Pacific Gas and Electric Company's
Unit Cost Guide
Updated: April 1, 2019

In accordance with Attachment A to Decision D.16-06-052 Unit Cost Guide represents facilities generally required for interconnection. Unit Cost Guide is not binding for actual facility costs and is provided only for additional cost transparency and developer reference. For reference, Ft = Per Foot

Item #	Category 1 - 12/16kV 480 volt transformer - includes 100' Sec. cable length		
	Equipment	Unit Cost	Equipment
1	150kva & Sec. Cable(120/208V)	$39,000	
2	300kva & Sec. Cable(120/208V)	$47,000	
3	500kva & Sec. Cable - 500kva is not current standard size for PG&E	N/A	
4	750kva & Sec. Cable(480/277V)	$58,000	
5	1000kva & Sec. Cable(480/277V)	$72,000	
6	1500kva & Sec. Cable(480/277V)	$98,000	
7	2500kva, Sec. Cable- Not generally used for distribution interconnections	N/A	

#	Category 2 - Overhead to Underground (UG)- Set Pole and make up Cable		
	Equipment	Unit Cost	Equipment
1	Primary UG Service up to 200ft cable	$45,000	
2	Pri 350 Cable - PG&E does not separate costs for different cable size	N/A	
3	Pri 1000 Cable - PG&E does not separate costs for different cable size	N/A	

#	Category 3 - Overhead (OH) Service		
		Unit Cost	Equipment
1	Primary Service-OH include 1 span ovh line	$20,000	
2	New Conductor extension from POI to PCC	$120/ft	

#	Category 4 - Underground to Underground - Cable with Terminators		
	Equipment	Unit Cost	Equipment
1	Pri Low Ampacity Cable - PG&E does not separate costs for different cable size	N/A	
2	Pri High Ampacity Cable - PG&E does not separate costs for different cable size	N/A	
3	UG Reconductor- repull or customer installed conduits	$130/ft	
4	New UG Line(SF)- Trench and Install	$495/ft	
5	Padmounted Visible SW at PCC	$45,500	
6	New Feeder and Conduit -Addressed Under Prior Category	N/A	
7	New 1000 KCMIL AL Cable and Connections (ft) Addressed Under Prior Category	N/A	
8	New 2/0 AL cable and connections - Addressed Under Prior Category	N/A	

#	Category 5 - Metering		
	Equipment	Unit Cost	Equipment
1	Secondary Service Metering	$5,000	
2	Primary Service Metering	$15,000	
3	33kV Pole Top - Not generally used for PG&E	N/A	

#	Category 6 - Telemetry		
	Equipment	Unit Cost	Equipment
1	Overhead SCADA Recloser	$80,000	
2	Underground SCADA Switch	$130,000	
3	N/A	N/A	
4	Dedicated Remote Terminal Unit	$120,000	
5	Bi-directional watt transducer - Not generally used at PG&E	N/A	

6	Data Point addtion and existing HMI - Not generally used at PG&E	N/A	
7	Overhead Remote Control Switch - Not generally used at PG&E	N/A	

Category 7 - System Equipment		
# Equipment	Unit Cost	Equipment
1 New overhead Air Switch	$30,000	
2 New Capacitor OH	$33,000	
3 PME 5 Padmount Switch	$57,000	
4 New Capacitor Padmounted	$47,000	
5 New Regulator- Close Delta	$150,000	
6 33kV Regulator 3-690/722 - Not generally used at PG&E	N/A	
7 New Voltage Regulator 600A Padmount with two switches - Not generally used at SCE	N/A	
8 Grounding/Stabilizing Transformer- Pole Mounted	$20,000	
9 Grounding/Stabilizing Transformer- Padmounted	$52,000	
10 Conductor (Per feet) - Overhead-Urban	$220/ft	
11 Reconductor (Per feet) - Overhead-Rural	$130/ft	
12 Reconductor (Per feet) - UG	$260/ft	
13 New Steel Pole (not priced separately, would be part of facility supporting need for pole)	N/A	
14 New Wooden Pole (not priced separately, would be part of facility supporting need for pole)	N/A	
15 Overhead Fuses	$10,000	
16 Fuse Cabinet UG 3 phase - Not generally used at PG&E	N/A	
17 Relocate Capacitor Bank	$18,000	
18 Regulator Control settings modifications	$2,500	
19 Relocate Regulator	$50,000	
20 Add a third Regulator to close the Delta	$55,000	
21 New Regulator - Closed Delta	$150,000	
22 Reclose blocking	$145,000	
23 Hardwire Tripping from Transformer Hi-side	$60,000	
24 Substation LTC Control change out	$60,000	
25 New IPAC relay cabinet for bi-direction power flow	$125,000	
26 Direct Transfer Trip	$600,000	
27 New Substation Circuit Breaker - Not generally used for distribution interconnections	N/A	
28 New 28MVA 69/12kV Transformer - Not generally used for distribution interconnections	N/A	
29 New 28MVA 138/12kV Transformer - Not generally used for distribution interconnections	N/A	

Unit Costs Guide - September 21, 2016 - Acronym Table

Acronym	Description
ITCC	Income Tax Component of Contribution
CIAC	Contributions in Aid of Construction
IF	Interconnection Facilities
DU	Distribution Upgrades
PCC	Point of Common Coupling
POI	Point of Interconnection
UG	Underground
OH, OVH	Overhead
DER	Distributed Energy Resource
DG	Distributed Generation
IC	Interconnection Customer
SLD	Single Line Diagram
ROW	Right of Way
BLM	Bureau of Land Management
SCADA	Supervisory Control and Data Acquisition
RTU	Remote Terminal Unit
GS	Gas Switch
PME	Pad Mount Equipment
COO	Cost of Ownership

Overall Disclosure - Unit Cost Guide Dated September 21, 2016

The impacts identified below are only examples of items based upon historic experience. While effort has been made to include numerous examples, this list is not meant to be viewed as all inclusive and is for illustrative purposes only. Impacts are not always know in advance and final estimates are driven by project specific conditions as reviewed during the system review process.

Examples of Potential Factors Effecting Rule 21 Estimated or Actual Costs

1 3rd Party or Multi-Party Easements

Example: Roof top solar project on leased building. Significant added coordination to obtain easements. Leasing tenant and/or developer failed to engage building owner of need for interconnection facilities in advance of proceeding with project. This issue is compounded when the site plans and drawings provided do not include surveyed property lines. Even with approval, 3rd party easements require additional document preparation, review and processing.

2 City Restrictions

Example: Traffic control in a school area limited work to 9:00 AM to 2:00, doubled project duration (days) of project, impacted efficiency and doubled traffic control and number of resource mobilizations (Road moratorium, customer research)

3 Local Jurisdiction Improvements

Example: Long term city plan for road widening. Required existing pole to be set back to get jurisdictional permits. Critical that customer communicate plans with city well in advance to determine required upgrades or improvements.

4 Outage Coordination

Utilities make best efforts to balance impacts to all customer when taking outages. Multiple customer needs must be considered. While there is obligation to get service connected impact to existing customer(s) must be considered.

5 Pole Height Restrictions

Deteriorated pole condition requires a replacement. Under build requires pole change and taller pole is restricted by view or other issues. Local airport restrictions on pole height.

6 Underground Impairments & Structure Limits

Errors in customer base map for underground. Mapping can not forecast underground structure volume available for new facilities. Overcrowded structures can be an issue.

7 Undisturbed Grounds

Customer environmental survey work does not take into account potential utility work.

8 Customer Base Map Quality

Low quality customer base maps requiring field visits, surveying and multiple back and forth communication to get correct details. Often causes months of delay to project construction.

9 Neighboring Customer Impacts

Customer on circuit with seasonal operation would be excessively impacted by outage. Circuit with high level of critical care customers. Generator required to support outage. Construction anticipated in winter months or during storm season.

10 Topology

What appeared to be "drainage channel" was classified as waterway and required long span crossing

11 Customer Civil Work

A high number or projects see delays in start and completion of customer civil work that extends project duration and can result in added crew trips to site for re-starts. Heavily impacts crew scheduling.

12 Requested Project Timing

Construction anticipated in winter months or during storm season.

PG&E Cost Table Assumptions - Unit Cost Guide Dated September 21, 2016

Assumptions

1	All labor is straight time and based on a 5 day work week schedule. Overtime may be required due to clearances and work hour restrictions to meet project schedules.
2	Unit costs include costs to procure materials, installation, engineering, project management costs, for majority of scenarios
3	Unit costs exclude generator's responsibility for Income Tax Component of Contribution (ITCC), (will be added to total cost estimates, if required)
4	Unit costs exclude environmental monitoring and mitigations
5	Unit Costs assume that operational clearances are available as required.
6	Unit Costs do not include Cost of Ownership (COO)
7	Unit Costs do not assume permitting and licensing related costs

Project Examples - Unit Cost Table Dated April 1, 2019

Examples provided for illustrative purposes only and is not binding for actual facility costs

Scenarios < 1MW:

Project 1	**Unit**	**Quantity**	**Cost ($)**	**Category**	
Secondary Revenue Metering	EA	1	$5,000	5	This is an 890kW PV system interconnecting to existing overhead secondary service located on a low DG penetration feeder close to existing OVH with no line regulator. Based on the size of the new DER the existing secondary cable and transformer requires upgrading. The main feeder and primary conductor does not require any upgrades.
Transformer Upgrade to 1000kVA	EA	1	$72,000	1	
		Subtotal	**$77,000**		
		Income Tax Component of Contribution (ITCC)	$18,480		
		One-time Cost of Ownership	$69,540		
		Total	**$165,020**		
Project 2					
Interconnection Facilities					
New Primary OH extension to PCC	FT	500	$60,000	3	This is a 520kW PV system interconnecting to new overhead primary service located approximately 700ft from existing OVH with line regulator.
Primary Revenue Metering	EA	1	$15,000	5	
Visible Disconnect Switch (Customer Option to install)	EA	1	$30,000	7	
Primary Service-OH include 1 span 200ft OVH	EA	1	$20,000	3	
		Total	**$125,000**		
Distribution Upgrades					
Relocate Existing Regulator	EA	1	$50,000	7	
Install new Switch Capacitor	EA	1	$33,000	7	
Upgrade Existing Fuse	EA	1	$10,000	7	
		Subtotal	**$93,000**		
		Income Tax Component of Contribution (ITCC)	$22,320		
		One-time Cost of Ownership	$83,990		
		Total	**$199,310**		
Project 3					
Interconnection Facilities					This is an 880kW PV system interconnecting to new overhead primary service located close to existing OVH with line regulator on high DG penetration feeder.
Primary Revenue Metering	EA	1	$15,000	5	
Visible Disconnect Switch (Install by IC per SLD)	EA	N/A		7	
Primary Service-OH	EA	1	$20,000	3	
		Total	**$35,000**		
Distribution Upgrades					

Hardwire trip from bank protection to Feeder breaker	EA	1	$60,000	7	
Hardwire trip from Bus Total Overcurrent to Feeder breaker	EA	1	$60,000	7	
Modify existing Regulator Control settings	EA	2	$5,000	7	
Upgrade Existing Fuse	EA	1	$10,000	7	
		Subtotal	**$135,000**		

Scenarios > 1MW:

Project 4

Primary Revenue Metering (existing)	EA	N/A			This is a 988kW PV system interconnecting to an existing overhead primary service located on a low DG penetration feeder close to existing OVH with no line regulator. There is an existing 1MW battery storage system on site. The main feeder and primary conductor does
Overhead SCADA Recloser	EA	1	$80,000	6	
		Subtotal	**$80,000**		

Project 5

Interconnection Facilities

					This is a 2.2MW PV system interconnecting to a new overhead primary service located close to existing OVH on high DG penetration feeder with reverse power flow to the Transmission System.
Primary Revenue Metering	EA	1	$15,000	5	
Visible Disconnect Switch	EA	1	$30,000	7	
Primary Service-OH	EA	1	$20,000	3	
Overhead SCADA Recloser	EA	1	$80,000	6	
		Total	**$145,000**		

Distribution Upgrades

Hardwire trip from bank protection to Feeder Breaker	EA	1	$60,000	7	
Hardwire trip from Bus Total Overcurrent to Feeder Breaker	EA	1	$60,000	7	
Reconductor 1500ft #6 Cu	FT	1500	$195,000	7	
Install IPAC cabinet for reclose blocking	EA	1	$125,000	7	
Add hardwire to existing Direct Transfer Trip	EA	1	$60,000	7	
		Subtotal	**$500,000**		

Project 6

Interconnection Facilities

					This is a 1.85MW Wind Turbine Generator interconnecting to existing underground secondary service. Existing transformer was adequately sized for new generation.
Secondary Revenue Metering (existing)	EA	N/A			
Visible Disconnect Switch (Install by IC per SLD)	EA	N/A			
Pad-Mounted Ground Fault detection Bank	EA	1	$52,000	7	
Underground SCADA switch	EA	1	$130,000	6	
		Total	**$182,000**		

Distribution Upgrades

Reclose blocking at Feeder breaker	EA	1	$145,000	7	
		Subtotal	**$145,000**		

Project 7

Interconnection Facilities

Primary Revenue Metering	EA	1	$15,000	5
Visible Disconnect Switch (Install by IC per SLD)	EA	N/A		
Ground Fault Detection (Install by IC per SLD)	EA	N/A		
Primary Service-Underground	EA	1	$45,000	2
Overhead SCADA Recloser	EA	1	$80,000	6
		Subtotal IF	**$140,000**	

Distribution Upgrades

Hardwire trip from bank protection to Feeder circuit Breaker	EA	1	$60,000	7
Install Reclose Blocking on feeder	EA	1	$145,000	7
Reconductor 4200 feet of 4ASCR	FT	4200	$546,000	7
Add a third Regulator to close Open Delta Reg	EA	1	$55,000	7
		Subtotal DU	**$806,000**	
		Subtotal IF & DU	**$946,000**	

This is a 2MW Synchronous Generator interconnecting to new a primary service located far from the existing substation on high DG penetration feeder with reverse power flow to the Transmission System.

Project 8

Interconnection Facilities

Ground Fault Sensing BankTransformer-OH	EA	1	$30,000	7
Overhead SCADA Recloser to replace existing fuse at POI	EA	1	$80,000	6
		Subtotal IF	**$122,500**	

Distribution Upgrades

Install Reclose Blocking at substation	EA	1	$145,000	7
		Subtotal DU	**$145,000**	
		Total IF & DU	**$267,500**	

This is a 200KW Synchronous Generator interconnecting to existing secondary service located far from the existing substation

NOTE: Costs for Income Tax Component of Contribution (ITCC) per Electric Preliminary Statement Part J and Cost of Ownership per Rule 2 are calculated for Example 1 and 2 only, but are applicable to all examples. These costs are subject to change and can be referenced at:

Electric Preliminary Statement Part J

Rule 2

PG&E Escalation Factors

Link to: 2016 PG&E Final Generator Interconnection Unit Cost Guide
Dated September 21, 2016

OVERVIEW :

Current PTO Unit Cost Guide as posted on the CAISO website is in 2016 Constant Dollars.
PTO's cost estimating is done in constant dollars and then escalated over the years during which the project will be constructed, arriving at project costs in nominal dollars.
Current escalation rates used to arrive at costs in nominal dollars are from for total electric transmission plant from IHS Global Insight's Q3 2015 Power Planner forecast.

DEFINITIONS USED :

Project Cost in Constant Dollars represents the cost of the Project if all costs were paid for at a single point in time.

Project Cost in Nominal Dollars represents the cost of the Project taking into account when actual dollars will be spent.
Mathematical formula: **Cost in Nominal Dollars = Cost in Constant Dollars + Escalation**
= Cost in Constant Dollars x Escalation Factor

CURRENT PTO ESCALATION RATES *:

	2019	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*
Escalation Rates	2.72%	2.44%	2.35%	2.08%	2.21%	2.19%	2.22%	2.18%	2.25%	2.00%	2.14%
2016 Escalation Factors	1.000	1.024	1.048	1.070	1.094	1.118	1.143	1.168	1.194	1.218	1.244

* Escalation Rates are from IHS Global Insight's 3rd Quarter 2018 Power Planner (released October 2018) electric utility

https://www.caiso.com/informed/Pages/StakeholderProcesses/ParticipatingTransmissionOwnerPerUnitCosts.aspx