

2016-2017 ISO Reliability Assessment - Preliminary 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%	
		Moss Landing -Los Banos 500 kV	P1	L-1	<95%	<95%	104.0%	107.2%	<95%	<95%	

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PGE BIK-T-1	LOS BANOS - QUINTO_SS 230 kV	Los Banos-Tracy 500 kV	P1	L-1	<95%	<95%	111.8%	115.6%	<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
		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%	
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%	

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PGE Bk-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%	
PGE Bk-T-15	ROUND MTN 500/230 kV x-former	Olinda-Tracy 500 kV & Capt Jack-Olinda 500 kV	P6	L-1/L-1	<95%	<95%	107.2%	107.0%	<95%	<95%	reduce some Pit River generation after first contingency or add Round Mtn x-former to Colusa SPS
		Olinda-Tracy 500 kV & Olinda 500/230 kV x-former	P6	L-1/T-1	<95%	<95%	107.6%	107.4%	<95%	<95%	
		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%	
		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 Bk-T-17	TABLE MTN-TESLA 500 kV	Vaca-Dixon-Tesla 500 kV & Olinda-Tracy 500 kV	P6	L-1/L-1	diverged	104.1%	<95%	<95%	<95%	97.7%	reduce COI flow according to nomogram after first contingency, dispatch generation in N. Cal in 2021
PGE Bk-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%	

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		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 Bk-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%	
PGE Bk-T-1	LOS BANOS - QUINTO_SS 230 kV	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%	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
		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%	
		Tesla-Los Banos 500 kV & Metcalf-Moss Landing 500 kV	P6	L-1/L-1	107.9%	<95%	142.4%	149.9%	<95%	<95%	
		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 Bk-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 Bk-T-21	LOS BANOS-SWITCHING STA 230 kV(Los Banos-Panoche)	Los Banos-Gates 500 kV # 1 and # 3	P6	L-1/L-1	<95%	<95%	108.6%	108.7%	<95%	<95%	reduce Path 15 flow after first contingency according to the Operational procedure
PGE Bk-T-22	PANOCHÉ-GATES 230 kV # 1 or # 2	Los Banos-Gates 500 kV # 1 and # 3	P6	L-1/L-1	<95%	<95%	119.3%	126.7%	<95%	<95%	reduce Path 15 flow after 500 kV contingency according to the Operational procedure, or dispatch Panoche generation after 230 kV contingency
		Los Banos-Gates 500 kV # 1 and Panoche-Gates 230 kV # 2 or # 1	P6	L-1/L-1	<95%	<95%	101.3%	108.3%	<95%	<95%	
		Los Banos-Gates 500 kV # 1 and Gates-Gregg 230 kV1	P6	L-1/L-1	<95%	<95%	98.6%	105.4%	<95%	<95%	
PGE Bk-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 Bk-T-23	PALERMO-BIG BEND 115 kV	Table Mtn 500/230 kV x-former & Caribou 230/60 kV x-former kV	P6	T-1/T-1	115.8%	<95%	121.7%	<95%	<95%	100.8%	reduce Caribou 2&3 generation after first contingency

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PGE Bk-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 Bk-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 Bk-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 Bk-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 Bk-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 Bk-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%	
PGE Bk-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 Bk-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 Bk-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 Bk-T-	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

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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	
34	COTTONWD E-ROUND MTN 230kV #2	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 Bk-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 Bk-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 Bk-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 Bk-T-38	EIGHT MILE-TESLA 230 kV	Table Mtn 500/230 kV x-former and STAGG-TESLA 230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	113.0%	<95%	reduce generation in Lodi after first contingency
PGE Bk-T-39	STAGG-TESLA 230 kV	Table Mtn 500/230 kV x-former and EIGHT MILE-TESLA 230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	102.8%	<95%	reduce generation in Lodi after first contingency
PGE Bk-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 Bk-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%	
PGE Bk-T-44	LOS BANOS-MIDWAY 500kV	Gates-Diablo 500 kV & Gates-Midway 500 kV	P6	L-1/L-1	<95%	<95%	104.2%	112.8%	<95%	<95%	use Operational Procedure for Path 15
		Los Banos-Gates # 1 and # 3 500 kV	P6	L-1/L-1	<95%	<95%	109.4%	114.8%	<95%	<95%	

2016-2017 ISO Reliability Assessment - Preliminary 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-45	LOS BANOS-GATES # 1 500kV	Los Banos-Gates # 3 500 kV and Los Banos-Midway 500 kV	P6	L-1/L-1	<95%	<95%	117.9%	124.2%	<95%	<95%	use Operational Procedure for Path 15, reduce Path 15 flow after 1st contingency
PGE BIK-T-46	GATES-MIDWAY 500 kV	Gates-Diablo 500 kV and Los Banos-Midway 500 kV	P6	L-1/L-1	<95%	<95%	107.4%	116.5%	<95%	<95%	
PGE BIK-T-47	GATES-MIDWAY 230 kV	Gates-Diablo 500 kV and Gates-Midway 500 kV	P6	L-1/L-1	<95%	<95%	108.9%	116.5%	<95%	<95%	reduce Path 15 flow after first contingency (loading with short term rating shown)
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 k	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, oevrloads with local contingencies
		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%	congenstion managemen, reduce generation at Henrietta
		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-Metclaf 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 #2 & 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
		Los Banos-Tesla and Los Banos-Tracy 500 kV with RAS	P7	L-2	106.0%	<95%	133.0%	140.3%	<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-1	LOS BANOS - QUINTO_SS 230 kV	Los Banos-Tesla and Los Banos-Tracy 500 kV with maximum RAS	P7	L-2	100.2%	<95%	128.0%	135.0%	<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
		Tracy-Tesla and Los Banos-Tracy 500 kV	P7	L-2	<95%	<95%	115.7%	119.3%	<95%	<95%	
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%	103.2%	103.8%		<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							add voltage support in Northern California
	insufficient reactive support	Malin-Round Mountain 500 kV # 1&2	P7	L-2	diverged							add voltage support in Northern California
	insufficient reactive support	Round Mtn-Table Mtn 500 kV # 1& 2	P7	L-2	diverged							add voltage support in Northern California
	insufficient reactive support	Table Mtn-Vaca Dix & Table Mtn-Tesla 500 kV	P7	L-2	diverged							add voltage support in Northern California
	insufficient reactive support	Vaca Dixon 500 kV stuck breaker # 732	P4	BRK	diverged							add voltage support at Vaca Dixon
	insufficient reactive support	Table Mtn 500 kV stuck breaker # 812	P4	BRK	diverged							add voltage support in Northern California



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



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			

Study Area: **PG&E Bulk**

Single Contingency Load Drop



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

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

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