	\$ 732	1.0244 (2021) 1.0333 (2022)	\$ 781	39,783	\$ 31,070,523
CGI ^(a)	\$ 1,172	1.0336 (2023)	\$ 1,282	3,410	\$ 4,371,620
Total				43,193	\$35,442,143
Total Unit Cost					821

Notes:

(a) In some instances access issues may occur where no access was available to perform MPP work. These instances are referred to Can't Get In (CGI) locations. These locations are often more complex and costly to remediate.

(b) The Non-CGI unit cost is based on a 2021 estimate from a contractor. The CGI unit cost is based on a 2020 estimate from a contractor.

(c) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Unit Forecast

MAT	CGI ^(a)	Customer Call-Ins ^(b)	New Finds ^(c)	Existing Locations ^(d)	Total
EXB	3,410	120	19,380	20,283	43,193

Notes:

(a) The CGI estimate is based on an 8% CGI rate seen from work performed in 2020.

(b) This estimate is generally based on approximations of customer generated monthly requests received over the last 5 years.

(c) This work is identified through AC inspection, leak survey inspection and abnormal operating conditions identified in the field by other PG&E employees. The new finds were estimated using the expected find rate per thousand inspections, using the 2021 inspection forecast. For additional information on AC inspections and leak survey, see Exhibit (PG&E-3), Chapter 10.

(d) Existing AOC backlog locations. PG&E forecasts addressing the existing backlog locations by 2026.

Relocation of Meter Sets (MAT 27A) Forecast Detail**Unit Cost Forecast**

MAT	2020 Unit Cost (Unescalated)	Escalation Factors ^(a)	2020 Unit Cost (Escalated to 2023 \$)
27A	\$ 27,553	1.0136 (2021) 1.0298 (2022) 1.0306 (2023)	\$ 29,640

Notes:

(a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Unit Forecast

MAT	Capital Meter Protection Units ^(a)	Inaccessible Valves ^(b)	CGI ^(c)	Total ^(d)
27A	15	61	175	250

Notes:

(a) PG&E estimates that a number of expense meter protection locations forecast will convert to capital work. The capital estimate is based on a capital conversion rate of 0.0003451% which was derived from dividing the number of 27A meter protection relocations completed from 2018-2020 (12) by the number of EXB meter protection locations completed from 2018-2020 (34,770). The conversion rate is then applied to the 2023 EXB forecast to calculate the meter protection capital forecast.

(b) The inaccessible valves estimate is based on an average of service relocations completed between 2018-2020 (26+98+60/3 =61).

(c) There are currently 141 meters on the CGI tracker. The capital estimate is based on a capital conversion rate of 0.00405522 % which was derived from dividing the number of CGI locations (141) by the number of EXB meter protection locations completed from 2018-2020 (34,770). The conversion rate is then applied to the 2023 EXB forecast to get the CGI capital forecast.

(d) The total adds up to 251, however, the forecast was held to 250.

**Workpaper Table 8-13
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Distribution Pipeline Markers and Distribution Patrols
MAT FHR Forecast Calculator**

Line No.

Forecast Summary Table

MAT	Description	2023 Forecast	Note
FHR	Pipeline Markers	\$ 1,717,636	Line 16
	Patrols	\$ 74,937	Line 52
	Total	\$ 1,792,573	Line 4 + Line 5

Pipeline Marker Maintenance Forecast Details

	2023 Forecast	Note
Class Analysis Refresh (Escalated \$)	\$186,573	(a)
Markers	4,144	Line 40
Cost per marker maintained (Escalated \$)	\$369	Line 28
Marker Install	\$1,531,063	Line 13 * Line 14
Total	\$1,717,636	Line 12 + Line 15

Notes:

(a) The class analysis refresh cost is based on the estimate from the vendor which performs the analysis every 3 years with escalation. See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Marker Costs

	Markers	Materials Cost/Each	Labor Cost/Each	Cost (Nominal)	Total	Note
Pavement Decals	3,108	\$ 3.95	\$ 207.00	\$ 210.95	\$ 655,597	
TriView Markers	1,036	\$ 22.00	\$ 696.00	\$ 718.00	\$ 743,808	
Total Cost (Nominal)					\$ 1,399,405	Line 23 + Line 24
				Total Markers	4,144	Line 40
				Cost per marker (Nominal \$)	\$ 338	Line 25 ÷ Line 26
				cost per marker (Escalated \$)	\$ 369	(a)

Notes:

(a) Used escalation factor of 1.0941. See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Markers

	Roads	Railroads	Notes
Estimated Crossings ^(a)	1,656	70	Line 42
Markers per Crossing	2	2	(b)
Markers Subtotal	3,313	141	Line 35 * Line 36
Field Addition	663	28	(c)
Subtotal	3,975	169	Line 37 + Line 38
Total	4144		

Markers	Type	Percent of total	Markers
4144	Pavement Decals	75%	3,108
	TriView Markers	25%	1,036

Mileage	Estimated Crossings	Estimated Crossings Railroads
189	568	60
516	1089	10
Subtotal	1656	70

Notes:

(a) Average number of crossings per mile was used to forecast markers needed at road and rail road crossings.

(b) Each crossing has markers on each side.

(c) Additional 20% added based on assumptions that additional locations will be discovered and addressed on site (in the field) during installation.

Distribution Patrol Forecast Details

	2020 Recorded Adjusted ^(a) (Nominal \$)	Escalation Factor ^(b)	2021 Forecast	Escalation Factor ^(b)	2022 Forecast	Escalation Factor ^(b)	2023 Forecast
Costs	\$ 62,785	2.44%	\$ 70,164	3.33%	\$ 72,502.03	3.36%	\$ 74,937

Notes:

(a) Adjusted to remove costs related to the distribution pipeline markers locations self-reported.

(b) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Workpaper Table 8-14
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 8, Operations and Maintenance
Transmission Damage Prevention
MATs DFA and DFB Forecast Calculator

Line No.

Forecast Summary Table - Gas Transmission

Description	2023 Units	2023 Unit Cost	2023 Forecast	Notes
Locate and Mark (DFA)	8,098	\$223	\$1,802,010	Units: Line 14, Unit Cost: Line 13
Standby Governance (DFB)	7,280	\$1,025	\$7,458,584	Units: Line 47, Unit Cost: Line 46

Locate and Mark (DFA) Forecast Detail

	2017 Recorded	2018 Recorded	2019 Recorded	2023 Forecast	Notes
Costs	\$1,029,001	\$1,119,968	\$910,561		
Units	4,932	5,198	5,807		Line 31
Unit cost (Nominal)	\$209	\$215	\$157		Line 9 + Line 10
Unit cost (Escalated to 2023 \$)	\$247	\$246	\$174		Line 11 * Line 53
			Unit Cost Forecast	\$223	Line 12 + 3
			Unit Forecast	8,098	Line 10 (2019 Units) * Line 54
			Forecast Total	\$1,802,010	Line 13 * Line 14

Transmission and Distribution Ticket %

	2017	2018	2019	2020
Sample Size for 3rd Party Tickets	1,350	1,350	1,500	3,000
# of tickets with GT Only Assests (No GD or ED Assests)	15	12	10	21
Proportion of Transmission tickets	1%	1%	1%	1%
Proportion of Distribution tickets	99%	99%	99%	99%

Transmission and Distribution Ticket Split

	2017	2018	2019	Notes
Total 3rd Party L&M Tickets	554,788	584,728	653,252	
Proportion of Transmission tickets	1%	1%	1%	Line 22
Proportion of Distribution tickets	99%	99%	99%	Line 23
# of Transmission tickets	4,932	5,198	5,807	Line 28 * Line 29
# of Distribution tickets	549,856	579,530	647,445	Line 28 * Line 30
Total	554,788	584,728	653,252	Line 28
Year Over Year Change	12%	5%	12%	(a)

Notes:

(a) 12% percent seen in 2019 was used for the forecast year over year escalation.

Standby Governance (DFB) Unit Cost Forecast Detail

	2017 Recorded	2018 Recorded	2019 Recorded	Notes
Costs	\$8,548,264	\$8,291,631	\$4,765,531	
Units	10,165	8,917	5,221	
Unit cost (Nominal)	\$841	\$930	\$913	Line 42 ÷ Line 43
Unit cost (Escalated to 2023 \$)	\$995	\$1,063	\$1,016	Line 44 * Line 53
2023 Unit Cost Forecast			\$1,024.52	Line 45 + 3
2023 Unit Forecast			7,280	Line 43 (2019 Units) * Line 53
2023 Forecast Total			\$7,458,584	Line 46 * Line 47

Escalation Factors

	2018	2019	2020	2021	2022	2023
Escalation Factor ^(a)	3.43%	2.77%	1.91%	2.28%	3.28%	3.36%
Units Escalation	-	-	12%	12%	12%	12%

Notes:

(a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

**Workpaper Table 8-15
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Transmission Pipeline Patrol
MATs JOF and JOV Forecast Calculator**

Line No.

Forecast Summary Table

MAT	Description	Units	Unit Cost	2023 Forecast	Notes
JOF	Required Ground Pipeline Patrol	10,461	\$ 99	\$ 1,033,237	Line 16
JOV	Required Aerial Pipeline Patrol	125,656	\$ 37	\$ 4,700,326	Line 30 * Line 69

Required Ground Pipeline Patrol (MAT JOF) Forecast Detail

JOF	Costs (Nominal \$)	Escalation Factor	Costs (Escalated \$)	Units ^(a)	Unit Cost
2017 Recorded	\$1,006,019	1.1828	\$1,189,879	11,831	\$101
2018 Recorded	\$857,868	1.1435	\$980,999	10,253	\$96
2019 Recorded	\$862,766	1.1127	\$959,967	9,615	\$100
2023 Forecast Sub-total (3-year average)	\$908,884	N/A	\$1,043,615	10,566	\$99
StanPac Adjustment ^(b)			(\$10,378)	105	N/A
2023 Forecast Total			\$1,033,237	10,461	\$99

Notes:

(a) The forecast unit for MAT JOF is a forecast for the number of hours to provide ground response to Aerial Observations and patrol areas obscured by the air from vegetation.

(b) The 2023 forecast was adjusted to remove StanPac. See Exhibit (PG&E-3), Chapter 13 for the StanPac forecast.

Required Aerial Pipeline Patrol (MAT JOV) Forecast Detail

Units ^(a)

System Patrols	79,404
Additional patrol of high consequence areas as conditions permit	47,514
Sub-total	126,918
StanPac Adjustment ^(b)	1,262
Total	125,656

(a) The forecast unit for MAT JOV is the number of miles patrolled.

(b) The 2023 forecast was adjusted to remove StanPac. See Exhibit (PG&E-3), Chapter 13 for the StanPac forecast.

Unit Cost

Cost	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Notes
Aerial Patrollers (labor cost)	\$741,109	\$784,705	\$762,417	\$787,422	\$813,964	
GIS (labor)	\$277,338	\$284,179	\$355,554	\$367,216	\$379,547	
Staff Augmentation - Labor	\$515,708	\$544,650	\$557,087	\$575,358	\$594,679	
Applied Overheads ^(a)	\$443,910	\$439,973	\$427,476	\$441,496	\$456,322	
Helicopter	\$644,634	\$518,080	\$643,039	\$664,129	\$686,431	
Fixed Wing	\$694,317	\$1,563,823	\$1,694,783	\$1,694,783	\$1,694,783	
Video Storage Fees	\$0	\$100,641	\$102,939	\$106,316	\$109,886	
Other	\$309,779	\$11,014	\$11,265	\$11,635	\$12,026	
StanPac Adjustment	-	(\$4,040)	-	-	-	(b)
Total	\$3,626,796	\$4,203,026	\$4,554,561	\$4,648,355	\$4,747,538	Sum Lines 38-46

Notes:

(a) The 2021-2023 forecast applies a 56% overhead.

(b) The 2023 forecast was adjusted to remove StanPac. See Exhibit (PG&E-3), Chapter 13 for the StanPac forecast.

Labor Hours	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
Aerial Patrollers (hours)	12,597	13,291	12,625	12,625	12,625
Aerial Patrollers Labor Hours per Mile Patrolled (minutes)	6	10	6	6	6
Geographic Information System (GIS)	3,803	3,116	3,812	3,812	3,812
GIS Labor Hours per Mile Patrolled (minutes)	2	2	2	2	2

Units	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Notes
Miles Patrolled	126,632	83,614	126,918	126,918	126,918	Line 28
Helicopter Hours	450	372	451	451	451	
Fixed Wing Hours	1,078	825	1,081	1,081	1,081	

Costs / Hours	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Notes
Aerial Patrollers Rate	\$58.83	\$59.04	\$60.39	\$62.37	\$64.46	
GIS Rate	\$73	\$91	\$93.28	\$96.34	\$99.58	
Helicopter Rate ^(a) (Cost / Flight Hours)	\$1,431	\$1,393	\$1,424	\$1,471	\$1,521	
Fixed Wing Rate ^(a) (Cost / Flight Hours)	\$644	\$1,896	\$1,568	\$1,568	\$1,568	

Unit Cost	\$29	\$50	\$36	\$37	\$37	Line 47 ÷ Line 59
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Escalation Factor ^(b)	2.284%	3.280%	3.358%
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Notes:

(a) See Exhibit (PG&E-7), Chapter 2 for more information.

(b) See Exhibit (PG&E-3), Chapter 2 Workpapers for more information.

WP Table 8-16
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Transmission Pipeline Preventative and Corrective Maintenance
MATs JO1, JO2, JOG, JOH, JOI, JOJ, JOK, JOL, JOM, JON, JOO, JOX, JOY Forecast Calculator

Line No.

Forecast Summary Table			
MAT	Program Description	2023 Forecast	Notes
Preventative Maintenance (PM)			
JO1	PM SCADA Maintenance	\$ 345,188	Line 26
JOG	PM Regulator Stations	\$ 3,887,269	Line 34
JOH	PM Manual Valve	\$ 1,467,763	Line 38
JOI	PM Automated Valve	\$ 39,245	Line 41
JOX	PM Meter Maintenance	\$ 1,932,502	Line 63
Corrective Maintenance (CM)			
JO2	CM SCADA Maintenance	\$ 248,391	Line 29
JOM	CM Regulator Stations	\$ 1,105,207	Line 53
JON	CM Manual Valve	\$ 942,366	Line 56
JOO	CM Automated Valve	\$ 220,451	Line 59
JOY	CM Meter Maintenance	\$ 285,017	Line 66
PM and CM			
JOJ	Gas Holders Maintenance	\$ 125,297	Line 44
Operational			
JOK	Operate Transmission Pipelines	\$ 728,192	Line 47
JOL	Operate Transmission Regulator Stations	\$ 479,128	Line 50

Forecast Details by MAT

MAT	Program Description	2018 Recorded (Nominal \$)	2018 Recorded (Escalated to 2020 \$)	2019 Recorded (Nominal \$)	2019 Recorded (Escalated to 2020 \$)	2020 Recorded (Nominal \$)	2018-2020 Average (In 2020 \$)	MAT JOL Re-Allocation ^(a) / Land Department Adjustments ^(b)	Forecast Base	2021 Forecast Adders ^(c)	2022 Forecast Adders ^(c)	2023 Forecast Adders ^(c)	Notes
JO1	PM SCADA Maintenance	\$ 186,144	\$ 194,955	\$ 173,617	\$ 176,933	\$ 328,170	\$ 233,353	\$ 82,799	\$ 316,152	N/A	N/A	N/A	(e)
									Escalation Factor	1.0228	1.0328	1.0336	(d)
									Forecast Total	\$ 323,360	\$ 333,966	\$ 345,188	Line 25 * Line 24
JO2 ^(f)	CM SCADA Maintenance	\$ 141,835	\$ 148,548	\$ 226,131	\$ 230,451	\$ 303,493	\$ 227,497	N/A	\$ 227,497	N/A	N/A	N/A	Line 28 * Line 24
									Forecast Total	\$ 232,684	\$ 240,316	\$ 248,391	
JOG	PM Regulator Stations	\$ 2,029,214	\$ 2,125,255	\$ 2,090,828	\$ 2,130,763	\$ 2,855,216	\$ 2,370,411	\$ 423,354	\$ 2,793,765	\$ 794,000	\$ 809,715	\$ 836,922	(e)
									Additional Resources	\$ 609,000	\$ 628,975	\$ 650,109	Line 93
									Large Volume Customers	\$ 175,000	\$ 180,740	\$ 186,813	Line 112
									Forecast Total	\$ 3,641,463	\$ 3,760,903	\$ 3,887,269	Line 31 * Line 24 + Adders (Line 31)
JOH	PM Manual Valve	\$ 1,215,600	\$ 1,273,133	\$ 1,185,346	\$ 1,207,986	\$ 1,313,828	\$ 1,264,983	\$ 42,654	\$ 1,307,637	\$ 37,500	\$ 38,730	\$ 40,031	(e)
									Large Volume Customers	\$ 37,500	\$ 38,730	\$ 40,031	Line 114
									Forecast Total	\$ 1,374,951	\$ 1,420,049	\$ 1,467,763	Line 36 * Line 24 + Adders (Line 36)
JOI	PM Automated Valve	\$ 42,902	\$ 44,932	\$ 32,319	\$ 32,937	\$ 29,964	\$ 35,944	N/A	\$ 35,944	N/A	N/A	N/A	Line 40 * Line 24
									Forecast Total	\$ 36,764	\$ 37,970	\$ 39,245	
JOJ	Gas Holders Maintenance	\$ 81,357	\$ 85,207	\$ 145,179	\$ 147,952	\$ 111,113	\$ 114,757	N/A	\$ 114,757	N/A	N/A	N/A	Line 43 * Line 24
									Forecast Total	\$ 117,374	\$ 121,224	\$ 125,297	
JOK	Operate Transmission Pipelines	\$ 907,707	\$ 950,668	\$ 1,107,383	\$ 1,128,534	\$ 1,007,618	\$ 1,028,940	\$ (362,000)	\$ 666,940	N/A	N/A	N/A	(e)
									Forecast Total	\$ 682,146	\$ 704,520	\$ 728,192	Line 46 * Line 24
JOL	Operate Transmission Regulator Stations	\$ 2,291,567	\$ 2,400,024	\$ 1,967,033	\$ 2,004,604	\$ 438,825	\$ 1,614,485	\$ (1,175,659)	\$ 438,825	N/A	N/A	N/A	(e)
									Forecast Total	\$ 448,831	\$ 463,552	\$ 479,128	Line 49 * Line 24
JOM	CM Regulator Stations	\$ 825,657	\$ 864,734	\$ 1,013,713	\$ 1,033,074	\$ 1,138,915	\$ 1,012,241	N/A	\$ 1,012,241	N/A	N/A	N/A	Line 52 * Line 24
									Forecast Total	\$ 1,035,320	\$ 1,069,279	\$ 1,105,207	
JON	CM Manual Valve	\$ 1,128,943	\$ 1,182,374	\$ 730,407	\$ 744,357	\$ 662,563	\$ 863,098	N/A	\$ 863,098	N/A	N/A	N/A	Line 55 * Line 24
									Forecast Total	\$ 882,777	\$ 911,732	\$ 942,366	
JOO	CM Automated Valve	\$ 245,772	\$ 257,404	\$ 193,842	\$ 197,544	\$ 150,774	\$ 201,908	N/A	\$ 201,908	N/A	N/A	N/A	Line 58 * Line 24
									Forecast Total	\$ 206,511	\$ 213,285	\$ 220,451	
JOX	PM Meter Maintenance	\$ 616,294	\$ 645,463	\$ 833,639	\$ 849,561	\$ 1,824,273	\$ 1,106,432	\$ 626,852	\$ 1,733,284	\$ 37,500	\$ 38,730	\$ 40,031	(e)
									Large Volume Customers	\$ 37,500	\$ 38,730	\$ 40,031	Line 114
									Forecast Total	\$ 1,810,303	\$ 1,869,681	\$ 1,932,502	Line 61 * Line 24 + Adders (Line 61)
JOY	CM Meter Maintenance	\$ 187,720	\$ 196,604	\$ 156,000	\$ 158,980	\$ 427,542	\$ 261,042	N/A	\$ 261,042	N/A	N/A	N/A	Line 65 * Line 24
									Forecast Total ^(g)	\$ 266,994	\$ 275,751	\$ 285,017	

Notes:

- (a) See Table below for MAT JOL re-allocation methodology.
- (b) MAT JOK land department costs (approximately \$360,000) were removed from the forecast base as these costs will now be under MAT JTO. This amount was based on the 3-year average of land department charges from 2018-2020.
- (c) See tables below for forecast adders methodology. The adders are with reference to the base forecast and are full value amounts (not incremental year-over-year adders).
- (d) The escalation factors used for escalating 2018 to 2019 is 1.0277. The escalation factor used for escalating 2019 to 2020 is 1.0191. See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.
- (e) The forecast base is the escalated 2018-2020 average cost plus the MAT JOL re-allocation for MATs JO1, JOG, JOH, and JOX. For MAT JO1 it also includes the land department adjustments.
- (f) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

WP Table 8-16
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Transmission Pipeline Preventative and Corrective Maintenance
MATs JO1, JO2, JOG, JOH, JOI, JOJ, JOK, JOL, JOM, JON, JOO, JOX, JOY Forecast Calculator

Line No.

MAT JOL Re-Allocation^(a)

MAT	Program Description	2020 Recorded	2018-2020 Average	Difference	% of Total Difference	% of JOL
JOI	PM SCADA Maintenance	\$ 328,170	\$ 233,353	\$ 94,818	7.04%	\$ 82,799
JOG	PM Gas Regulator General	\$ 2,855,216	\$ 2,370,411	\$ 484,805	36.01%	\$ 423,354
JOH	PM Manual Valve	\$ 1,313,828	\$ 1,264,983	\$ 48,845	3.63%	\$ 42,654
JOX	PM Meter Maintenance	\$ 1,824,273	\$ 1,106,432	\$ 717,841	53.32%	\$ 626,852
	Subtotal	\$ 6,321,487	\$ 4,975,178	\$ 1,346,309	100%	\$ 1,175,659
	MAT JOL Recorded	\$ 438,825	\$ 1,614,485	\$ (1,175,659)		

Notes:

(a) Costs are being shifted from MAT JOL to MATs JO1, JOG, JOH, and JOX to better align ongoing work with program scope.

Forecast Adders

1. Additional resources - Split between MATs JOG and JPE

MAT	Program Description	% Split	2021	2022	2023	Notes
	Escalation Factor		1.0228	1.0328	1.0336	
JOG	PM Regulator Stations	60%	\$ 609,000	\$ 628,975	\$ 650,109	(a), (b)
JPE	PM Storage/Compressor Station Support	40%	\$ 406,000	\$ 419,317	\$ 433,406	(a)
	Total	100%	\$ 1,015,000	\$ 1,048,292	\$ 1,083,515	

Notes:

(a) Increases in maintenance work expected in the future, this forecast estimate accounts for the additional resources that will be needed. Gas Pipeline Operations and Maintenance technicians go through a state certified 3-year apprenticeship program.

(b) This is full value adder amount, i.e. these are adders with reference to the base forecast (and not incremental year-over-year adders).

2. Large Volume Customers (LVC) - Transition from 5-year to annual Class A inspections

	# of stations	# of hours per station/job	Hours	Standard labor rate	Total	Notes
LVC (Large Volume Customers)	384	10	3,840	65.10	\$ 250,000	(a), (b)

Notes:

(a) Forecast assumes 10 hrs per job (10 x 384) using a standard labor rate which is then escalated to 2023.

(b) The total is split between MATs JOG, JOH, and JOX, see table below. Most of the additional work is expected to be at regulator stations.

3. LVC Cost Split

MAT	Program Description	Split	2021 Adder	2022 Adder	2023 Adder
	Escalation Factor		1.0228	1.0328	1.0336
JOG	PM Regulator Stations	70%	\$ 175,000	\$ 180,740	\$ 186,813
JOH	PM Manual Valve	15%	\$ 37,500	\$ 38,730	\$ 40,031
JOX	PM Meter Maintenance	15%	\$ 37,500	\$ 38,730	\$ 40,031
	Total	100%	\$ 250,000	\$ 258,200	\$ 266,876

WP Table 8-17
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Station Maintenance
MATs JPA, JPB, JPC, JPD, JPE, JPG, JPH, JPI, JPK, JPL, JPN, JPO, JPP Forecast Calculator

Line No.

Forecast Summary Table

MAT	Program Description	2023 Forecast	Note
Preventative Maintenance (PM)			
JPA	PM Station Piping Assets Outside Compressor Building	\$ 968,213	Line 29
JPC	PM Gas Processing Equipment	\$ 1,897,125	Line 35
JPD	PM Inside Compressor Building	\$ 1,787,795	Line 38
JPE	PM Storage/Compressor Station Support	\$ 2,245,356	Line 41
JPK	PM Power Units	\$ 137,575	Line 53
JPO	PM Storage Wells	\$ 557,406	Line 62
Corrective Maintenance (PM)			
JPB	CM Station Piping Assets Outside Compressor Building	\$ 464,765	Line 32
JPG	CM Gas Processing Equipment	\$ 972,739	Line 44
JPH	CM Inside Compressor Building	\$ 2,046,112	Line 47
JPI	CM Storage/Compressor Station Support	\$ 1,511,415	Line 50
JPL	CM Power Units	\$ 274,336	Line 56
JPP	CM Storage Wells	\$ 79,467	Line 65
Operational			
JPN	Station Operations	\$ 5,955,326	Line 59

Notes:

(a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Forecast Details by MAT

MAT	Program Description	2018 Recorded (Nominal \$)	2018 Recorded (Escalated to 2020 \$) ^(a)	2019 Recorded (Nominal \$)	2019 Recorded (Escalated to 2020 \$) ^(a)	2020 Recorded (Nominal \$)	2018-2020 Average (In 2020 \$)	Forecast Base	2021 Forecast Adders ^(b)	2022 Forecast Adders ^(b)	2023 Forecast Adders ^(b)	Notes	
									Escalation Factor	1.0228	1.0328	1.0336	(a)
JPA	PM Station Piping Assets Outside Compressor Building	\$ 593,880	\$ 621,988	\$ 1,008,748	\$ 1,028,015	\$ 1,010,311	\$ 886,771	\$ 886,771	N/A	N/A	N/A	Line 28 * Line 27	
									Forecast Total	\$ 906,990	\$ 936,739	\$ 968,213	Line 28 * Line 27
JPB	CM Station Piping Assets Outside Compressor Building	\$ 140,404	\$ 147,049	\$ 238,980	\$ 243,544	\$ 886,419	\$ 425,671	\$ 425,671	N/A	N/A	N/A	Line 31 * Line 27	
									Forecast Total	\$ 435,376	\$ 449,657	\$ 464,765	Line 31 * Line 27
JPC	PM Gas Processing Equipment	\$ 1,489,360	\$ 1,559,850	\$ 1,826,455	\$ 1,861,340	\$ 1,791,450	\$ 1,737,547	\$ 1,737,547	N/A	N/A	N/A	Line 34 * Line 27	
									Forecast Total	\$ 1,777,163	\$ 1,835,454	\$ 1,897,125	Line 34 * Line 27
JPD	PM Inside Compressor Building	\$ 1,191,481	\$ 1,247,873	\$ 1,787,558	\$ 1,821,700	\$ 1,842,668	\$ 1,637,413	\$ 1,637,413	N/A	N/A	N/A	Line 37 * Line 27	
									Forecast Total	\$ 1,674,746	\$ 1,729,678	\$ 1,787,795	Line 37 * Line 27
JPE	PM Storage/Compressor Station Support	\$ 1,683,962	\$ 1,763,662	\$ 1,477,038	\$ 1,505,249	\$ 1,709,698	\$ 1,659,536	\$ 1,659,536	\$ 406,000	\$ 419,317	\$ 433,406	Line 79 Line 40 * Line 27 + Adders (Line 40)	
									Forecast Total	\$ 2,103,374	\$ 2,172,364	\$ 2,245,356	Line 40 * Line 27 + Adders (Line 40)
JPG	CM Gas Processing Equipment	\$ 939,114	\$ 983,561	\$ 823,846	\$ 839,581	\$ 849,608	\$ 890,917	\$ 890,917	N/A	N/A	N/A	Line 43 * Line 27	
									Forecast Total	\$ 911,230	\$ 941,118	\$ 972,739	Line 43 * Line 27
JPH	CM Inside Compressor Building	\$ 934,274	\$ 978,493	\$ 2,743,155	\$ 2,795,549	\$ 1,847,963	\$ 1,874,002	\$ 1,874,002	N/A	N/A	N/A	Line 46 * Line 27	
									Forecast Total	\$ 1,916,729	\$ 1,979,598	\$ 2,046,112	Line 46 * Line 27
JPI	CM Storage/Compressor Station Support	\$ 1,593,943	\$ 1,669,383	\$ 1,600,572	\$ 1,631,143	\$ 852,316	\$ 1,384,281	\$ 1,384,281	N/A	N/A	N/A	Line 49 * Line 27	
									Forecast Total	\$ 1,415,842	\$ 1,462,282	\$ 1,511,415	Line 49 * Line 27
JPK	PM Power Units	\$ 104,236	\$ 109,170	\$ 137,489	\$ 140,115	\$ 128,724	\$ 126,003	\$ 126,003	N/A	N/A	N/A	Line 52 * Line 27	
									Forecast Total	\$ 128,876	\$ 133,103	\$ 137,575	Line 52 * Line 27
JPL	CM Power Units	\$ 279,896	\$ 293,143	\$ 303,220	\$ 309,012	\$ 151,624	\$ 251,260	\$ 251,260	N/A	N/A	N/A	Line 55 * Line 27	
									Forecast Total	\$ 256,988	\$ 265,418	\$ 274,336	Line 55 * Line 27
JPN ^(c)	Station Operations	\$ 4,837,995	\$ 5,066,973	\$ 5,376,523	\$ 5,479,214	\$ 5,816,980	\$ 5,454,389	\$ 5,454,389	N/A	N/A	N/A	Line 58 * Line 27	
									Forecast Total	\$ 5,578,749	\$ 5,761,732	\$ 5,955,326	Line 58 * Line 27
JPO	PM Storage Wells	\$ 431,745	\$ 452,179	\$ 393,575	\$ 401,092	\$ 510,519	N/A ^(d)	\$ 510,519	N/A	N/A	N/A	Line 61 * Line 27	
									Forecast Total	\$ 522,159	\$ 539,286	\$ 557,406	Line 61 * Line 27
JPP	CM Storage Wells	\$ 24,178	\$ 25,322	\$ 45,894	\$ 46,771	\$ 72,783	N/A ^(d)	\$ 72,783	N/A	N/A	N/A	Line 64 * Line 27	
									Forecast Total	\$ 74,442	\$ 76,884	\$ 79,467	Line 64 * Line 27

Notes:

(a) The escalation factors used for escalating 2018 to 2019 is 1.0277. The escalation factor used for escalating 2019 to 2020 is 1.0191. See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

(b) See Table below for forecast adders methodology. The adders are with reference to the base forecast and are full value amounts (not incremental year-over-year adders).

(c) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

(d) Instead of a 3-year average, JPO and JPP use 2020 recorded as the foundation of the 2023 forecast because 2020 reflects the current regulations related to valve maintenance compared to prior years.

Forecast Adders

1. Additional resources - costs split between JOG and JPE

MAT	Program Description	% Split	2021 Adder	2022 Adder	2023 Adder	Notes
			Escalation Factor	1.0228	1.0328	1.0336
JOG	PM Regulator Stations	60%	\$ 609,000	\$ 628,975	\$ 650,109	
JPE	PM Storage/Compressor Station Support	40%	\$ 406,000	\$ 419,317	\$ 433,406	(a), (b)
Total			100%	\$ 1,015,000	\$ 1,048,292	\$ 1,083,515

Notes:

(a) Increases in maintenance work expected in the future, this forecast estimate accounts for the additional resources that will be needed. Gas Pipeline Operations and Maintenance technicians go through a state certified 3-year apprenticeship program.

(b) This is full value adder amount, i.e. these are adders with reference to the base forecast (and not incremental year-over-year adders).

Workpaper 8-18
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Right Of Way (ROW) Maintenance
MATs JTO, JOT, and JOS Forecast Calculator

Line No.

Forecast Summary Table

MAT	Description	2023 Forecast	Note
JTO	Encroachments Structures & ROW Clean Up	\$ 1,223,006	Line 13
JOT	Routine Weed Abatement	\$ 1,477,452	Line 24
JOS	Pipeline Marker Maintenance	\$ 1,755,632	Line 35 * Line 45

Encroachments Structures & ROW Clean Up (MAT JTO) Forecast Detail

	2019 Recorded ^(a)	Escalation Factor ^(b)	2023 Forecast	Note
Encroachments Structures & ROW	\$ 580,255	1.1127	\$ 645,628	
Land (Access Roads)	\$ 518,915	1.1127	\$ 577,378	
Total	\$ 1,099,170	N/A	\$ 1,223,006	Line 11 + Line 12

Notes:

(a) Land costs were re-allocated from MAT JOK (Operate Transmission Pipelines) to MAT JTO to align costs better with work moving forward.

(b) See Exhibit (PG&E-3), Chapter 2 Workpapers for more information.

Routine Weed Abatement (MAT JOT) Forecast Detail

	2021 Forecast	Escalation Factor	2022 Forecast	Escalation Factor	2023 Forecast	Note
Routine Weed Abatement inside Facilities Perimeter or Maintenance around Facilities Border	\$ 1,294,056	3.28%	\$ 1,336,501	3.36%	\$ 1,381,382	(a)
	\$ 90,000	3.28%	\$ 92,952	3.36%	\$ 96,073	(b)
Total	\$ 1,384,056	N/A	\$ 1,429,453	N/A	\$ 1,477,455	

Notes:

(a) This work consists of routine vegetation control and herbicide applications to PG&E facilities inside the perimeter or "footprint" of the facility if unfenced to ensure weed-free conditions for site safety and line of site for gas personnel and inspectors. Forecasts are based on vendor estimates with escalation.

(b) This compliance maintenance includes: weed abatement/control, brush and flammable debris removal and hazard tree mitigation as needed to maintain a defined border extending out 100 feet around the perimeter of a facility footprint. 24 Critical facilities are treated three times a year, while smaller facilities are treated twice a year. Forecasts are based on vendor estimates with escalation.

Pipeline Marker Maintenance (MAT JOS) Forecast Detail**Historic Maintenance Performed**

MAT	2017	2018	2019	2017-2019 Average
JOS	2,525	2,623	2,018	2,389

Costs

	2017 Recorded (Nominal \$)	2018 Recorded (Nominal \$)	2019 Recorded (Nominal \$)	Note
Recorded Adjusted Costs	\$1,414,260	\$1,930,076	\$1,271,460	(a)
Maintenance Performed on Markers	2,525	2,623	2,018	Line 35
Cost per marker maintained (Nominal \$)	\$560	\$736	\$630	Line 40 + Line 41
Escalation Factor	1.1828	1.1435	1.1127	(b)
Cost per marker maintained (Escalated to 2023 \$)	\$662	\$841	\$701	Line 42 * Line 43
2017-2019 Average		\$735		

Notes:

(a) Scouting and inventory charges that are not expected to be recurring costs were removed to calculate the unit cost more accurately.

(b) See Exhibit (PG&E-3), Chapter 2 Workpapers for more information.

Workpaper Table 8-19
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Right Of Way (ROW) Maintenance
MAT JTK Vegetation Management - Forecast Calculator

Line No.		2021 Forecast		2022 Forecast		2023 Forecast	
		Units	Total Cost	Units	Total Cost	Units	Total Cost
1							
2	(a) Patrols & Operations						
3	Vegetation & Structure Patrols	2,250	\$ 284	2,250	\$ 284	2,250	\$ 284
4	Contractor support to run patrols and operations (hours)	30,400	\$ 67	30,400	\$ 70	30,400	\$ 70
5	Program Management (hours)	1,898	\$ 85	1,898	\$ 88	1,898	\$ 91
6			\$ 3,021,343		\$ 3,124,706		\$ 3,137,297
7	Patrols & Operations subtotal						
8	(b) Vegetation Maintenance						
9	Project Management (hours)	1,960	\$ 94	1,960	\$ 97	1,960	\$ 100
10	Vegetation Mowing and Herbicide Applications	250	\$ 15,000	250	\$ 15,000	250	\$ 15,000
11	Vegetation Treatment of Fee Strips	-	\$ -	-	\$ -	-	\$ -
12	Vegetation Maintenance subtotal	250	\$ 15,640	250	\$ 15,640	250	\$ 15,640
13			\$ 3,910,000		\$ 3,910,000		\$ 3,910,000
14	(c) Tree Management & Removal						
15	Unacceptable trees (change in condition)	3,500	\$ 1,700	2,500	\$ 1,700	2,500	\$ 1,700
16	Unacceptable trees (exposed pipe locations)	-	\$ -	628	\$ 1,067,000	628	\$ 1,067,000
17	New Plantings	265	\$ 400	500	\$ 400	500	\$ 400
18	Manageable trees	244	\$ 1,700	244	\$ 1,700	244	\$ 1,700
19	Mitigation	122	\$ 1,000	122	\$ 1,000	122	\$ 1,000
20	Tree Replacements (hours)	5,880	\$ 94	5,880	\$ 97	5,880	\$ 100
21	Tree Management & Removal subtotal		\$ 7,144,289		\$ 6,624,678		\$ 6,644,749
22							
23	(d) Public Affairs, Land & Environmental						
24	Permits	30	\$ 10,000	30	\$ 12,000	30	\$ 13,000
25	Environmental Project Review (hours)	1,650	\$ 101	1,650	\$ 105	1,650	\$ 109
26	Environmental – Field Bird Surveys	-	\$ -	-	\$ -	-	\$ -
27	Public Affairs	-	\$ -	-	\$ -	-	\$ -
28	Land Agents (hours)	5,950	\$ 90	5,950	\$ 90	5,950	\$ 90
29	Integrity Management (hours)	2,240	\$ 124	2,240	\$ 124	2,240	\$ 124
30	Public Affairs, Land & Environmental subtotal		\$ 2,094,021		\$ 2,159,911		\$ 2,196,008
31							
32	(e) Total		\$16,169,653		\$15,819,295		\$15,888,054

Notes:
(a) Patrols & Operations
This work includes a foot patrol and inspection of the Transmission Right of Way every 3 years to monitor changes in the health and condition of known vegetation and managed trees, identify new vegetation, and report potential structural encroachments. It also includes management of tree removal and vegetation treatment projects by geographic region as well as professional services for mapping, data management, operations, and customer support.

(b) Vegetation Maintenance
This work is the non-tree vegetation maintenance on easements and fee strips that requires mowing, weed eating, and herbicide spraying of sprouting stumps, tree seedlings, bushes, brambles, and tall grasses. Approximately 1,009 miles of pipeline requires (non-free) mowing, weed eating, and herbicide application. This approximate mileage has been calculated based on PG&E's yearly vegetation survey of the ROW. It also includes management of tree removal and vegetation treatment projects by geographic region.

(c) Tree Management & Removal
This maintenance work involves removal of trees categorized by the integrity management team as unmanageable (can include trees that are dead or dying). The trees requiring removal often require specialized equipment like cranes, extension buckets, as well as crews due to their proximity to houses or roads.

(d) Public Affairs, Land & Environmental
Estimated costs for permits and mitigation requirements, including support for environmental impacts (for example: Coastal Commission permits, sensitive species impact analysis, etc.) Land agents support maintenance of easements for the safe and reliable operation of the pipeline. Public Awareness includes government outreach and communications interface with communities, local jurisdictions, and customers to facilitate agreement for vegetation treatment and removal. Integrity Management evaluates tree information submitted from patrols regarding the risk that a tree may have to a pipe.

(e) Sum of Lines 6, 12, 21, and 30.

WP Table 8-20
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Transmission Permits and Fees
MAT JTH Forecast Calculator

Line No. 1

Forecast Summary Table

MAT ^(a)	Program Description	2023 Forecast	Note
JTH	Permits & Fees Projects	\$ 7,624,528	Line 13

Notes:
 (a) This is a non-unitized MAT.
 (b) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

Line No. 9

Forecast Detail

MAT	Program Description	2018 Recorded (Nominal \$)	2018 Recorded (Escalated to 2020 \$)	2019 Recorded (Nominal \$)	2019 Recorded (Escalated to 2020 \$)	2020 Recorded (Nominal \$)	2018-2020 Average (In 2020 \$)	Forecast Base	2021 Adder	2022 Adder	2023 Adder	Notes
JTH	Permits & Fees Projects	\$ 6,917,476	\$ 7,244,874	\$ 6,651,603	\$ 6,778,649	\$ 6,926,031	\$ 6,983,184	\$ 6,983,184	N/A	N/A	N/A	
							Escalation Factor	Total	1,0228	1,0328	1,0336	(a)
									\$ 7,142,401	\$ 7,376,672	\$ 7,624,528	Line 11 * Line 12

Notes:
 (a) The escalation factors used for escalating 2018 to 2019 is 1.0277. The escalation factor used for escalating 2019 to 2020 is 1.0191. See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DAMAGE PREVENTION (DISTRIBUTION AND TRANSMISSION)**

Project Title: Damage Prevention (Distribution and Transmission)

Major Work Categories: MWC DF (MATs DFA, DFB, DF#) and MWC JQ (MAT JQC)

Planning Order Numbers: 5056976, 5056567, 5055649, 5055648, 5055647, 5055646, 5055645, 5055472, 5057349, 5056568, 5055644, 5055643, 5055642, 5055641, 5055473, 5056976, 5055472, 5055473

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

PG&E's Transmission and Distribution Damage Prevention programs include the following activities: Locate and Mark (MAT DFA) and Standby Governance (MAT DFB). PG&E's Distribution Damage Prevention also includes the Dig-in Response Team (DiRT) (MAT JQC), and other program management activities (MAT DF#). These activities are discussed in more detail below.

Locate and Mark (MAT DFA). Locate and Mark activities are required to identify PG&E's gas and electric, transmission and distribution assets for third-parties who plan to dig near those assets. PG&E's response may include locating and field marking all subsurface installations identified within the area of proposed excavation, providing records of the locations of the subsurface installations, or advising the excavator PG&E operates no facilities within their proposed area of excavation.

PG&E belongs to two regional one call systems that share a common, toll-free "811" telephone number. The one-call systems are commonly referred to as Underground Service Alert (USA). Excavators must contact 811 at least two working days prior to proposed excavation. Prior to the notification (referred to as a ticket) start date PG&E must provide a response back to the excavator by responding to the USA ticket. USA tickets are transmitted electronically to PG&E and processed by ticket handling software, which sends the ticket directly to a PG&E locator. Each ticket is screened by the locator to determine if Company facilities conflict with the excavation. If there is a conflict, surface markings are required.

For USA tickets that could potentially involve high priority subsurface installations, the locator will notify the contractor and schedule a time to meet in the field. The locator will use the maps and locating instruments to identify the approximate location of the PG&E operated subsurface installations and place marks on the ground, showing the horizontal path of PG&E's facilities.

Standby Governance (MAT DFB). In the standby process, a PG&E field employee monitors an excavation activity in a watch and protect capacity to prevent damage to PG&E's critical facilities. Examples of the types of activities where PG&E performs a standby include excavations that are within five feet of the nearest edge of a critical facility¹ and boring activities that cross a critical facility within ten feet of its nearest edge. This process allows for greater visibility around contractor digging activity

¹ Critical facilities are facilities which, if damaged, are likely to result in difficulty controlling the gas flow due to their size, material properties, operating pressure, or location.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DAMAGE PREVENTION (DISTRIBUTION AND TRANSMISSION)**

near critical facilities and includes follow-up to all identified contractors. The process also provides feedback to excavators on the correct procedures to follow when digging near PG&E facilities.

Dig-In Reduction Team DiRT (MAT JQC). PG&E's Damage Prevention team is responsible for the overall management of PG&E's Damage Prevention Program, by managing the risks associated with excavations around PG&E's facilities and conducting investigations. As an additional control to manage the Damage Prevention Program, PG&E has established the Dig-In Reduction Team (DiRT). PG&E's DiRT is deployed systemwide to investigate dig-ins. Team members work closely with various local gas and electric operations personnel and respond to referrals from those employees when they observe excavations potentially not in compliance with the requirements of California Government Code Section 4216. DiRT personnel also assist the Ground Patrol team when they respond to immediate threats identified in the air by the Aerial Patrol team and other PG&E groups, in order to intervene in unsafe digging activities by third-parties and follow-up to educate excavators as necessary.

PG&E's Damage Prevention activities include educational outreach activities for professional excavators, local public officials, emergency responders, and the general public who lives and works within PG&E's service territory. The program communicates safe excavation practices, required actions prior to excavating near underground pipelines, availability of pipeline location information, and other gas safety information through a variety of methods throughout the year. These efforts are aimed at increasing public awareness about the importance of utilizing the 811 program before an excavation project is started, understanding the markings that have been placed, and following safe excavation practices after subsurface installations have been marked.

Other Damage Prevention Activities (MAT DF#). Includes membership fees to the Regional Notification Centers and fees assessed by the California Underground Facilities Safe Excavation Board. PG&E's portion of these fees is directly related to its percentage of total USA notifications statewide.

Justification

Federal pipeline safety regulations and state law require that the Company belongs to, and shares the costs of, operating the regional "one call" notification system.

49 CFR Section 192.614 requires that each operator of a buried pipeline carry out a program to prevent damage to that pipeline from excavation activities.

California Government Code (CGC) Section 4216 requires PG&E to belong to and share the costs of operating the regional "One-call" notification system.

Cost

Program costs are provided below.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DAMAGE PREVENTION (DISTRIBUTION AND TRANSMISSION)**

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast				Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	Total	
EXPENSE										
Distribution Expense Total	31,017	32,134	38,173	50,280	34,995	46,766	73,009	83,558	389,932	WP 8-9, Lines 9-11, Line 31
Transmission Expense Total	10,020	9,577	9,412	5,676	6,800	7,241	8,020	9,261	66,006	WP 8-10, Lines 34-36
TOTAL PROJECT COST	41,037	41,711	47,584	55,956	41,795	54,006	81,029	92,819	455,938	

Additional Cost Information Gas Distribution²:

The 2023 unit forecast for Gas Distribution MAT DFA (Locate and Mark) is based on the number of Locate and Mark USA tickets in 2019, apportioned to Gas Distribution, with a 12 percent year over year escalation applied. The 2023 units cost is based on a three-year average of recorded costs (2017-2019) with escalation. An additional \$14.1 million is forecast to capture increases in job time and an additional \$0.5 million is forecast for fiber optic work.

The 2023 unit forecast for Gas Distribution MAT DFB (Standby Governance) is based on 2019 recorded units with a 12 percent escalation applied due to the correlation between USA ticket request volumes and the need for standby activities. The 2023 unit cost forecast is based on a three-year average of recorded costs (2017-2019) with escalation. An additional \$0.2 million is forecast for incremental standby work added for distribution regulator stations.

The 2023 forecast for MAT JQC is based on 2020 recorded costs with escalation. This is a non-unitized MAT.

The 2023 forecast for MAT DF# is based on 2020 recorded costs with escalation. This is a non-unitized MAT.

Additional Cost Information Gas Transmission³:

The 2023 unit forecast for Gas Transmission MAT DFA (Locate and Mark) is based on the number of Locate and Mark USA tickets in 2019, apportioned to Gas Transmission, with a 12 percent YOY escalation applied. The 2023 units cost is based on three-year average of recorded costs (2017-2019) with escalation.

The 2023 unit forecast for Gas Transmission MAT DFB (Standby Governance) is based on 2019 recorded units with a 12 percent escalation applied due to the correlation between USA ticket request

² Exhibit (PG&E-3), WP 8-11.

³ Exhibit (PG&E-3), WP 8-23.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DAMAGE PREVENTION (DISTRIBUTION AND TRANSMISSION)**

volumes and the need for standby activities. The 2023 unit cost forecast is based on a three-year average of recorded costs (2017-2019) with escalation.

Benefits

PG&E's Locate and Mark activities, in conjunction with the USA system, have been instrumental in reducing damage to the Company's underground facilities caused by dig-ins. As shown on Table 8-4 of Exhibit (PG&E-3) Chapter 8 testimony, there has been a downward trend in the number of dig-ins per 1,000 USA Tickets. PG&E attributes this reduction in the number of dig-ins due to PG&E's increased Damage Prevention activities. This reduction in the number of dig-ins reduces the number of costly emergency repairs and improves public safety.

In addition to Locate and Mark, the additional Damage Prevention activities described above increase customer awareness of the importance of calling 811 prior to initiating excavation activities, which reduces the number of dig-ins on the Gas system and improves overall safety of the system.

Alternatives Considered

- Alternative 1
This alternative included a model for ticket volumes using a 3-year average (2018-2020). The use of a 3-year unit average would not have adequately reflected regulatory changes that began in July 2020 with the implementation of the investigations and enforcement responsibilities of the California Dig Safe Board.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION PIPELINE PREVENTATIVE AND CORRECTIVE
MAINTENANCE**

Project Title: Distribution Pipeline Preventative and Corrective Maintenance

Major Work Categories: MWCs FH and FI (MATs FH#, FHB, FHC, FHG, FHO, FHP, FIB, FIC, and FIF)

Planning Order Numbers: 5055709, 5055706, 5055707, 5055760, 5055576, 5055705, 5055702, 5055704, 5056561

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

Preventative Maintenance includes work required to comply with pipeline safety regulations that require PG&E to conduct periodic or routine maintenance on its gas distribution system. Preventative maintenance work includes maintenance of Supervisory Control and Data Acquisition (SCADA) field equipment, regulator stations, farm taps, distribution valves, and overall gas maintenance support.

Corrective Maintenance includes work required to repair or replace damaged or failed gas facilities. In many cases, the need for such restoration is identified during preventative maintenance inspections on the equipment described above.

Examples of such maintenance work include:

Preventative Maintenance

- Annual maintenance and inspection of all equipment inside the district regulator station, including distribution pressure inlet/outlet fire valves, atmospheric corrosion (AC) inspections and calibration of mechanical pressure recorders. (MAT FHB)
- Annual maintenance and inspection on all SCADA equipment associated with Remote Terminal Unit (RTU) and Electronic Recorders (ERX) type SCADA devices. (MAT FHO)
- Three-year maintenance and inspection of Farm Tap equipment and atmospheric corrosion (AC) inspection on customer high-pressure regulator (HPR) sets, which includes set point and lock-up tests (MAT FHC).
- Annual maintenance and inspection of distribution main, curb, emergency and sectionalizing valves, including operating, lubricating, and flushing valves. (MAT FHG)

Corrective Maintenance

- Repair of distribution main valves including the costs to excavate, repair or replace inoperative parts (such as seals, seats, bolts, bonnet, plug, gate, ball), and repair valve vaults and repairs of vault lids.
- Maintain and repair failed or inoperative distribution district regulation equipment, including inlet and outlet fire valves with a pressure of less than 60 psig, which includes repair of regulation, filters, station valves, permanent chart recorders, as well as vault dewatering during scheduled and non-scheduled maintenance. (MAT FIB)
- Perform repairs on customer HPR sets, Farm Taps (MAT FIC).
- Replacement of inoperable valves up to 2 inches in diameter. (MAT FIF)
- Repair of SCADA's RTU and ERX units in response to SCADA alarms and abnormal operating conditions. (MAT FHP)

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION PIPELINE PREVENTATIVE AND CORRECTIVE
MAINTENANCE**

Justification

There are several pipeline safety regulations that govern the operation and maintenance of gas distribution facilities and the work in this section. Regulations require three types of inspections of district regulator stations, referred to as “Class A,” “Class B” and “Class C” inspections, as well as required maintenance identified by such inspections.¹ Regulations require operators to maintain valves that may be needed for the safe operation of the distribution system.² There are also regulations requiring pipeline facilities found in unsatisfactory condition to be repaired or replaced³.

Cost

The program costs are shown below.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast			Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023		
EXPENSE										
MAT FH#	2,444	1,104	1,144	1,179	816	903	1,135	1,173	9,898	WP 8-9, Line 20
MAT FHB	3,512	3,384	4,090	4,046	4,143	4,850	4,661	4,994	33,680	WP 8-9, Line 16
MAT FHC	217	238	300	692	102	410	395	409	2,764	WP 8-9, Line 22
MAT FHG	983	1,018	1,056	1,103	1,613	1,737	2,127	2,422	12,061	WP 8-9, Line 18
MAT FHO	265	393	698	864	1,062	1,012	1,303	1,453	7,050	WP 8-9, Line 24
MAT FHP	351	303	371	378	638	623	727	752	4,142	WP 8-9, Line 23
MAT FIB	4,279	4,294	2,021	1,903	1,951	7,836	2,819	2,272	27,374	WP 8-9, Line 26
MAT FIC	201	155	221	919	427	663	951	983	4,520	WP 8-9, Line 28
MAT FIF	765	553	354	273	421	608	378	390	3,743	WP 8-9, Line 27
									-	
Expense Total	13,017	11,444	10,254	11,359	11,174	18,644	14,495	14,847	105,233	
TOTAL PROJECT COST	13,017	11,444	10,254	11,359	11,174	18,644	14,495	14,847	105,233	

Additional Cost Information:

The forecasts for many of the Distribution Pipeline Maintenance programs (MATs FH#, FHB, FHC, FHG, FIB, FIC, and FIF) are based on a 3-year historic cost average (2018-2020) escalated to 2023, except where noted. The forecasts include performing compliance, maintenance, and repair/replacement reliability tasks, and also include increases for preventative maintenance based on expectations of additional district regulator stations work, new emergency valves and SCADA.

¹ 49 Code of Federal Regulations (CFR) §192.739, 192.743.

² 49 CFR §192.747.

³ 49 CFR §192.613(b) states: “If a segment of pipeline is determined to be in unsatisfactory condition but no immediate hazard exists, the operator shall initiate a program to recondition or phase out the segment involved....”

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION PIPELINE PREVENTATIVE AND CORRECTIVE
MAINTENANCE**

The forecast for FHO and FHP are based on 2020 recorded costs escalated to 2023 which reflect maintenance for new SCADA units.

Benefits

Proactive preventative maintenance activities are intended to increase the useful life of gas distribution assets and reduce the likelihood of the asset becoming inoperative, breaking or failing. These activities increase the safety of the gas distribution system. Corrective maintenance activities, which involve repairing or replacing damaged or failed facilities, leads to improved reliability of the gas distribution system. In many cases corrective maintenance work addresses equipment issues before they become larger.

Alternatives Considered

PG&E performs all required preventative and corrective maintenance and did not consider alternatives in terms of performing compliance work. In terms of forecasting costs, the following alternatives were considered.

- Alternative 1
This alternative proposed using a 2-year historic cost average (2018-2019) as the basis for the 2023 forecast. This alternative was not selected because including 2020 gives a better view of the future work and spend, by using more recent spend. Over the years maintenance work has changed according to regulations and because of an increase in equipment to maintain.

- Alternative 2
This alternative proposed using the 2020 run rate as the basis for the 2023 forecast. This alternative was not selected because the run rate did not capture full year spend and was a snapshot in time.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8 OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – CUSTOMER DEMAND, COMPLIANCE, AND EMERGENCY RESPONSE
PROGRAMS (FIELD SERVICE)**

Project Title: Customer Demand, Compliance, and Emergency Response Programs (Field Service)

Major Work Categories: MWC DD (MAT DDD, DDE, DDF, DDG, DDK, DDL), MAT HYI, MAT 74A

Planning Order Numbers: 5055344, 5055370, 5055340, 5055346, 5055347, 555348, 5542194, 5055610.

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): Operative as installed (MAT 74A – Capital)

Project Description

PG&E's Gas Service Representatives (GSRs) respond to approximately 500,000 customer-generated gas service requests annually. These requests include investigating reports of possible gas leaks, carbon monoxide monitoring, re-lights, appliance safety checks and maintenance work including atmospheric corrosion (AC) remediation and regulator replacements. In some situations, GSRs respond to emergency situations as first responders.

Responding to emergency situations is PG&E's highest priority so that PG&E can prevent or ameliorate hazardous situations. Industry benchmarking indicates that it is an industry best practice to treat all customer-reported gas odor calls as immediate response, rather than same-day response, and to attempt to respond to such calls within 60 minutes. PG&E adopted this best practice in 2015. PG&E also follows utility best practices to use mobile data terminals, real-time Global Positioning Systems, backup on-call technicians, and shift coverage of 24 hours a day, seven days a week to meet their gas odor response metric.

PG&E's goal is to have a GSR on-site as quickly as possible for customer generated gas odor calls. For 2020, PG&E's target in responding to these Immediate Response (IR) calls was to respond on average within 20.8 minutes and to respond to 99 percent of all IR calls within 60 minutes. Additional information is available in PG&E's Safety Performance Metrics Report for the year 2020.

PG&E's costs for this work are included in the various Maintenance Activity Types (MATs) in MWC DD (see below), as well as in MATs HYI and 74A.¹

- Pilot Relights (MAT DDD)
- Appliance Adjustments (MAT DDE)
- Gas Fumigation Activity (MAT DDF)
- Gas Leaks and Emergencies (MAT DDG)
- Customer requests for starts and stops of gas service (MATs DDK and DDL)
- AC Remediation (MAT HYI)
- Regulator Replacements (MAT 74A)

¹ Meter Set Leak Repairs (MAT FIS) is discussed in Exhibit (PG&E-3), Chapter 10 Leak Management.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8 OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – CUSTOMER DEMAND, COMPLIANCE, AND EMERGENCY RESPONSE
PROGRAMS (FIELD SERVICE)**

Justification

Work performed in MATs DDD, DDE, DDF, DDG, DDK and DDL are requirements of California Public Utility Code Section 963 which includes “after-meter services” and includes, but is not limited to, leak investigation, inspection, customer piping and appliances, carbon monoxide investigation and pilot relights.

PG&E’s GSRs respond to emergency conditions or events in order to prevent or mitigate hazardous situations. Delays in responding to customer calls could lead to increased customer safety risk on the gas distribution system. Performing other tasks, such as appliance adjustments and gas starts and stops requests provides customer service in a safe manner.

PG&E’s GSRs perform remediation of AC at customer meters (MAT HYI). This work mitigates the risk of potential leaks caused by corrosion in the gas distribution system. The repair of damaged or weathered meter sets is critical to the operations of PG&E’s gas pipeline distribution system. AC repairs are required by 49 CFR Section 192.481(c), which states that “if atmospheric corrosion is found during an inspection the operator must provide protection against the corrosion as required by Section 192.479.”

Replacing regulators at customer meters also reduces risk on the gas distribution system (MAT 74A). As the regulators age, the valve material hardens and becomes less resilient, which impacts its ability to lock-up and limit pressure build-up under low or no-flow conditions. Older, regulators without internal relief valves (non-IRV) may not meet the federal control requirement of being able to limit the build-up of pressure under no-flow conditions that would cause the unsafe operation of any connected and properly adjusted gas utilization equipment.

Cost

Program costs are provided below.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT DDD	11,782	11,483	10,525	10,773	9,876	12,026	11,748	12,142	-	-	-	90,355	WP 8-9, Line 7
MAT DDE	846	1,033	913	1,030	801	1,137	1,113	1,150	-	-	-	8,023	WP 8-9, Line 2
MAT DDF	2,799	2,868	3,105	3,066	3,087	3,531	3,470	3,587	-	-	-	25,512	WP 8-9, Line 3
MAT DDG	17,572	16,697	17,540	28,120	29,425	30,424	30,311	31,329	-	-	-	201,418	WP 8-9, Line 4
MAT DDK	5,402	4,730	4,745	4,412	3,794	5,041	4,964	5,130	-	-	-	38,217	WP 8-9, Line 5
MAT DDL	5,004	4,593	3,891	4,083	2,912	4,629	4,435	4,584	-	-	-	34,132	WP 8-9, Line 6
MAT HYI	2,570	2,998	4,156	2,714	2,182	2,319	2,212	919	-	-	-	20,071	WP 8-9, Line 29
Expense Total	45,976	44,401	44,875	54,199	52,076	59,106	58,253	58,841	-	-	-	417,728	
CAPITAL													
MAT 74A	1,898	1,482	1,780	2,499	2,269	2,077	1,951	2,191	2,249	2,308	2,368	23,071	WP 8-65, Line 2
Capital Total	1,898	1,482	1,780	2,499	2,269	2,077	1,951	2,191	2,249	2,308	2,368	23,071	
TOTAL PROJECT COST	47,874	45,883	46,656	56,698	54,344	61,184	60,203	61,032	2,249	2,308	2,368	440,800	

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8 OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – CUSTOMER DEMAND, COMPLIANCE, AND EMERGENCY RESPONSE
PROGRAMS (FIELD SERVICE)**

Additional Cost Information:

The 2023 unit cost forecasts are based on 2019 unit costs with escalation. For the MWC DD MATs, the 2023 unit forecasts are based on a two-year average (2018-2019) of recorded units. The 2023 unit forecast for MAT HYI is based on a three-year average (2018-2020) of units identified during Leak Survey. Based on these surveys, a forecast find rate of 1.18 percent was applied to determine volume of units per year. The 2023 unit forecast for MAT 74A is based on a two-year average (2018-2019) of regulators updated, excluding the targeted pre-identified non-IRV replacements.

Benefits

PG&E's immediate response to all odor calls improves safety and customer service. Customers will have a shorter amount of time to wait for a PG&E technician to address their concerns. Responding more quickly to these calls will decrease the risk that a leak could become hazardous. In addition, it will allow more flexibility for the customer to plan their day.

By having a trained gas service professional assess the situation at the service point, rather than having a call center representative determine the severity of the situation over the phone, the risk of a misdiagnosis is minimized. Additionally, by responding to all odor calls as immediate it allows PG&E to provide safer service for its customers. By completing AC repairs at the meter, PG&E provides safer service, and improves the integrity of its system.

Replacing regulators that are worn at customer meters mitigates the risk of regulator failure. Mitigating this risk will improve customer satisfaction by reducing the amount of future equipment failures.

Alternatives Considered

- Alternative 1
For MWC DD MATs, this alternative considered a 3-year average (2017-2019) for the unit forecast. This alternative was not selected because 2017 included a higher volume of work due to 2017 wildfires. Using 2018 and 2019 seemed most reasonable as units in those years were very consistent.
- Alternative 2
This alternative considered using 2020 recorded data as part of the forecast. This alternative was not selected because 2020 recorded did not represent normal operating conditions.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION MAINTENANCE AND CONSTRUCTION PROGRAMS**

Project Title: Distribution Maintenance and Construction Programs

Major Work Categories: MWC FH (MATs FHA, FHE, FHI, FHJ), MAT EXB, and MAT 27A

Planning Order Numbers: 5055708, 5055710, 5055698, 555617, 5542195, 5055718

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

PG&E's Distribution Maintenance and Construction program is responsible for repairing or replacing pipeline facilities that are found in unsatisfactory condition. The scope of work of the Distribution Maintenance and Construction programs include the following:

- Routine Maintenance on Mains and Services (MATs FHA and FHE). Routine maintenance on mains and services includes any non-leak related maintenance on mains and service pipes, such as repairing pipe supports for above ground mains, lowering shallow mains and services, and restoring the cover over them.
- Service Valve Replacement or Repair (MAT FHI). PG&E replaces service line shut off valves when they are found to be broken, inoperative or leaking. The leaking service line shut off valves are often identified during the leak survey process.
- Non-recurring projects (MAT FHJ). Each year, PG&E identifies, prioritizes, and performs many special preventative maintenance projects. These projects, known as "Non-Recurring Projects," are safety or compliance related, but due to the nature of the work, are planned, managed, and tracked separately.¹ Examples include replacing or repairing district regulator station vault lids, fencing, gates, and access roadways. In 2020, it included service verification work² and corrective work to repair aged trenches. Other work related to monitoring the maximum allowable pressure of the gas distribution system is also included in MAT FHJ, including the monitoring of vaults with low-elevation vents to make sure the vents remain free of water.
- Meter Protection Program (MAT EXB). The purpose of the Meter Protection Program (MPP) is to protect meters and risers that are vulnerable to vehicular damage, and to install service valves where existing service valves are inaccessible. Meter protection is accomplished through the installation of bollards. Alternative meter protection measures are also available, such as customer-installed permanent structures. In some instances, access issues may occur where no access was available to perform MPP work. These instances are referred to Can't Get In (CGI) locations. These locations are often more complex and costly to remediate. The MPP remediated the remaining locations which were part of the original scope of the program, and part of PG&E's commitments from the 1990 GRC.

¹ Special projects do not include any of the work activities described above or in the Gas Distribution Integrity Management Program portion of Exhibit (PG&E 3), Chapter 4.

² More specifically, in 2020 PG&E performed copper service verification work to confirm whether locations that could not be cleared through record review had copper services.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION MAINTENANCE AND CONSTRUCTION PROGRAMS**

(Decision 89-12-057). With the completion of its original commitments, this program has transitioned from a dedicated program to ongoing corrective maintenance.³

- Relocation of Meter Sets (MAT 27A). Relocation of meter sets is covered under MAT 27A and includes activities such as meter protection through the re-location of the meter set, and relocating the meter set due to an inaccessible service valve.

Justification

Pipeline safety regulations require that pipeline facilities found in unsatisfactory condition be repaired or replaced. This work is required by 49 CFR §192.613(b) (2017) which states: “If a segment of pipeline is determined to be in unsatisfactory condition but no immediate hazard exists, the operator shall initiate a program to recondition or phase out the segment involved....”

Preventing damage from vehicles is required in accordance with CFR 49, Section 192.353.

Cost

Program costs are provided below.

Major Project Spending Estimates (Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT FHA	1,412	1,486	1,362	1,750	1,516	916	2,157	2,783				13,382	WP 8-9, Line 15
MAT FHE	2,590	2,957	4,121	4,600	4,870	8,747	5,864	4,686				38,436	WP 8-9, Line 17
MAT FHI	1,102	1,698	6,500	7,321	5,447	4,245	4,088	8,057				38,459	WP 8-9, Line 19
MAT FHJ	537	1,754	2,498	2,980	7,801	4,673	3,636	3,758				27,638	WP 8-9, Line 21
MAT EXB	873	217	358	8,450	11,471	7,938	8,046	35,425				72,780	WP 8-9, Line 12
Expense Total	6,515	8,111	14,840	25,102	31,105	26,518	23,792	54,710	-	-	-	190,693	
CAPITAL													
MAT 27A	612	697	1,038	2,338	1,818	7,878	7,541	7,410	7,609	7,807	8,011	52,759	WP 8-65, Line 1
Capital Total	612	697	1,038	2,338	1,818	7,878	7,541	7,410	7,609	7,807	8,011	52,759	
TOTAL PROJECT COST	7,126	8,808	15,878	27,440	32,924	34,396	31,333	62,120	7,609	7,807	8,011	243,452	

Additional Cost Information:

The 2023 unit forecasts for MAT FHA (Routine Maintenance on Mains and Services) is based on a two-year average (2018-2019) of completed units, with an added estimate for plastic joint replacements. The unit cost forecast for MAT FHA is based 2020 recorded costs with escalation.

³ With the completion of its original commitment, this program has transitioned from a dedicated program to ongoing corrective maintenance. As part of that transition, MPP inspections to confirm field conditions under MAT EXA, and MPP installation of new service valves on services which don't have accessible service valves under MAT EXC, will no longer be used.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION MAINTENANCE AND CONSTRUCTION PROGRAMS

The 2023 unit forecast for FHE (routine maintenance on mains and services) is based on a 2-year average of routine work found outside of AC inspection performed in 2018-2019, with an added estimate for incremental or new AOC finds expected from Leak Survey and AC inspection work. The unit cost forecast for MAT FHE is based on a 2-year average unit cost (2019-2020) with escalation.

The 2023 unit forecast for MAT FHI (service valve replacement) is based on a two-year average of routine work outside of AC inspection performed in 2018-2019, continued work on the AOC backlog, plus added estimates for incremental or new AOC finds expected from Leak Survey and AC inspection work and routine locations found in the field by Gas Service Representatives. The unit cost forecast for MAT FHI is based on a 2-year average unit cost (2019-2020) with escalation.

The 2023 unit forecast for MAT FHJ (non-recurring projects) is based on 2020 recorded cost. This is a non-unitized MAT.

The 2023 unit forecast for MAT EXB (meter protection) The unit forecast is based on a plan to address the AOC backlog by 2026 and also remediate incremental or new AOC finds expected annually from Leak Survey, AC inspection, field services activities and customer call-ins within 24 months, while also continuing to target CGI locations to preventing a CGI backlog from growing. The unit cost forecast was based on an estimate provided by the vendor performing the meter protection work plus CGI costs in 2020, with escalation.

The 2023 unit forecast for MAT 27A is based on a percentage of expense meter protection work and CGI work turning into capital work and three-year average (2018-2020) of inaccessible valve meter set relocations. The unit cost forecast for 2023 is based on 2020 recorded costs with escalation.

Benefits

These activities are intended to increase the useful life of gas distribution assets and reduce the likelihood of the asset becoming inoperative, breaking or failing. These activities increase the safety of the gas distribution system and lead to improved reliability of the gas distribution system. In many cases corrective maintenance work addresses equipment issues before they become larger.

Alternatives Considered

- Alternative 1 – MAT FHA
This alternative proposes using a 2019-2020 average unit cost. This alternative was not selected because the 2019 unit cost does not include plastic joint replacement work.

- Alternative 2 – MAT EXB
This alternative proposes a forecast basis using the two-year average of unit costs (2019-2020). This alternative was not selected because the 2019 unit cost does not accurately reflect CGI costs.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PGE&-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION PIPELINE MARKERS AND DISTRIBUTION PATROLS**

Project Title: Distribution Pipeline Markers and Distribution Patrols

Major Work Categories: MAT FHR

Planning Order Numbers: 5056869

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

This program includes two components:

- 1) Installing, replacing, and maintaining pipeline markers on distribution mains. The installation and maintenance of pipeline markers protects PG&E's underground pipeline infrastructure and indicates the presence of gas pipelines at public road and railroad crossings. Pipeline markers are visual indicators that can help prevent dig-ins or accidental damage of PG&E assets.
- 2) Pipeline Patrol on select distribution facilities. The frequency of patrolling mains is determined by the severity of the conditions which could cause failure or leakage, and hazards to public safety. Patrol is conducted either aerially (via fixed-wing airplane or helicopter), or on the ground via walking or driving.

MAT FHR was created in 2020 and includes costs for the distribution pipeline markers activities and pipeline patrols.

Justification

The installation of pipeline markers on buried distribution mains at public roads and railroad crossings is required by 49 CFR, §192.707.

Distribution facilities patrolled in accordance with 49 CFR §192.721 to observe threats to the safety and operation of distribution facilities in accordance with additional criteria regarding the frequency and scope of these patrols.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PGE&-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – DISTRIBUTION PIPELINE MARKERS AND DISTRIBUTION PATROLS**

Cost

Program costs are provided below.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast			Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023		
Expense Total	27	32	17	47	142	-	73	1,793	2,129	WP 8-9, Line 25
TOTAL PROJECT COST	27	32	17	47	142	-	73	1,793	2,129	

Additional Cost Information:

The 2023 pipeline marker forecast was based on miles of mains located within class locations 1-4. A sample percentage of each class was used to project miles in class 1 and 2 for the remainder of the distribution system. An average number of crossings per mile was used to forecast markers needed at road and railroad crossings. The cost forecast is based on costs for materials for markers, example triview & pavement decals, and installation costs with escalation. The cost forecast also includes costs for class location analysis performed every three years.

The 2023 distribution patrols forecast is based on 2020 recorded costs with escalation.

Benefits

The maintenance of pipeline markers protects PG&E's underground, aboveground, and cross waterway pipeline infrastructure from damage or interference.

PG&E's pipeline patrol contributes to damage prevention and safety of PG&E distribution facilities.

Alternatives Considered

No alternatives were considered.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – TRANSMISSION PIPELINE PATROL**

Title: Transmission Pipeline Patrol

Major Work Categories: MATs JOF, JOV

Planning Order Numbers: 5055774, 5055775, 5056712, 5055772

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

Pipeline patrol is an integrity management activity required to observe surface conditions on and adjacent to the pipeline's Right-Of-Way (ROW) for indications of leaks, construction activity, and other factors affecting safety and operations. A secondary purpose of patrolling is to report observations of new construction that may impact a pipeline's Class Location or classification as a High Consequence Area (HCA). PG&E patrols its pipelines both aerially via fixed-wing aircraft or helicopter (MAT JOV) and on the ground via walking or driving (MAT JOF).

Aerial patrol is conducted with pilots and Operator-Qualified aerial patrollers serving as mission commanders and operating the video equipment. The purpose of patrol is to observe surface conditions on and adjacent to the pipeline right-of-way (according to the current system of record for geospatial location of the pipeline) and to record reportable observations. Observations reported during aerial patrol or post-flight video review, depending on the urgency of the response, are sent to Operator-Qualified ground patrollers to investigate in the field. After an investigation is complete, the ground patroller submits documentation of their response and findings.

Ground patrol is implemented in order to investigate aerial observations, intervene with urgent threats (e.g. digging near the pipeline), and to patrol areas where the right-of-way is visually obscured from the air by vegetation which may limit the ability of aerial patrollers to visually assess the pipeline right-of-way. These centralized ground patrollers utilize electronic data collection technology to expedite navigation and increase the efficiency and quality of documentation.

Justification

PG&E's pipeline patrol program fulfills federal code requirement 49 Code of Federal Regulations (CFR) § 192.705 with respect to establishing a patrol program to observe threats to the safety and operation of transmission facilities in accordance with additional criteria regarding the frequency, methodology, and scope of these patrols.

It also fulfills federal code requirement CFR Title 49, §192.613, with respect to providing continuing surveillance of changes in class location, failures, and other unusual operating and maintenance conditions of gas facilities.

These requirements are also reflected in PG&E Utility Procedure TD-4412P-07, Revision 6 – "Patrolling Gas Pipelines."

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – TRANSMISSION PIPELINE PATROL**

Cost

The program costs are shown below.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast			Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023		
EXPENSE										
MAT JOF	1,097	1,006	858	863	975	939	1,000	1,033	7,770	WP 8-10, Line 38
MAT JOV	5,629	3,779	2,376	3,627	4,203	4,277	4,602	4,700	33,193	WP 8-10, Line 50
Expense Total	6,726	4,785	3,234	4,490	5,178	5,215	5,602	5,734	40,963	
TOTAL PROJECT COST	6,726	4,785	3,234	4,490	5,178	5,215	5,602	5,734	40,963	

Additional Cost Information:

Aerial Patrol (JOV) - The 2023 unit forecast for MAT JOV is based on a monthly transmission system patrol plan plus additional patrols as conditions permit. The 2023 unit cost forecast is an estimate of labor costs and aircraft rates.¹

Ground Patrol (JOF) – The 2023 unit forecast for MAT JOF is based on a three-year average of recorded units (2017-2019). The 2023 unit cost forecast for MAT JOF is based on a three-year average of recorded costs (2017-2019) with escalation.

Benefits

PG&E's pipeline patrol program contributes to damage prevention and safety of PG&E facilities. Patrollers report a variety of observations that may pose a risk to public safety or asset integrity. The impact of such activity is two-fold: it presents potential threats to pipeline integrity when it occurs near Company facilities (with the potential to result in dig ins or pipeline damage), and it may produce new structures that affect the Company's Class Location and HCA determinations.

Alternatives Considered

- **Alternative 1 - MAT JOV**
This alternative proposes using a 3-year historic average for the unit cost. This alternative was not selected because 2017 costs included contract costs that are no longer applicable, and 2018 costs did not include full program support costs due to changes in work scope.
- **Alternative 2 - MAT JOF**
This alternative proposes using 2020 recorded data. This alternative was not selected because it did not represent normal operating conditions.

¹ See Exhibit (PG&E-7), Chapter 2 for more information on aviation rates.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – TRANSMISSION PIPELINE PREVENTATIVE AND CORRECTIVE
MAINTENANCE**

Project Title: Transmission Pipeline Preventative and Corrective Maintenance

Major Work Categories: MWC JO (MATs JO1, JO2, JOG, JOH, JOI, JOJ, JOK, JOL, JOM, JON, JOO, JOX, and JOY)

Planning Order Numbers: See planning order table below.

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

Pipeline Maintenance is required to ensure safe and reliable operation of the Gas Transmission pipeline system and regulator stations. The Pipeline Maintenance program has eight subprograms:

- Preventative and Corrective Maintenance for Regulator Stations (MATs JOG and JOM). Regulator stations are used to support safe and adequate pressure settings and a number of temporary changes in pipeline pressure. These practices result in repairs and corrective maintenance actions to help ensure a safe pipeline system by preventing system over pressure events.
- Preventative and Corrective Maintenance for Manual Valves (MATs JOH and JON). Manual valves are required to be maintained on an annual basis. The total number of manual valves exceeds 10,000 and varies over time.
- Preventative and Corrective Maintenance for Automated Valves and Actuators (MATs JOI and JOO). Depending on type of valve, maintenance can be required, monthly, semiannually or annually. The total number of automated valves is increasing and will continue increasing in the future. PG&E continues to add automated valves to its system, and the valves that remain as manual valves continue to age and require increased maintenance to maintain operability.
- Preventative and Corrective Maintenance for Gas Holders (MAT JOJ). The Gas Transmission System has three Underground Holders—North Sacramento, Yuba City and Santa Cruz—that are used to support the balancing of system demands. These systems contain bottle holders and associated valves and other associated equipment.
- Preventative and Corrective Maintenance for Meters and Chromatographs (MATs JOX and JOY). Gas Transmission Operations and Maintenance maintains equipment to measure, odorize and test the gas quality. Operational meters are used to measure the flow of gas on and off the system to large volume customers. When gas is brought on and off the system, gas must be tested to ensure the proper British Thermal Units (BTUs) of the gas. The quality of this gas is checked with chromatographs that are located where gas is brought on to and at points the gas goes off of the transmission system. Odorization is added to the gas at the entry points where gas flows on to the gas transmission system. The gas is also sampled and tested to verify quality on a scheduled basis.
- Preventative and Corrective Maintenance for Supervisory Control and Data Acquisition (SCADA) (MATs JO1 and JO2). SCADA is used to provide visibility into and remotely control sections of the gas system. SCADA requires both preventative and corrective maintenance. PG&E continues to add new SCADA points to the transmission system that will allow data to be transmitted back to the Gas Control Center by a set of Remote Terminal Units (RTU). Other SCADA related equipment includes electronic data recorders,

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – TRANSMISSION PIPELINE PREVENTATIVE AND CORRECTIVE
MAINTENANCE**

transmitters and transducers. Gas employees will need to perform the routine maintenance checks and respond to reports where units are down. SCADA operations and maintenance requires higher skill sets, such as electronics, controls, communications, and more labor hours to perform the required operations and maintenance.

- Operate Transmission Pipelines (MAT JOK). Operating the Transmission Pipeline system includes operating valves as required, taking odometer readings and other equipment, calibrating test gauges and portable pressure recorders, monitoring pressures and removing pipeline liquids and collecting charts
- Operate Transmission Regulator Stations (MAT JOL). Operating transmission regulator stations includes controlling the flow of gas through the transmission system, adjusting regulator flow rates, and maintaining system pressure.

Justification

Pipeline Operations and Maintenance is performed to comply with 49 Code of Federal Regulations (CFR) §192.605, §192.701, § 192.703, §192.739, § 195.406 and § 192.745.

Cost

The program costs are shown below.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast			Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023		
EXPENSE										
MAT JO1	564	164	186	174	328	358	334	345	2,453	WP 8-10, Line 52
MAT JO2	337	198	140	226	307	382	240	248	2,079	WP 8-10, Line 53
MAT JOG	1314	1987	2029	2091	2855	3516	3761	3887	21,441	WP 8-10, Line 39
MAT JOH	974	1124	1216	1185	1314	1571	1420	1468	10,271	WP 8-10, Line 40
MAT JOI	159	8	43	32	30	33	38	39	383	WP 8-10, Line 49
MAT JOJ	177	80	81	145	111	201	121	125	1,042	WP 8-10, Line 45
MAT JOK	1001	874	731	1107	1008	689	705	728	6,844	WP 8-10, Line 41
MAT JOL	2649	2250	2292	1967	439	483	464	479	11,022	WP 8-10, Line 42
MAT JOM	414	903	826	1014	1139	1225	1069	1105	7,694	WP 8-10, Line 43
MAT JON	665	1015	1129	730	663	776	912	942	6,832	WP 8-10, Line 44
MAT JOO	23	203	246	194	151	193	213	220	1,443	WP 8-10, Line 48
MAT JOX	550	586	616	834	1824	1828	1870	1933	10,040	WP 8-10, Line 54
MAT JOY	113	102	188	156	428	158	276	285	1,705	WP 8-10, Line 37
									-	
Expense Total	8,941	9,492	9,722	9,855	10,596	11,413	11,422	11,806	83,248	
TOTAL PROJECT COST	8,941	9,492	9,722	9,855	10,596	11,413	11,422	11,806	83,248	

Additional Cost Information:

The forecasts for the Transmission Pipeline Maintenance programs are based on a 3-year historic cost average (2018-2020) escalated to 2023. Costs were added to the forecasts for additional resources to cover the increase in maintenance work, to account for adjustments to better align ongoing costs according to program scope, and to account for maintenance for Large Volume Customers (LVC) changing from five-year to annual maintenance.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – TRANSMISSION PIPELINE PREVENTATIVE AND CORRECTIVE
MAINTENANCE**

Benefits

Proactive preventative maintenance activities are intended to increase the useful life of gas transmission assets and reduce the likelihood of the asset becoming inoperative, breaking or failing. These activities increase the safety of the gas transmission system. Corrective maintenance activities, which involve repairing or replacing damaged or failed facilities, leads to improved reliability of the gas transmission system. In many cases corrective maintenance work addresses equipment issues before they become larger.

Alternatives Considered

PG&E performs all required preventative and corrective maintenance and did not consider alternatives in terms of performing compliance work. In terms of forecasting costs, the following alternatives were considered.

- Alternative 1
This alternative proposed using a 2-year historic cost average (2018-2019) as the basis for the 2023 forecast. This alternative was not selected because including 2020 gives a better view of the future work and spend, by using more recent spend. Over the years maintenance work has changed according to regulations and because of an increase in equipment to maintain.
- Alternative 2
This alternative proposed using the 2020 run rate as the basis for the 2023 forecast. This alternative was not selected because the run rate did not capture full year spend and was a snapshot in time.

Planning Orders
5056708, 5056707, 5056706, 5056705, 5056704, 5056703, 5056702, 5056701, 5055761, 5056628, 5056627, 5056626, 5056625, 5056624, 5056623, 5056622, 5056621, 5055577, 5056676, 5056675, 5056674, 5056673, 5056672, 5056671, 5056670, 5056669, 5055751, 5056700, 5056699, 5056698, 5056697, 5056696, 5056695, 5056694, 5056693, 5055757, 5056692, 5056691, 5056690, 5056689, 5056688, 5056687, 5056686, 5056685, 5055755, 5055615, 5056652, 5056651, 5056650, 5056649, 5056648, 5056647, 5056646, 5056645, 5055723, 5056660, 5056659, 5056658, 5056657, 5056656, 5056655, 5056654, 5056653, 5055725, 5056596, 5056595, 5056594, 5056593, 5056592, 5056591, 5056590, 5056589, 5055567, 5056620, 5056619, 5056618, 5056617, 5056616, 5056615, 5056614, 5056613, 5056612, 5056611, 5056610, 5056609, 5056608, 5056607, 5056606, 5056605, 5055573, 5055571, 5056684, 5056683, 5056682, 5056681, 5056680, 5056679, 5056678, 5056677, 5055753, 5056604, 5056603, 5056602, 5056601, 5056600, 5056599, 5056598, 5056597, 5055569

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – STATION MAINTENANCE**

Project Title: Station Maintenance

Major Work Categories: MWC JP (MATs JPA, JPB, JPC, JPD, JPE, JPF, JPG, JPH, JPI, JPJ, JPK, JPL, JPN, JPO, and JPP) and MAT JTH

Planning Order Numbers: 5055766, 5055582, 5055765, 5055764, 5055767, 5055581, 5055580, 5055585, 5055759, 5055575, 5055797, 5055763, 5055579, 5055727

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

PG&E's Station Maintenance program provides preventative and corrective maintenance for compressor stations and storage field compressors. The Station Maintenance program encompasses the following eight subprograms:

- Preventative and Corrective Maintenance for Station Piping Outside the Compressor Building (MATs JPA and JPB). This includes maintenance of instruments, regulators, valves, cathodic protection, meters, orifice plates, sulfur analyzers, filters, and chromatographs.
- Preventative and Corrective Maintenance for Gas Processing Equipment (MATs JPC and JPG). This includes maintenance work for gas processing equipment which includes re-boilers, thermal oxide components, filter separators, and cooling towers for example.
- Preventative and Corrective Maintenance Inside the Compressor Building (MATs JPD and JPH). This includes maintenance of compressor drive units, controls, turbines, heads, plugs, valves, engine control equipment, turbo chargers, auxiliary compressor equipment, filters, gas/water/oil cooling systems, and cylinder oil.
- Preventative and Corrective Maintenance for Storage/Compressor Station Support (MATs JPE and JPI). This work includes line inspections, testing, minor painting, replacing electrical equipment and filters, as well as maintaining or inspecting programmable logic controllers (PLC), alarm systems, air compressors, air dryers, air systems, evaporation ponds, hydraulic systems, fire water systems, and raw or fresh water systems.
- Preventative and Corrective Maintenance for Power Units (MATs JPK and JPL). This work includes repairs to all power unit equipment, uninterruptible power supply (UPS), motor control center (MCC)/switchgear, and automatic transfer switches (ATS).
- Preventative and Corrective Maintenance for Storage Wells (MATs JPO and JPP). This includes maintenance performed for well heads, up-hole safety valve (UHSV), downhole safety valve (DHSV), master gates, sand inspections, surface casings, wire lines, well meter, orifice plates, gauges, line rupture controls, and solenoids.
- Station Operations (MAT JPN). This work is associated with the continuous daily operations of the manned station facilities. Includes answering calls from Gas Control requesting to start and stop compressors and change the flow of gas through the stations, periodic rounds to ensure station and equipment operation, emergency shut-down testing, required inspections of fire extinguishers, and first aid/automated external defibrillator and eyewash inspections.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – STATION MAINTENANCE**

- Other GT&S Support (MAT JTH). Covers permits and fees associated with the operations of Transmission stations including McDonald Island Reclamation Fees, Gas Lease Fees, DOT Fees, California State Lands Commission Lease Payments and California Geologic Energy Management Division (CalGEM) fees. Lease payments are for right-of-way use for various natural gas transmission assets.

Justification

Preventive and corrective maintenance work on the Gas Transmission compressor stations, storage, and terminals is performed to meet requirements of 49 CFR §192.605, §192.731, §192.735 and §192.736.

Cost

Program costs are provided below.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast			Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023		
EXPENSE										
MAT JPA	697	655	594	1009	1010	959	937	968	6,829	WP 8-10, Line 65
MAT JPB	159	289	140	239	886	1450	450	465	4,078	WP 8-10, Line 59
MAT JPC	833	1109	1489	1826	1791	1942	1835	1897	12,724	WP 8-10, Line 63
MAT JPD	1125	1022	1191	1788	1843	1954	1730	1788	12,440	WP 8-10, Line 62
MAT JPE	1747	1772	1684	1477	1710	2015	2172	2245	14,823	WP 8-10, Line 64
MAT JPF	526	62	0	0	0	0	0	0	589	WP 8-10, Line 67
MAT JPG	944	448	939	824	850	992	941	973	6,910	WP 8-10, Line 57
MAT JPH	1251	1094	934	2743	1848	1902	1980	2046	13,798	WP 8-10, Line 56
MAT JPI	-173	940	1594	1601	852	1580	1462	1511	9,368	WP 8-10, Line 58
MAT JPJ	1558	348	-8	0	0	0	0	0	1,897	WP 8-10, Line 61
MAT JPK	167	92	104	137	129	176	133	138	1,077	WP 8-10, Line 66
MAT JPL	189	233	280	303	152	195	265	274	1,891	WP 8-10, Line 60
MAT JPN	6352	5845	4742	5281	5743	5518	5762	5955	45,197	WP 8-10, Line 55
MAT JPO	1966	933	432	394	511	635	539	557	5,966	WP 8-10, Line 69
MAT JPP	132	124	24	46	73	563	77	79	1,118	WP 8-10, Line 70
MAT JTH	6015	6753	6917	6652	6926	6289	7377	7625	54,553	WP 8-10, Line 71
Expense Total	23,486	21,720	21,058	24,319	24,323	26,170	25,660	26,522	193,258	
TOTAL PROJECT COST	23,486	21,720	21,058	24,319	24,323	26,170	25,660	26,522	193,258	

Additional Cost Information:

Most of the station maintenance forecasts costs are based on a 3-year average of recorded costs (2018-2020) with escalation. For preventative and corrective Maintenance for storage/compressor station support forecast (MAT JPE) costs were added for additional resources to cover the increase in maintenance work.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – STATION MAINTENANCE**

For storage wells maintenance (MATs JPO and JPP), the forecast is based on 2020 recorded costs with escalation. 2020 was selected because it reflects the current regulations related to storage valve maintenance compared to prior years.

Benefits

Proactive preventative maintenance activities are intended to insure the safe and compliant operation of and increase the useful life of gas storage and compression station assets and reduce the likelihood of the asset or components becoming inoperative, breaking or failing. These activities increase the safety of the gas transmission system. Corrective maintenance activities lead to improved reliability of the gas transmission system. In many cases corrective maintenance work addresses equipment issues before they become larger.

Alternatives Considered

PG&E performs all required preventative and corrective maintenance and did not consider alternatives in terms of performing compliance work. In terms of forecasting costs, the following alternatives were considered.

- Alternative 1
This alternative proposed using a 2-year historic cost average (2018-2019) as the basis for the 2023 forecast. This alternative was not selected as this wouldn't have given a better view of the spend ahead. Our adopted methodology is based on 3 year average and include years 2018-2020. Over the years there has always been changes to GPOM work with changing regulations, etc. Including 2020 in the average calculation gives a better view of the future work and spend.

- Alternative 2
This alternative proposed using the 2020 run rate as the basis for the 2023 forecast. This alternative was not selected because the run rate does not include a full year, and is only a snapshot of the year's spend at that time – with costs coming in at different intervals, this option may not be the best choice.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – RIGHT-OF-WAY (ROW) MAINTENANCE**

Project Title: Right-of-Way (ROW) Maintenance

Major Work Categories: JOS, JOT, JTO, JTK

Planning Order Numbers: 5057380, 5056668, 5056667, 5056665, 5056664, 5056663, 5056662, 5055733, 5055732, 5056732, 5056731, 5056729, 5055810, 5056636, 5056635, 5055600, 5055809

Project Start Date: Ongoing

Project Completion Date: Ongoing

Operative Date (only applies to Capital): N/A

Project Description

The objective of the PG&E Right-of-Way (ROW) Maintenance program is to support the safe and reliable operation of the entire gas transmission pipeline in PG&E's service territory. ROW Maintenance encompasses the following four subprograms:

- Pipeline Marker Maintenance (JOS) – This involves installing, replacing, and maintaining pipeline markers on transmission lines.
- Routine Weed Abatement (JOT) – This addresses weed abatement in and around PG&E facilities, such as compressor stations, storage fields, regulator stations, and meter stations.
- Vegetation Management (JTK) – Vegetation Management Operations take place to support the safety and integrity of gas pipelines by inspecting, removing, and maintaining vegetation in the ROW, and by keeping exposed pipelines clear of potential hazards. Ground inspections are performed to catalog and monitor vegetation conditions as well as identify any new vegetation or structural encroachments. This work is conducted to provide safe access to the pipeline to perform routine maintenance and prevent delays in the event of an emergency.
- Encroachment Structures and ROW Clean Up (JTO) – This provides safe access to the pipeline in the event of an emergency. Program activities include maintaining and repairing pipeline access roads as well as clearing non-vegetation encroachments. This program also maintains pipeline access by cleaning up trash and graffiti on the ROW.

Justification

PG&E Right-of-Way (ROW) Maintenance must be performed to allow for inspection of surface conditions as required by federal law. Wild vegetation on the ROW must be controlled and maintained so that it will not hinder pipeline inspection and maintenance activities. Extensive landscaping or other obstructions can also block the view of and impede the operator's access to the pipeline.

Overgrown vegetation, trees, and structures allowed to remain on the right of way can delay or prevent crews from performing important safety and maintenance work on the pipeline, which poses a threat to the safety of the public and environment. Tree roots also pose a safety risk because they can cause potential damage to the protective coating of the pipeline, which can lead to leakage or failure.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – RIGHT-OF-WAY (ROW) MAINTENANCE**

Pipeline Marker Maintenance (MAT JOS) is required by 49 CFR 14 Part 192.707.

Routine Weed Abatement (MAT JOT) which is required by 49 CFR Parts 192.613, 192.705, and 192.706 in order to provide accessibility to our assets to complete code required O&M tasks.

Vegetation Management (MAT JTK) which is required by 49 CFR Parts 192.613, 192.705, and 192.706 in order to provide accessibility to our assets to complete code required O&M tasks.

Encroachment Structures and ROW Clean-Up (MAT JTO) is required by GO-112F.

Cost

Program costs are provided below.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast			Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023		
EXPENSE										
MAT JOS	65	4,574	(431)	1,577	2,265	1,002	1,700	1,756	12,507	WP 8-10, Line 47
MAT JOT	104	6	433	797	699	298	1,429	1,477	5,245	WP 8-10, Line 46
MAT JTO	111	26	302	580	577	970	1,183	1,223	4,972	WP 8-10, Line 75
MAT JTK	2,635	3,119	6,323	10,314	13,821	10,008	15,819	15,888	77,927	WP 8-10, Line 74
									-	
Expense Total	2,915	7,724	6,627	13,268	17,363	12,278	20,132	20,344	100,651	
TOTAL PROJECT COST	2,915	7,724	6,627	13,268	17,363	12,278	20,132	20,344	100,651	

Additional Cost Information:

The 2023 forecast for MAT JOS (Pipeline Marker Maintenance) is based on a 3-year average (2017-2019) of the number of markers maintained using a 3-year average (2017-2019) of maintenance costs per marker with escalation.

The forecast cost for MAT JOT (Routine Weed Abatement) is based on 2019 recorded costs with escalation.

The forecast costs for MAT JTK (Vegetation Management) are predominantly based on the known mileage of pipe requiring weed abatement, the number of trees within our surveyed right-of-way requiring monitoring and removal, support costs for land and environmental technical experts, as well as public outreach and integrity management-related costs.

The forecast cost for MAT JTO (Encroachment Structures and ROW Clean-Up) is based on 2019 recorded costs with escalation.

**PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 8, OPERATIONS AND MAINTENANCE
PROJECT SUMMARY – RIGHT-OF-WAY (ROW) MAINTENANCE**

Benefits

A transmission pipeline ROW that is adequately maintained free of obstructions is an important visual indicator of the existence of transmission pipeline facilities for anyone performing construction or other work near the pipeline. Third-party incidents are a leading cause of damage to transmission pipelines and often occur when excavation or other construction activity occurs near the pipeline and the pipe is accidentally struck.

If pipeline damage occurs, the pipeline operator may need direct and immediate access to the pipeline and this will be facilitated by an adequately maintained ROW. In the event of an emergency, a clear ROW is necessary to facilitate access by both the pipeline operator and emergency response personnel. Obstructions on the ROW can prohibit their ability to respond.

Alternatives Considered

- Alternative 1 – MAT JOT
This alternative proposes using an average of historic costs. This alternative was not selected because it does not include labor rate increases and additional scope.

- Alternative 1 – MAT JTO
This alternative proposes using 3-year average (2017-2019) of historic costs. This alternative was not selected because it does not accurately represent all program costs for JOT Pipelines cleared of encroachments during CPSI were returned to normal operations and maintenance programs, and new encroachment issues began to materialize in 2018 and 2019. The scope for mitigation of encroachment structures and right-of-way clean up varies depending on the type and number of encroachments found per year plus removal costs and associated land agent support costs.

Worksheet Table 8-21
 Pacific Gas and Electric Company
 2023 General Rate Case
 Chapter 8, Gas Operations and Maintenance
 Expense Historical Walk by MWC - Distribution
 (Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DD	MWC DF	MWC EX	MWC FH	MWC FI	MWC HY	MWC JQ	MWC JU	Detailed Description/Explanation
1	2016	98,421	44,762	29,164	880	13,440	5,245	2,973	1,862	115	N/A
2			(3,103)								N/A
3				741							The decrease was driven by lower spending in meter protection installations due to a reduction in the number of units completed.
4					(640)						The increase was driven by additional SCADA preventative maintenance (MAT FHO).
5						926					N/A
6							(242)				N/A
7								35			The increase was driven by an increase in Damage Prevention work performed by the DIRT (MAT JQC).
8									377		The decrease was driven by the discontinuation of balancing account.
9	2017	96,400	41,649	29,905	239	14,367	5,003	3,008	2,229	(115)	N/A
10			(921)							0	The increase was driven by an increase in units performed and higher unit costs.
11				7,118							The increase was driven by an increase in AOC remediation work.
12					129						The increase was driven by an increase in the volume of work and use of contractor resources.
13						7,790					The decrease was driven by high cost corrective maintenance regulator station work (MAT FIB) in 2017.
14							(2,408)				The increase was driven by higher volume of meter repairs performed in 2018.
15								1,153			The decrease was driven by conversion of DIRT contractors to internal employees, and orders were not charging to MAT JQC.
16									(1,079)		N/A
17										0	The increase was driven by an accounting change in Gas Leaks and Emergencies MAT DDG. Labor costs related to Gas Leak & Emergencies while on standby are now reflected in this program to allow for greater visibility to the standby hours for emergency response. Prior to 2019, costs were recorded as indirect labor.
18	2018	108,183	40,728	37,023	369	22,157	2,596	4,161	1,150	0	The increase was driven by an increase in units performed and higher unit costs.
19											The increase was driven by meter protection (MAT EXB).
20			11,873								The increase was driven by an increase in volume of routine maintenance on mains (MAT FHA), services (MAT FHE), and service valves (MAT FHI). A second factor for the increase was preventative maintenance gas farm taps (MAT FHC) from performing "A" inspections on Farm Taps for the first time due to a new PHMSA requirement.
21				10,461	8,110						The increase was driven by additional scope to make the Farm Taps maintainable in order to perform "A" inspections (MAT FIC). The corrective costs went up due to having to test the function of all of the equipment.
22											The decrease was driven by a lower amount of planned and completed work resulting from fewer remediations pending after 2018.
23								(1,446)			The increase was driven by internal labor billing to MAT JQC as a result of updated billing instructions.
24									1,647		N/A
25										0	N/A
26										0	The decrease was driven by less units completed at a higher unit cost, partially driven by increased job time. In addition, costs for hiring additional staffing level were shareholder funded.
27											The increase was driven by meter protection (MAT EXB).
28	2019	142,131	52,601	47,484	8,479	24,961	3,096	2,714	2,796	0	The increase was driven by higher costs for performing copper service replacement validation work (MAT FHJ). A second factor for the increase was preventative maintenance gas main valves (MAT FHG) due to a combination of more emergency valves and beginning maintenance on curb valves.
29			(2,389)								The decrease was driven by corrective maintenance of farm taps (MAT FIC). A majority of "A" inspections were completed in 2019 that resulted in higher corrective costs in 2019 compared to 2020.
30				(15,718)	3,007						The decrease was driven by a lower amount of completed work.
31											Immaterial change in cost.
32						3,190					N/A
33							(297)				
34								(532)			
35									433		
36										0	
37	2020	129,814	50,203	31,765	11,485	28,151	2,799	2,182	3,229	0	

Note: Total amounts and amounts for each MWC are obtained from WP 8-9 by summing the relevant lines for each MWC.

Workpaper Table 8-22
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 8. Gas Operations and Maintenance
Expense Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DD	MWC DF	MWC EX	MWC FH	MWC FI	MWC HY	MWC JQ	Detailed Description/Explanation
1	2020	129,814	50,203	31,765	11,485	28,151	2,799	2,182	3,229	The increase is driven by an increase in units and escalation. 2020 did not represent normal operating conditions.
2			6,585							The increase is driven by a 12% YOY increase in the number of locate and mark requests driven by new regulatory oversight.
3				11,616						The decrease is driven by meter protection volume (MAT EXB).
4					(3,548)					Immaterial change in cost.
5						(34)				The increase is driven by regulator station corrective maintenance (MAT FIB).
6							6,308			The increase is driven by an increase in planned units and escalation.
7							137			The increase is driven by escalation. The 2021 budget also includes distribution patrols.
8									155	
9	2021	151,034	56,787	43,381	7,938	28,117	9,107	2,319	3,384	The decrease is driven by higher unit costs in 2021 due to COVID-19 impacts on job times. The 2022 forecast estimates job times will reduce post COVID-19.
10			(747)							The increase is driven by a 12% YOY increase in the number of locate and mark requests driven by new regulatory oversight.
11				26,233						Immaterial change in cost.
12					109					The decrease is driven by lower volume of routine maintenance on services (MAT FHE) and the expectation that there will not be any further copper service verifications (MAT FHJ).
13						(1,951)				The decrease is driven by corrective maintenance work that is not forecast in 2022 and beyond like AOC unvented regulator maintenance for example.
14							(4,960)			The decrease is driven by higher unit costs in 2021 due to COVID-19 impacts on job times. The 2022 forecast estimates job times will reduce post COVID-19.
15								(107)		The increase is driven by escalation offset by distribution patrol forecast being included in MAT FHR.
16									11	
17	2022	169,621	56,040	69,614	8,046	26,166	4,147	2,212	3,395	The increase is driven by an increase in units and applied escalation.
18			1,882							The increase is driven by a 12% YOY increase in the number of locate and mark requests driven by new regulatory oversight.
19				10,435						The increase is driven by meter protection volume (MAT EXB).
20					27,396					The increase is driven by service valve replacement volume increase (MAT FHI).
21						6,114				The increase is driven by escalation.
22							(501)			The decrease is driven by a slight reduction of new finds for meter set atmospheric corrosion remediation (MAT HYI).
23								(1,293)		
24									114	
25	2023	213,767	57,922	80,049	35,442	32,280	3,645	919	3,509	The increase is driven by escalation.

Note: Total amounts and amounts for each MWC are obtained from WP 8-9 by summing the relevant lines for each MWC.

Workpaper Table 8-23
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 8, Gas Operations and Maintenance
Expense Recorded Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DF	MWC JO	MWC JP	MWC JT	Detailed Description/Explanation
1	2016	53,295	10,078	16,344	17,893	8,980	
2			(501)				N/A
3				2,524			The increase was driven by an increase in scope of work.
4					(2,898)		The decrease was driven by reduced scope associated with corrective maintenance on storage compressor stations.
5						958	The increase driven by reorganization of right of way maintenance programs from localized to centralized.
6	2017	53,379	9,577	18,868	14,995	9,938	
7			(166)				N/A
8				(5,889)			The decrease was driven by resources.
9					(800)		The decrease was driven by lower costs associated with preventative maintenance on storage wells.
10						3,609	The increase was driven by reorganization of right of way maintenance programs from localized to centralized.
11	2018	50,134	9,412	12,979	14,195	13,547	
12			(3,736)				The decrease was driven by the reduction in standby units (MAT DFB). The Gas Standby Governance Team provided oversight of the standby process and were able to reduce, negotiate, and/or eliminate standbys based on their field observations and scheduling of resources.
13				3,778			The increase was driven by increase in scope of work for pipeline markers.
14					3,767		The increase was driven by costs associated with corrective maintenance inside compressor buildings (MAT JPH).
15						3,999	The increase was driven by reorganization of right of way maintenance programs from localized to centralized.
16	2019	57,942	5,676	16,757	17,962	17,546	
17			1,124				The increase was driven by increased labor rates resulting from a shift towards the end of 2020 to a different contractor.
18				2,021			The increase was driven by pipeline markers.
19					(365)		N/A
20						3,778	The increase was driven by reorganization of right of way maintenance programs from localized to centralized.
21	2020	64,499	6,800	18,778	17,597	21,324	

Note: Total amounts and amounts for each MWC are obtained from WP 8-9 by summing the relevant lines for each MWC.

Workpaper Table 8-24
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 8, Gas Operations and Maintenance
Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DF	MWC JO	MWC JP	MWC JT	Detailed Description/Explanation
1	2020	64,499	6,800	18,778	17,597	21,324	
2			441				
3				(849)			The increase is driven by an increase in Locate and Mark USA tickets of 12%.
4					2,284		The decrease is driven by a portion of cost being covered under a different MAT outside of the MWC.
5							The increase is driven by preventative maintenance cost for storage (MAT JPE) and corrective maintenance at terminals (MAT JPB).
6	2021	62,317	7,241	17,929	19,881	(4,058)	The decrease is driven by vegetation management costs in MAT JTK.
7			779			17,266	
8				2,224			The increase is driven by an increase in Locate and Mark USA tickets of 12%.
9					(1,598)		The increase is driven by an increase in units to be completed.
10						7,113	The decrease is driven by less corrective maintenance leak repairs at terminals forecast (MAT JPB) and lower repairs forecast at wells heads under (MAT JPP).
11	2022	70,836	8,020	20,153	18,283	24,379	The increase is driven by the cost for tree removal and professional services provided by contractors.
12			1,241				
13				619			The increase is driven by an increase in Locate and Mark USA tickets of 12%.
14					614		The increase is driven by escalation.
15						356	The increase is driven by escalation.
16	2023	73,666	9,261	20,773	18,898	24,736	

Note: Total amounts and amounts for each MWC are obtained from WP 8-9 by summing the relevant lines for each MWC.

Worksheet Table 8-25
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Gas Operations and Maintenance
 Capital Expenditures by Major Work Category
 (Thousands of Nominal Dollars)

No.	MWC	MWC Description	Capital Expenditures										Reference	
			2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast		2026 Forecast
1	27	Gas Meter Protection-Capital	612	697	1,038	2,338	1,818	7,878	7,541	7,410	7,609	7,807	8,011	
2	74	Install New Gas Meters	1,898	1,482	1,780	2,499	2,269	2,077	1,951	2,191	2,249	2,308	2,368	
3		Grand Total	2,510	2,178	2,818	4,837	4,087	9,955	9,492	9,601	9,858	10,115	10,379	WP 8-65, Line 3

Workpaper Table 8-26
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8
Gas Operations and Maintenance
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

Line No.	Description	Capital Expenditures						Reference
		2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	
1	Projects > \$3 Million*	-	7,878	9,492	9,601	9,858	10,115	10,379
2	Other Work	-	2,077	-	-	-	-	-
3	Total	-	9,955	9,492	9,601	9,858	10,115	10,379

WP 8-65, Line 3

* Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Workpaper Table 8-27
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Gas Operations and Maintenance
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million*
 (Thousands of Nominal Dollars)

Line No.	Planning Order	Description	MWC	Operative Date	CWIP 2020 Recorded Adjusted	Capital Expenditures					Subtotal	Reference	
						2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast			2026 Forecast
MWC - 27 Gas Meter Protection-Capital													
1	5510807	Meter Protection Capital - SF	27		-	7,878	-	-	-	-	-	7,878	
2	5542195	2023 GRC Meter Protection	27		-	-	7,541	7,410	7,609	7,807	8,011	38,378	
3	Total				-	7,878	7,541	7,410	7,609	7,807	8,011	46,256	
MWC - 74 Install New Gas Meters													
4	5542194	2023 GRC Install Regulators	74		-	-	1,951	2,191	2,249	2,308	2,368	11,067	
5	Total				-	-	1,951	2,191	2,249	2,308	2,368	11,067	
6	Grand Total				-	7,878	9,492	9,601	9,858	10,115	10,379	57,323	

* Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Workpaper Table 8-28
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Gas Operations and Maintenance
 Recorded and Forecast Capital Expenditures Details - Other Work*
 (Thousands of Nominal Dollars)

Line No.	MWC	MWC Description	Capital Expenditures												Reference
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
			Recorded	Recorded	Recorded	Recorded	Recorded	Recorded	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	
			Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	
1	27	Gas Meter Protection-Capital	608	697	1,038	2,291	1,749	-	-	-	-	-	-	-	
2	74	Install New Gas Meters	1,898	1,482	1,780	2,499	2,269	2,077	-	-	-	-	-	-	
3		Grand Total	2,506	2,178	2,818	4,790	4,017	2,077	-	-	-	-	-	-	

4 * Excludes projects greater than \$3M

Workpaper Table 8-29
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting Chapter 8, Gas Operations and Maintenance
 Summary of Capital Expenditures

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference WP 8-21, Line 4 WP 8-66, Line 5
1	Relocation of Meter Sets	27	27A	611,507	696,668	1,037,788	2,336,310	1,818,492	7,878,176	7,541,125	7,410,003	7,608,591	7,807,175	8,010,942	30,836,711	
2	Install Regulators	74	74A	4,889,032	1,481,627	1,780,474	2,498,667	2,268,512	2,077,278	1,950,587	2,190,684	2,249,407	2,308,019	2,368,159	9,116,268	
3	Total Capital Expenditures			2,509,540	2,178,314	2,818,262	4,835,977	4,087,005	9,955,454	9,491,712	9,600,687	9,857,998	10,115,194	10,379,100	39,952,979	

Workpaper Table 8-30
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8, Operations and Maintenance
Customer Demand, Compliance and Emergency Response Programs (Field Service)
MAT 74A - Regulator Replacements Forecast Calculator

Line No.

1 **Forecast Summary Table**

	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Notes
3 Unit Cost	\$ 321	\$ 329	\$ 338	\$ 347	Line 14
4 Unit	6,833	6,833	6,833	6,833	Line 23
5 Total	\$ 2,190,684	\$ 2,249,407	\$ 2,308,019	\$ 2,368,158	Line 3 * Line 4

7 Escalation Factors ^(a)	3.06%	2.68%	2.61%	2.61%
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9 **Unit Cost Forecast**

	2019 Recorded	Notes
11 Recorded Costs	\$ 2,498,668	
12 Recorded Units	8,337	
13 Unit Cost (unescalated)	\$ 300	Line 11 ÷ Line 12
14 Unit Cost (escalated to 2023 \$) ^(a)	\$ 321	(a)

16 Notes:

17 (a) See Exhibit (PG&E-3), Chapter 2 Workpapers for escalation factors.

19 **Unit Forecast**

	2018 Recorded Units	2019 Recorded Units	2023 Forecast Units	Notes
21 Targeted Non IRV Replacements Recorded to MAT 74A	636	652	-	(a)
22 Regulators Updated	5,981	7,685	6,833	(b)
23 Total Units under MAT 74A	6,617	8,337	6,833	

25 Notes:

26 (a) Targeted Non IRV replacements are not included in the forecast methodology because PG&E expects to complete these replacements by the end of 2022.

27 (b) The 2023 unit forecast is an average of 2018-2019.

Workpaper Table 8-31
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 8, Gas Operations and Maintenance
Capital Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 27	MWC 74	Detailed Description/Explanation
1	2016	2,510	612	1,898	
2			85		The increase was driven by an increase in unit cost.
3				(416)	The decrease was driven by a lower number of units being replaced.
4	2017	2,178	697	1,482	
5			341		The increase was driven by an increase in AOC remediation work.
6				299	The increase was driven by a higher number of units being replaced.
7	2018	2,818	1,038	1,780	
8			1,301		The increase was driven by an increase in AOC remediation work.
9				718	The increase was driven by a higher number of units being replaced.
10	2019	4,837	2,338	2,499	
11			(520)		The decrease was driven by less units being completed.
12				(230)	The decrease was driven by a lower number of units being replaced.
13	2020	4,087	1,818	2,269	

Note: Total amounts and amounts for each MWC are obtained from WP 8-65 by summing the relevant lines for each MWC.

Workpaper Table 8-32
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 8, Gas Operations and Maintenance
Capital Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 27	MWC 74	Detailed Description/Explanation
1	2020	4,087	1,818	2,269	
2			6,060		The increase is driven by the volume of capital meter replacement projects that may materialize due to increasing volume of expense meter protection CGIs (MAT EXB).
3				(191)	The decrease is driven by reduced units.
4	2021	9,955	7,878	2,077	
5			(337)		The decrease is driven by a lower 27A (meter protection) volume forecast.
6				(127)	The decrease is driven by reduced units.
7	2022	9,492	7,541	1,951	
8			(131)		Immaterial change in cost.
9				240	The increase is driven by planned volume and escalation.
10	2023	9,601	7,410	2,191	
11			199		The increase is driven by escalation.
12				59	The increase is driven by escalation.
13	2024	9,858	7,609	2,249	
14			199		The increase is driven by escalation.
15				59	The increase is driven by escalation.
16	2025	10,115	7,807	2,308	
17			204		The increase is driven by escalation.
18				60	The increase is driven by escalation.
19	2026	10,379	8,011	2,368	

Note: Total amounts and amounts for each MWC are obtained from WP 8-65 by summing the relevant lines for each MWC.

Pacific Gas and Electric Company

Gas Meter Protection Program

Final Progress Report

Submitted to the
Safety and Enforcement Division
California Public Utilities Commission

April 2021

This Final Progress Report on Pacific Gas and Electric Company's (PG&E) Meter Protection Program (MPP) is submitted pursuant to the 1990 General Rate Case (GRC) Decision 89-12-057.

This report presents an overview of the program since inception. In 1990, when the program began and through September 30, 2011, the MPP identified approximately 14,414 locations in addition to the original 394,830 locations for a total of 409,244 locations within the scope of this program. As of October 5, 2020, 100% of these locations have been resolved at a total cost of \$55.58 million (Attachment 1).

As reported in the revised "Gas Meter Protection Program 2018 Annual Progress Report," dated April 2019, PG&E committed to communicating with its customers and resolving the 34 "Can't Get In" (CGI) locations that remained at the end of 2018. In 2019, the MPP resolved 31 of the 34 locations. The remaining 3 CGI locations were pursued in 2020 and all meter protection requirements are satisfied.

PG&E is continuing to address locations identified on October 1, 2011 and beyond as part of ongoing corrective maintenance. In order to resolve these locations in a safe and timely manner, PG&E will continue to send each of these customers notices by priority mail requesting their cooperation to protect their meter from damage.

PG&E will continue to identify and mitigate meter locations requiring protection or other corrective work as part of ongoing corrective maintenance.

II BACKGROUND

Pursuant to the 1990 GRC Decision 89-12-057, PG&E established the MPP to identify and correct meter locations that had inadequate protection from vehicular damage. Generally, the corrective work involves installing “bollards,” which are steel posts designed to protect against incidental bump damage to a meter during low-speed maneuvering. In addition to protecting gas meters, PG&E’s MPP has also identified and corrected inaccessible service valves. Accessible service valves are necessary to terminate gas flow to a meter set assembly for routine maintenance or to respond to emergency conditions.

To correct meter locations that are vulnerable to vehicular traffic, PG&E installs protective bollards in accordance with PG&E Gas Standard J-95, “Meter Guard Design and Installation Arrangement.” Alternatives are also available to customers, including but not limited to approved permanent structures or relocation of the gas meter at the customer’s expense. Depending on the material and age of the service, a new service line may be required in accordance with PG&E Utility Standard TD-4801S, “Service Replacement Criteria.” For locations with inaccessible service valves, new service valves or curb valves are installed.

In 2012, PG&E delineated the scope of the MPP to include locations identified through September 30, 2011. Locations identified on October 1, 2011 and beyond will continue to be addressed as part of ongoing corrective maintenance.

III METER PROTECTION PROGRAM ACCOMPLISHMENTS

PG&E resolved the remaining 3 CGI locations in 2020. PG&E installed Meter protection at 1 location. PG&E moved the gas meter at the 2nd location. The customer installed a PG&E provided bollard at the 3rd location. Table 2 presents the composition of work performed by Area and Division (Attachment 2)

As reported in “Gas Meter Protection Program 2018 Annual Progress Report,” dated April 2019, PG&E committed to communicating with its customers and resolving the 34 CGI locations that remained at the end of 2018. PG&E implemented this CGI resolution effort in 2019 and has successfully resolved the 34 locations. As of October 5, 2020, 100% of the 409,244 MPP locations are completed. Table 1 presents the composition of work performed (Attachment 1).

IV CONCLUSION

Since MPP inception, PG&E has completed 100% of the MPP database at a total cost of \$55.58 million.

PG&E is submitting this final meter protection program report to the Commission's Safety and Enforcement Division, completing the commitment from the 1990 GRC Decision 89-12-057. Furthermore, PG&E will continue to identify and mitigate meter locations requiring protection or other corrective work as part of ongoing corrective maintenance.

Locations Addressed and Resulting Expenditures

	Actuals Since Inception	Actual 2020	Remaining Work To Be Completed	Forecast Program Total
A. MPP Locations	394,830			
B. New Locations (through September 30, 2011)	14,414	0	N/A	14,414
C. Total MPP Locations	409,244			409,244
D. Locations Inspected ¹	409,244	0	0	409,244
E. CGI ²	N/A	0	0	0
F. Locations Resolved (G+H+I+J)	409,244	0	N/A	409,244
G. No Work Required (Initial Inspection, Subsequent Inspections)	316,805	0	0	316,805
H. Post Work Completed, Expense	92,439	3	0	92,439
I. Valve Work Completed, Expense				
J. Work Completed, Capital				
K. Work Pending (L+P+Q)	0	0	0	
L. Inspected - Meter Protection Work Required (M+O)	0	0	0	
M. Anticipated Post Installations	0	0	0	
O. Anticipated Relocations				
P. Inspected - Valve Work Required	0	0	0	
Q. Inspected - Meter Protection and Valve Work Required	0	0	0	
R. Inspected - CGI ²	0	0	0	
S. Unit Costs, \$ per unit				
T. EXA Meter Protection Program - Inspections (Expense)	N/A	\$0	\$0	
U. EXB Meter Protection Program - Protections (Expense)	N/A	\$9,142	\$0	
V. 27A Meter Protection Program - Capital Expenditures	N/A			
W. EXC Meter Protection Program - Service Valves (Expense)	N/A	\$0	\$0	
Y. Total Expenditures³, \$000's				
Z. Expenditures, \$000's (AA+BB+CC+DD)	\$55,558	\$27	\$0	\$55,558
AA. Inspections and Program Management Expenses	\$8,527	\$0	\$0	\$8,527
BB. Post Work, Expense	\$47,031	\$27	\$0	\$47,031
CC. Valve Work, Expense				
DD. Correction, Capital				

Notes:

- Locations inspected are previously identified meters to confirm if protection is required.
- Can't Get In (CGI) is the sum of properties where no access was available to perform MPP work.
- Note that actual since inception costs are a summation of annual expenditures. The cost are not presented in net present value.

Meter Locations By Area Inception - 12/31/2020

Division	Total Locations	Total Work Pending	% Inspections Complete	% Work Complete
Peninsula	22,027	0	100%	100.00%
San Francisco	51,773	0	100%	100.00%
Area 1 Subtotal	73,800	0	100%	100.00%
Diablo	20,178	0	100%	100.00%
East Bay	35,916	0	100%	100.00%
Mission	30,006	0	100%	100.00%
Area 2 Subtotal	86,100	0	100%	100.00%
Central Coast	20,611	0	100%	100.00%
De Anza	30,667	0	100%	100.00%
San Jose	22,491	0	100%	100.00%
Area 3 Subtotal	73,769	0	100%	100.00%
Fresno	16,767	0	100%	100.00%
Kern	15,361	0	100%	100.00%
Area 4 Subtotal	32,128	0	100%	100.00%
Stockton	22,268	0	100%	100.00%
Yosemite	15,865	0	100%	100.00%
Area 5 Subtotal	38,133	0	100%	100.00%
North Valley	12,157	0	100%	100.00%
Sacramento	38,848	0	100%	100.00%
Sierra	11,439	0	100%	100.00%
Area 6 Subtotal	62,444	0	100%	100.00%
North Bay	20,464	0	100%	100.00%
North Coast	22,409	0	100%	100.00%
Area 7 Subtotal	42,873	0	100%	100.00%
Total	409,247	0	100%	100.00%

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 8
Deferred Work Analysis Summary

The Gas Distribution deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work.

Check 2a: The work is measured by units of work.

Check 2b: PG&E expects to perform fewer of such units during the 2020-2022 period.

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 2			Explanation	Units Comparison			Dollar Comparison				
						Check 1	Check 2a	Check 2b		2020 Rec. Adj. + 2021 2022 Forecast	2020 Rec. Adj. + 2021 2022 Forecast (A) (B)	2020 to 2022 Imputed	Difference	2020 Rec. Adj. + 2021 2022 Forecast (A) (B)	2020 to 2022 Imputed	Difference	
1	Capital	27	27A	Meter Protection	# of services	Y	Y	Y	No deferred work - Work is demand-driven.	585	1,884	1,299	(1,299)	17,237,793	54,793,132	(37,555,339)	
2	Capital	74	74A	Gas Regulator Replacement	# of regulators	Y	Y	Y	The 2023 forecast includes only funding for requested routine regulator replacements. Remaining non-riv unit replacements will be completed by 2023, and are not included in the forecast.	18,795	18,877		(82)	6,296,377	5,959,441	336,936	
3	Expense	DD	DD#	Provide Field Service, Other	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	-	153	-	152	
4	Expense	DD	DDA	Field Services, Other	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	305,662	578,168	-	(132,506)	3,088,784	-	2,956,278	
5	Expense	DD	DDB	Pipe Repair	# of Service Tickets	Y	Y	Y	No deferred work - Work is demand-driven.	32,902	38,466	-	(5,564)	3,050,558	38,370,090	(4,670,464)	
6	Expense	DD	DDC	Appliance Adjustments	# of Service Tickets	Y	Y	Y	No deferred work - Work is demand-driven.	96,843	111,576	-	(14,733)	10,087,981	9,030,368	1,057,613	
7	Expense	DD	DDD	Gas Furnace Activity	# of Service Tickets	Y	Y	Y	No deferred work - Work is demand-driven.	467,972	495,537	-	(27,565)	90,159,011	53,834,176	36,324,835	
8	Expense	DD	DDK	Gas Leaks & Emergencies	# of Service Tickets	Y	Y	Y	No deferred work - Work is demand-driven.	125,335	165,133	-	(39,798)	13,798,911	15,810,585	(2,131,674)	
9	Expense	DD	DDL	Gas Start	# of Service Tickets	Y	Y	Y	No deferred work - Work is demand-driven.	203,472	288,243	-	(84,771)	11,976,652	2,805,537	9,171,115	
10	Expense	DD	DDL	Gas Stop	# of Service Tickets	Y	Y	Y	No deferred work - Work is demand-driven.	2,276,068	2,150,700	-	125,368	137,105,211	126,398,876	10,706,335	
11	Expense	DF	DF#	Locate and Mark, Other	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	11,299	11,664	-	(365)	862,161	5,373,791	(4,511,630)	
12	Expense	DF	DF#-GD	Locate and Mark Standby	# of sites requiring a standby	Y	Y	Y	No deferred work - Work is demand-driven.	-	-	-	-	915	495	421	
13	Expense	EX	EXA	MPP Inspections	Non-Unitized	Y	N	N/A	No deferred work - PG&E expects to perform all adopted levels of work.	34,388	27,050	-	7,338	27,454,848	25,114,265	2,340,583	
14	Expense	EX	EXB	MPP Protection (Bollards)	# of Locations	Y	Y	N/A	No deferred work - Work is non-unitized.	-	-	-	-	13,800	7,521	(6,279)	
15	Expense	EX	EXC	MPP Service Valves	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	-	-	-	-	2,854,116	3,515,038	(660,922)	
16	Expense	FH	FH#	Preventive Maintenance, Other	Non-Unitized	Y	N	N/A	No deferred work - PG&E expects to perform all adopted levels of work.	-	-	-	-	4,588,886	3,677,941	910,945	
17	Expense	FH	FHA	Preventative Maintenance Main	# Mains Maintained	Y	Y	N/A	No deferred work - Work is non-unitized.	1,238	776	-	462	13,654,383	9,918,727	3,735,656	
18	Expense	FH	FHB	Preventative Maintenance Regulator Station	Non-Unitized	Y	Y	N/A	No deferred work - Work is non-unitized.	-	-	-	-	9,077,42	778,041	1,297,702	
19	Expense	FH	FHC	Preventative Maintenance Farm Tap	Non-Unitized	Y	N	N/A	No deferred work - PG&E expects to perform all adopted levels of work.	-	-	-	-	19,481,192	11,282,306	8,198,885	
20	Expense	FH	FHE	Preventative Maintenance Services	# Services Repaired	Y	Y	N/A	No deferred work - Work is non-unitized.	9,194	7,195	-	1,999	5,477,215	5,175,889	301,327	
21	Expense	FH	FHF	Preventative Maintenance Main Valves	Non-Unitized	Y	Y	N/A	No deferred work - PG&E expects to perform all adopted levels of work.	-	-	-	-	13,780,129	6,853,447	6,926,682	
22	Expense	FH	FHI	Maint-Corr. G Svc. Valves	# of valves replaced	Y	Y	N/A	No deferred work - Work is non-unitized.	63,056	53,909	-	9,147	16,109,899	8,754,412	7,355,487	
23	Expense	FH	FHI	Gas Non-Recurring Projects	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	-	-	-	-	3,377,989	1,274,339	2,103,651	
24	Expense	FH	FHO	SCADA Preventative Maintenance	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	-	-	-	-	1,988,427	1,017,346	971,081	
25	Expense	FH	FHP	SCADA Corrective Maintenance	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	-	-	-	-	214,062	-	214,062	
26	Expense	FH	FHR	Distribution Pipeline Markers	Non-Unitized	N	N	N/A	No deferred work - Work is non-unitized and was not to compliance-driven.	-	-	-	-	12,604,881	13,951,703	(1,346,822)	
27	Expense	FH	FHS	Corrective Maintenance Regulator General	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized and compliance-driven.	-	-	-	-	2,041,320	502,481	1,538,839	
28	Expense	FI	FIB	Corrective Maintenance Regulator General	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized and compliance-driven.	-	-	-	-	1,406,754	1,815,208	(408,454)	
29	Expense	FI	FIC	Corrective Maintenance Farm Tap	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized and compliance-driven.	-	-	-	-	(322)	1,033,975	(1,014,297)	
30	Expense	FI	FIF	Corrective Maintenance Main Valve	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	-	-	-	-	-	-	-	
31	Expense	HY	HY#	Gas Meter Maintenance, Other	Non-Unitized	Y	N	N/A	No deferred work - All planned and required work was performed. The 2023 forecast includes only the annual volume of forecast finds.	114,069	120,000	-	(5,931)	6,713,804	5,608,739	1,105,065	
32	Expense	HY	HYI	Gas Meter Atmospheric Corrosion	# of Meters Repaired	Y	Y	Y	No deferred work - Work is non-unitized.	-	-	-	-	10,009,136	7,603,419	2,405,717	
33	Expense	JQ	JQC	Damage Prevention	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	-	-	-	-	23,534,171	60,152,573	(37,218,402)	
34																	
35																	
36																	
37																	
38																	

(A) Recorded and forecast values vary from the values listed in the Results of Operations (RO) Model due to errors. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errors with the Joint Comparison Exhibit submittal.

(B) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 8
 Deferred Work Analysis Summary

The Gas Transmission/deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks listed below.

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work;

Check 3: PG&E expects to perform fewer of such units during the 2019-2022 period.

Check 4: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 2		Deferred Work	Explanation	Units Comparison		Dollar Comparison		Difference
						Check 1	Check 2a			Check 2b	2019 and 2020 Rec. Adj. 4-2021 to 2022 Forecast	2019 to 2022 Imputed	2019 and 2020 Rec. Adj. to 2022 Forecast (A) (B)	
1	Expense	DF	DFA-GT	Locate and Mark	# of Tickets	Y	Y	Y	No deferred work - Work is demand-driven.	18,582.00	39,725.53	(21,143.53)	4,558,753	1,762,270
2	Expense	DE	DFB-GT	Locate and Mark Standby	# of Requests	Y	Y	Y	No deferred work - All required standbys were performed. Work is demand-driven. In addition, the work is not measured by units of work; unitized for informative purposes only and not used as a calculation to drive the forecast.	22,937.00	33,393.69	(10,456.69)	76,848	(16,352,025)
3	Expense	JO	JOH	GT Pipeline Maintenance	Non-Unitized	Y	N	N/A	No deferred work - Work is non-unitized.	-	-	-	-	76,848
4	Expense	JO	JOL	PM SCADA Maintenance	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	1,195,593	(1,945,967)
5	Expense	JO	JOD	CM SCADA Maintenance	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	1,156,090	(351,553)
6	Expense	JO	JOF	Required Ground Pipeline Patrol	Hours	Y	Y	Y	No deferred work - All required demand driven and planned routine ground patrol work was performed.	40,240.17	59,740.00	(19,499.83)	3,776,423	(1,706,118)
7	Expense	JO	JOG	PM Gas Regulator General	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	12,222,927	5,886,693
8	Expense	JO	JOH	PM Gas Pipeline Valve Manual	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	5,489,734	4,354,610
9	Expense	JO	JOI	PM Gas Pipeline Valve Automated	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	133,548	753,990
10	Expense	JO	JOL	Gas Holders Maintenance	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	578,067	(791,022)
11	Expense	JO	JOK	Operate Transmission Pipelines	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	3,508,829	4,476,966
12	Expense	JO	JOL	Operate Transmission Regulator Station	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	3,352,486	11,844,620
13	Expense	JO	JOM	CM Gas Regulator General	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	4,446,805	1,821,550
14	Expense	JO	JON	CM Gas Pipeline Valve Manual	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	3,081,014	3,061,958
15	Expense	JO	JOO	CM Gas Pipeline Valve Automated	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	751,116	103,886
16	Expense	JO	JOS	Pipeline Marker Maintenance	Pipeline Markers	Y	Y	Y	2023 GRC forecast request includes funding for new finds only.	6,796.00	9,200.00	(2,404.00)	6,544,627	3,953,479
17	Expense	JO	JOT	Vegetation Management	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	3,224,308	1,177,298
18	Expense	JO	JOV	Required Aerial Pipeline Patrol	Miles Aerial Patrolled	Y	Y	Y	No deferred work - Entire system is patrolled monthly.	505,838.00	507,672.00	(1,834.00)	16,708,660	21,689,886
19	Expense	JO	JOX	PM Meter Maintenance	Non-Unitized	Y	N/A	N/A	All monthly patrols were completed as permitted by weather conditions. All required HCA patrols were performed.	-	-	-	6,355,204	2,464,826
20	Expense	JO	JOY	CM Meter Maintenance	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	1,017,423	499,061
21	Expense	JP	JPH	GT Station Maintenance	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	495,405	-
22	Expense	JP	JPA	PM StorCompStat Piping Assets	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	3,915,125	2,894,692
23	Expense	JP	JPB	PM StorCompStat Piping Assets	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	3,025,350	657,555
24	Expense	JP	JPC	PM StorCompStat GasProcess	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	7,395,671	3,442,904
25	Expense	JP	JPD	PM StorCompStat GasCompressor	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	7,313,572	4,667,737
26	Expense	JP	JPE	PM StorCompStat Support	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	7,374,056	9,437,495
27	Expense	JP	JPG	CM StorCompStat GasProcess	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	6,066,123	3,913,771
28	Expense	JP	JPH	CM StorCompStat GasProcess	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	8,177,928	5,187,977
29	Expense	JP	JPI	CM StorCompStat GasCompress	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	5,495,522	6,237,839
30	Expense	JP	JPK	PM Power Units	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	975,603	695,626
31	Expense	JP	JPL	CM Power Units	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	915,097	769,035
32	Expense	JP	JPM	Station Operations	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	22,303,132	26,044,318
33	Expense	JP	JPO	PM Storage Wells	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	2,078,030	8,176,386
34	Expense	JP	JPP	CM Storage Wells	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	758,432	2,081,271
35	Expense	JT	JTF	Station Compress Overhaul Insp	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	39	-
36	Expense	JT	JTG	Storage Well	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	(34)	-
37	Expense	JT	JTH	Permits & Fees Projects	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	27,242,948	28,237,306
38	Expense	JT	JTI	GT Information Technology	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	468	-
39	Expense	JT	JTK	Vegetation Management Project	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	49,962,033	32,856,290
40	Expense	JT	JTO	Encroachments Structures & ROW	Non-Unitized	Y	N/A	N/A	No deferred work - Work is non-unitized.	-	-	-	3,309,844	3,835,231
41									Expense Total				255,593,967	255,704,930
42														(111,023)

(A) Recorded and forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submitted.

(B) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. Chapter 2 and Exhibit (PG&E-1), Chapter 3 for further information about the 2023 GRC forecast process.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 9, GAS OPERATIONS CORROSION CONTROL

TABLE OF CONTENTS

Subject	Page No.
Expense Workpapers	
Recorded and Forecast Expenses by MWC (Nominal Dollars)	WP 9-1
Recorded and Forecast Expenses by MWC (Base Year Dollars)	WP 9-2
Recorded and Forecast Expenses by MAT Code (Nominal Dollars)	WP 9-3
Recorded and Forecast Expenses by MAT Code (Base Year Dollars)	WP 9-5
Summary of Expenses	WP 9-7
MAT DGA - Forecast Calculator	WP 9-8
MAT DGB - Forecast Calculator	WP 9-9
MAT DGC - Forecast Calculator	WP 9-10
MAT DGD - Forecast Calculator	WP 9-11
MAT DGE - Forecast Calculator	WP 9-12
MAT DGG - Forecast Calculator	WP 9-13
MAT DGH - Forecast Calculator	WP 9-14
MAT FHK - Forecast Calculator	WP 9-15
MAT FHL - Forecast Calculator	WP 9-16
MAT FHM - Forecast Calculator	WP 9-17
MAT FHN - Forecast Calculator	WP 9-18
MAT FII - Forecast Calculator	WP 9-19
MAT JOA - Forecast Calculator	WP 9-20
MAT JOB - Forecast Calculator	WP 9-21

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 9, GAS OPERATIONS CORROSION CONTROL

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
MAT JOC - Forecast Calculator	WP 9-22
MAT JOQ - Forecast Calculator	WP 9-23
MAT JOZ - Forecast Calculator	WP 9-24
MAT GJA - Forecast Calculator	WP 9-25
MAT GJB - Forecast Calculator	WP 9-27
MAT GJC - Forecast Calculator	WP 9-28
MAT GJD - Forecast Calculator	WP 9-29
MAT GJE - Forecast Calculator	WP 9-30
MAT GJF - Forecast Calculator	WP 9-31
MAT GJH - Forecast Calculator	WP 9-32
MAT GJJ - Forecast Calculator	WP 9-35
MAT GJK - Forecast Calculator	WP 9-36
MAT GJM - Forecast Calculator	WP 9-37
Project Summaries	
Enhanced Cathodic Protection Survey - DGD	WP 9-39
Electrically Connected Isolated Steel Services Project - DGE	WP 9-41
Casing Test Station Installation - DGG	WP 9-43
Casing Mitigations -DGH, 50Q	WP 9-45

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 9, GAS OPERATIONS CORROSION CONTROL

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Atmospheric Corrosion Span Inspection & Mitigation - FHK, FHL, FHM, FHN	WP 9-48
Internal Corrosion - 3K1, GJH	WP 9-50
AC Interference - 3K4, GJA	WP 9-53
Casings - 3K5, GJM	WP 9-55
Cathodic Protection - 3K6, 3K7, GJC	WP 9-59
Coupon Test Stations - 3K8, GJD	WP 9-63
DC Interference -3K9, GJF	WP 9-65
Close Interval Survey (CIS) - GJE	WP 9-67
Complex Low Read Investigation/Troubleshooting - GJJ	WP 9-69
Expense Historical and Forecast Walk Workpapers	
Expense MWC DG - 2016 through 2020 Historical Walk by MWC - Distribution	WP 9-71
Expense MWC DG - 2020 through 2023 Forecast Walk by MWC - Distribution	WP 9-72
Expense MWC FH - 2016 through 2020 Historical Walk by MWC - Distribution	WP 9-73
Expense MWC FH - 2020 through 2023 Forecast Walk by MWC - Distribution	WP 9-74
Expense MWC FI - 2016 through 2020 Historical Walk by MWC - Distribution	WP 9-75
Expense MWC FI - 2020 through 2023 Forecast Walk by MWC – Distribution	WP 9-76

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 9, GAS OPERATIONS CORROSION CONTROL

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
Expense MWC JU - 2016 through 2020 Historical Walk by MWC - Distribution	WP 9-77
Expense MWC GJ - 2016 through 2020 Historical Walk by MWC - Transmission	WP 9-78
Expense MWC GJ - 2020 through 2023 Forecast Walk by MWC - Transmission	WP 9-79
Expense MWC JO - 2016 through 2020 Historical Walk by MWC - Transmission	WP 9-80
Expense MWC JO - 2020 through 2023 Forecast Walk by MWC - Transmission	WP 9-81
Capital Workpapers	
Capital Expenditures by MWC (Nominal Dollars)	WP 9-82
Forecast Capital Expenditures Summary (Nominal Dollars)	WP 9-83
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million	WP 9-84
Recorded and Forecast Capital Expenditures Details - Other Work Capital – Projects Under \$3 Million	WP 9-85
Summary of Capital Expenditures	WP 9-86
MAT 50D - Forecast Calculator	WP 9-87
MAT 50P - Forecast Calculator	WP 9-88
MAT 50Q - Forecast Calculator	WP 9-89
MAT 3K1 - Forecast Calculator	WP 9-90
MAT 3K4 - Forecast Calculator	WP 9-91

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 9, GAS OPERATIONS CORROSION CONTROL

TABLE OF CONTENTS
(CONTINUED)

Subject	Page No.
MAT 3K5 - Forecast Calculator	WP 9-94
MAT 3K6 - Forecast Calculator	WP 9-95
MAT 3K7 - Forecast Calculator	WP 9-96
MAT 3K8 - Forecast Calculator	WP 9-98
MAT 3K9 - Forecast Calculator	WP 9-99
MAT 3KA - Forecast Calculator	WP 9-100
Project Summaries	
New/Replace Cathodic Protection Systems and Casing Mitigation - 50p	WP 9-101
Capital Historical and Forecast Walk Workpapers	
Capital MWC 50 - 2016 through 2020 Historical Walk by MWC - Distribution	WP 9-103
Capital MWC 50 - 2020 through 2023 Forecast Walk by MWC - Distribution	WP 9-104
Capital MWC 3K - 2016 through 2020 Historical Walk by MWC - Transmission	WP 9-105
Capital MWC 3K - 2020 through 2023 Forecast Walk by MWC - Transmission	WP 9-106
Deferred Work Workpapers	
Deferred Work Analysis	WP 9-107

Workpaper Table 9-1
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	DG	G Dist Cathodic Protection	9,443	12,147	15,766	22,333	23,954	19,034	23,725	26,924	
2	FH	G Dist Preventive Maint	1,815	2,811	3,639	2,940	3,000	4,825	16,399	16,348	
3	FI	G Dist Corrective Maint	5,833	2,706	3,644	5,558	4,567	7,971	5,869	6,172	
4	GJ	Gas Transmission Mitigate Corr	26,052	17,042	12,043	28,581	18,302	19,754	28,770	26,444	
5	JO	GT Pipeline Maintenance	1,716	1,443	2,390	2,831	2,933	2,803	2,692	2,943	
6	JU	Gas Distrib Leak Srvy & Repair	8,425								
7	Total		53,285	36,149	37,482	62,243	52,756	54,387	77,456	78,831	WP 9-7, Line 37

Notes: (A) Line 7, 2021 and 2023 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 9-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016		2017		2018		2019		2020		2021		2022		2023	
			Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Forecast	Forecast	Forecast	Forecast
1	DG	G Dist Cathodic Protection	10,504		13,079		16,285		22,486		23,954		18,669		22,553		24,792	
2	FH	G Dist Preventive Maint	2,024		3,035		3,803		2,984		3,000		4,708		15,484		14,931	
3	FI	G Dist Corrective Maint	6,434		2,904		3,776		5,579		4,567		7,823		5,584		5,689	
4	GJ	Gas Transmission Mitigate Corr	27,775		17,880		12,249		28,302		18,302		19,566		27,702		24,710	
5	JO	GT Pipeline Maintenance	1,932		1,581		2,510		2,909		2,933		2,749		2,559		2,708	
6	JU	Gas Distrib Leak Srvy & Repair	8,994															
7	Total		57,663		38,480		38,623		62,261		52,756		53,515		73,882		72,830	

Workpaper Table 9-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	DG	DGA	Cath Protect - Monitoring	2,002	2,896	3,281	4,460	4,253	3,792	4,291	4,673	WP 9-7, Line 2
2		DGB	Cath Protect-Troubleshoot	4,040	3,198	3,240	5,102	4,564	4,513	4,548	4,724	WP 9-7, Line 3
3		DGC	Cath Protect - Rectifier Maint	485	487	503	490	715	524	554	572	WP 9-7, Line 4
4		DGD	Cath Protect - Resurvey	1,372	3,571	2,594	2,813	4,849	6,440	3,456	3,572	WP 9-7, Line 5
5		DGE	G:Isolated Steel Svc Evaluatn	1,028	509	3,074	3,717	3,827	2,827	6,107	6,312	WP 9-7, Line 6
6		DGF	G:Unprotectd Steel Main Evalu		382	2,404	1,880	26				WP 9-7, Line 7
7		DGG	Install casing test stations				287	1,285	200	3,593	3,058	WP 9-7, Line 8
8		DGH	Casing mitigate < than 100ft		225	648	3,277	4,239	737	1,176	4,012	WP 9-7, Line 9
9		DGI	Casing monitoring w/o leads				56	143				WP 9-7, Line 10
10		DG#	Cathodic Protection Other	517	879	23	252	51				WP 9-7, Line 1
11		DG Total		9,443	12,147	15,766	22,333	23,954	19,034	23,725	26,924	
12	FH	FHK	GD Corrosion AC Inspections	144	1	79	220	546	847	108	140	WP 9-7, Line 11
13		FHL	Atmospheric Corsn Main Rep	335	858	1,707	981	498	2,000	3,441	3,051	WP 9-7, Line 12
14		FHM	Atmospheric Corsn Serv Rep	404	370	486	665	1,168	997	11,508	12,200	WP 9-7, Line 13
15		FHN	Atmospheric Corsn Reg Stn Rprs	932	1,582	1,367	1,074	788	981	1,342	957	WP 9-7, Line 14
16		FH Total		1,815	2,811	3,639	2,940	3,000	4,825	16,399	16,348	
17	FI	FII	Maint-Corr-G Cath Prot	5,833	2,706	3,644	5,558	4,567	7,971	5,869	6,172	WP 9-7, Line 15
18		FI Total		5,833	2,706	3,644	5,558	4,567	7,971	5,869	6,172	
19	GJ	GJA	Electrical Interference - AC	1,532	1,376	(1,311)	2,184	1,419		3,459	1,341	WP 9-7, Line 19
20		GJB	Atmospheric Corrosion	3,358	3,186	2,040	1,555	1,443	2,097	4,650	3,643	WP 9-7, Line 20
21		GJC	Cathodic Protection Expense	1,774	2,233	1,900	423	1,803	3,461	350	362	WP 9-7, Line 21
22		GJD	Test Stations	3,546	3	26	386	402	269	230	238	WP 9-7, Line 22
23		GJE	Close Interval Survey (CIS)	1,782	1,124	3,046	7,089	4,488	5,200	5,620	5,808	WP 9-7, Line 23
24		GJF	Electrical Interference - DC	654	960	1,153	1,117	697	748	772	798	WP 9-7, Line 24
25		GJH	Internal Corrosion	1,831	668	986	2,408	2,291	3,734	6,361	6,650	WP 9-7, Line 25
26		GJJ	Low Read Investigations	4,295	2,678	(5,403)	296	1		265	274	WP 9-7, Line 26
27		GJK	Corrosion Support	2,192	1,256	1,801	2,560	2,489	2,185	2,629	2,717	WP 9-7, Line 27
28		GJL	Casings Monitoring	829	229	169	186	171				WP 9-7, Line 28
29		GJM	Casings	3,772	3,329	7,635	10,377	3,099	2,061	4,434	4,612	WP 9-7, Line 29
30		GJ#	Corrosion Control Other	486								WP 9-7, Line 18
31		GJ Total		26,052	17,042	12,043	28,581	18,302	19,754	28,770	26,444	

Workpaper Table 9-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
32	JO	JOA	Cath Prot Rectifier Maintenanc	196	137	127	124	176	155	108	111	WP 9-7, Line 30
33		JOB	Cath Prot Monitoring	701	689	1,418	1,832	1,402	1,373	1,206	1,231	WP 9-7, Line 31
34		JOC	Cath Prot Troubleshoot	516	338	404	520	726	506	745	770	WP 9-7, Line 32
35		JOD	Cath Prot Resurvey	2								WP 9-7, Line 33
36		JOQ	Cath Protection Corr Maintnc	294	279	442	356	520	473	329	340	WP 9-7, Line 34
37		JOZ	Atmospheric Corrosion Inspect	6				108	296	305	490	WP 9-7, Line 35
38	JO Total			1,716	1,443	2,390	2,831	2,933	2,803	2,692	2,943	
39	JU	JU#	Gas Distribution Leak Survey & Repair Other	8,425								WP 9-7, Line 16
40	JU Total			8,425								
41	Total			53,285	36,149	37,482	62,243	52,756	54,387	77,456	78,831	WP 9-7, Line 37

Notes: (A) Line 41, 2021 and 2023 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 9-4
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Expenses by MAT Code
(Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016		2017		2018		2019		2020		2021		2022		2023	
				Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Forecast	Forecast	Forecast	Forecast
1	DG	DGA	Cath Protect - Monitoring	2,260		3,180		3,476		4,548		4,253		3,720		4,079		4,303	
2		DGB	Cath Protect-Troubleshoot	4,558		3,511		3,444		5,253		4,564		4,426		4,324		4,350	
3		DGC	Cath Protect - Rectifier Maint	548		535		534		504		715		514		526		527	
4		DGD	Cath Protect - Resurvey	1,467		3,717		2,639		2,792		4,849		6,317		3,285		3,289	
5		DGE	G:Isolated Steel Svc Evaluath	1,091		527		3,076		3,655		3,827		2,773		5,806		5,813	
6		DGF	G:Unprotectd Steel Main Evalu			401		2,419		1,856		26							
7		DGG	Install casing test stations					673		285		1,285		196		3,415		2,816	
8		DGH	Casing mitigate < than 100ft			241				3,276		4,239		723		1,118		3,694	
9		DGI	Casing monitoring w/o leads							57		143							
10		DG#	Cathodic Protection Other	581		966		25		259		51							
11		DG Total		10,504		13,079		16,285		22,486		23,954		18,669		22,553		24,792	
12	FH	FHK	GD Corrosion AC Inspections	160		2		84		221		546		826		102		128	
13		FHL	Atmospheric Corsn Main Rep	372		922		1,777		991		498		1,952		3,249		2,787	
14		FHM	Atmospheric Corsn Serv Rep	450		401		509		679		1,168		973		10,866		11,142	
15		FHN	Atmospheric Corsn Reg Stn Rprs	1,042		1,711		1,433		1,093		788		957		1,267		874	
16		FH Total		2,024		3,035		3,803		2,984		3,000		4,708		15,484		14,931	
17	FI	FI	Maint-Corr-G Cath Prot	6,434		2,904		3,776		5,579		4,567		7,823		5,584		5,689	
18		FI Total		6,434		2,904		3,776		5,579		4,567		7,823		5,584		5,689	
19	GJ	GJA	Electrical Interference - AC	1,628		1,432		(1,298)		2,155		1,419				3,331		1,253	
20		GJB	Atmospheric Corrosion	3,598		3,368		2,125		1,570		1,443		2,077		4,477		3,405	
21		GJC	Cathodic Protection Expense	1,886		2,382		1,908		423		1,803		3,428		337		338	
22		GJD	Test Stations	3,754		3		26		381		402		267		221		222	
23		GJE	Close Interval Survey (CIS)	1,898		1,168		3,046		6,991		4,488		5,151		5,411		5,427	
24		GJF	Electrical Interference - DC	703		1,003		1,160		1,108		697		741		744		746	
25		GJH	Internal Corrosion	1,962		706		1,003		2,399		2,291		3,698		6,125		6,214	
26		GJJ	Low Read Investigations	4,575		2,780		(5,381)		291		1		2,164		255		256	
27		GJK	Corrosion Support	2,375		1,331		1,839		2,574		2,489				2,531		2,539	
28		GJL	Casings Monitoring	878		252		179		192		171							
29		GJM	Casings	4,001		3,455		7,642		10,219		3,099		2,041		4,270		4,310	
30		GJ#	Corrosion Control Other	516															
31		GJ Total		27,775		17,880		12,249		28,302		18,302		19,566		27,702		24,710	

Workpaper Table 9-4
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 9
 Gas Operations Corrosion Control
 Expenses by MAT Code
 (Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016		2017		2018		2019		2020		2021		2022		2023	
				Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted	Recorded	Adjusted
32	JO	JOA	Cath Prot Rectifier Maintenanc	222		150		134		127		176		152		102		102	
33		JOB	Cath Prot Monitoring	792		757		1,487		1,884		1,402		1,347		1,146		1,133	
34		JOC	Cath Prot Troubleshoot	582		371		429		535		726		496		708		709	
35		JOD	Cath Prot Resurvey	2															
36		JOQ	Cath Protection Corr Maintnc	326		303		460		363		520		464		313		313	
37		JOZ	Atmospheric Corrosion Inspect	7								108		291		290		451	
38		JO Total		1,932		1,581		2,510		2,909		2,933		2,749		2,559		2,708	
39	JU	JU#	Gas Distribution Leak Survey & Repair Other	8,994															
40		JU Total		8,994															
41		Total		57,663		38,480		38,623		62,261		52,756		53,515		73,882		72,830	

Workpaper Table 9-5
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 9, Gas Operations Corrosion Control
Summary of Expenses

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	Reference	Notes
1	Cathodic Protection Other	DG	DGF	517,128	879,348	23,356	251,939	51,478	3,792,260	4,291,135	4,291,135	4,672,726	WP 9-8	1
2	Cath Protect - Monitoring	DG	DGA	2,002,370	2,895,768	3,280,613	4,480,119	4,253,411	4,512,876	4,548,231	4,548,231	4,724,485	WP 9-9	
3	Cath Protect-Troubleshoot	DG	DGB	4,039,664	3,239,928	5,101,776	4,583,755	714,787	524,286	553,686	553,686	572,187	WP 9-10	
4	Cath Protect - Resurvey	DG	DGC	484,520	487,445	503,472	489,805	4,849,438	6,440,104	6,440,104	6,440,104	3,659,038	WP 9-11	
5	G-Isolated Steel Svc Evaluath	DG	DGD	1,371,794	3,570,742	2,593,574	3,716,593	3,827,305	2,827,275	6,107,254	6,107,254	6,312,457	WP 9-12	2
6	G-Unprotected Steel Main Evalu	DG	DGE	1,027,982	508,997	3,073,552	1,879,566	26,215	200,000	3,592,689	3,592,689	3,132,627	WP 9-13	
7	Install casing test stations	DG	DGF	-	381,673	2,403,849	286,707	1,285,260	4,239,489	737,140	1,176,263	4,109,989	WP 9-14	3
8	Casing mitigate < than 100ft	DG	DGH	-	224,901	647,626	3,276,957	4,239,489	737,140	1,176,263	1,176,263	4,109,989	WP 9-14	
9	Casing monitoring w/o leads	DG	DGI	-	-	-	55,673	143,182	846,803	107,860	107,860	140,038	WP 9-15	
10	GD Corrosion AC Inspections	FH	FHK	144,251	1,371	78,977	220,311	980,526	2,000,216	3,440,923	3,440,923	3,051,467	WP 9-16	
11	Atmospheric Corrn Main Rep	FH	FHL	335,053	857,852	1,706,867	485,134	996,982	11,508,430	12,199,694	12,199,694	956,748	WP 9-17	
12	Atmospheric Corrn Srv Rep	FH	FHM	404,058	369,570	684,859	1,168,249	980,772	7,970,978	7,970,978	7,970,978	6,171,991	WP 9-18	
13	Atmospheric Corrn Reg Sin Rprs	FH	FHN	931,603	1,592,142	3,366,739	1,074,498	880,772	4,566,667	4,566,667	4,566,667	5,869,304	WP 9-19	
14	Atmospheric Corrn Reg Sin Rprs	FI	FI	5,633,244	2,705,728	3,644,383	5,568,101	4,566,667	7,970,978	7,970,978	7,970,978	6,171,991	WP 9-19	
15	Maint-Corr-G Cath Prot	FI	FI	8,425,211	-	-	-	-	-	-	-	-	WP 9-19	
16	Gas Distribution Leak Survey & Repair Other	JU	JU#	-	-	-	-	-	-	-	-	-	WP 9-19	
17	Total Expenses			25,516,879	17,663,571	23,048,929	30,830,859	31,520,519	31,829,692	45,993,533	45,993,533	49,703,447		

Notes
(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRG forecast process.
(1) DGF is not normally used as a budget MAT but is used as an internal clearing account for other MATS and it is not forecasted in this rate case period.
(2) DGF was used for the Unprotected Pipe Survey which is complete and is not forecasted for this rate case period.
(3) DGI was used for the distribution Casing Without Leads program which costs have been moved to DGA and is not forecasted for this rate case period.

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	Reference	Notes
18	Corrosion Control Other	GJ	GJ#	485,853	1,375,892	(1,310,887)	2,184,297	1,419,135	3,860,862	3,458,963	3,458,963	1,400,049	WP 9-25	4
19	Electrical Interference - AC	GJ	GJA	1,531,580	3,165,514	2,040,326	1,594,658	1,442,756	2,097,099	4,650,043	4,650,043	3,643,474	WP 9-27	
20	Atmospheric Corrosion	GJ	GJB	3,356,382	2,233,021	1,900,411	423,169	1,802,656	3,460,908	350,166	350,166	385,431	WP 9-28	
21	Cathodic Protection Expense	GJ	GJC	1,774,231	2,595	26,072	386,072	402,465	208,280	229,896	229,896	237,727	WP 9-29	
22	Test Stations	GJ	GJD	3,946,293	1,24,190	3,046,051	7,089,282	4,488,421	5,200,000	5,619,538	5,619,538	5,808,385	WP 9-30	
23	Close Interval Survey (CIS)	GJ	GJE	1,782,026	959,976	1,162,827	1,116,839	686,560	747,716	772,241	772,241	760,533	WP 9-31	
24	Electrical Interference - DC	GJ	GJF	654,212	668,028	986,345	2,408,435	2,291,013	3,734,010	6,360,606	6,360,606	6,650,291	WP 9-32	
25	Internal Corrosion	GJ	GJH	1,830,983	2,678,333	(5,402,897)	2,955,777	1,180	256,375	2,628,990	2,628,990	2,738,880	WP 9-36	5
26	Low Read Investigations	GJ	GJJ	4,295,214	1,256,287	1,800,590	2,559,703	2,488,746	2,184,625	2,184,625	2,184,625	2,177,313	WP 9-36	
27	Corrosion Support	GJ	GJK	2,192,095	829,041	169,282	186,224	170,951	2,060,816	4,454,393	4,454,393	4,525,610	WP 9-37	
28	Casings Monitoring	GJ	GJL	3,771,768	3,329,122	7,635,233	10,376,652	3,098,526	154,883	107,889	107,889	111,308	WP 9-20	
29	Cath Prot Rectifier Maintenance	GJ	GJM	196,464	137,069	126,601	123,637	176,405	1,373,051	1,205,650	1,205,650	1,231,263	WP 9-21	
30	Cath Prot Monitoring	JO	JOA	701,119	688,000	1,417,710	1,831,732	1,402,486	505,721	745,243	745,243	770,283	WP 9-22	
31	Cath Prot Troubleshoot	JO	JOB	516,217	337,515	403,687	519,730	725,804	-	-	-	-	WP 9-22	
32	Cath Prot Resurvey	JO	JOC	2,142	-	-	-	-	-	-	-	-	WP 9-23	
33	Cath Protection Corr Mainline	JO	JOD	294,118	279,236	442,149	355,938	520,128	473,040	328,966	328,966	340,022	WP 9-24	
34	Atmospheric Corrosion Inspect	JO	JOZ	6,080	107,786	296,212	107,786	296,212	304,599	489,852	489,852	489,852	WP 9-24	
35	Total Expenses			27,757,818	18,465,227	14,433,389	31,471,944	21,235,018	26,674,598	31,462,033	31,462,033	29,355,191		

Notes
(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRG forecast process.
(4) GJ# is not normally used as a budget MAT but is used as an internal clearing account for other MATS therefore it is not forecasted in this rate case period.
(5) GJL was used for the transmission Casing Without Leads program which costs have been moved to JOB and is not forecasted for this rate case period.
(6) JOD was used in 2016 for a resurvey program which has not been used since and is not forecasted for this rate case period.

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
37	Total Expense			53,284,697	36,148,798	37,482,317	62,242,803	62,755,537	58,504,290	77,455,616	77,455,616	79,058,638

Workpaper Table 9-6
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT DGA - Forecast Calculator

Line No.

1 **MAT DGA (UNIT OF MEASURE: # OF MONITORING POINT READS)**

2	Description	Value	Note
3	2018-2020 Total Average Cost	\$3,804,956.40	(A)
4	2021 Total Planned Units	70937	(B)
5	Total Average Unit Cost	\$53.64	Line (3)/ Line (4)
6	Cost Basis for Unit Cost	\$53.64	

7

8		2021 (E)	2022 (F)	2023	Note
9	Escalation Factor	2.44%	3.33%	3.36%	(C)
10	Escalation Amount	\$1.31	\$1.83	\$1.91	(D)
11	Forecast Unit Cost	\$54.95	\$56.78	\$58.68	
12	Forecast Units	91836	75429	79622	(I)
13	RMU Modem Upgrades		\$9,175.70	\$0.00	(H)
14	Total Forecast	\$5,046,141.17	\$4,291,812.22	\$4,672,598.33	Line (14)+Line (13) (G)

15

16 **Notes and References**

17 (A) 2018-2020 Total Average costs includes average total costs from 2018-2020 plus contract analyst work and RMU service costs (at \$10.00 per unit rate).

18 (B) 2021 Total Planned Units includes a decrease of units due to the automatic reads from the installed RMU units

19 (C) Escalation factors provided by GRC PMT

20 (D) Previous year unit cost x Escalation Factor.

21 (E) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

22 (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

23 (G) 2022 Forecast reflects total forecast including RMU Modem upgrades.

24 (H) Total RMU Modem Upgrade Costs

25 (I) For 2022 Total Forecast Units includes 14 units at \$655.41 (per unit) for RMU Modem Upgrades

Workpaper Table 9-7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT DGB - Forecast Calculator

Line No.1 **MAT DGB (UNIT OF MEASURE: # OF CPA'S TROUBLESHOT)**

Description	Value	Note
2017-2019 Total Average Costs	\$3,784,415.02	(I)
2017-2019 Total Average Units	10947	
Cost Basis for Unit Cost	\$345.71	Line (3)/Line (4)

	2021 (G)	2022 (H)	2023	Note
Escalation Factor	2.44%	3.33%	3.36%	(A)
Escalation Amount	\$8.44	\$11.79	\$12.30	(B)
Forecast Unit Cost	\$354.15	\$365.94	\$378.24	(C)
Forecast Units	17763	13938	14103	(D)
Corrosion Support Team Costs	\$83,841.53	\$86,633.45	\$89,544.34	(E)
Total Forecast	\$5,237,855.74	\$4,548,206.10	\$4,724,458.45	(F)

16 **Notes and References**

17 (A) Escalation factors provided by GRC PMT

18 (B) Previous year unit cost x Escalation Factor.

19 (C) Combined Unit cost from isolated steel work and other work

20 (D) Combined total units from isolated steel work and other work

21 (E) Costs for the corrosion support team were added and were used to calculate the total forecast

22 (F) This is not a representation of the total forecast but a representation of a bundled unit cost total forecast

23 (G) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

24 (H) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit

25 (I) Historic unit costs consist of a mixed work MAT, consisting of isolated steel services and other troubleshooting work. Forecast calculated as follows: Total average costs from 2017-2019 divided by the total average units from 2017-2019. (Isolated Steel work unit cost \$129.80 x escalation x 8,085 units in 2023 + Other troubleshooting work unit cost \$529.56 x escalation x 6,018 units in 2023).

Workpaper Table 9-8
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT DGC - Forecast Calculator

Line No.1 **MAT DGC (UNIT OF MEASURE: # OF RECTIFIERS MAINTAINED)**

Description	Value	Note
2016-2019 Total Average Recorded Costs	\$484,055.40	(A)
2016-2019 Total Average Recorded Units	4013.5	
2016-2019 Total Average Unit Cost	\$120.61	Line (3)/Line (4)
Additional Cost	\$12.06	(B)
Cost Basis for Unit Cost	\$132.67	Line (5)+ Line (6)

8

	2021 (E)	2022 (F)	2023	Note
9 Escalation Factor	2.44%	3.33%	3.36%	(C)
10 Escalation Amount	\$3.24	\$4.53	\$4.72	(D)
11 Forecast Unit Cost	\$135.90	\$140.43	\$145.15	
12 Forecast Units	3941	3942	3942	
13 Total Forecast	\$535,597.16	\$553,572.97	\$572,173.03	

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Notes and References

17 (A) Total Recorded cost include completed and open orders (with all costs in 2016-2019 time period) orders only. This was used to get a better representation of unit cost.

18 (B) 10% increase due to unit cost increase found in 2020.

19 (C) Escalation factors provided by GRC PMT

20 (D) Previous year unit cost x Escalation Factor.

(E) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

21 (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and
22 Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-9
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT DGD - Forecast Calculator

Line No.1 **MAT DGD (UNIT OF MEASURE: NON-UNITIZED)**

Description	Value	Note
2023 Forecast Cost	\$3,344,402.00	(A)/(G)
2023 Forecast Unit Cost	1	
2023 Average Unit Cost	\$3,344,402.00	Line (3)/ Line (4)
Cost Basis for Forecast	\$3,344,402.00	(B)

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	2021 (B)	2022 (C)/ (E)	2023 (F)	Note
9 Forecast Unit Cost	\$6,440,104.00	\$6,654,599.00	\$3,659,038.46	
10 Forecast Units	1	1	1	(D)
11 Total Forecast	\$6,440,104.00	\$6,654,599.00	\$3,659,038.46	

12

13

14 **Notes and References**

15 (A) Includes 3% union increase per year for Inyon Corrosion Technicians. Also, PG&E cost forecast is based on 2020 rates.

16 (B) In 2021 and 2022 this program will be steady state and in 2023, the total forecast will reflect future state of the program.

17 (C) 2022 forecast includes 3.33% escalation rate

18 (D) MAT is non-unitized

19 (E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

20 (F) 2023 total forecast is escalated at 3.36%

(G) The forecast includes costs for mapping work, project management, Corrosion Technicians and the Corrosion Engineering team. The forecast is calculated as (4 UDC x \$54/hour x 1,960 hours) + (2 UDC x \$155/hour x 2,360 hours) + (7 Inyon x \$188.73/hour x 13,720 hours) + (3 PG&E x \$73.63/hour x 2,250 hours)= \$3,344,402. Also, includes 3% union increase per year for Inyon Corrosion Technicians and for PG&E costs, forecast is based on 2020 rates.

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Workpaper Table 9-10
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT DGE - Forecast Calculator

Line No.1 **MAT DGE (UNIT OF MEASURE: NON-UNITIZED)**

Description	Value	Note
2023 Forecast Cost	\$5,910,436.00	(A)/(G)
2023 Forecast Unit Cost	\$1.00	
Cost Basis for Forecast	\$5,910,436.00	Line (3)/ Line (4)

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	2021 (F)	2022 (B)	2023 (C)/ (D)	Note
8 Forecast Unit Cost	\$2,827,275.00	\$6,107,253.52	\$6,312,457.24	
9 Forecast Units	1	1	1	(E)
10 Total Forecast	\$2,827,275.00	\$6,107,253.52	\$6,312,457.24	

11

12 **Notes and References**

13 (A) Total Unit Cost is based on contractor estimate and PG&E internal average costs

14 (B) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

15 (C) In 2023, as the program in MAT DGD is ending, MAT DGE is absorbing those costs. See footnote in "Adjustments to Forecasting Methodology" section.

16 (D) The 2023 forecast includes a 3.36% escalation factor

17 (E) MAT is non-unitized

18 (F) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

(G) The forecast includes costs for hosting fees, project management, Corrosion Technicians, quality control and field inspectors. The forecast is calculated as : (UDC Hosting Fees \$5,100/month x 12 months) + (1 EEI Technician x \$95/hour x 1,920 hours) + (1 Inyon CGI Dispatch x \$86.65/hour x 1,960 hours) + (1 Inyon Analyst x \$115.14/hour x 1,960 hours) + (1 Inyon QC x \$163.23/hour x 1,960 hours) + (1 Inyon Project Manager x \$137.07/hour x 1,960 hours) + (1 EEI Project Manager x \$125.00/hour x 1,920 hours) + (14 Inyon Technicians x \$155.87/hour x 27,440 hours) = \$5,910,436

19

Workpaper Table 9-11
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT DGG - Forecast Calculator

Line No.

1 **MAT DGG (UNIT OF MEASURE: # OF TEST STATIONS)**

2	Description	Value	Note
3	2020 Total Unit Cost	\$20,451.83	(A)
4	Cost Basis for Forecast	\$20,451.83	

5
6

7		2021 (D)	2022 (E)	2023	Note
8	Escalation Factor	2.44%	3.33%	3.36%	(B)
9	Escalation Amount	\$499.02	\$697.66	\$727.39	(C)
10	Forecast Unit Cost	\$20,950.85	\$21,648.52	\$22,375.91	
11	Forecast Units	20	170	140	
12	Total Forecast	\$419,017.09	\$3,680,248.08	\$3,132,627.16	

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Notes and References

- 15 (A) Total Unit Cost is based on engineering estimate of \$20,451.83. PG&E originally forecast this work to be conducted with in-house construction crews but was required to utilize contractors.
- 16 (B) Escalation factors provided by GRC PMT
- 17 (C) Previous year unit cost x Escalation Factor
- 18 (D) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- 19 (E) PG&E’s 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-12
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT DGH - Forecast Calculator

Line No.1 **MAT DGH (UNIT OF MEASURE:) # OF CASING MITIGATED**

Description	Value	Note
2020-2023 Total Casings Proposed Work	\$8,310,000.00	(A)
2020 Total Known Projects	73	
Cost Basis for Forecast	\$113,835.62	Line (3)/Line (4)

	2021 (D)	2022 (E)	2023	Note
Escalation Factor	2.44%	3.33%	3.36%	(B)
Escalation Amount	\$2,777.59	\$3,883.22	\$4,048.68	(C)
Forecast Unit Cost	\$116,613.21	\$120,496.43	\$124,545.11	
Forecast Units	8	10	33	
Total Forecast	\$932,905.64	\$1,204,964.25	\$4,109,988.47	

17 **Notes and References**

18 (A) Engineering estimates of 73 actual/pending projects was utilized to calculate unit cost. Cost estimate includes 65 projects less than 100 feet that do not require CalTrans or Railroad permits at \$110,000 each; 3 projects that require CalTrans permits at \$120,000 each; and 5 projects that require Railroad permits at \$160,000 each. Calculated total unit cost is as follows: $(65 \times \$110,000) + (3 \times \$120,000) + (5 \times \$160,000) = \$8,310,000$.

19 (B) Escalation factors provided by GRC PMT

20 (C) Previous year unit cost x Escalation Factor.

21 (D) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

22 (E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-13
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT FHK - Forecast Calculator

Line No.1 **MAT FHK (UNIT OF MEASURE: # OF INSPECTIONS COMPLETED)**

Description	Value	Note
2019 Recorded Costs	\$95,511.64	(A)
2019 Recorded Units	344	
Cost Basis for Forecast	\$277.65	Line (3)/ Line (4)

	2021 (D)	2022 (E)	2023	Note
Escalation Factor	2.44%	3.33%	3.36%	(B)
Escalation Amount	\$6.77	\$9.47	\$9.87	(C)
Forecast Unit Cost	\$284.42	\$293.90	\$303.77	
Forecast Units	500	367	461	
Total Forecast	\$142,212.39	\$107,859.88	\$140,038.45	

15 **Notes and References**

16 (A) PG&E did not use data from 2016-2018 because the data for those years does not include 532 spans identified in the atmospheric corrosion span inspection project. For forecasting purposes, in 2019 contract costs were excluded as they will not be incurred in the 2023 rate case.

17 (B) Escalation factors provided by GRC PMT

18 (C) Previous year unit cost x Escalation Factor.

19 (D) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

20 (E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-14
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT FHL - Forecast Calculator

Line No.1 **MAT FHL (UNIT OF MEASURE: # OF MAIN SPAN REPAIRS)**

Description	Value	Note
2018-2020 Total Average Unit Cost	\$19,235.40	(E)
Cost Basis for Forecast	\$19,235.40	

	2021 (C)	2022 (D)	2023	Note
Escalation Factor	2.44%	3.33%	3.36%	(A)
Escalation Amount	\$469.34	\$656.17	\$684.13	(B)
Forecast Unit Cost	\$19,704.74	\$20,360.91	\$21,045.04	
Forecast Units	99	169	145	
Total Forecast	\$1,950,769.63	\$3,440,994.08	\$3,051,530.56	

12
13 **Notes and References**

14 (A) Escalation factors provided by GRC PMT

15 (B) Previous year unit cost x Escalation Factor.

16 (C) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

17 (D) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

18 (E) PG&E excluded 2017 as the unit cost for this year was significantly lower due to inconsistencies with unit reporting that has since been resolved.

Workpaper Table 9-15
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT FHM - Forecast Calculator

Line No.1 **MAT FHM (UNIT OF MEASURE: # OF SERVICES REPAIRED)**

Description	Value	Note
2018 Total Recorded Costs	\$417,866.81	(A)
2018 Total Recorded Units	552	(B)
2018 Total Unit Cost	\$757.01	Line (3)/Line (4)
Cost Basis for Forecast	\$757.01	

	2021 (G)	2022 (H)	2023	Note
Escalation Factor	2.44%	3.33%	3.36%	(C)
Escalation Amount	\$18.47	\$25.82	\$26.92	(D)
Forecast Unit Cost	\$775.48	\$801.30	\$828.22	
Forecast Units	1474	1454	1822	
Total Forecast	\$1,143,051.65	\$1,165,089.28	\$1,508,815.30	
Total Wrap Damage Work Forecast		\$10,343,333.00	\$10,690,868.99	(E)
Total Forecast	\$1,143,051.65	\$11,508,422.28	\$12,199,684.29	

18 **Notes and References**

19 (A) Total Recorded cost for completed orders only. This was used to get a better representation of unit cost.

20 (B) Total Units for completed orders only. This was used to get a better representation of unit cost.

21 (C) Escalation factors provided by GRC PMT

22 (D) Previous year unit cost x Escalation Factor.

23 (E) Total forecast is based on 55,000 units per year at \$182 unit cost per year (2022 and 2023). Total forecast includes escalation factors.

24 (G) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

25 (H) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-16
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT FHN - Forecast Calculator

Line No.1 **MAT FHN (UNIT OF MEASURE: # OF STATIONS MITIGATED)**

Description	Value	Note
2016-2018 Total Average Costs	\$947,351.28	(A)
2016-2018 Total Average Units	65	(B)
2016-2018 Total Average Unit Cost	\$14,574.64	Line (3)/Line (4)
Cost Basis for Forecast	\$14,574.64	

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	2021 (E)	2022 (F)	2023	Note
Escalation Factor	2.44%	3.33%	3.36%	(C)
Escalation Amount	\$355.62	\$497.18	\$518.36	(D)
Forecast Unit Cost	\$14,930.26	\$15,427.44	\$15,945.80	
Forecast Units	57	87	60	
Total Forecast	\$851,024.89	\$1,342,187.19	\$956,748.05	

Notes and References

(A) Total Recorded cost for completed orders only. This was used to get a better representation of unit cost.

PG&E did not use data from 2019 because the data for that year is inconsistent with 2016-2018.

(B) Total Units for completed orders only. This was used to get a better representation of unit cost.

(C) Escalation factors provided by GRC PMT

(D) Previous year unit cost x Escalation Factor.

(E) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

(F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-17
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT FII - Forecast Calculator

Line No.1 **MAT FII (UNIT OF MEASURE: # OF CORROSION TAGS CLEARED)**

Description	Value	Note
2017-2019 Total Average Unit Cost	\$3,169.04	(A)
Cost Basis for Unit Cost	\$3,169.04	

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	2021 (G)	2022 (H)	2023	Note
Escalation Factor	2.44%	3.33%	3.36%	(B)
Escalation Amount	\$77.32	\$108.10	\$112.71	(C)
Forecast Unit Cost	\$3,246.36	\$3,354.47	\$3,467.18	(D)
Forecast Units	6974	5210	5375	(E)
Total Forecast	\$6,736,082.71	\$5,869,305.21	\$6,172,000.65	(F)

Notes and References

(A) Historic unit costs consist of a mixed work MAT, consisting of isolated steel services and other troubleshooting work. Forecast calculated as follows: Total average costs from 2017-2019 divided by the total average units from 2017-2019. (Isolated Steel work unit cost \$584.34 x escalation x 4,125 units in 2023 + Other troubleshooting work unit cost \$2,584 x escalation x 1,250 units in 2023).

(B) Escalation factors provided by GRC PMT

(C) Previous year unit cost x Escalation Factor.

(D) Combined Unit cost from isolated steel work and other work

(E) Combined total units from isolated steel work and other work

(F) This is not a representation of the total forecast but a representation of a bundled unit cost total forecast

(G) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

(H) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

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Workpaper Table 9-18
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT JOA - Forecast Calculator

Line No.

1 **MAT JOA (UNIT OF MEASURE: # OF RECTIFIERS MAINTAINED)**

Description	Value	Note
2016-2020 Total Average Recorded Cost	\$152,035.37	
2016-2020 Total Average Recorded Units	1370.6	
Cost Basis for Forecast	\$110.93	Line (3)/Line (4)

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	2021 (C)	2022 (D)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(A)
Escalation Amount	\$2.53	\$3.72	\$3.94	(B)
Forecast Unit Cost	\$113.46	\$117.18	\$121.11	
Forecast Units	962	919	919	
Total Forecast	\$109,143.96	\$107,685.29	\$111,303.51	

13

14 **Notes and References**

15 (A) Escalation factors provided by GRC PMT

16 (B) Previous year unit cost x Escalation Factor.

17 (C) The 2021 unit cost shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

18 (D) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-19
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT JOB - Forecast Calculator

Line No.1 **MAT JOB (UNIT OF MEASURE: # OF CP MONITORING POINTS READS)**

Description	Value	Note
2016-2020 Total Average Recorded Costs	\$1,208,410.63	
2016-2020 Total Average Recorded Units	14653.6	
2016-2020 Total Average Unit Cost	\$82.47	
Cost Basis for Forecast	\$82.47	Line (3)/ Line (4)

	2021 (C)	2022 (D)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(A)
Escalation Amount	\$1.88	\$2.77	\$2.93	(B)
Forecast Unit Cost	\$84.35	\$87.11	\$90.04	
Forecast Units	17887	13696	13674	(E)
Total Forecast for RMU Modem Upgrades		\$14,412.72		(F)
Total Forecast	\$1,508,684.51	\$1,207,496.39	\$1,231,190.43	

17 **Notes and References**

18 (A) Escalation factors provided by GRC PMT

19 (B) Previous year unit cost x Escalation Factor.

20 (C) The 2021 unit cost shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

21 (D) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

22 (E) 2022 Total Units includes 22 units for RMU Upgrade work

23 (F) Total forecast amount is for RMU Modem Upgrade Work

Workpaper Table 9-20
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT JOC - Forecast Calculator

Line No.

1 **MAT JOC (UNIT OF MEASURE: # OF CPA'S TROUBLESHOT)**

2	Description	Value	Note
3	2016-2020 Total Average Recorded Cost	\$500,592.63	
4	2016-2020 Total Average Recorded Units	1268	
5	Cost Basis for Forecast	\$394.79	Line (3)/Line (4)

6		2021 (C)	2022 (D)	2023	Note
7					
8	Escalation Factor	2.28%	3.28%	3.36%	(A)
9	Escalation Amount	\$9.00	\$13.24	\$14.01	(B)
10	Forecast Unit Cost	\$403.79	\$417.03	\$431.05	
11	Forecast Units	1787	1787	1787	
12	Total Forecast	\$721,573.32	\$745,240.93	\$770,281.02	

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15 **Notes and References**

16 (A) Escalation factors provided by GRC PMT

17 (B) Previous year unit cost x Escalation Factor.

18 (C) The 2021 unit cost shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

19 (D) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-21
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT JOQ - Forecast Calculator

Line No.1 **MAT JOQ (UNIT OF MEASURE: # OF CORRECTIVE WORK ORDERS COMPLETED)**

Description	Value	Note
2016-2020 Total Average Recorded Cost	\$378,316.02	
2016-2020 Total Average Recorded Units	393.6	
Cost Basis for Forecast	\$961.17	Line (3)/Line (4)

	2021 (C)	2022 (D)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(A)
Escalation Amount	\$21.91	\$32.25	\$34.12	(B)
Forecast Unit Cost	\$983.08	\$1,015.33	\$1,049.44	
Forecast Units	324	324	324	
Total Forecast	\$318,519.02	\$328,966.44	\$340,019.72	

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15 **Notes and References**

16 (A) Escalation factors provided by GRC PMT

17 (B) Previous year unit cost x Escalation Factor.

18 (C) The 2021 unit cost shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

19 (D) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-22
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT JOZ - Forecast Calculator

Line No.1 **MAT JOZ (UNIT OF MEASURE: # OF SPANS PATROLLED)**

Description	Value	Note
2020 Recorded Cost	\$107,786.00	(E)
2020 Recorded Units	117	
Cost Basis for Forecast	\$921.25	Line (3)/ Line (4)

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	2021 (C)	2022 (D)	2023	Note
8 Escalation Factor	2.28%	3.28%	3.36%	(A)
9 Escalation Amount	\$21.00	\$30.91	\$32.70	(B)
11 Forecast Unit Cost	\$942.25	\$973.16	\$1,005.86	
12 Forecast Units	690	313	487	
13 Total Forecast	\$650,154.10	\$304,598.51	\$489,852.02	

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15 **Notes and References**

16 (A) Escalation factors provided by GRC PMT

17 (B) Previous year unit cost x Escalation Factor.

18 (C) The 2021 unit cost shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

19 (D) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

20 (E) Historical costs were not used as this work was previously being worked under MAT JOB.

Workpaper Table 9-23
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJA - Forecast Calculator

Line No.**1 MAT GJA (Electric Poles/Towers Investigated)**

Line	Description	Value	Notes and References
3	2016/2019 Average Unit Costs	\$1,585.69	(A)
4	Adjustments to Forecast Basis	\$30.29	(B)
5	Cost Basis for Forecast	\$1,615.98	Line (3) + Line (4)

	2021 (F)	2022 (G)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(C)
Escalation Amount	\$36.84	\$54.21	\$57.36	(D)
Forecast Unit Cost	\$1,652.82	\$1,707.03	\$1,764.39	(E)
Forecast Units	765	300	300	(H)
Total Forecast	\$1,264,407.61	\$512,109.87	\$529,316.76	

Notes and References

(A) PG&E forecast costs for this workstream using contract costs from vendors that performed the work. PG&E took the two-year average of unit costs from 2016 and 2019 (\$1,639.42 and \$1,531.96). PG&E did a two-year average of historical data (2016 and 2019). 2017 and 2018 was excluded due to a low volume of work being completed which resulted in an inaccurate unit cost for this typical style of project. 2016 and 2019 are more representative of what is typically seen in this program.

(B) Added escalation amount for 2020 escalation rate

(C) Escalation factors provided by GRC PMT.

(D) Previous year unit cost x Escalation Factor.

(E) Previous year unit cost + Escalation Amount.

(F) The 2021 total forecast are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

(G) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

(H) Unit forecast based on engineer estimate

MAT GJA (Electric Poles/Mitigated)

Line	Description	Value	Notes and References
26	2016 Recorded Cost	\$96,601.77	(I)
27	2016 Recorded Units	5	
28	2016 Average Unit Cost	\$19,320.35	Line (26)/Line (27)
29	Adjustments to Forecast Basis	\$369.02	(J)
30	Cost Basis for Forecast	\$19,689.37	Line (28) + Line (29)

	2021 (N)	2022 (O)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(K)
Escalation Amount	\$448.92	\$660.54	\$698.84	(L)
Forecast Unit Cost	\$20,138.29	\$20,798.83	\$21,497.67	(M)
Forecast Units	6	20	25	(P)
Total Forecast	\$120,829.74	\$415,976.53	\$537,441.67	

Workpaper Table 9-23
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJA - Forecast Calculator

Line No.

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39 **Notes and References**

40 (I) There is little historical data due to the program starting with investigations and then transition into the mitigation phase starting in 2021. The PG&E forecast for Arc Fault Mitigation at electric poles and towers co-located with gas facilities is based on the average cost of mitigations that PG&E completed in 2016 with escalation rates applied.

41 (J) Added escalation amount for 2020 escalation rate

42 (K) Escalation factors provided by GRC PMT.

43 (L) Previous year unit cost x Escalation Factor.

44 (M) Previous year unit cost + Escalation Amount.

45 (N) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

46 (O) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

47 (P) Unit forecast based on an engineer estimate of 25 units per year requiring remediation

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MAT GJA (AC Induced Investigations)

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Line	Description	Value	Notes and References
51	2016 -2019 Average Unit Costs	\$74,883.56	(Q)
52	Adjustments to Forecast Basis	\$1,430.27	(R)
53	Cost Basis for Forecast	\$76,313.83	Line (50) + Line (51)

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	2021 (V)	2022 (W)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(S)
Escalation Amount	\$1,739.96	\$2,560.16	\$2,708.63	(T)
Forecast Unit Cost	\$78,053.79	\$80,613.95	\$83,322.58	(U)
Forecast Units	2	7	4	(X)
Total Forecast	\$156,107.58	\$564,297.68	\$333,290.33	

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Notes and References

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	2021	2022	2023	Note
Total Forecast	\$1,541,345	\$1,492,384	\$1,400,049	Line (12) + Line (37) + Line (59)

Workpaper Table 9-24
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJB - Forecast Calculator

Line No.1 **MAT GJB (Atmospheric Corrosion Mitigation)**

2	Line	Description	Value	Note
3	3	2020 Average Cost	\$35,500.00	(A)
4	4	Adjustments to Forecast Basis	\$0	
5	5	Cost Basis for Forecast	\$35,500.00	Line (1) + Line (2)

6		2021 (E)	2022 (F)	2023	Note
7					
8	Escalation Factor	2.28%	3.28%	3.36%	(B)
9	Escalation Amount	\$809.40	\$1,190.95	\$1,260.01	(C)
10	Forecast Unit Cost	\$36,309.40	\$37,500.35	\$38,760.36	(D)
11	Forecast Units	306	124	94	
12	Total Forecast	\$11,110,676.40	\$4,650,043.19	\$3,643,473.84	

13

14 **Notes and References**

- 15 (A) PG&E utilized the 2020 average cost which accounts for cost increases in Topock, Hinkley and Kettleman regions where PG&E expects the work to be more expensive due to costly permitting and additional equipment being required to complete the mitigations.
- 16 (B) Escalation factors provided by GRC PMT.
- 17 (C) Previous year unit cost x Escalation Factor.
- 18 (D) Previous year unit cost + Escalation Amount.
- 19 (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit
- 20 (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-25
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJC - Forecast Calculator

Line No.

1 MAT GJC (Bonds, Insulators, and other CP Expenses (Non-Unitized))

2	Line	Description	Value	Notes and References
3	3	2019 Recorded Cost	\$247,534.73	(A)
4	4	Adjustments to Forecast Basis	\$4,727.91	(B)
5	5	Cost Basis for Forecast	\$252,262.64	Line (4) + Line (5)

7		2021 (F)	2022 (G)	2023	Note
8	Escalation Factor	2.28%	3.28%	3.36%	(C)
9	Escalation Amount	\$5,751.59	\$8,462.87	\$8,953.63	(D)
10	Forecast Unit Cost	\$258,014.23	\$266,477.10	\$275,430.73	(E)
11	Forecast Units	1	1	1	
12	Total Forecast	\$258,014.23	\$266,477.10	\$275,430.73	

13 Notes and References

14 (A) PG&E calculated a unit cost using 2019 actuals and applying escalation factors for the following years due to 2019 having no
15 Enhanced CP Criterion costs thus utilizing a more accurate representation of what future costs will look like once that program is
complete.

16 (B) Added 2020 escalation amount (1.91%)

17 (C) Escalation factors provided by GRC PMT.

18 (D) Previous year unit cost x Escalation Factor.

19 (E) Previous year unit cost + Escalation Amount.

20 (F) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to
the 2021 forecast amounts.

21 (G) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2),
Chapter 3 for further information about the 2023 GRC forecast process.

22 MAT GJC (RMU Covered by Service Fees)

24	Line	Description	Value (H)	Notes and References
25	25	2020 Service Fee per RMU	\$96.00	
26	26	2021 Service Fee per RMU	\$120.00	(I)
27	27	Adjustments to Forecast Basis	\$0.00	
28	28	Cost Basis for Forecast	\$120.00	Line (25) + Line (26)

30		2021 (K)	2022 (L)	2023	Note
31	Escalation Factor	2.28%	3.28%	3.36%	
32	Escalation Amount	\$0	\$0	\$0	(J)
33	Forecast Unit Cost	\$120.00	\$120.00	\$120.00	
34	Forecast Unit	970	1,000	1,000	(M)
35	Total Forecast	\$116,400.00	\$120,000.00	\$120,000.00	

36 Notes and References

37 (H) Cost estimates provided by Elecsys for 2019-2023

38 (I) Cost will increase from \$96 to \$120 in 2021 due to new contract agreement

39 (J) No escalation amounts due to contracted price agreement

40 (K) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to
41 the 2021 forecast amounts.

42 (L) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2),
Chapter 3 for further information about the 2023 GRC forecast process.

43 (M) Forecast units are the current amount of RMUs in the system with additional forecast to grow to 1,000 total in 2022 and
44 2023.

45		2021	2022	2023	Note
46	Total Forecast	\$374,414	\$386,477	\$395,431	Line (12) + Line (34)

Workpaper Table 9-26
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJD - Forecast Calculator

Line No.

1 **MAT GJD (Test Stations)**

2	Line	Description	Value	Notes and References
3	3	2019 Recorded Unit Cost	\$21,364.75	(A)
4	4	Adjustments to Forecast Basis	\$408.07	(B)
5	5	Cost Basis for Forecast	\$21,772.82	Line (3) + Line (4)

7		2021 (F)	2022 (G)	2023	Note
8	Escalation Factor	2.28%	3.28%	3.36%	(C)
9	Escalation Amount	\$496.42	\$730.43	\$772.79	(D)
10	Forecast Unit Cost	\$22,269.24	\$22,999.67	\$23,772.46	(E)
11	Forecast Units	3	10	10	
12	Total Forecast	\$66,807.71	\$229,996.68	\$237,724.57	

13

14 **Notes and References**

15 (A) PG&E calculated unit cost based on the 2019 actuals of completed projects as this was more representative of a typical project in this program.

16 (B) Added 2020 escalation amount (1.91%)

17 (C) Escalation factors provided by GRC PMT.

18 (D) Previous year unit cost x Escalation Factor.

19 (E) Previous year unit cost + Escalation Amount.

20 (F) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

21 (G) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-27
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJE - Forecast Calculator

Line No.**1 MAT GJE (CIS – Miles Surveyed)**

Line	Description	Value	Notes and References
3	2016 -2019 Average Unit Costs	\$11,332.84	(A)
4	Adjustments to Forecast Basis	\$0.00	
5	Cost Basis for Forecast	\$11,332.84	Line (3) + Line (4)

	2021 (E)	2022 (F)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(B)
Escalation Amount	\$258.39	\$380.20	\$402.24	(C)
Forecast Unit Cost	\$11,591.23	\$11,971.43	\$12,373.67	(D)
Forecast Units	457.6	450	450	
Total Forecast	\$5,304,148.35	\$5,387,141.58	\$5,568,149.54	

Notes and References

- (A) PG&E took the four-year average of unit costs (\$17,938.66, \$9,779.82, \$3,361.94, \$14,250.96)
- (B) Escalation factors provided by GRC PMT.
- (C) Previous year unit cost x Escalation Factor.
- (D) Previous year unit cost + Escalation Amount.
- (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

23 MAT GJE (Digs Excavations)

Line	Description	Value	Note
25	ECDA Cost Estimate for Similar Work	\$220,000	(G)
26	Adjustments to Forecast Basis	\$0	
27	Cost Basis for Forecast	\$220,000	Line (25) + Line (26)

	2021 (K)	2022 (L)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(H)
Escalation Amount	\$5,016.00	\$7,380.52	\$7,808.52	(I)
Forecast Unit Cost	\$225,016.00	\$232,396.52	\$240,205.05	(J)
Forecast Units	1	1	1	
Total Forecast	\$225,016.00	\$232,396.52	\$240,205.05	

Notes and References

- (G) PG&E utilized a cost estimate provided by Digs workstream since no excavations have been performed in this workstream before.
- (H) Escalation factors provided by GRC PMT.
- (I) Previous year unit cost x Escalation Factor.
- (J) Previous year unit cost + Escalation Amount.
- (K) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- (L) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

	2021	2022	2023	Note
Total Forecast	\$5,529,164	\$5,619,538	\$5,808,355	Line (12) + Line (34)

Workpaper Table 9-28
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJF - Forecast Calculator

Line No.1 **MAT GJF (DC Investigations, Non-Unitized)**

2	Line	Description	Value	Notes and References
3	3	2020 Recorded Cost	\$696,560.17	(A)
4	4	Adjustments to Forecast Basis	\$0.00	
5	5	Cost Basis for Forecast	\$696,560.17	Line (3) + Line (4)

6

7		2021 (E)	2022 (F)	2023	Note
8	Escalation Factor	2.28%	3.28%	3.36%	(B)
9	Escalation Amount	\$15,881.57	\$23,368.09	\$24,723.21	(C)
10	Forecast Unit Cost	\$712,441.74	\$735,809.83	\$760,533.04	(D)
11	Forecast Units	1	1	1	
12	Total Forecast	\$712,441.74	\$735,809.83	\$760,533.04	

13

14 **Notes and References**

15 (A) PG&E used 2020 recorded cost plus escalation factors to forecast 2021-2023.

16 (B) Escalation factors provided by GRC PMT.

17 (C) Previous year unit cost x Escalation Factor.

18 (D) Previous year unit cost + Escalation Amount.

19 (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

20 (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-29
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJH - Forecast Calculator

Line No.

1 MAT GJH (IC Investigations (Digs))

Line	Description	Value	Note
3	ICDA Cost Estimate for Similar Work	\$500,000	(A)
4	Adjustments to Forecast Basis	\$0	
5	Cost Basis for Forecast	\$500,000	Line (3) + Line (4)

	2021 (E)	2022 (F)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(B)
Escalation Amount	\$11,400.00	\$16,773.92	\$17,746.64	(C)
Forecast Unit Cost	\$511,400.00	\$528,173.92	\$545,920.56	(D)
Forecast Units	3	3	3	
Total Forecast	\$1,534,200.00	\$1,584,521.76	\$1,637,761.69	

Notes and References

- (A) Slow start to program due to a key vacancy on the IC team which led to a lack of historical costs. PG&E forecast costs for this workstream using current cost estimates from PG&E's construction management group.
- (B) Escalation factors provided by GRC PMT.
- (C) Previous year unit cost x Escalation Factor.
- (D) Previous year unit cost + Escalation Amount.
- (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

22 MAT GJH (IC Non-Destructive Examinations)

Line	Description	Value	Note
24	IC Non-Destructive Examinations Cost Estimate Per Unit	\$75,000.00	(G)
25	Adjustments to Forecast Basis	\$0	
26	Cost Basis for Forecast	\$75,000.00	Line (24) + Line (25)

	2021 (L)	2022 (M)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(H)
Escalation Amount	\$1,710.00	\$2,516.09	\$2,661.99	(I)
Forecast Unit Cost	\$76,710.00	\$79,226.09	\$81,888.08	(J)
Forecast Units	15	5	5	(K)
Total Forecast	\$1,150,650.00	\$396,130.44	\$409,440.42	

Notes and References

- (G) Slow start to program due to a key vacancy on the IC team which led to a lack of historical costs. PG&E forecast costs for this workstream using engineer costs estimates.
- (H) Escalation factors provided by GRC PMT.
- (I) Previous year unit cost x Escalation Factor.
- (J) Previous year unit cost + Escalation Amount.
- (K) End of 2021 is when PG&E will finish assessment then PG&E will do a fraction each year based on the initial assessment
- (L) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- (M) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-29
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJH - Forecast Calculator

Line No.

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MAT GJH (IC Equipment Monitoring (Coupon/Sensor/ER Probe))

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Line	Description	Value	Note
46	IC Equipment Monitoring (Coupon/Sensor/ER Probe) Cost Per Year	\$60,000	(N)
47	2020 Recorded Units	932	
48	Average Unit Cost	\$64.38	Line (47) / Line (48)
49	Adjustments to Forecast Basis	\$0	
50	Cost Basis for Forecast	\$64.38	Line (49) + Line (50)

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	2021 (R)	2022 (S)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(O)
Escalation Amount	\$1.47	\$2.16	\$2.28	(P)
Forecast Unit Cost	\$65.85	\$68.01	\$70.29	(Q)
Forecast Units	1,254	1,374	1,404	
Total Forecast	\$82,570.25	\$93,439.18	\$98,687.44	

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Notes and References

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(N) ATS charges \$10k bi-monthly for all reads. This will be approximately \$60K per year based on contractor cost estimates.

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(O) Escalation factors provided by GRC PMT.

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(P) Previous year unit cost x Escalation Factor.

63

(Q) Previous year unit cost + Escalation Amount.

64

(R) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

65

(S) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

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MAT GJH (Inline Cleaning)

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Line	Description	Value	Note
69	2021 Inline Cleaning Estimate Cost	\$500,000	(T)
70	Adjustments to Forecast Basis	\$0	
71	Cost Basis for Forecast	\$500,000	Line (70) + Line (71)

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	2022 (Z)	2023	Note
Escalation Factor	3.28%	3.36%	(U)
Escalation Amount	\$56,347.84 (X)	\$35,493.29	(V)
Forecast Unit Cost	\$1,056,348 (Y)	\$1,091,841	(W)
Forecast Units	1	1	
Total Forecast	\$1,056,348	\$1,091,841.13	

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Notes and References

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(T) Based on engineer estimate due to lack of historical data and slow start to program from key vacancy on IC team; note that the cost estimates of 2021 were half of 2022-2023 due to the timing of larger, more complex projects (i.e. cleaning more total lines in one project).

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(U) Escalation factors provided by GRC PMT.

82

(V) Previous year unit cost x Escalation Factor.

83

(W) Previous year unit cost + Escalation Amount.

84

(X) Escalation amount of 2020 and 2021 were used

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(Y) Cost estimate increased due to timing of larger, more complex cleaning projects (cleaning more total lines per project)

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(Z) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-29
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJH - Forecast Calculator

Line No.

88

89 **MAT GJH (IC Liquids Monitoring (Drip, ILI, EFS))**

Line	Description	Value	Note
91	IC Liquids Monitoring Cost Estimate	\$675.00	(AA)
92	Adjustments to Forecast Basis	\$0	
93	Cost Basis for Forecast	\$675.00	Line (92) + Line (93)

94

	2021 (EE)	2022 (FF)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(BB)
Escalation Amount	\$15.39	\$22.64	\$23.96	(CC)
Forecast Unit Cost	\$690.39	\$713.03	\$736.99	(DD)
Forecast Units	1,100	1,200	1,300	
Total Forecast	\$759,429.00	\$855,641.75	\$958,090.59	

101

102 **Notes and References**

103 (AA) Slow start to program due to a key vacancy on the IC team which led to a lack of historical costs. PG&E forecast costs for this workstream using engineer costs estimates.

104 (BB) Escalation factors provided by GRC PMT.

105 (CC) Previous year unit cost x Escalation Factor.

106 (DD) Previous year unit cost + Escalation Amount.

107 (EE) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

108 (FF) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

109

110 **MAT GJH (IC Equipment Monitoring Installations (Coupon/Sensor/ER Probe))**

Line	Description	Value	Note
112	IC Equipment Monitoring Installations Cost Estimate Per Unit	\$75,000	(GG)
113	Adjustments to Forecast Basis	\$0	
114	Cost Basis for Forecast	\$75,000	Line (113) + Line (114)

115

	2021 (KK)	2022 (LL)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(HH)
Escalation Amount	\$1,710.00	\$2,516.00	\$2,662.00	(II)
Forecast Unit Cost	\$76,710	\$79,226	\$81,888	(JJ)
Forecast Units	30	30	30	
Total Forecast	\$2,301,300.00	\$2,376,782.64	\$2,456,642.54	

122

123 **Notes and References**

124 (GG) Slow start to program due to a key vacancy on the IC team which led to a lack of historical costs. PG&E forecast costs for this workstream using engineer costs estimates.

125 (HH) Escalation factors provided by GRC PMT.

126 (II) Previous year unit cost x Escalation Factor.

127 (JJ) Previous year unit cost + Escalation Amount.

128 (KK) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

129 (LL) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

130

	2021	2022	2023	Note
Total Forecast	\$6,328,149	\$6,362,864	\$6,652,464	Line (12) + Line (33) + Line (57) + Line (78) + Line (100) + Line (121)

131

Workpaper Table 9-30
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJJ - Forecast Calculator

Line No.

1 **MAT GJJ (Investigations (Non-Unitized))**

Line	Description	Value	Notes and References
3	2021 Forecast Cost	\$256,375.00	(A)
4	Adjustments to Forecast Basis	\$0.00	
5	Cost Basis for Forecast	\$256,375.00	Line (3) + Line (4)

	2021	2022 (E)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(B)
Escalation Amount	\$0	\$8,409.10	\$8,896.75	(C)
Forecast Unit Cost	\$256,375.00	\$264,784.10	\$273,680.85	(D)
Forecast Units	1	1	1	
Total Forecast	\$256,375.00	\$264,784.10	\$273,680.85	

14 **Notes and References**

15 (A) Due to completion of the Enhanced CP Criterion program, historical costs were high which would have led to an inaccurate forecast if PG&E used historical data to determine future costs since cost is going down over time. PG&E instead used an engineering estimate to forecast this MAT. The average four year spend (2016-2019) was \$1,985,467.04 which PG&E can reduce to \$256,375 per year starting in 2021 due to completion of the Enhanced CP Criterion program.

16 (B) Escalation factors provided by GRC PMT.

17 (C) Previous year unit cost x Escalation Factor.

18 (D) Previous year unit cost + Escalation Amount.

19 (E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-31
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJK - Forecast Calculator

Line No.

1 **MAT GJK (Corrosion – Other, Non-Unitized)**

Line	Description	Value	Notes and References
3	2020 Recorded Cost	\$2,488,746.27	(A)
4	Adjustments to Forecast Basis	\$0.00	
5	Cost Basis for Forecast	\$2,488,746.27	Line (3) + Line (4)

6

	2021	2022 (B)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(C)
Escalation Amount	\$56,743.41	\$83,492.07	\$88,333.78	(D)
Forecast Unit Cost	\$2,545,489.68	\$2,628,981.75	\$2,717,315.53	(E)
Forecast Units	1	1	1	
Total Forecast	\$2,545,489.68	\$2,628,981.75	\$2,717,315.53	

13

14 **Notes and References**

15 (A) PG&E used 2020 recorded cost plus escalation factors to forecast 2021-2023.

16 (B) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

17 (C) Escalation factors provided by GRC PMT.

18 (D) Previous year unit cost x Escalation Factor.

19 (E) Previous year unit cost + Escalation Amount.

Workpaper Table 9-32
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJM - Forecast Calculator

Line No.**1 MAT GJM (Contacted Casing Remediation)**

Line	Description	Value	Notes and References
3	2016 -2019 Average Unit Costs	\$736,867.53	(A)
4	Adjustments to Forecast Basis	\$0.00	
5	Cost Basis for Forecast	\$736,867.53	Line (3) + Line (4)

	2021 (E)	2022 (F)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(B)
Escalation Amount	\$16,800.58	\$24,720.31	\$26,153.86	(C)
Forecast Unit Cost	\$753,668.11	\$778,388.42	\$804,542.28	(D)
Forecast Units	4	4	4	
Total Forecast	\$3,014,672.44	\$3,113,553.70	\$3,218,169.10	

Notes and References

(A) Unit cost per year reflects actual units divided by total cost of those projects (Excludes cancelled projects and outliers). PG&E took the four-year average of unit costs (\$534,605.57, \$662,004.30, \$445,475.05, \$1,305,385.20).

(B) Escalation factors provided by GRC PMT.

(C) Previous year unit cost x Escalation Factor.

(D) Previous year unit cost + Escalation Amount.

(E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

(F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

23 MAT GJM (Casing Test Stations)

Line	Description	Value	Notes and References
25	2017/2019 Average Unit Costs	\$152,151.87	(G)
26	Adjustments to Forecast Basis	\$0.00	
27	Cost Basis for Forecast	\$152,151.87	Line (25) + Line (26)

	2021 (K)	2022 (L)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(H)
Escalation Amount	\$1,379.56	\$4,329.32	\$4,813.65	(I)
Forecast Unit Cost	\$155,620.93	\$160,725.30	\$166,125.67	(J)
Forecast Units	9	6	6	
Total Forecast	\$1,400,588.39	\$964,351.80	\$996,754.02	

Notes and References

(G) Unit cost per year reflects actual units divided by total cost of those projects (Excludes cancelled projects and outliers). PG&E took the average of 2017 and 2019 unit costs (\$122,491.15, and \$181,812.59). No test stations were installed in 2016 and 2018 thus those years were excluded from unit cost basis.

(H) Escalation factors provided by GRC PMT.

(I) Previous year unit cost x Escalation Factor.

(J) Previous year unit cost + Escalation Amount.

(K) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

(L) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-32
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT GJM - Forecast Calculator

Line No.

45

46

MAT GJM (Leak Surveys Performed on Cased Crossings)

47

Line	Description	Value	Note
48	Gas Leak Survey Cost Estimate	\$243.00	(M)
49	Adjustments to Forecast Basis	\$0	
50	Cost Basis for Forecast	\$243.00	Line (48) + Line (49)

51

52

	2021 (Q)	2022 (R)	2023	Note
Escalation Factor	2.28%	3.28%	3.36%	(N)
Escalation Amount	\$5.54	\$8.15	\$8.63	(O)
Forecast Unit Cost	\$248.54	\$256.69	\$265.32	(P)
Forecast Units	828	1,065	1,171	(S)
Total Forecast	\$205,791.45	\$273,377.54	\$310,686.67	

58

59

Notes and References

60

(M) Based on cost estimate from leak survey department for average cased crossings due to historic costs being charged to another MAT code.

61

(N) Escalation factors provided by GRC PMT.

62

(O) Previous year unit cost x Escalation Factor.

63

(P) Previous year unit cost + Escalation Amount.

64

(Q) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

65

(R) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

66

(S) PG&E forecasts completion of 1,171 contacted casing leak surveys in 2023 based on a 2020 population of approximately 250 contacted casings that require quarterly leak monitoring with a 10 percent growth rate based on historic trends.

66

67

	2021	2022	2023	Note
Total Forecast	\$4,621,052.28	\$4,351,283.04	\$4,525,609.79	Line (12) + Line (36) + Line (57)

68

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- ENHANCED CATHODIC PROTECTION SURVEY**

Project Title: Enhanced Cathodic Protection Survey

Major Work Categories: DG (MAT DGD)

Planning Order Numbers: See table below

Project Start Date: On-going program

Project Completion Date:

Operative Date (only applies to Capital): N/A

Project Description

The Enhanced Cathodic Protection Survey (ECPS) is forecast to complete in 2022 and involved confirming the cathodic protection area (CPA) boundaries of all steel distribution pipe (approximately 20,000 miles of main), identifying pipe that is currently unprotected and unmonitored, clearing minor electrical contacts from the pipe, performing current requirement testing when necessary, and investigating steel distribution casings to determine electrical isolation. PG&E will transition the program in 2023 to a centralized support, oversight, and audit program responsible for maintaining the quality and consistency of approximately 8,000 CPAs across the PG&E service territory.

Justification

The ongoing maintenance of Cathodic Protection Areas (CPAs) is required to maintain compliance with Subpart I, 49 CFR 192.

This project addresses the External Corrosion risk in the Gas Distribution Risk Register by assuring that all steel distribution pipe is placed under cathodic protection and meets minimum cathodic protection criteria.

Cost

The 2023 expense forecast of \$3,659,038 million includes the cost of field survey and support personnel.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
EXPENSE														
MAT DGD	1,372	3,571	2,594	2,813	4,849	6,440	3,456	3,659	N/A	N/A	N/A	28,754	WP 9-7	
TOTAL PROJECT COST	1,372	3,571	2,594	2,813	4,849	6,440	3,456	3,659	-	-	-	28,754		

Benefits

- Maintain effective levels of CP to Gas Distribution piping
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

As alternatives to this program, PG&E considered the option of not forming a centralized support, oversight, and audit program. PG&E rejected this option as it would likely necessitate a future Enhanced Cathodic Protection Survey program.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- ENHANCED CATHODIC PROTECTION SURVEY

Planning Orders

Planning Order
5016614
5042730
5055553
5202034
5202035
5202036
5202037
5202038
5202039
5202040
5202041
5202042
5202043
5202044
5202045
5202046
5202047
5202048
5202049
5202050
5210636

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- ELECTRICALLY CONNECTED ISOLATED STEEL SERVICES PROJECT**

Project Title: Electrically Connected Isolated Steel Services Project

Major Work Categories: DG (MAT DGE)

Planning Order Numbers: See table below

Project Start Date: 2016

Project Completion Date: On-going program

Operative Date (only applies to Capital): N/A

Project Description

The Electrically Connected Isolated Steel Services Project (EC-ISSP) identifies isolated steel segments that are cathodically protected separately and monitored once every 10 years and those that are electrically continuous to other isolated steel segments via locate wire and cathodically protected as a group and monitored annually as a CPA.

Justification

This is a mandated project. It addresses Subpart I, 49 CFR 192.

The EC-ISSP was included in the 2020 GRC. The scope of the project includes approximately 370,000 steel distribution risers inspected over a 7-year time frame. The 2023 GRC includes approximately 165,000 risers forecast to be surveyed.

The purpose of the EC-ISSP is to assure that the location of all isolated steel pipe has been identified, cathodically protected, and is being monitored appropriately. The EC-ISSP increases system reliability and reduces risk as corrosion of the pipeline is controlled and leaks due to corrosion are reduced.

At the same time, it aligns PG&E's corrosion control program with PHMSA guidance for monitoring electrically continuous pipe segments.

This project addresses the External Corrosion risk in the Gas Distribution Risk Register by assuring that all steel pipe is placed under cathodic protection and meets minimum cathodic protection criteria.

Cost

The estimated cost of the project for 2023 is \$6,312,457.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT DGE	1,028	509	3,074	3,717	3,827	2,827	6,107	6,312	N/A	N/A	N/A	27,401	WP 9-7
TOTAL PROJECT COST	1,028	509	3,074	3,717	3,827	2,827	6,107	6,312	-	-	-	27,401	

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- ELECTRICALLY CONNECTED ISOLATED STEEL SERVICES PROJECT**

Benefits

- Identify CP insufficiencies
- Identifies location that need to be monitored
- Reduce or eliminate notices of violation

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

Planning Orders

Planning Order
5055609
5207492
5207634
5207635
5207638
5207639
5207641
5207643
5207644
5207646
5207648
5253076

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- CASING TEST STATION INSTALLATION**

Project Title: Casing Test Station Installation

Major Work Categories: DG (MAT DGG)

Planning Order Numbers: See table below

Project Start Date: 2018

Project Completion Date: On-going program

Operative Date (only applies to Capital): N/A

Project Description

This project is for installing casing test stations at distribution casings which lack either a metallic connection to the casing such as a vent pipe or a metallic connection to the carrier pipe or both. The casing test stations are used to determine if the casing is electrically isolated from the steel carrier main. PG&E inspected approximately 3,200 steel distribution casings for electrical isolation. These had not been inspected previously.

Justification

This is a mandated project. It addresses CFR 192.467(c) (External corrosion control: Electrical Isolation) which requires the inspection of each metallic casing to verify that it is electrically isolated from ferrous pipe.

This project is a continuation from the 2020 GRC. The scope of the project includes the installation of test stations on those casings which do not currently have equipment to allow annual testing. Approximately 140 test stations will be installed in 2023.

This project reduces risk as corrosion of the pipeline is controlled and leaks due to corrosion are reduced. At the same time, it ensures compliance with CFR 192 Subpart I.

Cost

The estimated cost of the project for 2023 is \$3,132,627.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT DGG	-	-	-	287	1,285	200	3,593	3,133	N/A	N/A	N/A	8,497	WP 9-7
TOTAL PROJECT COST	-	-	-	287	1,285	200	3,593	3,133	-	-	-	8,497	

Benefits

- Allows casings to be easily tested for electrical isolation
- PG&E will comply with federal regulations and better align with industry practices.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- CASING TEST STATION INSTALLATION**

Alternatives Considered

PG&E believes that permanent installation of casing test stations is the most cost-effective and is often the only way to monitor for electrical isolation. In cases where the installation of permanent test stations is not cost effective compared to alternative methods of testing, testing without leads (wires) connected to individual casings will be used (MAT DGA).

Planning Orders

Planning Order
5044760
5044761
5044764
5044765
5044766
5044789
5044790
5044791
5044794
5044796
5055682

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- CASING MITIGATIONS**

Project Title: Casing Mitigations

Major Work Categories: DG (MAT DGH) and 50 (MAT 50D/50Q)

Planning Order Numbers: See table below

Project Start Date: 2017

Project Completion Date: On-going program

Operative Date (only applies to Capital): 2017

Project Description

The expense Distribution Casing Mitigation program represents the mitigation of steel-cased pipe with contacted casings less than 100 feet in length. As of January 1, 2021, casings 100 feet or greater in length will be mitigated under MAT 50Q as capital work. This work was previously included in MAT 50D.

In the past, casings were placed around pipelines installed under roads, railroads, canals, and other locations for protection from mechanical stresses. Casing installations have since been phased out when possible for two main reasons: (1) the pipe cannot be externally inspected when it is housed in a casing, and (2) the casing and pipe can come in contact with one another causing corrosion concerns at or near the point of contact. Federal regulations (49 CFR 192.467(c)) require that “each buried or submerged pipeline must be electrically isolated from other underground metallic structures... [and] each pipeline must be electrically isolated from metallic casings that are a part of the underground system.”

The primary threat to cased pipeline is corrosion inside the casing.

Through the expense and capital programs, casings identified as being contacted will be mitigated in the manner that is most appropriate and cost effective. Mitigation work will be prioritized by risk analysis. Distribution casing mitigation generally involves eliminating the casing by replacing the steel pipeline with plastic.

Justification

This is a mandated project. It addresses CFR 192.467 (External Corrosion Control: Electrical Isolation) which requires that “each buried or submerged pipeline must be electrically isolated from other underground metallic structures...[and] each pipeline must be electrically isolated from metallic casings that are a part of the underground system.”

This project reduces risk as corrosion of the pipeline is controlled and leaks due to corrosion are reduced.

This project addresses the External Corrosion risk in the Gas Distribution Risk Register by assuring that all steel pipe is placed under cathodic protection and meets minimum cathodic protection criteria.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- CASING MITIGATIONS**

Cost

The expense forecast for MAT DGH in 2022 and 2023 is \$1,176,263 and \$4,109,988, respectively. The capital forecast for MAT 50D/50Q in 2022 and 2023 is \$19,462,603 and \$3,957,179, respectively.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT DGH	-	225	648	3,277	4,239	737	1,176	4,110	N/A	N/A	N/A	14,412	WP 9-7
Expense Total	-	225	648	3,277	4,239	737	1,176	4,110	-	-	-	14,412	
CAPITAL													
MAT 50D/50Q	8,447	6,901	8,333	16,972	10,001	15,316	19,463	3,957	4,063	4,169	4,278	101,901	WP 9-86
Capital Total	8,447	6,901	8,333	16,972	10,001	15,316	19,463	3,957	4,063	4,169	4,278	101,901	
TOTAL PROJECT COST	8,447	7,126	8,981	20,249	14,240	16,053	20,639	8,067	4,063	4,169	4,278	116,313	

Additional Cost Information

The Casings program is ongoing from the 2023 GRC.

Cost assumptions for Casing Mitigation:

43 contacted casings are forecast for mitigation in 2023. Of those casings it is anticipated that approximately 33 of the mitigation units will be expense and 10 capital.

Benefits

- Contacted casings will be identified and cleared, which will reduce the risk of corrosion related leaks
- Improved system reliability and confidence of corrosion mitigations by identifying corrosion issues as they arise
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- CASING MITIGATIONS

Planning Orders

MAT	Planning Orders			
DGH	5042898	5042904	5042910	5044170
DGH	5042899	5042905	5042911	5054514
DGH	5042900	5042906	5042912	5055532
DGH	5042901	5042907	5042913	5254953
DGH	5042902	5042908	5042914	
DGH	5042903	5042909	5042915	

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-ATMOSPHERIC CORROSION SPAN INSPECTION & MITIGATION

Project Title: Atmospheric Corrosion Span Inspection & Mitigation

Major Work Categories: FH (MATs FHK, FHL, FHM, FHN)

Planning Order Numbers: See table below

Project Start Date: Ongoing

Project Completion Date: On-going program

Operative Date (only applies to Capital): N/A

Project Description

These projects are as follows:

- Inspection of main and service spans for atmospheric corrosion;
- Mitigation of atmospheric corrosion on main and service spans, service risers and stations

PG&E currently performs AC inspection on 1,621 distribution main and service spans on a three-year cycle per CFR 192.481(a) which requires the inspection of each pipeline or portion of pipeline that is exposed to the atmosphere for evidence of atmospheric corrosion at least once every 3 years.

A project to research records and perform field inspections to identify additional spans was completed in 2020 using the GD-GIS mapping system to identify possible span locations. Approximately 12,000 locations where steel distribution pipe crosses water features such as rivers and canals were investigated with an additional 532 spans identified.

In addition, approximately 55,000 service risers with wrap damage in the soil to air transition zone are forecast to be mitigated in 2023. These risers were identified during the atmospheric corrosion inspection of meters and risers conducted by PG&E.

The identified atmospheric corrosion issues are mitigated within 39 months of the inspection.

Justification

These are mandated programs. They address CFR 192.481 (Atmospheric Corrosion Control: Monitoring) which requires the inspection of each pipeline or portion of pipeline that is exposed to the atmosphere for evidence of atmospheric corrosion at least once every 3 years and 192.479 (Atmospheric Corrosion Control: General) which requires that the pipelines exposed to the atmosphere be coated to prevent atmospheric corrosion.

These programs reduce risk as corrosion of the pipeline is controlled and leaks due to corrosion are reduced. At the same time, they ensure compliance with CFR 192 Subpart I.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-ATMOSPHERIC CORROSION SPAN INSPECTION & MITIGATION**

Cost

The estimated cost of the programs for 2023 is \$16,347,947.

Major Project Spending Estimates

(Thousands of Nominal Dollars)

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT FHK	144	1	79	220	546	847	108	140	N/A	N/A	N/A	2,085	WP 9-7
MAT FHL	335	858	1,707	981	498	2,000	3,441	3,051	N/A	N/A	N/A	12,871	WP 9-7
MAT FHM	404	370	486	665	1,168	997	11,508	12,200	N/A	N/A	N/A	27,798	WP 9-7
MAT FHN	932	1,582	1,367	1,074	788	981	1,342	957	N/A	N/A	N/A	9,022	WP 9-7
TOTAL PROJECT COST	1,815	2,811	3,639	2,940	3,000	4,825	16,399	16,348	-	-	-	51,776	

Planning Orders

Planning Order
5055507
5055508
5055529
5055626

Benefits

- Identify atmospheric corrosion control insufficiencies
- Mitigate atmospheric corrosion after it is found by inspection
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-INTERNAL CORROSION**

Project Title: Internal Corrosion (IC)

Major Work Categories: 3K (MAT 3K1) and GJ (GJH)

Planning Order Numbers: See Table Below

Project Start Date: 2014

Project Completion Date: Ongoing program

Operative Date (only applies to Capital): 2014

Project Description

This project summary includes the following work types:

- 3K1
 - Drip Replacement/Removal – Projects either cut out a pipeline drip and replace it with straight pipe (without a drip) OR cut out and replace the pipeline drip.
- GJH
 - IC Investigations (digs) – An investigation (to include excavations) performed to assess for internal corrosion, excluding ICDA.
 - IC Non-Destructive Examinations - An NDE (typically a ultrasonic wall thickness survey) performed as a standalone inspection (i.e., separate inspections at McDonald Island) or as part of an internal corrosion investigation.
 - IC Equipment Monitoring Installations (Coupon/Sensor/ER Probe) – The installation or replacement of an ultrasonic wall thickness probe, coupon, or sensor on gas transmission assets.
 - IC Equipment Monitoring (Coupon/Sensor/ER Probe) – The monitoring of ultrasonic wall thickness probes, coupons, and sensors installed on gas transmission assets.
 - Inline Cleaning – A project to run cleaning tools through piping (not in advance of an In-Line Inspection).
 - IC Liquids Monitoring (Drip, ILI, EFS) - The collection and analysis of liquids obtained from drips, separators, and storage wells on the gas transmission system.

PG&E's IC Program is designed to detect and mitigate potentially corrosive conditions in accordance with U.S. DOT requirements for IC provided in 49 CFR §192 Subpart I, Requirements for Corrosion Control.

PG&E's IC Program incorporates best practice guidance contained in National Association of Corrosion Engineers International SP0106, "Control of IC in Steel Pipelines and Piping Systems."

Justification

These are mandated projects. Unmitigated internal corrosion can lead to loss of containment of natural gas piping systems. The projects address Subpart I, 49 CFR 192.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-INTERNAL CORROSION**

Cost

The expense forecast for MAT GJH in 2022 and 2023 is \$6,360,806.10 and \$6,650,291.08, respectively.

The capital forecast for MAT 3K1 in 2022 and 2023 is \$9,961,512.29 and \$13,067,411.75, respectively.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT GJH	1,831	668	986	2,408	2,291	3,734	6,361	6,650	N/A	N/A	N/A	24,930	WP 9-7
Expense Total	1,831	668	986	2,408	2,291	3,734	6,361	6,650	-	-	-	24,930	
CAPITAL													
MAT 3K1	57	7	(51)	136	3,408	12,026	9,962	13,067	13,408	13,757	14,105	79,882	WP 9-86
Capital Total	57	7	(51)	136	3,408	12,026	9,962	13,067	13,408	13,757	14,105	79,882	
TOTAL PROJECT COST	1,888	675	935	2,544	5,699	15,760	16,322	19,718	13,408	13,757	14,105	104,812	

Planning Orders

MAT	Planning Orders				
3K1	5531260	5542345	5543361	5794673	5785081
3K1	5531261	5542925	5543793	5794674	5785082
3K1	5533499	5543003	5751459	5794675	5543010
3K1	5533500	5543004	5759497	5794676	5543359
3K1	5533501	5543005	5764875	5794677	5537638
3K1	5533502	5543006	5781442	5794718	
3K1	5533503	5543007	5783805	5794719	
3K1	5533506	5543008	5783806	5794758	
3K1	5533508	5543009	5784020	5794759	
3K1	5539654	5543360	5793399	5537739	
GJH	5037785	5260536	5264620	5269374	5271620
GJH	5055684	5260793	5264621	5269375	5271621
GJH	5055685	5261674	5264622	5269376	5271622
GJH	5057449	5263017	5264772	5269439	5271728
GJH	5057450	5263620	5264956	5269452	5268962
GJH	5057451	5263621	5264957	5269453	5269054
GJH	5057452	5263622	5264958	5269454	5269372
GJH	5057453	5263623	5264959	5269972	5269373
GJH	5057454	5263624	5268074	5269973	5264614
GJH	5057455	5263625	5268958	5269974	5264615
GJH	5057507	5263626	5268959	5270426	5264616
GJH	5245563	5264612	5268960	5271618	5264617
GJH	5245564	5264613	5268961	5271619	5264618
GJH	5256952	5257035	5256974	5257034	5264619

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-INTERNAL CORROSION**

Benefits

- Reduces potential for internal corrosion in natural gas piping systems
- Increase monitoring to identify possible instances of internal corrosion
- Mitigate potentially corrosive conditions when they occur
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-AC INTERFERENCE**

Project Title: AC Interference

Major Work Categories: 3K (MAT 3K4) and GJ (MAT GJA)

Planning Order Numbers: See Table Below

Project Start Date: 2013

Project Completion Date: 2026

Operative Date (only applies to Capital): 2013

Project Description

This project summary includes the following work types:

- 3K4
 - Alternating Current (AC) Coupon Test Stations - A new test station installed to monitor/mitigate AC interference.
 - Induced AC Mitigation (Ground Rod) - A project to mitigate the threat of AC interference with grounding equipment other than zinc ribbon.
 - Induced AC Mitigation (Zinc Ribbon) -A project to mitigate the threat of AC interference along gas transmission piping using zinc ribbon anodes.
- GJA
 - Arc Fault Investigation - The investigation of the susceptibility to arc fault conditions
 - Arc Fault Mitigation (Poles & Towers) - A project to mitigate the threat of arc fault
 - Induced AC Investigations - A study of the susceptibility of a section of piping to AC interference

Subpart I of 49 § CFR 192 requires operators to protect pipelines from fault currents when gas and electric assets are located in close proximity.

Justification

These are mandated projects. Unmitigated AC interference can lead to loss of containment of natural gas piping systems. The projects address Subpart I, 49 CFR 192.

Cost

The expense forecast for MAT GJA in 2022 and 2023 is \$3,458,963.00 and \$1,400,048.76, respectively.

The capital forecast for MAT 3K4 in 2022 and 2023 is \$8,198,312.16 and \$2,909,767.96, respectively.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-AC INTERFERENCE**

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT GJA	1,532	1,376	(1,311)	2,184	1,419	3,861	3,459	1,400	N/A	N/A	N/A	13,920	WP 9-7
Expense Total	1,532	1,376	(1,311)	2,184	1,419	3,861	3,459	1,400	-	-	-	13,920	
CAPITAL													
MAT 3K4	1,778	18,879	1,324	(15)	3,571	11,726	8,198	2,910	2,986	3,064	3,141	57,562	WP 9-86
Capital Total	1,778	18,879	1,324	(15)	3,571	11,726	8,198	2,910	2,986	3,064	3,141	57,562	
TOTAL PROJECT COST	3,310	20,255	13	2,169	4,990	15,587	11,657	4,310	2,986	3,064	3,141	71,482	

Planning Orders

MAT	Planning Order		
3K4	5521212	5538042	5773878
3K4	5521252	5538043	5773879
3K4	5527339	5538044	5773880
3K4	5527340	5538045	5774047
3K4	5527341	5538046	5786298
3K4	5527342	5538047	5793350
3K4	5533820	5538048	5793351
3K4	5534906	5541310	5793352
3K4	5537699	5542124	5794720
3K4	5537740	5751887	5794721
3K4	5537979	5758931	5794722
3K4	5537980	5763405	5794723
3K4	5537981	5763442	5794724
3K4	5537982	5763446	5764701
3K4	5538039	5763451	5765962
3K4	5538040	5538041	
3K4	5773794	5766445	
GJA	5037814	5057410	5264973
GJA	5055597	5057411	5266032
GJA	5057407	5057412	5266352
GJA	5057408	5057413	5270512
GJA	5057409	5245561	5256138

Benefits

- Reduce personal safety risk, as well as reducing the risk of AC corrosion.
- Reduce the risk of arc fault between our pipeline and transmission electric towers and poles, which can lead to shock hazards or loss of containment.
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

- This is a compliance workstream, no alternatives were considered.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-TRANSMISSION CASINGS**

Project Title: Casings

Major Work Categories: 3K (MAT 3K5) and GJ (MAT GJM)

Planning Order Numbers: See Table Below

Project Start Date: Ongoing

Project Completion Date: Ongoing program

Operative Date (only applies to Capital): Pre-2012

Project Description

This project summary includes the following work types:

- 3K5
 - Contacted Casing Pipeline Replacement - A project to replace a section of gas transmission piping, that includes one or more electrically contacted cased crossings, with new uncased piping in exceedance of 100 feet.
 - Contacted Casing Remediation - A project to mitigate electrical isolation at a cased crossing by a) removing the casing; or b) successfully filling 100 feet or more of casing with dielectric gel. An unsuccessful application on 100 feet or more of casing is expensed.
- GJM
 - Contacted Casing Gas Leak Survey - Expense work to perform non-routine gas leak surveys at contacted casings identified by Corrosion Engineering.
 - Contacted Casing Remediation - A project to mitigate electrical isolation at a cased crossing by successfully filling less than 100 feet of casing with dielectric gel. Contacted Casing Test Station Installation - A project to install a new test station or replace damaged test stations at a cased crossing.

Loss of electrical isolation between a casing and gas piping can divert CP current and increase the risk of external corrosion. PG&E monitors each cased transmission crossing annually (MAT JOB) and investigates anomalous conditions to determine whether remedial action is required to mitigate the risk of external corrosion created by the contact between the casing and gas piping.

Justification

These are mandated projects per Subpart I, 49 CFR 192. PG&E procedures for the management of cased pipeline crossings have been developed in accordance with industry best practices provided in NACE International SO0200-2014, "Steel-Cased Pipeline Practices."

Cost

The expense forecast for MAT GJM in 2022 and 2023 is \$4,434,393.05 and \$4,525,609.79, respectively.

The capital forecast for MAT 3K5 in 2022 and 2023 is \$17,494,407.00 and \$12,161,546.44, respectively.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-TRANSMISSION CASINGS**

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT GJM	3,772	3,329	7,635	10,377	3,099	2,061	4,434	4,526	N/A	N/A	N/A	39,232	WP 9-7
Expense Total	3,772	3,329	7,635	10,377	3,099	2,061	4,434	4,526	-	-	-	39,232	
CAPITAL													
MAT 3K5	13,545	(1,591)	25,411	11,567	13,148	18,179	17,494	12,162	12,479	12,805	13,129	148,327	WP 9-86
Capital Total	13,545	(1,591)	25,411	11,567	13,148	18,179	17,494	12,162	12,479	12,805	13,129	148,327	
TOTAL PROJECT COST	17,316	1,739	33,046	21,943	16,246	20,240	21,929	16,687	12,479	12,805	13,129	187,559	

Planning Orders

MAT	Planning Orders					
3K5	5516623	5530941	5763387	5763490	5763539	5777774
3K5	5517702	5531239	5763389	5763491	5763540	5777775
3K5	5518139	5531499	5763391	5763492	5763541	5777776
3K5	5518140	5531844	5763397	5763493	5763542	5780341
3K5	5523659	5531951	5763402	5763494	5763543	5780342
3K5	5523782	5534280	5763404	5763495	5763544	5780343
3K5	5523979	5534599	5763411	5763496	5763545	5780344
3K5	5524559	5535014	5763412	5763497	5763546	5783244
3K5	5524560	5537343	5763413	5763498	5763547	5783245
3K5	5525778	5537344	5763414	5763499	5763548	5783251
3K5	5525799	5537345	5763415	5763500	5763549	5783315
3K5	5525800	5537346	5763416	5763501	5763550	5783367
3K5	5525801	5537347	5763417	5763502	5763555	5784019
3K5	5525802	5537348	5763419	5763503	5763558	5784119
3K5	5525803	5537700	5763420	5763504	5763587	5784301
3K5	5525804	5537741	5763421	5763505	5763751	5784369
3K5	5525805	5538020	5763422	5763506	5763927	5784502
3K5	5525806	5538021	5763423	5763507	5764626	5786138
3K5	5525807	5538022	5763424	5763508	5764628	5789822
3K5	5525808	5538023	5763426	5763509	5765265	5790420
3K5	5529259	5538024	5763427	5763510	5765266	5790521
3K5	5529260	5540879	5763429	5763511	5765267	5790972
3K5	5529261	5540880	5763431	5763512	5765268	5792924
3K5	5529262	5541081	5763432	5763513	5765269	5793328
3K5	5529263	5541082	5763438	5763514	5765270	5793329
3K5	5529264	5541083	5763466	5763515	5766553	5794725
3K5	5529265	5541084	5763467	5763516	5768279	5794726
3K5	5529266	5541085	5763468	5763517	5769079	5794727
3K5	5529267	5541086	5763469	5763518	5769126	5794728

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-TRANSMISSION CASINGS**

3K5	5529268	5541087	5763470	5763519	5775656	5794729
3K5	5529269	5542853	5763471	5763520	5777196	5794730
3K5	5529270	5750482	5763472	5763521	5777588	5794760
3K5	5529271	5751481	5763473	5763522	5777589	5794761
3K5	5529272	5757250	5763474	5763523	5777758	
3K5	5529273	5757256	5763475	5763524	5777759	
3K5	5529274	5759558	5763476	5763525	5777760	
3K5	5529275	5763331	5763477	5763526	5777761	
3K5	5529276	5763332	5763478	5763527	5777762	
3K5	5529277	5763333	5763479	5763528	5777763	
3K5	5529279	5763334	5763480	5763529	5777764	
3K5	5529280	5763335	5763481	5763530	5777765	
3K5	5529281	5763336	5763482	5763531	5777766	
3K5	5529282	5763337	5763483	5763532	5777767	
3K5	5529283	5763378	5763484	5763533	5777768	
3K5	5529284	5763379	5763485	5763534	5777769	
3K5	5529285	5763383	5763486	5763535	5777770	
3K5	5529287	5763384	5763487	5763536	5777771	
3K5	5529288	5763385	5763488	5763537	5777772	
3K5	5530761	5763386	5763489	5763538	5777773	
GJM	5041313	5250490	5257171	5263056	5270694	
GJM	5041314	5250491	5257232	5263564	5270695	
GJM	5055534	5250492	5257795	5264874	5270696	
GJM	5057477	5250493	5258061	5264898	5270698	
GJM	5057478	5250494	5258140	5265413	5270699	
GJM	5057479	5250495	5258141	5267085	5270700	
GJM	5057480	5250496	5258272	5267086	5271433	
GJM	5057481	5250497	5258273	5267087	5271612	
GJM	5057482	5250498	5258274	5267088	5271623	
GJM	5057483	5250499	5258275	5267089		
GJM	5057512	5250500	5258276	5267090		
GJM	5057513	5253400	5258277	5267091		
GJM	5245565	5254114	5258278	5267152		
GJM	5250457	5255514	5258279	5267153		
GJM	5250459	5255515	5258280	5267512		
GJM	5250460	5255516	5258281	5267513		
GJM	5250462	5255517	5259054	5267712		
GJM	5250466	5255518	5259232	5267772		
GJM	5250469	5255519	5260796	5267773		
GJM	5250470	5255520	5261773	5267774		
GJM	5250471	5255992	5261774	5267775		
GJM	5250473	5256140	5262053	5268102		
GJM	5250474	5256317	5262236	5270215		
GJM	5250475	5256318	5262238	5270596		
GJM	5250478	5257170	5263055	5270693		

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-TRANSMISSION CASINGS**

Benefits

- Identify and monitor external corrosion in casings to reduce risk
- Mitigate the risk of external corrosion presented by the contact between the casing and gas piping through multiple mitigation methods discussed above
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CATHODIC PROTECTION**

Project Title: Cathodic Protection

Major Work Categories: 3K (MATs 3K6 and 3K7) and GJ (MAT GJC)

Planning Order Numbers: See Table Below

Project Start Date: Ongoing

Project Completion Date: Ongoing program

Operative Date (only applies to Capital): Ongoing

Project Description

This project summary includes the following work types:

- 3K6
 - CP System (New) - A project to install an impressed current grounded or galvanic anode system at a location where PG&E did not previously operate one.
- 3K7
 - Anode/Groundbed Replacement - A project to replace an existing impressed current grounded in an area where PG&E has discovered inadequate Cathodic Protection (a low read).
 - Rectifier Replacement - A project to replace the Direct Current power source (rectifier) for an existing/operational impressed current grounded.
- GJC
 - Bonds, Insulators, Other CP Expenses – An expense project related to Cathodic Protection that is not covered by capital work.
 - Enhanced CP Criteria - Each mile of gas transmission piping where field investigations and/or engineering analysis have been performed to transition to the enhanced CP criterion (-850 mv "Off" or 100mv shift).
 - RMU Expenses – Yearly budget to pay the cellular and satellite license fees for remote monitoring equipment.

CP Systems are required to maintain cathodic protection of metallic gas piping systems, as required by Subpart I, 49 CFR 192.

Justification

These are mandated projects. Unmitigated external corrosion can lead to loss of containment of natural gas piping systems. The projects address Subpart I, 49 CFR 192.

Cost

The expense forecast for MAT GJC in 2022 and 2023 is \$350,188.00 and \$395,430.73, respectively.

The capital forecast for MAT 3K6 in 2022 and 2023 is \$1,388,178.20 and \$1,430,656.45, respectively.

The capital forecast for MAT 3K7 in 2022 and 2023 is \$3,478,372.98 and \$3,584,811.20, respectively.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CATHODIC PROTECTION**

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT GJC	1,774	2,233	1,900	423	1,803	3,461	350	395	N/A	N/A	N/A	12,340	WP 9-7
Expense Total	1,774	2,233	1,900	423	1,803	3,461	350	395	-	-	-	12,340	
CAPITAL													
MAT 3K6	4,964	4,644	9,271	11,342	9,837	6,180	1,388	1,431	1,469	1,507	1,545	53,579	WP 9-86
MAT 3K7	6,327	6,356	9,915	5,177	3,748	2,390	3,478	3,585	3,678	3,774	3,870	52,299	WP 9-86
Capital Total	11,292	10,999	19,187	16,519	13,585	8,570	4,867	5,015	5,147	5,282	5,415	105,878	
TOTAL PROJECT COST	13,066	13,232	21,087	16,942	15,388	12,031	5,217	5,411	5,147	5,282	5,415	118,218	

Planning Orders

MAT	Planning Orders						
3K6	5519487	5528920	5529426	5530044	5536023	5763557	5780700
3K6	5521242	5528921	5529427	5530046	5536082	5763564	5780701
3K6	5522957	5528928	5529428	5530225	5538447	5763588	5785558
3K6	5523083	5528929	5529429	5530410	5538780	5763926	5789899
3K6	5524799	5528930	5529430	5530411	5541030	5764702	5793332
3K6	5524800	5528931	5529431	5530412	5541519	5765238	5793333
3K6	5524802	5528932	5529432	5530413	5541520	5765239	5793334
3K6	5524803	5528949	5529433	5530414	5542892	5765241	5793335
3K6	5524805	5529020	5529560	5530416	5542893	5765280	5793336
3K6	5524806	5529021	5529561	5530417	5542894	5765965	5794731
3K6	5525029	5529022	5529562	5530418	5542895	5765966	5794732
3K6	5525065	5529046	5529725	5530419	5543011	5766288	5794733
3K6	5525812	5529047	5529761	5530420	5543188	5766554	5794762
3K6	5525879	5529119	5529859	5530421	5543794	5766679	5794763
3K6	5526662	5529124	5529860	5530422	5543795	5766681	
3K6	5526663	5529125	5529861	5530423	5759491	5766682	
3K6	5526664	5529126	5529862	5530425	5763394	5768027	
3K6	5526665	5529233	5529863	5530539	5763399	5770970	
3K6	5526666	5529339	5529864	5530540	5763407	5771221	
3K6	5526879	5529419	5529865	5530659	5763433	5771222	
3K6	5526883	5529420	5529866	5532499	5763436	5771223	
3K6	5527161	5529421	5529867	5532619	5763437	5771225	
3K6	5527363	5529422	5529941	5533040	5763448	5771226	
3K6	5527460	5529423	5530041	5534904	5763458	5772688	
3K6	5527481	5529424	5530042	5534905	5763551	5778587	
3K6	5528901	5529425	5530043	5535479	5763556	5780699	
3K7	5513820	5525922	5528582	5536545	5543183	5766442	5772858
3K7	5517315	5525923	5528924	5536780	5543184	5766443	5773223

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CATHODIC PROTECTION**

3K7	5517701	5526523	5528953	5536781	5543185	5766444	5773224
3K7	5519489	5526543	5529048	5537202	5543186	5766547	5773658
3K7	5523080	5527052	5529123	5537503	5543187	5766683	5773659
3K7	5523081	5527053	5529868	5538433	5543362	5766684	5773660
3K7	5523439	5527054	5529869	5539145	5543363	5766685	5773662
3K7	5524809	5527055	5529870	5539146	5543364	5766686	5773663
3K7	5524811	5527056	5530040	5539147	5543365	5766687	5776999
3K7	5524813	5527057	5530309	5539399	5543796	5768028	5777000
3K7	5525025	5527058	5530339	5539655	5543797	5770972	5777001
3K7	5525165	5527059	5530819	5540127	5733012	5770973	5777018
3K7	5525166	5527060	5530860	5540539	5748185	5771218	5778305
3K7	5525219	5527061	5531184	5540540	5751746	5771219	5778342
3K7	5525245	5527062	5531279	5540541	5751771	5771220	5778343
3K7	5525246	5527063	5531280	5540542	5757231	5771224	5778344
3K7	5525247	5527064	5531364	5540543	5757245	5771227	5778346
3K7	5525420	5527065	5531840	5540544	5758244	5771228	5778399
3K7	5525507	5527066	5532361	5540545	5758933	5771238	5778586
3K7	5525780	5527067	5532362	5540546	5759490	5771268	5778730
3K7	5525810	5527068	5532707	5540547	5763380	5771269	5778731
3K7	5525811	5527069	5532708	5540548	5763392	5771633	5779179
3K7	5525852	5527071	5532709	5540549	5763401	5771634	5782218
3K7	5525853	5527072	5532710	5540550	5763403	5771898	5793338
3K7	5525854	5527073	5532711	5540641	5763441	5771899	5793339
3K7	5525855	5527074	5532712	5540899	5763459	5771900	5793340
3K7	5525856	5527075	5532713	5540900	5763460	5771901	5793341
3K7	5525857	5527076	5532714	5540901	5763552	5771902	5794734
3K7	5525858	5527077	5532715	5541032	5763553	5771903	5794735
3K7	5525899	5527078	5532716	5541033	5763565	5771904	5794736
3K7	5525900	5527079	5532717	5541399	5763566	5771905	5794737
3K7	5525901	5527080	5532718	5541400	5763567	5771906	5794764
3K7	5525902	5527081	5532759	5541521	5763568	5771907	5794765
3K7	5525903	5527082	5532760	5541522	5763569	5771908	
3K7	5525904	5527083	5532761	5541523	5763570	5771909	
3K7	5525905	5527084	5532762	5541524	5763585	5771910	
3K7	5525906	5527085	5532763	5541525	5763878	5771911	
3K7	5525907	5527086	5532764	5541526	5763925	5771912	
3K7	5525908	5527102	5532809	5541689	5763999	5771913	
3K7	5525909	5527162	5532819	5542123	5764132	5771914	
3K7	5525910	5527163	5532820	5542125	5764620	5771915	
3K7	5525911	5527201	5532821	5542126	5764622	5771916	
3K7	5525912	5527262	5532822	5542316	5764624	5771917	
3K7	5525913	5527292	5532823	5542317	5764625	5771918	
3K7	5525914	5527293	5532843	5542318	5764703	5771919	
3K7	5525915	5527364	5532844	5542399	5764799	5771920	

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CATHODIC PROTECTION**

3K7	5525916	5527401	5532899	5542896	5765099	5771921	
3K7	5525917	5527402	5533039	5542897	5765240	5771922	
3K7	5525918	5527447	5533606	5543179	5765963	5771923	
3K7	5525919	5527881	5534279	5543180	5765964	5771924	
3K7	5525920	5528103	5534281	5543181	5766120	5772471	
3K7	5525921	5528104	5535060	5543182	5766289	5772472	
GJC	5037774	5057425	5057422	5253494	5057501	5255878	5267084
GJC	5046799	5057426	5057423	5253752	5057502	5257093	
GJC	5055555	5057427	5057424	5254401	5248418	5257154	
GJC	5057421	5264072	5264445	5255790	5266263	5262792	
GJC	5271113	5271876	5271112	5270553	5270552	5268334	

Benefits

- Reduce risk of external corrosion on the GT&S system
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-TEST STATIONS**

Project Title: Coupon Test Stations
Major Work Categories: 3K (MAT 3K8) and GJ (MAT GJD)
Planning Order Numbers: See Table Below
Project Start Date: 2015
Project Completion Date: Ongoing program
Operative Date (only applies to Capital): 2015

Project Description

This project summary includes the following work types :

- 3K8
 - Test stations - The installation of a new test station.
- GJD
 - Test stations - The installation or repair of a test station.

PG&E utilizes test stations to monitor levels of CP on buried piping systems in accordance with Subpart I of 49 CFR §192. Damaged test stations require replacement or repair. PG&E can capitalize the installation of five or more test stations on the same line.

Justification

These are mandated projects. Undetected external corrosion can lead to loss of containment of natural gas piping systems. The projects address Subpart I, 49 CFR 192.

Cost

The expense forecast for MAT GJD in 2022 and 2023 is \$229,996.68 and \$237,724.57, respectively.

The capital forecast for MAT 3K8 in 2022 and 2023 is \$111,609.88 and \$115,025.14, respectively.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT GJD	3,546	3	26	386	402	269	230	238	N/A	N/A	N/A	5,100	WP 9-7
Expense Total	3,546	3	26	386	402	269	230	238	-	-	-	5,100	
CAPITAL													
MAT 3K8	6,807	7,336	30,234	7,007	2,117	665	112	115	118	121	124	54,756	WP 9-86
Capital Total	6,807	7,336	30,234	7,007	2,117	665	112	115	118	121	124	54,756	
TOTAL PROJECT COST	10,354	7,338	30,260	7,393	2,520	935	342	353	118	121	124	59,856	

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-TEST STATIONS**

Planning Orders

MAT	Planning Orders			
3K8	5513824	5529910	5529981	5763582
3K8	5529891	5529911	5534539	5764260
3K8	5529892	5529912	5534540	5764627
3K8	5529893	5529913	5534542	5765362
3K8	5529894	5529914	5534907	5765367
3K8	5529895	5529915	5537983	5765369
3K8	5529896	5529916	5538049	5765373
3K8	5529897	5529917	5540902	5765374
3K8	5529898	5529918	5541311	5765959
3K8	5529899	5529919	5741610	5765960
3K8	5529900	5529920	5751409	5765961
3K8	5529901	5529921	5757292	5766636
3K8	5529902	5529922	5763388	5767679
3K8	5529903	5529923	5763390	5769741
3K8	5529904	5529924	5763396	5778618
3K8	5529905	5529925	5763445	5793448
3K8	5529906	5529926	5763463	5793449
3K8	5529907	5529927	5763574	5793450
3K8	5529908	5794740	5763575	5794738
3K8	5529909	5794741	5763576	5794739
3K8				5794742
GJD	5055800	5057434	5250505	5268754
GJD	5057428	5057503	5250506	5268755
GJD	5057429	5057504	5250507	5268756
GJD	5057430	5250472	5253372	5269413
GJD	5057431	5250502	5264653	5269414
GJD	5057432	5250503	5264897	5271702
GJD	5057433	5250504	5268077	

Benefits

- Ensure adequate cathodic protection is on the GT&S system
- Reduce risk of loss of containment
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-DC INTERFERENCE**

Project Title: DC Interference

Major Work Categories: 3K (MAT 3K9) and GJ (MAT GJF)

Planning Order Numbers: See Table Below

Project Start Date: 2014

Project Completion Date: Ongoing program

Operative Date (only applies to Capital): 2014

Project Description

This project summary includes the following work types:

- 3K9
 - Dynamic Direct Current Interference (DCI) Mitigation - A project to mitigate the threat of dynamic DC interference on gas transmission piping within one mile of both BART and MUNI (Priority 1), within one mile of just BART (Priority 2), within two miles of both BART and MUNI (Priority 3) or within two miles of just BART (Priority 2) by installing a grounding system (ground cell or deep-well anode), electrical isolation, and/or alternative mitigation systems. All other projects are Priority 5.
 - Static DC Interference - A project to mitigate the threat of static DC interference at a location.
- GJF
 - DC Interference Investigations (non-unitized) - A project to investigate any DC interference (static or dynamic) not addressed by the capital DC interference program. This can either be a proactive investigation or a reactive investigation triggered from data found from other groups/programs.

DC interference occurs when DC currents in the earth utilize buried metallic piping systems as part of their electrical circuit. The point at which the DC current flows back to the earth may be subject to accelerated metal loss which could compromise the integrity of the metallic piping system.

Justification

These are mandated projects. Unmitigated DC interference can lead to loss of containment of natural gas piping systems. The projects address Subpart I, 49 CFR 192.

Cost

The expense forecast for MAT GJF in 2022 and 2023 is \$772,241.00 and \$760,533.04, respectively.

The capital forecast for MAT 3K9 in 2022 and 2023 is \$10,910,765.68 and \$7,144,529.97, respectively.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-DC INTERFERENCE**

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT GJF	654	960	1,153	1,117	697	748	772	761	N/A	N/A	N/A	6,861	WP 9-7
Expense Total	654	960	1,153	1,117	697	748	772	761	-	-	-	6,861	
CAPITAL													
MAT 3K9	1,183	2,473	14,197	7,038	10,025	10,441	10,911	7,145	3,124	3,205	3,287	73,027	WP 9-86
Capital Total	1,183	2,473	14,197	7,038	10,025	10,441	10,911	7,145	3,124	3,205	3,287	73,027	
TOTAL PROJECT COST	1,837	3,433	15,350	8,154	10,721	11,188	11,683	7,905	3,124	3,205	3,287	79,888	

Planning Orders

MAT	Planning Order					
3K9	5524818	5536284	5529236	5541024	5771278	5778169
3K9	5525260	5536285	5529237	5541025	5771361	5778944
3K9	5525940	5536286	5529238	5541312	5771778	5793354
3K9	5526260	5536288	5530045	5541313	5772282	5794743
3K9	5526261	5536289	5531003	5543789	5772687	5794744
3K9	5526262	5536290	5531281	5759496	5773239	5794745
3K9	5527463	5536291	5531580	5763409	5773258	5794746
3K9	5527464	5536292	5531581	5765309	5773458	5794747
3K9	5528922	5536939	5531582	5765310	5773465	5794748
3K9	5528923	5537199	5535362	5766222	5777471	5794749
3K9	5528999	5537200	5536280	5766389	5777472	
3K9	5529000	5541021	5536281	5766692	5778166	
3K9	5529234	5541022	5536282	5768029	5778167	
3K9	5536283	5529235	5541023	5770971	5778168	
GJF	5057441	5057445	5263219	5057448	5258213	5256895
GJF	5057442	5057446	5263220	5245562	5057444	5263222
GJF	5057443	5057447				

Benefits

- Identify and mitigate DC interference throughout GT&S system
- Reduce degradation of pipeline from DC interference
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CLOSE INTERVAL SURVEY (CIS)**

Project Title: Close Interval Survey (CIS)
Major Work Categories: GJ (Mat GJE)
Planning Order Numbers: See Table Below
Project Start Date: 2014
Project Completion Date: Ongoing
Operative Date (only applies to Capital): N/A

Project Description

This project summary includes the following work types:

- Close Interval Survey (CIS) – PG&E performs CIS between test stations to obtain near continuous CP reads at approximate 2.5-foot intervals for the length of the pipeline. A unit of measure is one total mile of close interval survey performed.
- Excavations - An excavation performed to assess for external corrosion, excluding ECDA digs.

CIS is a proactive program to verify that PG&E's CP Monitoring Program accurately reflects levels of CP on piping installed between monitoring locations. CIS is recognized as a best practice to assess CP along the entire pipeline, verify electrical isolation, and identify potential interference gradients that may compromise the integrity of the system.

Justification

This is not a compliance program but an industry best practice. CIS addresses the threat of external corrosion and the associated risk of loss of containment.

Though the CIS program is currently not required by Subpart I of 49 CFR 192, any low reads must be mitigated to maintain compliance.

Cost

The expense forecast for MAT GJE in 2022 and 2023 is \$5,619,538.10 and \$5,808,354.59, respectively.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
EXPENSE													
MAT GJE	1,782	1,124	3,046	7,089	4,488	5,200	5,620	5,808	N/A	N/A	N/A	34,158	WP 9-7
TOTAL PROJECT COST	1,782	1,124	3,046	7,089	4,488	5,200	5,620	5,808	-	-	-	34,158	

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CLOSE INTERVAL SURVEY (CIS)**

Planning Orders

<u>MAT</u>	<u>Planning Order</u>
GJE	5041318
GJE	5055558
GJE	5248419
GJE	5248420
GJE	5250910
GJE	5252872
GJE	5252873
GJE	5256320
GJE	5256994
GJE	5257039
GJE	5258112
GJE	5258142
GJE	5258143
GJE	5263153
GJE	5263154
GJE	5263155
GJE	5264896
GJE	5267055
GJE	5267056
GJE	5267057
GJE	5267058
GJE	5270932
GJE	5270933

Benefits

- Identify low potentials between monitoring points
- Verify adequate CP monitoring points
- Prevent loss of containment due to external corrosion
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

PG&E considered other timeframes, both shorter and longer than 15 years, and has determined that the 15 year timeframe balances an appropriate risk reduction pace with resource constraints (engineering and field personnel) which govern the amount of mileage that can be accomplished in a given year.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CORROSION SUPPORT**

Project Title: Complex Low Read Investigation/Troubleshooting

Major Work Categories: GJ (MAT GJJ)

Planning Order Numbers: See Table Below

Project Start Date: 2019

Project Completion Date: Ongoing program

Operative Date (only applies to Capital): N/A

Project Description

This project summary includes the following work types:

- Complex Low Read Investigations & Troubleshooting (non-unitized) – An expense project related to investigation and troubleshooting of complex low reads, as requested by Corrosion Mechanics.

Complex Corrosion Investigations (MAT GJJ) are driven by requests from Corrosion Field Services to Corrosion Engineering to help troubleshoot/solve complex corrosion issues. This work stream is “as needed” and the level of support varies based on the unique circumstances of each problem.

Justification

These are mandated projects. Unmitigated external corrosion can lead to loss of containment of natural gas piping systems. The projects address Subpart I, 49 CFR 192.

Cost

The expense forecast for MAT GJJ in 2022 and 2023 is \$264,784.10 and \$273,680.85, respectively.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
EXPENSE														
MAT GJJ	4,295	2,678	(5,403)	296	1	256	265	274	N/A	N/A	N/A	2,662	WP 9-7	
TOTAL PROJECT COST	4,295	2,678	(5,403)	296	1	256	265	274	-	-	-	2,662		

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY-CORROSION SUPPORT**

Planning Orders

MAT	Planning Order
GJJ	5028551
GJJ	5037815
GJJ	5055695
GJJ	5057456
GJJ	5057457
GJJ	5057458
GJJ	5057459
GJJ	5057460
GJJ	5057461
GJJ	5057462
GJJ	5057508
GJJ	5057509
GJJ	5245559
GJJ	5255993
GJJ	5257025
GJJ	5257026
GJJ	5257435

Benefits

- Investigate complex low reads found and troubleshoot to reduce amount of complex low reads found
- Mitigate the loss of containment to external corrosion
- PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

Workpaper Table 9-33
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC DG - Expense Historical Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	9,443	Increase in DGD, DGE, and DGF costs as new Enhanced CP Survey (ECPS) and Electrically Connected Isolated Steel programs (EC-ISSP) began in 2016. Increase in CP monitoring as policy was changed to require 2 reads per mile of CPA main.
2		2,703	
3	2017	12,147	Increase in DGE, and DGF costs as new Enhanced CPA Survey and Electrically Connected Isolated Steel programs were fully implemented.
4		3,619	
5	2018	15,766	Increase in DGA and DGB due to additional reads and troubleshooting identified during ECPS and EC-ISSP. Increase in DGH as expense casing mitigation program ramped up as shorted casings were identified during ECPS.
6		6,567	
7	2019	22,333	N/A
8		1,622	
9	2020	23,954	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-34
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC DG - Expense Forecast Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Program/Activity	Amount	Detailed Description/Explanation
1	2020	Recorded Adjusted	23,954	
2		DG# Not Assigned	(51)	Immaterial Change in Cost
3		DGA Cath Protect - Monitoring	(461)	Immaterial Change in Cost
4		DGB Cath Protect-Troubleshoot	(51)	Immaterial Change in Cost
5		DGC Cath Protect - Rectifier Maint	(191)	Immaterial Change in Cost
6		DGD Cath Protect - Resurvey	1,591	2021 forecast was based on imputed 2020 costs plus escalation which was approximately \$1.5 million more than 2020 actual costs.
7		DGE G:Isolated Steel Svc Evaluatn	(1,000)	2021 forecast was based on imputed 2020 costs plus escalation which was approximately \$1 million less than 2020 actual costs.
8		DGF G:Unprotectd Steel Main Evalu	(26)	Immaterial Change in Cost
9		DGG Install casing test stations	(1,085)	Reduction due to budget reprioritization
10		DGH Casing mitigate < than 100ft	(3,502)	Reduction due to budget reprioritization
11		DGI Casing monitoring w/o leads	(143)	Immaterial Change in Cost
12	2021	Forecasted	19,034	
13		DG# Not Assigned	0	N/A
14		DGA Cath Protect - Monitoring	499	Immaterial Change in Cost
15		DGB Cath Protect-Troubleshoot	35	Immaterial Change in Cost
16		DGC Cath Protect - Rectifier Maint	29	Immaterial Change in Cost
17		DGD Cath Protect - Resurvey	(2,984)	Enhanced CP survey project will be finishing in 2021 and 2022 resulting in an estimated reduction in the number of field corrosion technicians on the project. Backoffice contractor costs that were charged to DGD are moving to DGE as the EC-ISSP continues through 2023-2024.
18		DGE G:Isolated Steel Svc Evaluatn	3,280	Backoffice contractor costs that were charged to DGD are moving to DGE as the EC-ISSP continues through 2023-2024. We also increased the scope of work by approximately 20,000 risers and increased the number of field technicians to finish the project on time.
19		DGF G:Unprotectd Steel Main Evalu	0	Immaterial Change in Cost
20		DGG Install casing test stations	3,393	2021 budget was based on reprioritization resulting in only 20 units forecast. 2022 budget forecasts 170 units to make up for units not installed in 2021.
21		DGH Casing mitigate < than 100ft	439	Immaterial Change in Cost
22		DGI Casing monitoring w/o leads	0	Immaterial Change in Cost
23	2022	Forecasted	23,725	
24		DG# Not Assigned	0	N/A
25		DGA Cath Protect - Monitoring	382	Immaterial Change in Cost
26		DGB Cath Protect-Troubleshoot	176	Immaterial Change in Cost
27		DGC Cath Protect - Rectifier Maint	19	Immaterial Change in Cost
28		DGD Cath Protect - Resurvey	203	Immaterial Change in Cost
29		DGE G:Isolated Steel Svc Evaluatn	205	Immaterial Change in Cost
30		DGF G:Unprotectd Steel Main Evalu	0	Immaterial Change in Cost
31		DGG Install casing test stations	(460)	Immaterial Change in Cost
32		DGH Casing mitigate < than 100ft	2,934	2022 budget forecast 10 units of expense casing mitigation with project focusing on higher risk capital casing mitigation. In 2023 focus will change to expense casing mitigation with 33 units forecast as identified capital casing mitigations are nearing completion.
33		DGI Casing monitoring w/o leads	0	Immaterial Change in Cost
34	2023		27,184	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-35
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC FH - Expense Historical Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	1,815	Continued to increase the focus on this work (from the Insulation and Coatings (I&C) paint groups).
2		996	
3	2017	2,811	Unit cost for MAT FHL increased from \$2k to \$20k. Span mitigations vary from a small patch repair to a full span recoat with costs varying with the size of the repair and access/environmental issues.
4		828	
5	2018	3,639	Reduction in MAT FHL costs due to a reduction in the number of main span units requiring mitigation from 76 to 62.
6		(698)	
7	2019	2,940	N/A
8		59	
9	2020	3,000	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-36
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC FH - Expense Forecast Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Program/Activity	Amount	Detailed Description/Explanation
1	2020	Recorded Adjusted	3,000	
2		FHK GD Corrosion AC Inspections	301	Immaterial Change in Cost
3		FHL Atmospheric Corsn Main Rep	1,502	Increase in number of spans to be mitigated from 24 units in 2020 to forecast 99 units in 2021.
4		FHM Atmospheric Corsn Serv Rep	(171)	Immaterial Change in Cost
5		FHN Atmospheric Corsn Reg Stn Rprs	193	Immaterial Change in Cost
6	2021	Forecast	4,825	
7		FHK GD Corrosion AC Inspections	(739)	Immaterial Change in Cost
8		FHL Atmospheric Corsn Main Rep	1,441	Increase in number of spans to be mitigated from forecast 99 units in 2020 to forecast 169 units in 2022.
9		FHM Atmospheric Corsn Serv Rep	10,511	Increase in MAT FHM riser repairs as 55,000 new atmospheric corrosion riser repairs were identified for mitigation
10		FHN Atmospheric Corsn Reg Stn Rprs	361	Immaterial Change in Cost
11	2022	Forecast	16,399	
12		FHK GD Corrosion AC Inspections	32	Immaterial Change in Cost
13		FHL Atmospheric Corsn Main Rep	(389)	Immaterial Change in Cost
14		FHM Atmospheric Corsn Serv Rep	691	Immaterial Change in Cost
15		FHN Atmospheric Corsn Reg Stn Rprs	(385)	Immaterial Change in Cost
16	2023	Forecast	16,348	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-37
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC FI - Expense Historical Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	5,833	The decreased spend is attributed to a decrease in units inspected and a corresponding decrease in CP Maintenance/Construction (MAT FII) associated with said inspections.
2		(3,128)	
3	2017	2,706	Unit cost for MAT FII increased by \$500/unit although the number of units remained relatively flat. The types of units and the cost of repairs under FII can vary greatly depending on the types of repairs made in a given year.
4		939	
5	2018	3,644	Number of units repaired increased from 1698 units to 4382 units attributed to an increase in anodes installed on deficient risers found during the EC-ISSP.
6		1,914	
7	2019	5,558	Number of units repaired decreased from 4382 units to 2221 units attributed to a decrease in anodes installed on deficient risers found during the EC-ISSP.
8		(991)	
9	2020	4,567	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-38
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC FI - Expense Forecast Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Program/Activity	Amount	Detailed Description/Explanation
1	2020	Recorded Adjusted	4,567	
2		FII Maint-Corr-G Cath Prot	3,404	Increase in number of deficient risers to be mitigated
3	2021	Forecast	7,971	
4		FII Maint-Corr-G Cath Prot	(2,102)	Decrease in number of deficient risers to be mitigated
5	2022	Forecast	5,869	
6		FII Maint-Corr-G Cath Prot	303	Immaterial Change in Cost
7	2023	Forecast	6,172	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-39
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC JU - Expense Historical Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	8,425	MAT JU# was the Leak Management balancing account that was active from 2014-2016.
2		(8,425)	
3	2017	0	
4		0	N/A
5	2018	0	N/A
6		0	
7	2019	0	N/A
8		0	
9	2020	0	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-40
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC GJ - Expense Historical Walk - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	26,052	Modifications to the transmission casing mitigation program as detailed in the 2019 GT&S.
2		(9,009)	
3	2017	17,042	Modifications to the transmission casing mitigation program as detailed in the 2019 GT&S.
4		(4,999)	
5	2018	12,043	Internal corrosion work increased , 2018 actuals included shareholder funded work that had been incorrectly charged to active accounts
6		16,538	
7	2019	28,581	Transition from backlog of casing mitigation to find and fix casing mitigation
8		(10,279)	
9	2020	18,302	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-41
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC GJ - Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Program/Activity	Amount	Detailed Description/Explanation
1	2020	Recorded Adjusted	18,302	
2		GJ# Not Assigned	0	NA
3		GJA Electrical Interference - AC	2,442	Annual change in pace of work
4		GJB Atmospheric Corrosion	654	Immaterial Change in Cost
5		GJC Cathodic Protection Expense	1,658	Annual change in pace of work
6		GJD Test Stations	(133)	Immaterial Change in Cost
7		GJE Close Interval Survey (CIS)	712	Immaterial Change in Cost
8		GJF Electrical Interference - DC	51	Immaterial Change in Cost
9		GJH Internal Corrosion	1,443	Annual change in pace of work
10		GJJ Low Read Investigations	255	Immaterial Change in Cost
11		GJK Corrosion Support	(304)	Immaterial Change in Cost
12		GJL Casings Monitoring	(171)	Immaterial Change in Cost
13		GJM Casings	(1,038)	Increase in Casing Leak Survey that was incorrectly charged to MAT GJL in 2020 and increase in Casing Mitigation is attributed to a casing disallowance recorded in 2020
14	2021	Forecast	23,872	
15		GJ# Not Assigned	0	N/A
16		GJA Electrical Interference - AC	(402)	Annual change in pace of work
17		GJB Atmospheric Corrosion	2,553	Annual change in pace of work
18		GJC Cathodic Protection Expense	(3,111)	Annual change in pace of work
19		GJD Test Stations	(39)	Immaterial Change in Cost
20		GJE Close Interval Survey (CIS)	420	Immaterial Change in Cost
21		GJF Electrical Interference - DC	25	Immaterial Change in Cost
22		GJH Internal Corrosion	2,627	Annual change in pace of work
23		GJJ Low Read Investigations	8	Immaterial Change in Cost
24		GJK Corrosion Support	444	Immaterial Change in Cost
25		GJL Casings Monitoring	0	Immaterial Change in Cost
26		GJM Casings	2,374	Annual change in pace of work and increase in Casing Test Station installations
27	2022	Forecast	28,770	
28		GJ# Not Assigned	0	N/A
29		GJA Electrical Interference - AC	(2,059)	Annual change in pace of work
30		GJB Atmospheric Corrosion	(1,007)	Annual change in pace of work
31		GJC Cathodic Protection Expense	45	Immaterial Change in Cost
32		GJD Test Stations	8	Immaterial Change in Cost
33		GJE Close Interval Survey (CIS)	189	Immaterial Change in Cost
34		GJF Electrical Interference - DC	(12)	Immaterial Change in Cost
35		GJH Internal Corrosion	289	Immaterial Change in Cost
36		GJJ Low Read Investigations	9	Immaterial Change in Cost
37		GJK Corrosion Support	88	Immaterial Change in Cost
38		GJL Casings Monitoring	0	Immaterial Change in Cost
39		GJM Casings	91	Immaterial Change in Cost
40	2023	Forecast	26,412	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-42
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control MWC
JO - Expense Historical Walk - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	1,716	Annual changes in troubleshoot and correctives required
2		(273)	
3	2017	1,443	Annual changes in troubleshoot and correctives required
4		947	
5	2018	2,390	Annual changes in troubleshoot and correctives required
6		441	
7	2019	2,831	N/A
8		102	
9	2020	2,933	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-43
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC JO - Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Program/Activity	Amount	Detailed Description/Explanation
1	2020	Recorded Adjusted	2,933	
2		JOA Cath Prot Rectifier Maintenanc	(22)	Immaterial Change in Cost
3		JOB Cath Prot Monitoring	(29)	Immaterial Change in Cost
4		JOC Cath Prot Troubleshoot	(220)	Immaterial Change in Cost
5		JOD Cath Prot Resurvey	0	Immaterial Change in Cost
6		JOQ Cath Protection Corr Maintnc	(47)	Immaterial Change in Cost
7		JOZ Atmospheric Corrosion Inspect	188	Immaterial Change in Cost
14	2021	Forecast	2,803	
15		JOA Cath Prot Rectifier Maintenanc	(47)	Immaterial Change in Cost
16		JOB Cath Prot Monitoring	(167)	Immaterial Change in Cost
17		JOC Cath Prot Troubleshoot	240	Immaterial Change in Cost
18		JOD Cath Prot Resurvey	0	Immaterial Change in Cost
19		JOQ Cath Protection Corr Maintnc	(144)	Immaterial Change in Cost
20		JOZ Atmospheric Corrosion Inspect	8	Immaterial Change in Cost
27	2022	Forecast	2,692	
28		JOA Cath Prot Rectifier Maintenanc	4	Immaterial Change in Cost
29		JOB Cath Prot Monitoring	26	Immaterial Change in Cost
30		JOC Cath Prot Troubleshoot	25	Immaterial Change in Cost
31		JOD Cath Prot Resurvey	0	Immaterial Change in Cost
32		JOQ Cath Protection Corr Maintnc	11	Immaterial Change in Cost
33		JOZ Atmospheric Corrosion Inspect	185	Immaterial Change in Cost
40	2023	Forecast	2,943	

Note: Total amounts and amounts for each MWC are obtained from WP 9-7 by summing the relevant lines for each MWC.

Workpaper Table 9-44
 Pacific Gas and Electric Company
 2023 General Rate Case
 Exhibit (PG&E-3), Chapter 9
 Gas Operations Corrosion Control
 Capital Expenditures by Major Work Category
 (Thousands of Nominal Dollars)

No.	MWC	MWC Description	Capital Expenditures										Reference (A)	
			2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast		2026 Forecast
1	3K	Gas Trans Remediate Corrosion	35,277	37,701	90,793	42,414	45,905	61,807	51,943	40,598	38,416	38,550	39,399	
2	50	G Dist Reliability General	9,593	15,576	14,778	34,551	29,118	34,816	36,821	21,847	22,432	23,018	23,618	
3		Grand Total	44,870	53,277	105,571	76,965	75,022	96,623	88,764	62,444	60,848	61,568	63,017	WP 9-86, Line 14

Notes: (A) Line 3 2023-2026 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 9-45
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

Line No.	Description	Capital Expenditures					Reference (A)		
		2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast		2025 Forecast	2026 Forecast
1	Projects > \$3 Million*	-	91,868	78,824	55,410	53,988	55,396	56,816	
2	Other Work	6,560	4,755	9,939	7,034	6,860	6,172	6,201	
3	Total	6,560	96,623	88,764	62,444	60,848	61,568	63,017	WP 9-86, Line 14

4 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Notes: (A) Line 3 2023-2026 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Workpaper Table 9-46
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million*
(Thousands of Nominal Dollars)

Line No.	Planning Order	Description	MWC	Operative Date	2020 Recorded Adjusted	Capital Expenditures						Subtotal	Reference
						2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast		
MWC - 3K Gas Trans Remediate Corrosion													
1	5526262	Remediate DCI L105N MP27.38-36.34	3K		-	10,441	-	-	-	-	-	10,441	
2	5528930	Irvington Station DWA	3K		-	6,180	-	-	-	-	-	6,180	
3	5537638	Internal Corrosion - BA (offsetting 3K1)	3K		-	12,026	-	-	-	-	-	12,026	
4	5537699	Electrical Interference (offsetting 3K4)	3K		-	11,726	-	-	-	-	-	11,726	
5	5537700	Casings - BA (offsetting 3K5)	3K		-	18,179	-	-	-	-	-	18,179	
6	5793328	2023 GRC Casing Mitigation (GT401LINE)	3K		-	1,121	772	813	834	834	834	4,334	
7	5793329	2023 GRC Casing Mitigation (GTLTRAN)	3K		-	11,901	8,199	8,631	8,412	8,631	8,850	45,993	
8	5793336	2023 GRC Cathodic Protect-New(GTLTRAN)	3K		-	944	973	1,025	999	1,025	1,051	4,994	
9	5793341	2023 GRC Cathodic Protect-Rep(GTLTRAN)	3K		-	2,366	2,439	2,568	2,502	2,568	2,633	12,508	
10	5793352	2023 GRC Elect Interference-AC (GTLTRAN)	3K		-	5,618	1,994	2,100	2,046	2,100	2,153	13,911	
11	5793354	2023 GRC Elect Interference-DC (GTLTRAN)	3K		-	7,477	4,896	2,197	2,141	2,197	2,252	18,963	
12	5793399	2023 GRC Internal Corrosion (GTLTRAN)	3K		-	6,142	8,057	8,483	8,267	8,483	8,697	39,647	
13	5794674	2023 GRC Internal Corrosion (GT401LINE)	3K		-	579	759	799	779	799	820	3,736	
14	5794677	2023 GRC Internal Corrosion (GTLN300)	3K		-	704	924	948	948	973	997	4,546	
15	5794718	2023 GRC Internal Corrosion (GTLN300)	3K		-	704	924	948	948	973	997	4,546	
16	5794726	2023 GRC Casing Mitigation (GT400LINE)	3K		-	810	558	587	573	587	602	3,130	
17	5794728	2023 GRC Casing Mitigation (GTLN300)	3K		-	1,365	940	990	965	990	1,015	5,273	
18	5794729	2023 GRC Casing Mitigation (GTLN300)	3K		-	1,365	940	990	965	990	1,015	5,273	
19	5794758	2023 GRC Internal Corrosion (GSMCD)	3K		-	906	1,188	1,251	1,219	1,251	1,282	5,845	
20	Total				-	58,552	42,003	33,563	31,556	32,379	33,198	231,251	
MWC - 50 G Dist Reliability General													
21	5523069	IMPR RELB/SYS DEPND-Deep Well Anode-PN	50		-	19,500	-	-	-	-	-	19,500	
22	5541845	Casings - EB	50		-	13,816	-	-	-	-	-	13,816	
23	5542186	2023 GRC Impr Rel/Dep Gas CP Systems	50		-	19,463	3,957	4,169	4,063	4,169	4,278	35,930	
24	5542193	2023 GRC ImprRelb/SysDepd-G-DpWellAnode	50		-	17,358	17,889	18,848	18,369	18,848	19,340	91,805	
25	Total				-	33,316	36,821	21,847	22,432	23,018	23,618	161,051	
26		Grand Total			-	91,868	78,824	55,410	53,988	55,396	56,816	392,302	

* Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Workpaper Table 9-47
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Gas Operations Corrosion Control
Recorded and Forecast Capital Expenditures Details - Other Work*
(Thousands of Nominal Dollars)

Line No.	MWC	MWC Description	Capital Expenditures										Reference	
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025		2026
			Recorded	Recorded	Recorded	Recorded	Recorded	Recorded	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
			Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted						
1	3K	Gas Trans Remediate Corrosion	35,277	37,548	86,558	30,375	45,846	3,255	9,939	7,034	6,860	6,172	6,201	
2	50	G Dist Reliability General	9,514	15,177	13,568	30,152	23,889	1,500	-	-	-	-	-	
3	Grand Total		44,791	52,725	100,126	60,527	69,735	4,755	9,939	7,034	6,860	6,172	6,201	

4 * Excludes projects greater than \$3M

Workpaper Table 9-48
 Pacific Gas and Electric Company
 2023 General Rate Case
 Workpapers Supporting the Proposed Revenue Corrosion Control
 Summary of Capital Expenditures

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Forecast	2020 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference	Notes
1	Imp Reg Gas CP Systems	50	50D56D	8,447,285	6,851,650	8,333,375	16,971,607	10,000,911	15,515,664	19,462,504	3,857,160	4,063,232	4,169,292	4,276,101	WP 9-89	
2	Imp Reg Gas CP Schematics	50	50P	445,285	224,150	14,778,251	34,650,603	29,117,674	34,813,664	40,189,482	1,899,445	1,950,445	1,999,445	2,048,445	WP 9-90	
3	Total Capital Expenditures			9,892,570	7,075,800	14,778,251	34,650,603	29,117,674	34,813,664	39,651,986	21,446,611	22,432,100	23,017,577	23,613,337		

(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference	Notes
4	Corrosion Control Other	3K	3KQ	-	(8,483)	-	135,612	3,407,517	12,026,338	9,861,512	13,067,412	13,407,902	13,757,264	14,106,419	WP 9-90	
5	Internal Corrosion	3K	3K1	57,500	1,777,936	(51,155)	(15,088)	3,571,293	11,725,810	8,186,312	2,809,768	2,895,713	3,063,640	3,141,150	WP 9-91	
6	Electrical Interference - AC	3K	3K4	13,544,526	(1,590,569)	25,410,622	11,566,699	13,147,624	18,179,334	17,494,407	12,161,546	12,478,963	12,804,664	13,128,602	WP 9-94	
7	Casing Mitigation	3K	3K6	4,864,269	4,843,089	3,271,499	11,342,191	9,836,650	6,160,000	3,388,719	1,434,656	1,468,998	1,507,339	1,546,475	WP 9-95	
8	Cathodic Protection - New	3K	3K7	1,807,445	7,333,555	30,233,769	7,038,697	2,117,300	2,662,250	111,810	3,145,025	3,180,027	3,215,027	3,250,027	WP 9-96	
9	Electrical Interference - DC	3K	3K8	6,807,445	1,182,961	14,196,767	7,037,557	10,024,778	10,440,659	11,910,766	7,144,530	3,123,884	3,205,418	3,286,515	WP 9-98	
10	Test Station Installation	3K	3K9	1,182,961	2,472,963	4,196,767	7,037,557	10,024,778	10,440,659	11,910,766	7,144,530	3,123,884	3,205,418	3,286,515	WP 9-99	
11	Electrical Interference - DC	3K	3K9	1,182,961	2,472,963	4,196,767	7,037,557	10,024,778	10,440,659	11,910,766	7,144,530	3,123,884	3,205,418	3,286,515	WP 9-99	
12	Atmospheric Corrosion	3K	3KA	615,157	(393,306)	492,378	163,827	51,093	200,000	399,500	294,087	1,207,408	433,495	317,474	WP 9-100	
13	Total Capital Expenditures			35,277,064	37,700,696	90,792,633	42,414,474	45,904,693	61,807,391	61,942,659	40,707,635	38,522,269	38,667,309	39,516,699		

(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

(1) 3K9 is an internal clearing account that is not normally used for budget purposes and is not forecasted for this rate case period.

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast
14	Total Capital	All	All	44,870,285	83,276,691	105,070,884	76,564,977	75,022,438	96,623,055	88,783,831	62,554,446	60,961,369	61,664,846	63,137,036

Workpaper Table 9-49
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 50D

Line No.

1 **MAT 50D (UNIT OF MEASURE: # OF RECTIFIERS REPLACED)**

Description	Value	Note
2016-2019 Total Average Unit Costs	\$14,800.00	(A)
Cost Basis for Forecast	\$14,800.00	

	2021 (D)	2022 (E)	2023	Note
Escalation Factor	1.36%	2.98%	3.06%	(B)
Escalation Amount	\$201.28	\$447.04	\$472.72	(C)
Forecast Unit Cost	\$15,001.28	\$15,448.32	\$15,921.04	
Forecast Units	60	80	80	
Total Forecast	\$900,076.80	\$1,235,865.45	\$1,273,682.93	Line (11)*Line (12)

	2024	2025	2026	Note
Escalation Factor	2.68%	2.61%	2.61%	
Escalation Amount	\$426.68	\$426.68	\$437.81	
Forecast Unit Cost	\$16,347.72	\$16,774.40	\$17,212.21	
Forecast Units	80	80	80	
Total Forecast	\$1,307,817.64	\$1,341,951.68	\$1,376,976.62	Line (19)*Line (20)

22 **Notes and References**

23 (A) This total average unit cost was based on the average of 2016-2019 costs for completed orders divided by the total average units from
24 2016-2019 for completed orders. This total was rounded to \$14,800.

25 (B) Escalation factors provided by GRC PMT

26 (C) Previous year unit cost x Escalation Factor.

27 (D) The 2021 unit cost shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast
amounts

(E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for
further information about the 2023 GRC forecast process.

Workpaper Table 9-50
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 50P

Line No.1 **MAT 50P (UNIT OF MEASURE: # OF CP SYSTEMS REPLACED)**

Description	Value	Note
2020 Total Average Unit Cost	\$255,843	(A)
Cost Basis for Forecast	\$255,843	

5

	2021 (D)	2022 (E)	2023	Note
6 Escalation Factor	1.36%	2.98%	3.06%	(B)
7 Escalation Amount	\$3,479.46	\$7,727.81	\$8,171.74	(C)
8 Forecast Unit Cost	\$259,322.46	\$267,050.27	\$275,222.01	
9 Forecast Units	75	65	65	
10 Total Forecast	\$19,449,184.86	\$17,358,267.83	\$17,889,430.82	

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	2024	2025	2026	Note
13 Escalation Factor	2.68%	2.61%	2.61%	
14 Escalation Amount	\$7,375.95	\$7,375.81	\$7,568.32	
15 Forecast Unit Cost	\$282,597.96	\$289,973.77	\$297,542.08	
16 Forecast Units	65	65	65	
17 Total Forecast	\$18,368,867.57	\$18,848,295.01	\$19,340,235.51	

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20 **Notes and References**

(A) Average is based on a list of 41 known ground bed and deep well anode projects with 2020 costs.

21 Historical costs are not reflective of the work currently recorded to this MAT.

22 (B) Escalation factors provided by GRC PMT

23 (C) Previous year unit cost x Escalation Factor.

24 (D) The 2021 unit cost shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts

(E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

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Workpaper Table 9-51
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 50Q

Line No.

1 **MAT 50Q (UNIT OF MEASURE: # OF CASINGS REMEDIATED)**

Description	Value	Note
Total Casings Proposed Work	\$13,720,000.00	(A)
Total Known Projects	55	
Cost Basis for Forecast	\$249,454.55	Line (3)/Line (4)

	2021 (D)	2022 (E)	2023	Note
Escalation Factor	1.36%	2.98%	3.06%	(B)
Escalation Amount	\$3,392.58	\$7,534.84	\$7,967.69	(C)
Forecast Unit Cost	\$252,847.13	\$260,381.97	\$268,349.66	
Forecast Units	72	70	10	
Total Forecast	\$18,204,993.16	\$18,226,738.02	\$2,683,496.60	

	2024	2025	2026	Note
Escalation Factor	2.68%	2.61%	2.61%	
Escalation Amount	\$7,191.77	\$7,191.63	\$7,379.33	
Forecast Unit Cost	\$275,541.43	\$282,733.06	\$290,112.40	
Forecast Units	10	10	10	
Total Forecast	\$2,755,414.31	\$2,827,330.62	\$2,901,123.95	

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22 **Notes and References**

- 23 (A) Engineering estimates of 55 actual/pending projects was utilized to calculate unit cost. Cost estimate includes 19 projects between 100 and 200 feet that do not require CalTrans or Railroad permits at \$160,000 each; 6 projects greater than 200 feet that do not require CalTrans or Railroad permits at \$280,000 each ; and 30 projects that require CalTrans and/or Railroad permits at \$300,000 each. Calculated total unit cost is as follows: $(19 \times \$160,000) + (6 \times \$280,000) + (30 \times \$300,000) = \$13,720,000$.
- 24 (B) Escalation factors provided by GRC PMT
- 25 (C) Previous year unit cost x Escalation Factor.
- 26 (D) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast
- 27 (E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-52
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K1 - Forecast Calculator

Line No.**1 MAT 3K1 (Internal Corrosion - Drip Removal)**

Description	Value	Note
Average cost of pipe replacement cost curves	\$2,444,039.01	(A)
Adjustments to Unit Cost	\$0	
Cost Basis for Forecast	\$2,444,039.01	Line (3) + Line (4)

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	2021 (E)	2022 (F)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(B)
Escalation Amount	\$10,920.00	\$34,269.04	\$77,483.09	(C)
Forecast Unit Cost	\$1,210,920.00 (G)	\$1,245,189.04 (G)	\$2,613,482.35 (G)	(D)
Forecast Units	26	8	5	
Total Forecast	\$31,483,920.00	\$9,961,512.29	\$13,067,411.75	

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	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(B)
Escalation Amount	\$68,098.07	\$69,872.46	\$69,630.95	(C)
Forecast Unit Cost	\$2,681,580.42	\$2,751,452.87	\$2,821,083.83	(D)
Forecast Units	5	5	5	
Total Forecast	\$13,407,902.08	\$13,757,264.37	\$14,105,419.13	

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Notes and References

- (A) No historical data for 2016-2019 due to slow start to program from a key vacancy on the IC team thus PG&E analyzed historical pipe replacement costs to determine a pipe replacement cost curve based on the pipe's length and diameter. PG&E estimated that each replacement will encompass approximately 100 feet, the cost curve's first variable. PG&E calculated the second variable by analyzing pipe diameter at its backbone drips to find the most common (36 inches). This created an average cost basis of \$2,444,039.01.
- (B) Escalation factors provided by GRC PMT.
- (C) Previous year unit cost x Escalation Factor.
- (D) Previous year unit cost + Escalation Amount.
- (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.
- (G) Low forecast unit cost in 2021 and 2022 is due to bundling opportunities with other workstreams and it is not known if these opportunities will exist in 2023 and beyond. PG&E used the pipe replacement cost curve method outlined above starting in 2023 for this reason.

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Workpaper Table 9-53
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K4 - Forecast Calculator

Line No.

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MAT 3K4 (AC CTS)

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Line	Description	Value	Note
3	2016-2019 Total Average Unit Costs	\$72,187	(A)
4	Adjustments to Forecast Basis	\$0	
5	Cost Basis for Forecast	\$72,187	Line (3) + Line (4)

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	2021 (E)	2022 (F)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(B)
Escalation Amount	\$656.90	\$2,061.48	\$2,292.11	(C)
Forecast Unit Cost	\$72,843.90	\$74,905.38	\$77,197.49	(D)
Forecast Units	52	20	10	(G)
Total Forecast	\$3,787,882.89	\$1,498,107.68	\$771,974.89	

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	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(B)
Escalation Amount	\$2,014.85	\$2,067.45	\$2,053.37	(C)
Forecast Unit Cost	\$79,212.34	\$81,279.79	\$83,336.16	(D)
Forecast Units	10	10	10	(G)
Total Forecast	\$792,123.43	\$812,797.85	\$833,361.64	

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Notes and References

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(A) PG&E used an average unit cost from a representative sample size of AC CTS projects over the time period 2016-2019. PG&E used a representative sample size due to bundling of work with other equipment types.

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(B) Escalation factors provided by GRC PMT.

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(C) Previous year unit cost x Escalation Factor.

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(D) Previous year unit cost + Escalation Amount.

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(E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

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(F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

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(G) Unit forecast estimate provided by program lead

Workpaper Table 9-53
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K4 - Forecast Calculator

Line No.

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MAT 3K4 (Ground Rods)

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Line	Description	Value	Note
32	Total Cost for 2016-2019 Ground Rods	\$5,457,584.48	(H)
33	Total Units	36	
34	Average Unit Cost	\$151,600	Line (32)/Line (33)
35	Adjustments to Forecast Basis	\$0	
36	Cost Basis for Forecast	\$151,600	Line (34)

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	2021 (L)	2022 (M)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(I)
Escalation Amount	\$1,379.56	\$4,329.32	\$4,813.65	(J)
Forecast Unit Cost	\$152,979.56	\$157,308.88	\$162,122.53	(K)
Forecast Units	5	4	2	(N)
Total Forecast	\$764,897.80	\$629,235.53	\$324,245.07	

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	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(I)
Escalation Amount	\$4,231.40	\$4,341.84	\$4,318.60	(J)
Forecast Unit Cost	\$166,353.93	\$170,695.77	\$175,014.37	(K)
Forecast Units	2	2	2	(N)
Total Forecast	\$332,707.86	\$341,391.54	\$350,028.74	

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Notes and References

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MAT 3K4 (Zinc Ribbon)

Line	Description	Value	Note
64	Total Cost for Bundled Projects	\$1,102,920.08	(O)
65	Total Cost for AC CTS for Bundled Projects	\$594,167.27	(P)
66	Total Cost of Zinc Ribbon for Bundled Projects	\$508,752.81	Line (1) - Line (2)
67	Total Zinc Ribbon Units for Bundled Projects	6	
68	Cost Basis for Forecast	\$84,792	Line (66) / Line (67)

Workpaper Table 9-53
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K4 - Forecast Calculator

Line No.

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	2021 (T)	2022 (U)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(Q)
Escalation Amount	\$77.61	\$2,421.45	\$2,692.34	(R)
Forecast Unit Cost	\$85,563.61	\$87,985.06	\$90,677.40	(S)
Forecast Units	2.81	6.9	2	(V)
Total Forecast	\$2,404,337.36	\$6,070,968.95	\$1,813,548.00	

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	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(O)
Escalation Amount	\$2,366.68	\$2,428.45	\$2,415.46	(P)
Forecast Unit Cost	\$93,044.08	\$95,472.53	\$97,887.99	(Q)
Forecast Units	2	2	2	(V)
Total Forecast	\$1,860,881.60	\$1,909,450.61	\$1,957,759.71	

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Notes and References

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- (O) PG&E used an average unit cost from a representative sample size of zinc ribbon projects in 2019 due to historic unit costs being bundled with other equipment types.
- (P) Removed cost of AC CTS units that were bundled with zinc ribbon projects
- (Q) Escalation factors provided by GRC PMT.
- (R) Previous year unit cost x Escalation Factor.
- (S) Previous year unit cost + Escalation Amount.
- (T) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the
- (U) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.
- (V) Cost basis is based on 0.1 miles (2021 example – 2.81 miles is equal to 28.1 units)

	2021	2022	2023	Note
Total Forecast	\$6,957,118.05	\$8,198,312.16	\$2,909,767.96	Line (12) + Line (44) + Line (75)

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	2024	2025	2026	Note
Total Forecast	\$2,985,712.89	\$3,063,640.00	\$3,141,150.09	Line (19) + Line (51) + Line (82)

Workpaper Table 9-54
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K5 - Forecast Calculator

Line No.

MAT 3K5 (Contacted Casing Remediation/Removals)				
Description	Value	Note		
2016-2019 Total Average Recorded Cost	\$63,394,799.04			
2016-2019 Total Average Recorded Units	70			
Cost Basis for Forecast	\$905,639.99	Line (3)/Line (4)		
	2021 (D)	2022 (E)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(A)
Escalation Amount	\$8,241.32	\$25,862.84	\$28,756.17	(B)
Forecast Unit Cost	\$913,881.31	\$939,744.15	\$968,500.32	(C)
Forecast Units	13	6	10	
Total Forecast	\$11,880,457.03	\$5,638,464.91	\$9,685,003.22	
	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(A)
Escalation Amount	\$25,277.86	\$25,937.61	\$25,798.81	(B)
Forecast Unit Cost	\$993,778.18	\$1,019,715.79	\$1,045,514.60	(C)
Forecast Units	10	10	10	
Total Forecast	\$9,937,781.81	\$10,197,157.91	\$10,455,146.01	
Notes and References				
(A) Escalation factors provided by GRC PMT.				
(B) Previous year unit cost x Escalation Factor.				
(C) Previous year unit cost + Escalation Amount.				
(D) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.				
(E) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.				
MAT 3K5 (Contacted Casing Pipeline Replacement)				
Description	Value	Notes and References		
Average cost of casings in pipe replacement cost curve model	\$2,315,803.64	(F)		
Adjustments to Forecast Basis	\$0.00			
Cost Basis for Forecast	\$2,315,803.64	Line (3) + Line (4)		
	2021 (J)	2022 (K)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(G)
Escalation Amount	\$21,073.81	\$66,133.64	\$73,532.13	(H)
Forecast Unit Cost	\$2,336,877.45	\$2,403,011.09	\$2,476,543.22	(I)
Forecast Units	5	5	1	
Total Forecast	\$11,684,387.27	\$12,015,055.43	\$2,476,543.22	
	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(G)
Escalation Amount	\$64,637.78	\$66,324.83	\$65,969.89	(H)
Forecast Unit Cost	\$2,541,181.00	\$2,607,505.83	\$2,673,475.72	(I)
Forecast Units	1	1	1	
Total Forecast	\$2,541,181.00	\$2,607,505.83	\$2,673,475.72	
Notes and References				
(F) PG&E completed a few projects in 2019 but unit cost was low due to bundling/projects that were for downrates and not a full replacement thus it wasn't an accurate unit cost. PG&E utilized a pipe replacement cost curve model based on the pipe's length and diameter instead. PG&E then input the replacement length and pipe diameter for each of its contacted casing pipeline replacement projects to determine an estimate for each. PG&E took the average of these costs to determine unit cost.				
(G) Escalation factors provided by GRC PMT.				
(H) Previous year unit cost x Escalation Factor.				
(I) Previous year unit cost + Escalation Amount.				
(J) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.				
(K) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.				
	2021	2022	2023	Note
Total Forecast	\$23,564,844.30	\$17,653,520.34	\$12,161,546.44	Line (13) + Line (42)
	2024	2025	2026	Note
Total Forecast	\$12,478,962.81	\$12,804,663.74	\$13,128,621.73	Line (21) + Line (49)

Workpaper Table 9-55
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K6 - Forecast Calculator

Line No.1 **MAT 3K6 (New CP systems)**

Line	Description	Value	Notes and References
3	2016 -2019 Average Unit Costs	\$267,559.99	(A)
4	Adjustments to Forecast Basis	\$0.00	
5	Cost Basis for Forecast	\$267,559.99	Line (3) + Line (4)

	2021 (E)	2022 (F)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(B)
Escalation Amount	\$2,434.80	\$7,640.85	\$8,495.65	(C)
Forecast Unit Cost	\$269,994.79	\$277,635.64	\$286,131.29	(D)
Forecast Units	32	5	5	
Total Forecast	\$8,639,833.17	\$1,388,178.20	\$1,430,656.45	

	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(B)
Escalation Amount	\$7,668.32	\$7,668.17	\$7,627.13	(C)
Forecast Unit Cost	\$293,799.61	\$301,467.78	\$309,094.91	(D)
Forecast Units	5	5	5	
Total Forecast	\$1,468,998.04	\$1,507,338.89	\$1,545,474.56	

22 **Notes and References**

23 (A) Unit cost per year reflects actual units divided by total cost of those projects (Excludes cancelled projects and outliers). PG&E took the four-year average of unit costs (\$234,494.28, \$234,793.61, \$234,793.61, \$341,000.99)

24 (B) Escalation factors provided by GRC PMT.

25 (C) Previous year unit cost x Escalation Factor.

26 (D) Previous year unit cost + Escalation Amount.

27 (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

28 (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-56
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K7 - Forecast Calculator

Line No.**1 MAT 3K7 (Groundbed Replacements)**

Line	Description	Value	Notes and References
3	2016 -2019 Average Unit Costs	\$248,796.98	(A)
4	Adjustments to Forecast Basis	\$0.00	
5	Cost Basis for Forecast	\$248,796.98	Line (3) + Line (4)

	2021 (E)	2022 (F)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(B)
Escalation Amount	\$2,264.05	\$7,105.03	\$7,899.88	(C)
Forecast Unit Cost	\$251,061.03	\$258,166.06	\$266,065.94	(D)
Forecast Units	13	12	12	
Total Forecast	\$3,263,793.39	\$3,097,992.68	\$3,192,791.26	

	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(B)
Escalation Amount	\$6,944.32	\$7,125.57	\$7,087.43	(C)
Forecast Unit Cost	\$273,010.26	\$280,135.83	\$287,223.26	(D)
Forecast Units	12	12	12	
Total Forecast	\$3,276,123.11	\$3,361,629.92	\$3,446,679.16	

Notes and References

(A) Unit cost per year reflects actual units divided by total cost of those projects (Excludes cancelled projects and outliers). PG&E took the four-year average of unit costs (\$213,567.05, \$236,813.10, \$247,831.78, \$296,975.98).

(B) Escalation factors provided by GRC PMT.

(C) Previous year unit cost x Escalation Factor.

(D) Previous year unit cost + Escalation Amount.

(E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

(F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

29 MAT 3K7 (Rectifiers Replaced)

Line	Description	Value	Notes and References
31	2016 -2019 Average Unit Costs	\$36,657.60	(G)
32	Adjustments to Forecast Basis	\$0.00	
33	Cost Basis for Forecast	\$36,657.60	Line (31) + Line (32)

	2021 (K)	2022 (L)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(H)
Escalation Amount	\$333.58	\$1,046.85	\$1,163.96	(I)
Forecast Unit Cost	\$36,991.18	\$38,038.03	\$39,201.99	(J)
Forecast Units	19	10	10	
Total Forecast	\$702,832.41	\$380,380.30	\$392,019.94	

	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(H)
Escalation Amount	\$1,023.18	\$1,049.87	\$1,044.26	(I)
Forecast Unit Cost	\$40,225.17	\$41,275.04	\$42,319.30	(J)
Forecast Units	10	10	10	
Total Forecast	\$402,251.66	\$412,750.43	\$423,193.01	

Workpaper Table 9-56
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K7 - Forecast Calculator

Line No.

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49 **Notes and References**

50 (G) Unit cost per year reflects actual units divided by total cost of those projects (Excludes cancelled projects and outliers). PG&E took the four-year average of unit costs (\$30,946.52, \$32,323.29, \$40,364.95, \$42,995.62).

51 (H) Escalation factors provided by GRC PMT.

52 (I) Previous year unit cost x Escalation Factor.

53 (J) Previous year unit cost + Escalation Amount.

54 (K) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

55 (L) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

2021	2022	2023	Note
\$3,966,625.80	\$3,478,372.98	\$3,584,811.20	Line (12) + Line (40)

2024	2025	2026	Note
\$3,678,374.77	\$3,774,380.35	\$3,869,872.17	Line (19) + Line (47)

Workpaper Table 9-57
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K8 - Forecast Calculator

Line No.

1 **MAT 3K8 (Test Stations)**

2	Line	Description	Value	Notes and References
3	3	2016 -2019 Average Unit Costs	\$21,511.89	(A)
4	4	Adjustments to Forecast Basis	\$0.00	
5	5	Cost Basis for Forecast	\$21,511.89	Line (1) + Line (2)

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7		2021 (E)	2022 (F)	2023	Note
8	Escalation Factor	0.91%	2.83%	3.06%	(B)
9	Escalation Amount	\$195.76	\$614.33	\$683.05	(C)
10	Forecast Unit Cost	\$21,707.65	\$22,321.98	\$23,005.03	(D)
11	Forecast Units	25	5	5	
12	Total Forecast	\$542,691.22	\$111,609.88	\$115,025.14	

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14		2024	2025	2026	Note
15	Escalation Factor	2.61%	2.61%	2.53%	(B)
16	Escalation Amount	\$600.43	\$616.10	\$612.81	(C)
17	Forecast Unit Cost	\$23,605.46	\$24,221.56	\$24,834.37	(D)
18	Forecast Units	5	5	5	
19	Total Forecast	\$118,027.29	\$121,107.81	\$124,171.83	

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21

22 **Notes and References**

23 (A) Unit cost per year reflects actual units divided by total cost of those projects (Excludes cancelled projects and outliers). PG&E took the four-year average of unit costs (\$33,587.67, \$14,431.47, \$21,626.74, \$16,401.68).

24 (B) Escalation factors provided by GRC PMT.

25 (C) Previous year unit cost x Escalation Factor.

26 (D) Previous year unit cost + Escalation Amount.

27 (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

28 (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Workpaper Table 9-58
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3K9 - Forecast Calculator

Line No.

MAT 3K9 (Dynamic DC Interference)

Line	Description	Value	Notes and References
3	Total Average Cost of Equipment Types	\$1,341,896	(A)
4	Total Different Equipment Types	7	
5	Average Unit Cost of Dynamic Projects	\$191,699.43	Line (3) / Line (4)
6	Adjustments to Forecast Basis	\$0.00	
7	Cost Basis for Forecast	\$191,699.43	Line (5) + Line (6)

	2021 (E)	2022 (F)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(B)
Escalation Amount	\$1,744.46	\$5,474.47	\$6,086.90	(C)
Forecast Unit Cost	\$193,443.89	\$198,918.36	\$205,005.26	(D)
Forecast Units	85.58	40	20	
Total Forecast	\$16,554,928.39	\$7,956,734.22	\$4,100,105.14	

	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(B)
Escalation Amount	\$0	\$0	\$0	(C)
Forecast Unit Cost	\$0	\$0	\$0	(D)
Forecast Units	0	0	0	
Total Forecast	\$0	\$0	\$0	(G)

Notes and References

- (A) Total average unit cost is four-year historical average (2016-2019) of DC interference mitigations systems installed
- (B) Escalation factors provided by GRC PMT.
- (C) Previous year unit cost x Escalation Factor.
- (D) Previous year unit cost + Escalation Amount.
- (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.
- (G) No forecast for 2024-2026 due to dynamic program completion by end of 2023

MAT 3K9 (Static DC Interference)

Line	Description	Value	Notes and References
34	2016 -2019 Average Unit Costs	\$142,341.35	(H)
35	Adjustments to Forecast Basis	\$0.00	
36	Cost Basis for Forecast	\$142,341.35	Line (34) + Line (35)

	2021 (L)	2022 (M)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(I)
Escalation Amount	\$1,295.31	\$4,064.91	\$4,519.67	(J)
Forecast Unit Cost	\$143,636.66	\$147,701.57	\$152,221.24	(K)
Forecast Units	12	20	20	
Total Forecast	\$1,723,639.87	\$2,954,031.46	\$3,044,424.83	

	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(I)
Escalation Amount	\$3,972.98	\$4,076.66	\$4,054.86	(J)
Forecast Unit Cost	\$156,194.22	\$160,270.88	\$164,325.74	(K)
Forecast Units	20	20	20	
Total Forecast	\$3,123,884.31	\$3,205,417.69	\$3,286,514.76	

Notes and References

- (H) Unit cost per year reflects actual units divided by total cost of those projects (Excludes cancelled projects and outliers). PG&E took the four-year average of unit costs (\$138,151.94, \$314,244.08, \$27,108.94, \$89,860.44).
- (I) Escalation factors provided by GRC PMT.
- (J) Previous year unit cost x Escalation Factor.
- (K) Previous year unit cost + Escalation Amount.
- (L) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.
- (M) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

	2021	2022	2023	Note
Total Forecast	\$18,278,568.26	\$10,910,765.68	\$7,144,529.97	Line (14) + Line (43)

	2024	2025	2026	Note
Total Forecast	\$3,123,884	\$3,205,418	\$3,286,515	Line (21) + Line (50)

Workpaper Table 9-59
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9, Corrosion Control
MAT 3KA - Forecast Calculator

Line No.1 **MAT 3KA (Span Mitigation)**

Line	Description	Value	Notes and References
3	2020 Cost Estimate	\$55,000.00	(A)
4	Adjustments to Forecast Basis	\$0.00	
5	Cost Basis for Forecast	\$55,000.00	Line (3) + Line (4)

6

	2021 (E)	2022 (F)	2023	Note
Escalation Factor	0.91%	2.83%	3.06%	(B)
Escalation Amount	\$500.50	\$1,570.66	\$1,746.38	(C)
Forecast Unit Cost	\$55,500.50	\$57,071.16	\$58,817.54	(D)
Forecast Units	4	7	5	
Total Forecast	\$222,002.00	\$399,498.15	\$294,087.71	

13

	2024	2025	2026	Note
Escalation Factor	2.61%	2.61%	2.53%	(B)
Escalation Amount	\$1,535.14	\$1,575.20	\$1,566.78	(C)
Forecast Unit Cost	\$60,352.68	\$61,927.88	\$63,494.66	(D)
Forecast Units	21	7	5	
Total Forecast	\$1,267,406.27	\$433,495.19	\$317,473.30	

20

21 **Notes and References**

22 (A) A 2020 cost estimate provided by PG&E's Insulation & Coatings department was used due to program being stood up as a new maintenance process thus historic costs would not be an accurate basis for forecast.

23 (B) Escalation factors provided by GRC PMT.

24 (C) Previous year unit cost x Escalation Factor.

25 (D) Previous year unit cost + Escalation Amount.

26 (E) The 2021 total forecast shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

27 (F) PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

**PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- NEW/REPLACE CATHODIC PROTECTION SYSTEMS AND CASING MITIGATION**

Project Title: NEW/REPLACE CATHODIC PROTECTION SYSTEMS AND CASING MITIGATION

Major Work Categories: 50 (MAT 50P)

Planning Order Numbers: See table below

Project Start Date: 2017

Project Completion Date: Ongoing

Operative Date (only applies to Capital):

Project Description

The CP Systems- New/Replace Program involves the capital installation and replacement of corrosion control facilities as required to maintain effective levels of cathodic protection and maximize the useful life of underground steel gas facilities. The facilities involved in the CP system include impressed current ground beds, rectifiers, remote monitoring units, and other components involved in the corrosion control system. Maintaining and installing new CP Systems is required for metallic gas-carrying distribution facilities as indicated in federal regulation 49 CFR Subpart I.

Justification

This is a required program per Subpart I of 49 CFR 192.

Cost

The estimated cost of the project for 2023 is \$17,889,430.

**Major Project Spending Estimates
(Thousands of Nominal Dollars)**

	Recorded					Forecast						Total	Workpaper Reference	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026			
CAPITAL														
MAT 50P	1,146	8,675	6,445	17,579	19,117	19,500	17,358	17,889	18,369	18,848	19,340	164,266	WP 9-86	
TOTAL PROJECT COST	1,146	8,675	6,445	17,579	19,117	19,500	17,358	17,889	18,369	18,848	19,340	164,266		

Planning Orders

MAT	Planning Orders			
50P	5523059	5523068	5523074	5523067
50P	5523060	5523069	5523075	
50P	5523061	5523070	5523076	
50P	5523062	5523071	5542193	
50P	5523063	5523072	5523065	
50P	5523064	5523073	5523066	

PACIFIC GAS AND ELECTRIC COMPANY
EXHIBIT (PG&E-3), CHAPTER 9, CORROSION CONTROL
PROJECT SUMMARY- NEW/REPLACE CATHODIC PROTECTION SYSTEMS AND CASING MITIGATION

Benefits

PG&E will comply with federal regulations and better align with industry practices

Alternatives Considered

This is a compliance workstream, no alternatives were considered.

Workpaper Table 9-60
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC 50 - Capital Historical Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	9,593	Increase in number of replacement groundbeds. This is find it and fix it work
2		5,983	
3	2017	15,576	Number of groundbeds requiring replacement reduced
4		(798)	
5	2018	14,778	Unit cost of groundbed replacement increased as work was shifted from Company drill crew to contractor crews and the number of mitigated casings increased.
6		19,772	
7	2019	34,551	Number of mitigated casings reduced due to Covid-19 restrictions and commensurate reduction in contractor resources.
8		(5,433)	
9	2020	29,118	

Note: Total amounts and amounts for each MWC are obtained from WP 9-86 by summing the relevant lines for each MWC.

Workpaper Table 9-61
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC 50 - Capital Forecast Walk - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Program/Activity		Amount	Detailed Description/Explanation
1	2020	Recorded Adjusted		29,118	
2		50D/50Q	Impr CP Systems/Casings	5,315	Increase in number of capital casing mitigations as project focus shifts from expense to capital
3		50P	ImprRelb/SysDepd-G-DpWellAnode	383	Immaterial change in cost
4	2021	Forecast		34,816	
5		50D/50Q	Impr CP Systems/Casings	4,147	2021 budget established at imputed values. The increase in 2022 returns to forecasted budget.
6		50P	ImprRelb/SysDepd-G-DpWellAnode	(2,142)	Reduction in the number of groundbeds forecast in 2022. This is find it, fix it work.
7	2022	Forecast		36,821	
8		50D/50Q	Impr CP Systems/Casings	(15,505)	Reduction in the number of capital casing mitigation as project focus shifts from capital to expense casings.
9		50P	ImprRelb/SysDepd-G-DpWellAnode	531	Immaterial change in cost
10	2023	Forecast		21,847	
11		50D/50Q	Impr CP Systems/Casings	106	
12		50P	ImprRelb/SysDepd-G-DpWellAnode	479	Immaterial change in cost
13	2024	Forecast		22,432	
14		50D/50Q	Impr CP Systems/Casings	106	Immaterial change in cost
15		50P	ImprRelb/SysDepd-G-DpWellAnode	479	Immaterial change in cost
16	2025	Forecast		23,018	
17		50D/50Q	Impr CP Systems/Casings	109	Immaterial change in cost
18		50P	ImprRelb/SysDepd-G-DpWellAnode	492	Immaterial change in cost
19	2026	Forecast		23,618	

Note: Total amounts and amounts for each MWC are obtained from WP 9-86 by summing the relevant lines for each MWC.

Workpaper Table 9-62
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC 3K - Capital Historical Walk - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	Detailed Description/Explanation
1	2016	35,277	N/A
2		2,424	
3	2017	37,701	Significant increase in pace of work primarily due to casing mitigations and installation of new test stations.
4		53,092	
5	2018	90,793	Decrease in pace of work primarily due to reduction in casing mitigations and installation of new test stations
6		(48,378)	
7	2019	42,414	N/A
8		3,490	
9	2020	45,905	

Note: Total amounts and amounts for each MWC are obtained from WP 9-86 by summing the relevant lines for each MWC.

Workpaper Table 9-63
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 9, Gas Operations Corrosion Control
MWC 3K - Capital Forecast Walk - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Program/Activity	Amount	Detailed Description/Explanation
	2020	Recorded	45,905	
		3K# Not Assigned	0	Immaterial change in cost
		3K1 Internal Corrosion	8,619	Significant increase in pace of work as program became fully staffed
		3K4 Electrical Interference - AC	8,155	Forecast pipe replacment in electrical substation
		3K5 Casing Mitigation	5,032	Pace of work for pipe replacement projects
		3K6 Cathodic Protection-New	(3,657)	Reduced pace of work to imputed budget
		3K7 Cathodic Protection-Replacemen	(1,358)	Reduced pace of work to imputed budget
		3K8 Test Station Installation	(1,452)	Annual change in pace of work
		3K9 Electrical Interference - DC	416	Immaterial change in cost
		3KA Atmospheric Corrosion	149	Immaterial change in cost
	2021	Forecast	61,807	
		3K# Not Assigned	0	Immaterial change in cost
		3K1 Internal Corrosion	(2,065)	Annual change in pace of work
		3K4 Electrical Interference - AC	(3,527)	Decrease in forecast for pipe replacement in electrical substation
		3K5 Casing Mitigation	(685)	Immaterial change in cost
		3K6 Cathodic Protection-New	(4,792)	Reduced pace of work to imputed budget
		3K7 Cathodic Protection-Replacemen	1,088	Annual change in pace of work
		3K8 Test Station Installation	(554)	Immaterial change in cost
		3K9 Electrical Interference - DC	470	Immaterial change in cost
		3KA Atmospheric Corrosion	200	Immaterial change in cost
	2022	Forecast	51,943	
		3K# Not Assigned	0	Immaterial change in cost
		3K1 Internal Corrosion	3,106	Annual change in pace of work
		3K4 Electrical Interference - AC	(5,289)	Decrease in forecast for pipe replacement in electrical substation
		3K5 Casing Mitigation	(5,333)	Reduction in pipe replacement work for casing mitigation
		3K6 Cathodic Protection-New	42	Immaterial change in cost
		3K7 Cathodic Protection-Replacemen	106	Immaterial change in cost
		3K8 Test Station Installation	3	Immaterial change in cost
		3K9 Electrical Interference - DC	(3,766)	Favorable pace of dynamic DC interference program
		3KA Atmospheric Corrosion	(105)	Immaterial change in cost
	2023	Forecast	40,708	
		3K# Not Assigned	0	Immaterial change in cost
		3K1 Internal Corrosion	340	Immaterial change in cost
		3K4 Electrical Interference - AC	76	Immaterial change in cost
		3K5 Casing Mitigation	317	Immaterial change in cost
		3K6 Cathodic Protection-New	38	Immaterial change in cost
		3K7 Cathodic Protection-Replacemen	94	Immaterial change in cost
		3K8 Test Station Installation	3	Immaterial change in cost
		3K9 Electrical Interference - DC	(4,021)	Completion of dynamic
		3KA Atmospheric Corrosion	973	Immaterial change in cost
	2024	Forecast	38,529	
		3K# Not Assigned	0	Immaterial change in cost
		3K1 Internal Corrosion	349	Immaterial change in cost
		3K4 Electrical Interference - AC	78	Immaterial change in cost
		3K5 Casing Mitigation	326	Immaterial change in cost
		3K6 Cathodic Protection-New	38	Immaterial change in cost
		3K7 Cathodic Protection-Replacemen	96	Immaterial change in cost
		3K8 Test Station Installation	3	Immaterial change in cost
		3K9 Electrical Interference - DC	82	Immaterial change in cost
		3KA Atmospheric Corrosion	(834)	Immaterial change in cost
	2025	Forecast	38,667	
		3K# Not Assigned	0	Immaterial change in cost
		3K1 Internal Corrosion	348	Immaterial change in cost
		3K4 Electrical Interference - AC	78	Immaterial change in cost
		3K5 Casing Mitigation	324	Immaterial change in cost
		3K6 Cathodic Protection-New	38	Immaterial change in cost
		3K7 Cathodic Protection-Replacemen	95	Immaterial change in cost
		3K8 Test Station Installation	3	Immaterial change in cost
		3K9 Electrical Interference - DC	81	Immaterial change in cost
		3KA Atmospheric Corrosion	(116)	Immaterial change in cost
	2026	Forecast	39,519	

Note: Total amounts and amounts for each MWC are obtained from WP 9-86 by summing the relevant lines for each MWC.

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 9
Deferred Work Analysis Summary

The Gas Transmission deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks listed below.

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (optical or imputed) units of work.

Check 3: PG&E is responsible for units of work that were not performed during the 2019-2022 period.

Check 4: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service.

Line	2023 GRC Changer	Type	MWC	MAT CODE	Description	Unit of Measure	Check 2			Deferred Work	Explanation	Units Comparison			Dollar Comparison		
							Check 1	Check 2a	Check 2b			2019 and 2020 Rec. Adj. + 2021 Forecast	2019 to 2022 Imputed	Difference	2019 and 2020 Rec. Adj. + 2021 Forecast (A)(B)	2019 to 2022 Imputed	Difference
1	9	Capital	3K	3K1	Internal Corrosion	# of flaps replaced	Y	Y	N	N	No deferred work - PG&E expects to perform all imputed units.	40.00	17.95	22.05	\$ 25,550,979	\$ 48,717,048	\$ (23,186,069)
2	9	Capital	3K	3K4	Electrical Interference - AC	Various	Y	Y	Y	N	No deferred work - All required work is forecast to be completed. In addition, this MAT is subject to a one-way balancing account.	137.31	233.32	(96)	\$ 23,480,326	\$ 48,714,450	\$ (25,234,123)
3	9	Capital	3K	3K5	Casing Mitigation	Various	Y	Y	Y	N	No deferred work - demand / compliance driven work. All groundbeds identified for installation expected to be completed.	49.00	50.10	(1)	\$ 60,386,174	\$ 91,392,006	\$ (31,004,832)
4	9	Capital	3K	3K6	Cathodic Protection-New	# of new CP systems installed	Y	Y	Y	N	No deferred work - Work is non-utilized.	81.00	105.75	(25)	\$ 28,747,181	\$ 25,645,930	\$ 3,101,251
5	9	Capital	3K	3K7	Cathodic Protection Replacement	Various	Y	Y	N	N	No deferred work - PG&E expects to perform all imputed units.	138.00	108.53	29.47	\$ 14,293,309	\$ 19,160,087	\$ (4,866,778)
6	9	Capital	3K	3K8	Test Stations Installation	# of test stations installed	N	Y	N	N	No deferred work - Work is forecast to be completed.	44.00	44.00	0	\$ 9,056,827	\$ 9,056,827	\$ 0
7	9	Capital	3K	3K9	Electrical Interference - DC	# of projects completed	Y	Y	N	N	No deferred work - PG&E expects to perform all imputed units.	338.80	130.42	208.38	\$ 38,413,760	\$ 45,906,664	\$ (6,592,904)
8	9	Capital	3K	3KA	Atmospheric Corrosion Remediation	# of spans recoated/upgraded	Y	Y	Y	N	No deferred work - All required work is forecast to be completed. In addition, this MAT is subject to a one-way balancing account.	10.00	28.03	(18)	\$ 814,420	\$ 10,304,813	\$ (9,490,393)
9	9	Capital	75	75A	Cathodic Protection	Non-Utilized	N	Y	N/A	N/A	No deferred work - Work is non-utilized.	-	-	-	\$ 4,654	\$ -	\$ 4,654
10	9	Expense	GI	G1A	Electrical Interference - AC	Various	Y	Y	Y	N	No deferred work - All known work in this program will be completed by 2022. The 2023 forecast is based on new finds in the next rate case period.	2,546.00	4,076.00	(1,530)	\$ 10,923,257	\$ 10,884,497	\$ 38,760
11	9	Expense	GI	G1B	Atmospheric Corrosion	Various	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	567.00	59.82	507.18	\$ 9,744,536	\$ 8,292,435	\$ 1,452,101
12	9	Expense	GI	G1C	Cathodic Protection Expense	Various	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	5,168.89	4,980.00	188.89	\$ 6,036,921	\$ 18,247,023	\$ (12,210,102)
13	9	Expense	GI	G1D	Test Stations	# of test stations installed	Y	Y	Y	N	No deferred work - Work is demand-driven and subject to regulatory timelines for completion. All damaged test stations are forecast to be repaired. No units have been deferred.	4.00	48.00	(44)	\$ 1,287,814	\$ 1,064,798	\$ 223,016
14	9	Expense	GI	G1E	Close Interval Survey (CIS)	Various	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	3,898.13	3,832.00	66.13	\$ 22,397,402	\$ 27,706,139	\$ (5,308,737)
15	9	Expense	GI	G1F	Electrical Interference - DC	Non-Utilized	Y	Y	N/A	N/A	No deferred work - Work is non-utilized.	-	-	-	\$ 5,333,316	\$ 2,936,031	\$ 2,397,285
16	9	Expense	GI	G1H	Internal Corrosion	Various	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	8,076.00	6,392.00	1,684	\$ 14,464,653	\$ 14,313,167	\$ 151,486
17	9	Expense	GI	G1I	Internal Corrosion	Non-Utilized	Y	Y	N/A	N/A	No deferred work - Work is non-utilized.	-	-	-	\$ 817,919	\$ 1,033,167	\$ (215,248)
18	9	Expense	GI	G1K	Corrosion Support	Non-Utilized	Y	Y	N/A	N/A	No deferred work - Work is non-utilized.	-	-	-	\$ 9,862,054	\$ 9,590,161	\$ 271,893
19	9	Expense	GI	G1L	Casings Monitoring	# of casings tested	Y	Y	Y	N	timelines for completion. All identified work will be completed. No units forecast for 2021/2022 as this work has become routine monitoring and will be moved to MAT JOB.	544.00	1,968.00	(1,424)	\$ 357,175	\$ 379,429	\$ (22,254)
20	9	Expense	GI	G1M	Casings	Various	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	4,479.00	256.00	4,223.00	\$ 19,970,387	\$ 8,148,964	\$ 11,821,424
21	9	Expense	JO	J0A	Rectifier Maintenance	# of rectifiers maintained	Y	Y	Y	N	No deferred work - Work is demand-driven. All required work is expected to be completed.	3,805.00	3,868.00	(63.00)	\$ 562,634	\$ 384,237	\$ 178,397
22	9	Expense	JO	J0B	Cathodic Protection Monitoring	# of CP monitoring point reads (P/S reads)	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	66,818.00	40,000.00	26,818.00	\$ 5,812,919	\$ 3,344,678	\$ 2,468,242
23	9	Expense	JO	J0C	Cathodic Protection Troubleshooting	# of troubleshoots	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	8,030.00	4,232.00	3,798.00	\$ 2,496,498	\$ 2,357,638	\$ 138,860
24	9	Expense	JO	J0Q	Cathodic Protection Corrective Maintenance	# of corrective work orders completed	Y	Y	Y	N	No deferred work - Work is demand-driven and subject to regulatory timelines.	1,273.00	1,776.00	(503)	\$ 1,678,072	\$ 2,862,409	\$ (1,184,336)
25	9	Expense	JO	J0Z	Atmospheric Corrosion Patrol	# of spans patrolled	Y	Y	Y	N	No deferred work - PG&E expects to perform all imputed units.	1,260.00	324.00	936.00	\$ 110,783,644	\$ 107,137,047	\$ 3,646,597
26																	
27																	
28																	
29																	
30																	

(A) Recorded and forecast values vary from the values listed in the Results of Operations (RO) Model due to errors. These amounts do not align to the RO Model provided to the Public Advocate Office at the time of filing. The RO will be updated to incorporate these errors with the Joint Comparison Exhibit submitted.

(B) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.