

2016-2017 ISO Reliability Assessment - Final Study Results

Study Area: **PG&E Bulk Sensitivity**

*Thermal Overloads*



ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)						Potential Mitigation Solutions
					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE BIK-T-1	LOS BANOS - QUINTO_SS 230 kV	normal conditions	P0	normal	<95%	<95%	98.5%	101.6%	<95%	<95%	congestion management: reduce generation from the project connected to the Panoche-Los Banos 230 kV line to the total output of 150 MW. Or consider line upgrade
PGE BIK-T-2	MOSSLANDING-LAS AGUILAS 230 kV	normal conditions	P0	normal	<95%	<95%	102.0%	97.8%	<95%	<95%	congestion management if overload: reduce output of the project connected to Las Aguilas, increase generation from Moss Landing
PGE BIK-T-3	WILSON A-LE GRAND 115 kV	normal conditions	P0	normal	<95%	<95%	100.6%	99.5%	<95%	<95%	congestion management if overload: reduce solar PV output from Chowchilla 115 kV
PGE BIK-T-4	CHICO JCT-ANITA 60 kV	normal conditions	P0	normal	102.5%	111.9%	<95%	<95%	119.0%	112.7%	radial line, section of Glenn-Anita line, mitigation in area studies
PGE BIK-T-5	GLENN-CAPAY JCT - HEADGATE 60 kV	normal conditions	P0	normal	<95%	101.9%	<95%	<95%	109.5%	102.4%	mitigation in area studies
PGE BIK-T-6	TAFT-TX_BV_HILLS 70 kV	normal conditions	P0	normal	<95%	98.9%	<95%	<95%	99.3%	95.1%	radial line, section of Taft-Elk Hills 70 kV, mitigation in area studies
PGE BIK-T-7	JCBS TAP-GUR3TPT 70 kV (Guersney-Jacobs Corner)	normal conditions	P0	normal	<95%	<95%	<95%	<95%	127.9%	116.5%	congestion management, reduce generation from Guersney
PGE BIK-T-8	GUERSNEY-GUR3TPT 70 kV (Guersney-Jacobs Corner)	normal conditions	P0	normal	<95%	<95%	<95%	<95%	105.7%	<95%	congestion management, reduce generation from Guersney
PGE BIK-T-11	E. NICOLAUS-PLUMAS 60 kV	normal conditions	P0	normal	<95%	<95%	<95%	<95%	106.7%	99.7%	radial line, mitigation in area studies
PGE BIK-T-12	AVENAL T - KETTLEMAN T 70 kV	normal conditions	P0	normal	162.8%	<95%	97.0%	<95%	<95%	<95%	reduce output from Sun City and/or Sandrag
PGE BIK-T-13	KETTLEMAN T -GATES 70 kV	normal conditions	P0	normal	114.9%	<95%	<95%	<95%	<95%	<95%	reduce output from Sun City and/or Sandrag
PGE BIK-T-2	MOSSLANDING-LAS AGUILAS 230 kV	Moss Landing -Los Banos 500 kV	P1	L-1	115.0%	<95%	139.3%	136.6%	<95%	<95%	reduce output of the project connected to Las Aguilas, increase generation from Moss Landing, reduce Path 15 flow. Use short-term rating
		Los Banos-Midway 500 kV	P1	L-1	<95%	<95%	103.4%	100.0%	<95%	<95%	
		Los Banos-Gates 500 kV # 1	P1	L-1	<95%	<95%	108.2%	104.6%	<95%	<95%	
		Los Banos-Gates 500 kV # 3	P1	L-1	<95%	<95%	99.5%	<95%	<95%	<95%	
		Metcalf-Tesla 500 kV	P1	L-1	98.4%	<95%	106.9%	103.1%	<95%	<95%	
		Moss Landing -Metcalf 500 kV	P1	L-1	<95%	<95%	<95%	102.7%	<95%	<95%	
		Los Banos-Tracy 500 kV	P1	L-1	<95%	<95%	101.8%	<95%	<95%	<95%	
		Los Banos-Tesla 500 kV	P1	L-1	<95%	<95%	104.6%	101.1%	<95%	<95%	
		Moss Landing 500/230 kV x-former	P1	T-1	102.7%	<95%	114.2%	106.9%	<95%	<95%	
PGE BIK-T-1	LOS BANOS - QUINTO_SS 230 kV	Moss Landing -Los Banos 500 kV	P1	L-1	<95%	<95%	104.0%	107.2%	<95%	<95%	reduce generation from the project connected to the Panoche-Los Banos 230 kV line to the total output of 150 MW under normal conditions, use short-term rating if still overload
		Los Banos-Tracy 500 kV	P1	L-1	<95%	<95%	111.8%	115.6%	<95%	<95%	
		Moss Landing -Metcalf 500 kV	P1	L-1	<95%	<95%	98.8%	102.7%	<95%	<95%	
		Los Banos-Tesla 500 kV	P1	L-1	<95%	<95%	116.9%	120.7%	<95%	<95%	

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					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE BIK-T-14	ROUND MTN –TABLE MTN #1 or #2 500 kV	Rnd Mtn –Table Mtn #2 or # 1 500 kV	P1	L-1	100.0%	103.4%	<95%	<95%	103.7%	101.2%	bypass ser caps on the remaining Round Mtn-Table Mtn 500 kV line or Tbl Mtn-Vaca Dix or reduce COI flow according to seasonal nomogram
PGE BIK-T-15	ROUND MTN 500/230 kV x-former	Olinda 500/230 kV transformer	P1	T-1	<95%	<95%	102.0%	103.0%	<95%	<95%	congestion management, reduce some Pit River generation or add Round Mtn x-former to Colusa SPS
PGE BIK-T-16	OLINDA 500/230 kV x-former	Round Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	98.0%	99.5%	<95%	<95%	use Colusa SPS if overload
PGE BIK-T-1	LOS BANOS - QUINTO_SS 230 kV	Metcalf 500 kV stuck breaker	P4	BRK	<95%	<95%	98.7%	102.3%	<95%	<95%	congestion management: reduce generation from the project connected to the Panoche-Los Banos 230 kV line to the total output of 150 MW under normal conditions, use short-term raring if still overload
		Moss Landing 500 kV stuck breaker	P4	BRK	<95%	<95%	104.4%	107.2%	<95%	<95%	
		Los Banos 500 kV stuck breaker	P4	BRK	<95%	<95%	115.9%	119.0%	<95%	<95%	
PGE BIK-T-2	MOSSLANDING-LAS AGUILAS 230 kV	Los Banos stuck Brk 500 kV	P4	BRK	<95%	<95%	114.8%	111.7%	<95%	<95%	reduce output of the project connected to Las Aguilas, increase generation from Moss Landing, use short-term rating,
		Gates 500 kV stuck breaker	P4	BRK	<95%	<95%	98.6%	<95%	<95%	<95%	
		Mosslanding stuck Brk 500 kV	P4	BRK	115.0%	<95%	139.3%	136.63	<95%	<95%	
PGE BIK-T-3	WILSON A-LE GRAND 115 kV	Los Banos stuck Brk 500 kV	P4	BRK	<95%	<95%	99.5%	98.7%	<95%	<95%	congestion management if overload: reduce solar PV output from Chowchilla 115 kV
PGE BIK-T-14	ROUND MTN –TABLE MTN #1 or #2 500 kV	Table Mtn-Thermalito 230 kV & Round Mtn-Table Mtn #2 or # 1	P6	L-1/L-1	108.6%	114.2%	<95%	<95%	109.8%	111.3%	bypass ser caps on the remaining Round Mtn-Table Mtn 500 kV line or Tbl Mtn-Vaca Dix or reduce COI flow according to seasonal nomogram
		Table Mtn 500/230 kV x-former & Round Mtn-Table Mtn #2 or # 1	P6	T-1/L-1	119.4%	105.5%	<95%	<95%	119.5%	102.2%	
		Tracy-Tesla 500 kV & Round Mtn-Table Mtn #2 or # 1	P6	L-1/L-1	109.6%	111.4%	<95%	<95%	109.8%	106.4%	
		Table Mtn-Oroville 230 kV & Round Mtn-Table Mtn #2 or # 1	P6	L-1/L-1	106.4%	113.1%	<95%	<95%	108.1%	110.5%	
		Delevan-Cortina 230 kV & Round Mtn-Table Mtn #2 or # 1	P6	L-1/L-1	104.1%	108.6%	<95%	<95%	106.7%	103.7%	
		Tracy 500/230 kV x-former kV & Round Mtn-Table Mtn #2 or # 1	P6	T-1/L-1	100.7%	106.6%	<95%	<95%	104.1%	105.4%	
		one 230 kV line in N.Cal & Round Mtn-Table Mtn #2 or # 1	P6	L-1/L-1	up to 107%	up to 103%	<95%	<95%	up to 112%	up to 103%	
PGE BIK-T-14	ROUND MT -TABLE MT 500 kV #1 (or #2)	Round Mountain-Table Mountain #1 (or # 2) and Olinda-Tracy 500 kV	P6	L-1/L-1	104.7%	113.1%	<95%	<95%	110.1%	112.3%	Reduce COI flow after first contingency past 3200 MW mandated by Operational Procedure. Bypass series caps on remaining Round Mtn-Table Mtn line if overload
		Round Mountain-Table Mountain #1 (or # 2) and Capt Jack-Olinda 500 kV	P6	L-1/L-1	98.2%	103.5%	<95%	<95%	101.0%	102.8%	
		Olinda-Tracy 500 kV & Capt Jack-Olinda 500 kV	P6	L-1/L-1	<95%	<95%	107.2%	107.0%	<95%	<95%	
		Olinda-Tracy 500 kV & Olinda 500/230 kV x-former	P6	L-1/T-1	<95%	<95%	107.6%	107.4%	<95%	<95%	



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PGE Blk-T-15	ROUND MTN 500/230 kV x-former	Round Mtn-Table Mtn #1 or 2 500 kV & Olinda 500/230 kV x-former	P6	L-1/T-1	<95%	<95%	102.7%	104.4%	<95%	<95%	reduce some Pit River generation after first contingency or add Round Mtn x-former to Colusa SPS
		Captain Jack-Olinda & Olinda 500/230 kV x-former	P6	L-1/T-1	<95%	<95%	107.2%	105.4%	<95%	<95%	
		KE South-Obanion 230 kV & Olinda 500/230 kV x-former	P6	L-1/T-1	<95%	<95%	107.2%	107.4%	<95%	<95%	
		230 kV line in Olinda area & Olinda 500/230 kV x-former	P6	L-1/T-1	<95%	<95%	up to 107%	up to 107%	<95%	<95%	
		Capt Jack-Olinda 500 kV and Table Mtn 500/230 kV x-former	P6	T-1/L-1	<95%	<95%	99.7%	99.7%	<95%	<95%	
PGE Blk-T-2	MOSSLANDING-LAS AGUILAS 230 kV	Mosslanding-Los Banos 500 kV & Tesla-Metcalf 500 kV	P6	L-1/L-1	diverged	<95%	214.6%	214.1%	97.7%	<95%	Dispatch Moss Landing generation, reduce generation connected to Las Aguilas
		Tesla-Los Banos 500 kV & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	136.2%	<95%	173.5%	174.2%	<95%	<95%	
		Tesla-Tracy 500 kV & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	122.8%	124.8%	144.8%	142.7%	<95%	<95%	
		Tracy-Los Banos 500 kV & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	128.3%	<95%	163.8%	163.2%	<95%	<95%	
		Mosslanding 500/230 kV x-former & Mosslanding - Coburn 230 kV	P6	L-1/T-1	125.7%	<95%	140.8%	133.0%	<95%	<95%	
		Mosslanding 500/230 kV x-former & other 230 kV lines	P6	L-1/T-1	up to 117%	<95%	up to 117%	up to 120.2%	<95%	<95%	
		Moss Landing 500/230 kV x-former & Metcalf-Moss Landing 500 kV	P6	T-1/L-1	131.2%	<95%	147.0%	130.7%	<95%	<95%	
		Moss Landing 500/230 kV x-former & other 500 kV lines	P6	T-1/L-1	up to 124%	<95%	up to 126%	up to 121.2%	<95%	<95%	
		Mosslanding-Coburn 230 kV & 500 kV line from Los Banos	P6	L-1/L-1	up to 137%	<95%	up to 165.3%	up to 162.1%	<95%	<95%	
		Moss Landing-Los Banos 500 kV & Westley-Quinto 230 kV	P6	L-1/L-1	133.4%	<95%	159.2%	157.5%	<95%	<95%	
		Moss Landing-Los Banos 500 kV & other 230 kV lines 230 kV	P6	L-1/L-1	up to 133%	<95%	up to 159%	up to 151.2%	<95%	<95%	
		other 500 kV lines & Westley-Quinto or Tesla-Quinto230 kV	P6	L-1/L-1	up 131%	<95%	up to 157%	up to 122.9%	<95%	<95%	
PGE Blk-T-19	MOSS LANDING-COBURN 230 kV	Metcalf-Tesla 500 kV & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	diverged	<95%	103.5%	103.0%	<95%	<95%	Dispatch Moss Landing generation after first contingency
		Moss Landing - Las Aguilas 230 kV & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	98.8%	97.0%	<95%	<95%	
		Moss Langing-Los Banos 500 kV & Tesla-Los Banos 500 kV	P6	L-1/L-1	123.6%	<95%	157.2%	163.8%	<95%	<95%	
		Tesla-Los Banos 500 kV & Tracy-Los Banos 500 kV	P6	L-1/L-1	125.1%	<95%	191.8%	125.2%	<95%	<95%	
		Moss Langing-Los Banos 500 kV & Tracy-Los Banos 500 kV	P6	L-1/L-1	114.7%	<95%	145.8%	152.1%	<95%	<95%	

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					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE BIK-T-1	LOS BANOS - QUINTO_SS 230 kV	Tesla-Los Banos 500 kV & Metcalf-Moss Landing 500 kV	P6	L-1/L-1	107.9%	<95%	142.4%	149.9%	<95%	<95%	dispatch Moss Landing generation, reduce generation from the project connected to the Panoche-Los Banos 230 kV line, use short term rating if still overload. Consider line upgrade
		Tracy-Los Banos 500 kV & Metcalf-Moss Landing 500 kV	P6	L-1/L-1	101.9%	<95%	133.8%	140.6%	<95%	<95%	
		Moss Langing-Los Banos 500 kV & 230 kV line	P6	L-1/L-1	up to 100%	<95%	up to 122%	up to 116.0%	<95%	<95%	
		Tesla-Los Banos 500 kV & a 230 kV line	P6	L-1/L-1	up to 101%	<95%	up to 125%	up to 130.0%	<95%	<95%	
		Tracy-Los Banos & a 230 kV line	P6	L-1/L-1	up to 97%	<95%	up to 121%	up to 125%	<95%	<95%	
PGE BIK-T-20	WESTLEY - QUINTO_SS 230 kV	Moss Landing-Los Banos 500 kV & Tesla-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	97.6%	101.5%	<95%	<95%	reduce generation connected to Los Banos-Westely line after first contingency
PGE BIK-T-61	PALERMO-PEASE 115 kV	Table Mtn 500/230 kV x-former & Colgate-Rio Oso 230 kV	P6	L-1/L-1	101.8%	<95%	<95%	<95%	<95%	<95%	dispatch Yuba city peaking generation after first contingency
PGE BIK-T-24	LAS AGUILASS - PANOCHE 230kV # 1 or 2	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	diverged	<95%	106.2%	105.8%	<95%	<95%	Dispatch Moss Landing generation after first contingency
PGE BIK-T-25	METCALF 500/230 kV x-former #11, 12 or 13	Metcalf 500/230 kV Tranformers #11 and #12 or #13	P6	T-1/T-1	up to 140%	<95%	up to 118%	up to 123.0%	up to 102%	<95%	dispatch Ls Esteros peakers after 1st contingency, and Metcalf Energy Centr, trip load in San Jose if overload persists
		Metcalf 500/230 kV # 11,12 or 13 & Moss Landing 500/230 kV x-formers	P6	T-1/T-1	105.3%	<95%	<95%	<95%	<95%	<95%	
PGE BIK-T-26	MIDWAY 500/230 kV x-former #1, 2 or 3	MIDWAY 500/230 kV x-former #1& 2 or 2&3 or 1&3	P6	T-1/T-1	<95%	<95%	112.8%	106.3%	<95%	<95%	reduce generation at Midway 230 kV after first contingency
PGE BIK-T-27	LS ESTEROS - NWK DIST 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	diverged	<95%	113.1%	114.0%	<95%	<95%	dispatch Ls Esteros peakers after 1st contingency
		Tesla-Metcalf 500 kV & Moss Landing-Metcalf 500 kV	P6	L-1/L-1	100.9%	<95%	<95%	<95%	<95%	<95%	
PGE BIK-T-28	NEWARK E - NWK DIST 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	diverged	<95%	110.5%	111.7%	<95%	<95%	Dispatch generation in San Jose after first contingency
		Tesla-Metcalf 500 kV & Moss Landing-Metcalf 500 kV	P6	L-1/L-1	99.7%	<95%	<95%	<95%	<95%	<95%	Dispatch generation in San Jose after first contingency
PGE BIK-T-16	OLINDA 500/230 kV x-former	Round Mtn 500/230 kV x-former & Olinda (or KE South)-Obanion 230 kV	P6	T-1/L-1	<95%	<95%	104.9%	104.3%	<95%	<95%	use Colusa SPS for off-peak overload
		Round Mtn and Table Mtn 500/230 kV x-formers	P6	T-1/L-1	<95%	<95%	103.4%	103.9%	<95%	<95%	
		Round Mtn 500/230 kV x-former & Round Mtn-Table Mtn 500 kV # 1 or # 2	P6	T-1/L-1	<95%	<95%	99.2%	99.9%	<95%	<95%	
		Round Mtn 500/230 kV x-former & Cortina-Vaca Dix 230 kV	P6	T-1/L-1	<95%	<95%	100.7%	101.9%	<95%	<95%	
		Round Mtn 500/230 kV x-former & Cortina-Delevan 230 kV	P6	T-1/L-1	<95%	<95%	102.0%	104.1%	<95%	<95%	
		Round Mtn 500/230 kV x-former & 230 kV line between Cottonw & Roseville	P6	T-1/L-1	<95%	<95%	up to 104%	up to 104%	<95%	<95%	





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PGE BIK-T-29	TRACY 500 /230 kV x-former #1 or # 2	Tesla-Tracy 500 kV Line and Tracy 500/230 kV x-former # 2 or # 1	P6	L-1/T-1	137.8%	<95%	<95%	<95%	102.7%	<95%	open Tracy-Tesla 230 kV lines if overload, trip Tracy pumps if it persists or dispatch generation in SMUD after first contingency
PGE BIK-T-56	NEWARK-LOCKHEED JCT #1 115 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	diverged	<95%	<95%	<95%	99.6%	<95%	Dispatch generation in San Jose after first contingency
PGE BIK-T-33	TRIMBLE-SJB DG 115 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	diverged	106.0%	116.8%	118.3%	116.0%	119.6%	Dispatch generation in San Jose after first contingency
		Tesla-Metcalf 500 kV & Moss Landing-Metcalf 500 kV	P6	L-1/L-1	<95%	99.5%	<95%	<95%	102.2%	109.9%	
PGE BIK-T-34	COTTONWD E-ROUND MTN 230kV #2	COTTONWD E-RND MTN 230kV #1 or 2 & Round Mtn 500/230 kV x-former	P6	L-1/T-1	<95%	<95%	97.9%	98.1%	<95%	<95%	not a violation, monitor this line
		COTTONWD E-RND MTN 230kV #1 or 2 & Captain Jack-Olinda 500 kV	P6	L-1/L-1	99.9%	<95%	<95%	<95%	<95%	<95%	not a violation, monitor this line
PGE BIK-T-35	COTTONWD E-ROUND MTN 230kV #3	COTTONWD E-RND MTN 230kV #1 or 2 & Round Mtn 500/230 kV x-former	P6	L-1/T-1	101.8%	101.5%	109.9%	110.0%	101.4%	101.4%	upgrade the line, or limit COI import within nomogram for peak, reduce Pit River generaion after 1st contingency for off-peak and if first contingency is 230 kV line
		Table Mtn 500/230 kV x-former & Captain Jack-Olinda 500 kV	P6	T-1/L-1	104.1%	97.7%	<95%	<95%	<95%	<95%	
		COTTONWD E-RND MTN 230kV #1 or 2 & Captain Jack-Olinda 500 kV	P6	L-1/L-1	111.8%	104.2%	<95%	<95%	100.3%	96.6%	
PGE BIK-T-36	OLINDAW - COTWWAP2 230 kV	Round Mtn 500/230 kV x-former and OLINDAW- COTWDWAP 230 kV	P6	L-1/T-1	<95%	<95%	108.6%	109.9%	<95%	<95%	reduce Shasta generation
	OLINDAW - COTWWAP 230 kV	Round Mtn 500/230 kV x-former and OLINDAW- COTWDWAP2 230 kV	P6	L-1/T-1	<95%	<95%	112.4%	109.0%	<95%	<95%	
		Round Mtn 500/230 kV x-former and COTWWAP2 - COTWD_F2 230	P6	L-1/T-1	<95%	<95%	104.7%	105.1%	<95%	<95%	
		Capt Jack-Olinda 500 kV and COTWWAP2 - COTWD_F2 230	P6	L-1/T-1	102.3%	98.7%	<95%	<95%	97.7%	100.7%	
PGE BIK-T-37	DELEVAN-CORTINA 230 kV	Olinda-Tracy 500 kV & Round 500/230 kV x-former	P6	L-1/T-1	<95%	100.1%	<95%	<95%	105.1%	99.9%	reduce Colusa generation after 1st conitngency, if overload
		Olinda-Tracy 500 kV & Delevan-Vaca-Dixon 230 kV	P6	L-1/L-1	<95%	98.1%	<95%	<95%	105.9%	100.2%	
PGE BIK-T-42	MORROBAY- SOLARSS 230 kV # 1 or # 2	Gates-Midway 500 kV & Morro Bay-Solar SS 230 kV # 2 or # 1	P6	L-1/L-1	<95%	<95%	112.6%	118.6%	<95%	<95%	reduce generation from Topaz Solar after first contingency
		any Midway 500/230 kV x-former & Morro Bay-Solar SS 230 kV #2 or #1	P6	L-1/L-1	<95%	<95%	105.3%	108.8%	<95%	<95%	
		Gates-Diablo 500 kV & Morro Bay-Solar SS 230 kV # 2 or # 1	P6	L-1/L-1	<95%	<95%	100.8%	105.0%	<95%	<95%	
		Los Banos-Midway 500 kV & Morro Bay-Solar SS 230 kV # 2 or # 1	P6	L-1/L-1	<95%	<95%	105.5%	110.0%	<95%	<95%	
PGE BIK-T-43	GATES -CALFLATSSS 230 kV	Gates-Midway 500 kV and GATES-TEMPLTON 230 kV	P6	L-1/L-1	<95%	<95%	95.8%	97.3%	<95%	<95%	reduce generation from renewable project connected to Estrella-Gates 230 kV line
		Gates-Midway 500 kV and Gates-Diablo 500 kV	P6	L-1/L-1	<95%	<95%	98.1%	100.3%	<95%	<95%	
		Gates-Midway 500 kV and Morro BAY-TEMPLTON 230 kV	P6	L-1/L-1	<95%	<95%	102.0%	104.1%	<95%	<95%	



ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)						Potential Mitigation Solutions
					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE BIK-T-48	TESLA-LOS BANOS 500 kV	Tracy-Los Banos 500 kV and Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	101.6%	106.7%	<95%	<95%	dispatch generation at Metcalf Energy Center after first contingency
PGE BIK-T-57	WILSON A-LE GRAND 115 kV	Gregg-Henrietta 230 kV & Tesla-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	107.2%	<95%	<95%	<95%	mitigation in area studies, overloads with local contingencies. Wilson-Le Grand reconductoring project
		Tesla-Los Banos 500 kV & Westley-Quinto 230 kV	P6	L-1/L-1	<95%	<95%	113.1%	<95%	<95%	<95%	
		Los Banos 500/230 kV x-former & Quinto-Los Banos 230 kV	P6	L-1/L-1	<95%	<95%	107.9%	<95%	<95%	<95%	
		Kearney-Mc Mullin 230 kV & Tesla-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	105.0%	<95%	<95%	<95%	
PGE BIK-T-58	ALTM MDW - TESLA D 230	TableMtn-Vaca Dix 500 kV & Vaca Dix-Tesla 500 kV	P6	L-1/L-1	110.9%	<95%	<95%	<95%	<95%	<95%	Dispatch generation in Bay Area
PGE BIK-T-59	BORDEN-GREGG 230 kV #1	BORDEN-GREGG 230 kV #2 & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	98.4%	<95%	<95%	<95%	111.5%	96.5%	congestion management, reduce generation at Henrietta or Helms
		BORDEN-GREGG 230 kV #2 & Midway-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	110.4%	<95%	
		BORDEN-GREGG 230 kV #2 & Los Banos-Gates # 1 500 kV	P6	L-1/L-1	100.5%	<95%	<95%	<95%	110.4%	<95%	
		BORDEN-GREGG 230 kV #2 & Mosslanding-Metcalf 500 kV	P6	L-1/L-1	98.4%	<95%	<95%	<95%	111.5%	96.0%	
PGE BIK-T-60	BORDEN-GREGG # 2 230 kV	BORDEN-GREGG 230 kV #1 & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	102.4%	<95%	
		BORDEN-GREGG 230 kV #1 & Mosslanding-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	102.3%	<95%	
PGE BIK-T-60		BORDEN-GREGG 230 kV #1 & Los Banos-Gates # 1 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	101.1%	<95%	
PGE BIK-T-55	RNCHSECO -BELLOTA 230 kV # 1 or 2	Captain Jack-Olinda 500 kV (or other 500 kV lines) & Rancho Seco-Bellota # 2 or # 1 230 kV	P6	L-1/L-1	up to 117%	<95%	<95%	<95%	<95%	<95%	dispatch Cosumnes generation under peak load conditions
		Tracy 500/230 kV x-former ( or other 500/230 kV x-formers)& Rancho Seco-Bellota # 2 or # 1 230 kV	P6	L-1/L-1	up to 114%	<95%	<95%	<95%	<95%	<95%	
PGE BIK-T-51	CAPTAIN JACK-OLINDA 500 kV	Malin- Round Mtn #1 and #2 500 kV	P7	L-2	diverged	103.9%	<95%	<95%	102.4%	99.6%	operate within COI seasonal nomogram
		Round Mtn-Table Mtn # 1 & # 2 500 kV	P7	L-2	diverged	105.2%	<95%	<95%	104.5%	101.1%	
PGE BIK-T-52	OLINDA-TRACY 500 KV	Round Mtn-Table Mtn # 1 & # 2 500 kV	P7	L-2	diverged	98.1%	<95%	<95%	96.7%	95.2%	not a violation, monitor this line. Operate within COI nomogram
PGE BIK-T-1	LOS BANOS - QUINTO_SS 230 kV	Los Banos-Tesla and Los Banos-Tracy 500 kV with RAS	P7	L-2	106.0%	<95%	133.0%	140.3%	<95%	<95%	Use more RAS for Path 15 in 2021 Peak case with high renewables, use short-term rating if still overload. Consider line upgrade
		Los Banos-Tesla and Los Banos-Tracy 500 kV with maximum RAS	P7	L-2	100.2%	<95%	128.0%	135.0%	<95%	<95%	
		Tracy-Tesla and Los Banos-Tracy 500 kV	P7	L-2	<95%	<95%	115.7%	119.3%	<95%	<95%	



ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)						Potential Mitigation Solutions
					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE BIK-T-2	MOSSLANDING-LAS AGUILAS 230 kV	Los Banos-Gates #1 and Los Banos-Midway 500 kV	P7	L-2	<95%	<95%	110.7%	107.4%	<95%	<95%	use short-term rating , or trip renewable generation connected to this line, or trip 3rd Helms pump
		Los Banos-Tesla 500 kV and Los Banos-Tracy 500 kV	P7	L-2	<95%	<95%	98.5%	<95%	<95%	<95%	
		Tracy-Tesla and Los Banos-Tracy 500 kV	P7	L-2	<95%	<95%	101.7%	<95%	<95%	<95%	
		Midway-Gates 500 kV & Midway-Los Banos 500 kV w/RAS	P7	L-2	<95%	<95%	98.5%	<95%	<95%	<95%	
		Gates-Mustang 230 kV # 1 and 2	P7	L-2	<95%	<95%	105.9%	100.9%	<95%	<95%	
PGE BIK-T-21	LOS BANOS-SWITCHING STA 230 kV (Los Banos-Panoche)	Los Banos-Gates #1 and Los Banos-Midway 500 kV	P7	L-2	<95%	<95%	103.2%	103.8%	<95%	<95%	trip renewable generation connected to this line, or trip 3rd Helms pump if overload
PGE BIK-T-35	COTTONWD E-ROUND MTN 230kV #3	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	diverged	104.1%	<95%	<95%	101.8%	98.7%	upgrade the line, or limit COI import within nomogram
PGE BIK-T-37	DELEVAN-CORTINA 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	diverged	<95%	<95%	<95%	101.2%	95.8%	upgrade or re-rate the line or reduce Colusa generation, or operate within seasonal COI nomogram
PGE BIK-T-41	RIO OSO-GREENLEAF TAP 115 kV	Tbl Mtn-Tesla & Tbl Mtn-Vaca Dix 500 kV	P7	L-2	diverged	101.1%	<95%	<95%	<95%	<95%	South of Palermo Project. Prior to the project: limit COI import within nomogram
PGE BIK-T-40	TABLE MTN-RIO OSO 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	diverged	<95%	<95%	<95%	<95%	<95%	Upgrade terminal equipment on this line.
PGE BIK-T-54	PEASE-E. MARYSVL J - OLIVEHN J 115 kV (Pease-Rio Oso)	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	diverged	109.5%	<95%	<95%	<95%	<95%	South of Palermo Project. Prior to the project: limit COI import within nomogram

Study Area: PG&E Bulk Sensitivity

Voltage Deviations



ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %							Potential Mitigation Solutions
					2021 Peak High Renewables	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-peak	2026 Summer Peak no DG	2026 Summer Peak	2026 Spring Off-Peak	
PGE Blk-VD-1	buses in NW 115 kV and below	PDCI mono-pole outage	P1	PDCI	deviations up to 7% (Northcst 69 kV)	deviations up to 8.7% (Northcst 69 kV)	none	none	none	none	none	adjust svds and transformer taps
	insufficient reactive support	Moss Landing-Los Banos 500 kV & Tesla-Metcalf 500 kV	P6	L-2	diverged	no volt deviation violations						add voltage support in Northern California
	insufficient reactive support	Malin-Round Mountain 500 kV # 1&2	P7	L-2	diverged	no volt deviation violations						add voltage support in Northern California
	insufficient reactive support	Round Mtn-Table Mtn 500 kV # 1& 2	P7	L-2	diverged	no volt deviation violations						add voltage support in Northern California
	insufficient reactive support	Table Mtn-Vaca Dix & Table Mtn-Tesla 500 kV	P7	L-2	diverged	no volt deviation violations						add voltage support in Northern California
	insufficient reactive support	Vaca Dixon 500 kV stuck breaker # 732	P4	BRK	diverged	no volt deviation violations						add voltage support at Vaca Dixon
	insufficient reactive support	Table Mtn 500 kV stuck breaker # 812	P4	BRK	diverged	no volt deviation violations						add voltage support in Northern California



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Study Area: PG&E Bulk Sensitivity

High/Low Voltage



ID	Substation	Worst Contingency	Category	Category Description	Voltage (kV)						Potential Mitigation Solutions
					2021 Peak High Renewables	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-peak	2026 Summer Peak no DG	2026 Summer Peak	
PGE Blk-V-1	500 kV in NW	normal conditions and all contingencies	P0-P7	normal & outages	no violations	no violations	up to 554 kV Rock Crk, BPA	up to 553 kV Rock Crk, BPA	no violations	no violations	consider installing additional reactors
PGE Blk-V-2	Diablo 500kV	normal conditions and all contingencies	P0-P7	normal & outages	no violations	no violations	no violations	no violations	>=551 kV	>=553 kV	consider installing shunt reactor on Diablo or Gates 500 kV after Diablo Canyon plant retires and opening one of the Diablo-Midway 500kV lines
PGE Blk-V-3	Midway 500 kV	normal conditions and all contingencies	P0-P7	normal & outages	no violations	no violations	no violations	no violations	>=542 kV	>=543 kV	
PGE Blk-V-4	Gates 500 kV	normal conditions and all contingencies	P0-P7	normal & outages	no violations	no violations	no violations	no violations	>=544 kV	>546 kV	
PGE Blk-V-5	Pit River 1 area 60 kV	normal conditions and all contingencies	P0-P7	normal & outages	no violations	up to 65.3 kV	up to 65.5 kV	up to 65.5 kV	up to 65.3 kV	up to 65.3 kV	mitigation in area studies
PGE Blk-V-6	Vaca Dix 115 kV and adjacent buses	normal conditions	P0-P7	normal & outages	no violations	no violations	122.2 kV	122 kV	no violations	no violations	mitigation in area studies
PGE Blk-V-7	Gold Hill-Newcastle-Placer 115 kV area	normal conditions	P0-P7	normal & outages	no violations	no violations	no violations	no violations	no violations	no violations	mitigation in area studies
PGE Blk-V-8	Atlantic-Rocklin 60 kV area	normal conditions	P0-P7	normal & outages	no violations	no violations	no violations	no violations	no violations	no violations	mitigation in area studies
	COLUSA 60 kV	normal condiitons	P0	normal	no violations	no violations	no violations	no violations	56.1 kV	56.7 kV	mitigation in area studies

Study Area: **PG&E Bulk Sensitivity**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance						Potential Mitigation Solutions	
					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base		
PGE Blk-TS-1	Solar PV COLUMBIA 0.36 kV (bus 33102), capacity 19.2 MW	3 Ph fault Contra Costa-La Positas 230 KV	P1	L-1	not tripped	4.8 MW output, not tripped	tripped for high volt at 2.3 sec	18.2 MW output, tripped for high voltage in 2.3 sec	tripped for high voltage at 2.3 sec. 4.8 MW output, 1.081 p.u. voltage in the base case	tripped for high voltage at 2.3 sec. 4.8 MW output, 1.083 p.u. voltage in the base case	Modeled with old solar PV model (wt4g, wt4e), protection trips at 1.1 pu in 1 sec, no issues if shunt capacitor on the collector system is turned off, or generator can absorb reactive power in power flow. Consider having voltage regulation requirement for this project. Need to contact generation owner and update the models	
		3 Ph fault Newark-Ravenswood 230 kV	P1	L-1			not tripped, output 18.2 MW					tripped for high voltage in 2.3 sec
		3ph fault Pittsburg 230 kV, Pittsb-Tesla # 1 and 2	P7	L-2	tripped for high volt at 2.9 sec			not tripped				
		3 Ph fault Tesla-Newark 230 kV	P1	L-1	not tripped, output 19.2 MW		tripped for high volt at 2.3 sec		tripped for high voltage at 2.3 sec			
		3ph fault Vaca Dix 500/230 kV x-former, or Vaca Dix-Tesla 500 kV	P1	T-1								
		Tesla 500 kV stuck breaker	P4	BRK			tripped for high volt at 2.3 sec	tripped for high voltage at 2.3 sec				
		3Ph fault C.-Costa-Brentwood and C.Costa-Delta 230 kV	P7	L-2								
		3 Ph fault Contra Costa-La Positas and C.Costa-Lone Tree 230 KV	P7	L-2	not tripped, output 18.2 MW		tripped for high voltage at 2.3 sec					
		Vca Dix stuck brk # 732						tripped for high volt at 2.6 sec	not tripped	not tripped		not tripped
PGE Blk-TS-2	wind generators at Shilo # 2 ( bus 32177), capacity 150 MW	3Ph fault Contra-Costa-Brentwood and Contra Costa-Delta 230 kV	P7	L-2	tripped for low voltage w/fault, 49.5 MW		tripped for low voltage, output 150 MW	tripped for low voltage, output 150 MW	tripped for low voltage, output 49.5 MW		these are old induction generator units that don't have LVRT, they may trip with faults close to these units	
		Tesla 500 kV stuck breaker	P4	BRK	tripped for low volt w/fault	not tripped			not tripped			
		3 Ph fault C. Costa-La Positas 230 KV	P1	L-1	tripped for low volt 49.5 MW				tripped for low voltage			
		3 Ph fault Tesla-Newark 230 KV	P1	L-1	tripped for low voltage w/fault 49.5 MW	not tripped, output 49.5 MW			tripped for low voltage			
		3 Ph fault Newark 230 KV, Newark-Ravenswood	P1	L-1					not tripped, output 49.5 MW			
		3 Ph fault Contra Costa-La Positas and C.Costa-Lone Tree 230 KV	P7	L-2	tripped for low volt w/fault 49.5 MW				tripped for low voltage			
			P7	L-2	not tripped	tripped for high voltage with fault	not tripped	not tripped	tripped for high voltage with fault, 60 MW	tripped for high voltage with fault, 60 MW		
		3 ph fault on Gates 230 kV, any outage			tripped for low freq w/fault, output 244 MW	not tripped						
		3Ph fault on Malin 500 kV, single or double outage to Round Mtn	P1, P7	L-1, L-2								
		3Ph fault on Olinda 500 kV, Olinda-Tracy, or Olinda 500/230 kV x-former	P1	L-1, T-1								
		3ph fault Newark 230 kV, Newark-Ravenswood outage	P1	L-1								
		3Ph fault on Gates 500 kV, any outage	P1	L-1, T-1	not tripped, output 244 MW		not tripped	tripped for high voltage w/fault				
		3Ph fault on Los Banos 500 kV, any single line outage	P1	L-1								
		3Ph fault on Los Banos 500 kV, DLO North of Los Banos	P7	L-2								
		3Ph fault on Midway 500 kV, Midway-Gates 500 kV	P1	L-1								



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance						Potential Mitigation Solutions
					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE Blk-TS-3	Solar PV # 1 and 2 (bus 34347) connected to Las Aguilas 230 kV substation, total capacity 244 MW	3Ph fault on Midway 500 kV, Midway-Vincent 500 kV #1&2	P7	L-2		not tripped, output 60 MW	not tripped	not tripped	not tripped, output 60 MW	not tripped, output 60 MW	need to contact generation owner and to check the models and protection settings. Slow frequency recovery on generator and high voltage buses with other faults (Capt Jack Olinda)
		3Ph fault on Midway 500 kV, DLO North of Midway	P7	L-2							
		3Ph fault on Tesla 500 kV, any outage	P1, P7	L-1, L-2			tripped for high volt w/fault				
		3Ph fault on Tesla 230 kV, Tesla-Newark 230 kV	P1	L-1	tripped for high volt w/fault		tripped for high voltage w/fault, 232 MW	tripped for high voltage with fault, 232 MW			
		3Ph fault on Tracy 500 kV, Tracy-Los Banos 500 kV	P1	L-1	tripped for high volt w/fault						
		3Ph fault on Los Banos 500 kV, 500/230 kV x-former	P1	T-1	not tripped, ouput 244 MW						
		3Ph fault on MossLanding 500 kV, Mosslanding-Metcalf 500 kV	P1	L-1							
		3Ph fault on Metcalf 500 kV, 500/230 kV x-former	P1	T-1							
		3Ph fault on Tracy or Tesla 500 kV, 500/230 kV x-former	P1	T-1	tripped for high volt w/fault		tripped for high voltage w/fault, 232 MW	tripped for high voltage w/fault			
		3Ph fault on Tracy 500 kV, DLO south of Tracy 500 kV	P7	L-2	tripped for high volt w/fault						
		3ph fault Vaca Dix 500/230 kV x-former, or Vaca Dix-Tesla	P1	T-1	tripped for high volt w/fault						
		3Ph fault on Tesla 500 kV, DLO north of Tesla 500 kV	P7	L-2							
		3Ph fault Round Mtn 500 kV, any contingency	P1, P7	L-1, T-1, L-2	slow frequency recovery		normal recovery	tripped for low freq w/fault			
PGE Blk-TS-4	Solar PV KANSAS 12.47 (bus 34680), capacity 20 MW	3Ph fault on Gates 230 kV, any single or double contingency	P1, P7	L-1, L-2	tripped for low voltage w/fault, output 20 MW	not tripped, output 5 MW	tripped for low voltage w/fault, 19 MW		not tripped, output 5 MW		Modeled with old solar PV model (wt4g, wt4e). Need to contact generation owner and update the models and check protection settings
PGE Blk-TS-5	Solar PV KENT_S (bus 34694), capacity 20 MW	3ph fault Gates 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for low volt w/fault	not tripped, output 5 MW	tripped for low voltage w/fault		not tripped, output 5 MW	Old wt4g, wt4e models. Under-voltage protection trips in 0.02 sec with vlt 0.5 p.u. Need to discuss protection settings and the plant model parameters with the generation owner.	
		3ph fault Los Banos 500 kV, Gates-Los Banos 500 kV # 1 or 3	P1	L-1	not tripped, output 20 MW		tripped for high frequency with fault, output 19 MW	tripped for high frequency with fault, output 19 MW			
		3ph fault Los Banos 500 kV, Los Banos-Midway 500 kV	P1	L-1							
		3ph fault Los Banos 500 kV, Los Banos-Moss landing 500 kV	P1	L-1							
		3ph fault Los Banos 500 kV, Los Banos 500/230 kV x-former	P1	T-1							
		3ph fault Los Banos 500 kV, DLO north of Los Banos	P7	L-2							
		3ph fault Los Banos 500 kV, DLO south of Los Banos	P7	L-2							
		3ph fault Gates 230 kV Gates-Arco and Gates-Midway 230 kV	P7	L-2							tripped for low volt w/fault, 19 MW
		3 ph Gates 230 kV, Gates-Greg and Gates-MCal	P7	L-2							

Study Area: **PG&E Bulk Sensitivity**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance						Potential Mitigation Solutions
					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE Blk-TS-6	Solar PV REGULUS 0.38 kV (Bus 35019), capacity 60.5 MW	3Ph fault on Midway 500 kV or 230 kV, any contingency	P1, P7	L-1, L-2	not tripped, output 60.5 MW	not tripped, output 15 MW	tripped for high frequency with fault, output 57.5 MW		not tripped, output 15 MW		Modeled with old solar PV model (wt4g, wt4e). Need to contact generation owner and update the models and check protection settings
PGE Blk-TS-7	Wind generator NSR_WND1 0.69 kV (bus 29474), capacity 162 MW	1 Diablo unit	P1	G-1	tripped for high voltage with fault, output 160 MW	tripped for high voltage with fault, output 160 MW	the unit is off in this case		the unit is off in this case		This generator is on the SCE system. Need to discuss generator model and study results with SCE
		any contingency w/3 ph fault on Diablo 500 kV	P1,P7	L-1/L-2							
		any contingency w/3 ph fault on Los Banos 500 kV	P1,P7	L-1/L-2							
		any contingency w/3 ph fault on Midway 500 kV	P1,P7	L-1/L-2							
		any contingency w/3 ph fault on Gates 500 kV	P1,P7	L-1/L-2							
PGE Blk-TS-8	Solar PV AD SOLAR 0.26 kV (bus 26949), capacity 10 MW	any contingency w/3 ph fault on Midway 500 kV	P1,P7	L-1/L-2	not tripped, output 7.5 MW	not tripped, output 7.5 MW	off in this case	off in this case	tripped for high volt after 8.8 sec, output 7.5 MW, except for Midway-Vincent # 1 or # 2	tripped for high volt after 9 sec, output 7.5 MW	This generator is on the LADWP system. Need to discuss generator model and study results with LADWP
PGE Blk-TS-9	Solar PV connected to Wheeler 115 kV (bus 35021), capacity 20 MW	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for low voltage w/fault, output 20 MW	tripped for low voltage with fault, output 5 MW	not tripped	tripped for low voltage with fault, output 19 MW	tripped for low voltage with fault, output 5 MW		Old wt4g, wt4e models. Under-voltage protection trips in 0.02 sec with vlt 0.5 p.u. Need to discuss protection settings and the plant model parameters with the generation owner.
		3Ph fault Midway230 kV, Midway-Kern # 1 and 2 230 kV	P7	L-2			tripped for low volt w/fault				
		3Ph fault Midway 500 kV, any contingency	P1, P7	L-1, L-2	not tripped	not tripped	tripped for high frequency with fault, 19 MW		not tripped	not tripped	
PGE Blk-TS-10	Solar PV ORION (35082), capacity 20 MW	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for low voltage w/fault, output 20 MW	tripped for low voltage with fault, output 5 MW	tripped for low voltage with fault, output 19 MW		tripped for low voltage with fault, output 5 MW		Old wt4g, wt4e models. Under-voltage protection trips in 0.02 sec with vlt 0.5 p.u. Over-frequency trips for 60. 5 Hz in 0.02 sec. Need to discuss protection settings and the plant model parameters with the generation owner.
		3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2							
		3Ph fault Midway 500 kV, any contingency	P1, P7	L-1, T-1, L-2	not tripped	not tripped	tripped for high frequency with fault, 19 MW		not tripped		
PGE Blk-TS-11	Solar PV Willwood (bus 39184, on Goose Lake-Semiotrophic 115 kV line), capacity 20 MW	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for high freq w/fault, output 20 MW	not tripped, output 5 MW	tripped for high frequency with fault, 19 MW	tripped for high frequency with fault, output 19 MW	not tripped, output 5 MW		Frequency protection trips the unit at 60.5 Hz or 59.3 Hz in 0.02 sec. Need to discuss the models and protection settings with the generation owner. Same refers to the Pumpjack plant (bus 39176)
		3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2			not tripped				
PGE Blk-TS-12	Solar PV, bus 35069 on Copus-Old River 70 kV line, capacity 20 MW	3Ph fault on Gates 500 kV, any contingency	P1 ,P7	L-1, T-1, L-2	tripped for high voltage w/fault, 12 MW	not tripped, output 3 MW	not tripped		not tripped, output 3 MW	not tripped, output 3 MW	this is old dynamic model. Need to update the model and specify model parameters and protection settings with the generation owner
		3Ph fault on Midway 500 kV, any contingency	P1 ,P7	L-1, T-1, L-2		tripped for high voltage with fault	tripped for high volt w/fault, 11.4 MW		tripped for high volt with fault	not tripped, output 3 MW	

Study Area: PG&E Bulk Sensitivity

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance						Potential Mitigation Solutions
					2021 Peak high renewable	2021 Summer Peak Base	2018 Off-Peak Max PV	2018 Spring off-Peak Base	2026 Summer Peak no DG	2026 Summer Peak Base	
PGE Blk-TS-13	Russel City, 15 kV, 18 kV and 230 kV buses	3Ph fault East Shore 230 kV, East Shore-San Mateo	P1	L-1	slow freq recovery	normal recovery	normal recovery		normal recovery		Russel City plant off in the 2021 peak sensitivity case
PGE Blk-TS-14	Gateway & Marsh Landing 16.5, 18 kV & 230 kV buses	3Ph fault on Contra Costa 230 kV, any outage	P1, P7	L-1, L-2	normal recovery		slow freq recovery		normal recovery		These plants are off in the 2018 off-peak cases
PGE Blk-TS-15	Solar PV plant at buses 34663 & 34667, connected to Gates-Estrella 230 kV line	3Ph fault on Gates 230 kV or 500 kV, any contingency	P1,P7	L-1, L-2	slow freq recovery	normal recovery	slow freq recovery		normal recovery		need to contact generation owner and to check the models and protection settings.
		3Ph fault Midway 500 kV, any outage	P7	L-2			normal recovery		normal recovery		
PGE Blk-TS-16	Topaz Solar PV plant	3Ph fault Midway 500 kV, any outage	P1, P7	L-1, T-1,L-2	slow freq recovery	normal recovery	normal recovery		normal recovery		need to check the models with the generator owners
PGE Blk-TS-16	Load on Ashlan 230 kV	3Ph fault Gregg 230 kV, Greg-Herndon 230 kV # 1 & 2	P7	L-2	normal recovery	slow frequency recovery	normal recovery		normal recovery		need to check load model at Ashlan
PGE Blk-TS-18	Load on Santiago 66 kV (SCE)	3Ph fault Midway 500 kV, any contingency	P1, P7	L-1, L-2	normal recovery	slow frequency recovery	normal recovery		normal recovery		need to check load model at Santiago
PGE Blk-TS-19	Load on Gates 115 kV	3Ph fault on Gates 230 kV, Gates-Midway 230 kV	P1	L-1	tripped by UFLS	not tripped, slow frequency recovery	tripped by UFLS		not tripped, slow frequency recovery	tripped by UFLS	slow frequency recovery, load tripped with fault, modeling issue because of low impedance between the fault and load.
		3Ph fault on Gates 230 kV, Gates-Gregg, Gates-Mc Call 230 kV	P7	L-2	tripped by UFLS		tripped by UFLS			not tripped	
		3Ph Fault Gates-Arco, Gates-Midway 230 kV	P7	L-2	tripped by UFLS		tripped by UFLS				
PGE Blk-TS-20	Load on Gates-distr 12.5 kV	3Ph fault on Gates 230 kV, Gates-Midway 230 kV	P1	L-1	not tripped	tripped by UFLS	not tripped		tripped by UFLS		slow frequency recovery, load tripped with fault, modeling issue because of low impedance between the fault and load
		3Ph fault on Gates 230 kV, Gates-Gregg, Gates-Mc Call 230 kV	P7	L-2							
		3Ph Fault Gates-Arco, Gates-Midway 230 kV	P7	L-2							
PGE Blk-TS-21	Caribou 230 kV, Butt Vly, Grizzly, Big Bend 115 kV, 60 kV buses between Caribou& Table Mtn	3 Ph fault Table Mtn 500kV, Table Mtn 500/230 kV x-former out	P1	T-1	no violations	no violations	large frequency dip between 1.6 & 1.9 sec	large frequency dip between 1.8 & 2.2 sec	no violations		not a violation according to the new standard
PGE Blk-TS-22	Load in Santa Clara on Palm, Mission, Walsh & Kenneth 60 kV	3Ph fault on Los Banos 500 kV, Round Mtn 500 kV, Table Mtn 500 kV, Tesla 500 kV or Vaca Dix 500 kV any contingency	P1, P7	L-1,T-1,L-2	tripped by UFLS, 1st stage	not tripped	not tripped		not tripped		under investigation
PGE Blk-TS-23	70 kV and 115 kV buses around Midway	3Ph fault on Midway 230 kV, any contingency	P1	L-1	slow voltage and frequency recovery						This is a possible numerical issue because of slow convergence due to large amount of inverter-based generation in the area and composite load models. Large voltage dips observed around 0.1 sec after fault clearing. Also slow frequency recovery after the fault in Midway area. According to the new standard, these are not violations
PGE Blk-TS-24	Buena Vista pumps		P1	L-1							
PGE Blk-TS-25	Wheeler Ridge pumps		P1	L-1							
PGE Blk-TS-26	Wind Gap pumps		P1	L-1							



2016-2017 ISO Reliability Assessment -Final Study Results

Study Area: PG&E Bulk

Single Contingency Load Drop

ID	Worst Contingency	Category	Category Description	Amount of Load Drop (MW)					
				Select..	Select..	Select..	Select..	Select..	Select..
PGE Bulk-SLD-1	NONE								

No single contingency resulted in total load drop of more than 250 MW.



		Potential Mitigation Solutions
Select..	Select..	

Study Area: **PG&E Bulk**



Single Source Substation with more than 100 MW Load

ID	Substation	Load Served (MW)								Potential Mitigation Solutions
		Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	
PGE Bulk-SS-1	NONE									

No single source substation with more than 100 MW Load