

2021-2022 ISO Reliability Assessment - Study Results

Study Area: PG&E Bulk
Thermal Overloads



Overloaded Facility	Contingency (All and Worst P6)	Category	Category Description	Loading % (Baseline Scenarios)							Loading % (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
				2023 Summer Peak	2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2026 Spring Off- Peak	2031 Spring Off- Peak	2031 Winter Off- Peak	2023 SP Heavy Renewable & Min Gas Gen	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
500 kV LINES														
MALIN-ROUND MTN # 2 500 kV	Diablo unit and Capt Jack-Olinda 500 kV	P3	G-1/L-1	<95%	N/A	N/A	96.7%	<95%	<95%	<95%	<95%	<95%	<95%	Reduce COI flow according to seasonal nomogram
MALIN-ROUND MTN # 2 500 kV	Diablo unit and Malin-Round Mtn # 1 500 kV	P3	G-1/L-1	109.3%	N/A	N/A	107.5%	<95%	<95%	<95%	104.2%	<95%	<95%	
MALIN-ROUND MTN # 1 500 kV	Diablo unit and Malin-Round Mtn # 2 500 kV	P3	G-1/L-1	95.7%	N/A	N/A	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
ROUND MTN –TABLE MTN #1 or #2 500 kV	Rnd Mtn –Table Mtn #2 or # 1 500 kV	P1	L-1	102.7%	N/A	N/A	97.0%	N/A	N/A	<95%	99.9%	N/A	<95%	Install SPS to bypass series capacitors on the remaining Round Mtn-Table Mtn 500 kV line if overload. With Diablo unit out, need to reduce COI flow after first contingency to avoid voltage collapse when series caps are bypassed
	Round Mtn-Table Mtn # 2 or # 1 500 KV and Diablo unit	P3	G-1/L-1	115.8%	N/A	N/A	109.4%	N/A	N/A	<95%	114.1%	N/A	<95%	
	Round Mtn-Table Mtn # 1 and Table Mtn 500/230 kV	P6	L-1/T-1	105.1%	N/A	N/A	100.1%	N/A	N/A	<95%	104.6%	N/A	<95%	
ROUND MTN-TABLE MTN # 1 500 KV	Round Mtn-Table Mtn # 2 and Table Mtn 500/230 kV	P2/P6	BRK	105.0%	N/A	N/A	99.3%	N/A	N/A	<95%	103.9%	N/A	<95%	
ROUND MTN –ROUND MT STATCOM #1 or #2 500 kV	Round Mtn - Round Mtn Statcom # 1 or 2 500 kV	P1	L-1	N/A	112.0%	115.3%	N/A	<95%	<95%	<95%	N/A	112.1%	N/A	Install SPS to bypass series capacitors on Round Mtn and Table Mtn on both lines
TABLE MTN –ROUND MT STATCOM #1 or #2 500 kV	Table Mtn - Round Mtn Statcom # 1 or 2 500 kV	P1	L-1	N/A	103.0%	107.5%	N/A	<95%	<95%	<95%	N/A	102.8%	N/A	
	Round Mtn Statcom - Table Mtn # 1 500 kV and Table Mtn 500/230 kV	P6	L-1/T-1	N/A	105.5%	109.1%	N/A	<95%	<95%	<95%	N/A	105.3%	N/A	
TABLE MTN –ROUND MT STATCOM #1 500 kV	Round Mtn Statcom-Table Mtn # 2 and Table Mtn 500/230 kV	P2	BRK	N/A	105.3%	108.9%	N/A	<95%	<95%	<95%	N/A	105.2%	N/A	
TABLE MTN-TESLA 500 kV	Table Mtn-Vaca Dix 500 kV and Diablo unit	P3	G-1/L-1	<95%	N/A	N/A	<95%	N/A	N/A	N/A	101.3%	N/A	<95%	reduce COI flow after first contingency
MIDWAY-WHIRLWIND # 3 500 kV	Midway-Vincent # 1 and 2 500 kV	P6	L-1/L-1	140.6%	<95%	<95%	<95%	<95%	142.5%	<95%	145.2%	<95%	154.8%	These overload are on the SCE lines. Please refer to SCE bulk results for potential mitigation solutions.
MIDWAY-VINCENT # 1 500 kV	Midway-Vincent # 2 and Midway-Whirlwind	P6	L-1/L-1	104.3%	<95%	<95%	<95%	<95%	106.3%	<95%	107.6%	<95%	114.8%	
MIDWAY-VINCENT # 2 500 kV	Midway-Vincent # 1 and Midway-Whirlwind 500 kV	P6	L-1/L-1	106.3%	<95%	<95%	<95%	<95%	108.4%	<95%	105.4%	<95%	117.1%	
500/230 kV TRANSFORMERS														
	Olinda 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	118.0%	124.2%	97.1%	<95%	<95%	<95%	
	Captain Jack-Olinda 500 kV	P1	L-1	<95%	<95%	<95%	<95%	107.9%	109.4%	<95%	<95%	<95%	<95%	
	Round Mtn-Statcom # 2 500 kV	P1	L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV transformer and Table Mtn-Statcom # 1 or 2 500 kV	P2/P6	BRK	N/A	<95%	<95%	N/A	<95%	98.5%	<95%	N/A	<95%	N/A	
	Captain Jack-Olinda 500 kV and Olinda 500/230 kV transformer	P6	L-1/T-1	<95%	<95%	<95%	<95%	123.6%	128.8%	95.7%	<95%	<95%	<95%	

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ROUND MTN 500/230 kV transformer	Olinda 500/230 kV transformer and Olinda-Tracy 500 kV line	P6	L-1/T-1	<95%	<95%	<95%	<95%	124.0%	131.6%	98.9%	<95%	<95%	<95%	Reduce COI flow according to the nomogram, reduce generation in the area
	Olinda-Tracy 500 kV and Captain Jack-Olinda 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	124.0%	128.5%	95.6%	<95%	<95%	<95%	
	Round Mnt-Round Mnt Statcom # 1 and #2 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	123.7%	125.2%	<95%	<95%	<95%	N/A	
	Table Mnt-Round Mnt Statcom # 1 and #2 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	125.0%	127.9%	<95%	<95%	<95%	N/A	
	Table Mt -Vaca Dix 500 kV and Table Mt 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	<95%	107.6%	<95%	<95%	<95%	<95%	
	Table Mt -Tesla 500 kV and Table Mt 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	<95%	103.5%	<95%	<95%	<95%	<95%	
	Malin-Round Mtn #1 and #2 500 kV	P6	L-1/L-1	<95%	96.3%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
TABLE MTN 500/230 kV transformer	normal conditions	P0	normal	<95%	<95%	<95%	<95%	97.0%	<95%	<95%	<95%	<95%	<95%	Reduce COI flow according to the nomogram, or reduce generation in the area
	Table Mtn-Vaca Dix or Table Mtn-Tesla 500 kV	P1	L-1	<95%	<95%	<95%	<95%	98.3%	<95%	<95%	<95%	<95%	<95%	
	Captain Jack-Olinda 500 kV	P1	L-1	<95%	<95%	<95%	<95%	100.8%	<95%	<95%	<95%	<95%	<95%	
	Olinda 500/230 kV	P1	T-1	<95%	<95%	<95%	<95%	97.6%	<95%	<95%	<95%	<95%	<95%	
	Olinda-Tracy 500 kV	P1	L-1	<95%	<95%	<95%	<95%	98.0%	<95%	<95%	<95%	<95%	<95%	
	Round Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	100.8%	<95%	<95%	<95%	<95%	95.0%	
	Vaca Dix 500 kV stuck BRK- lines to Table Mtn & transformer #11	P2/P6	BRK	<95%	<95%	<95%	<95%	99.8%	<95%	<95%	<95%	<95%	<95%	
	Round Mtn 500 kV stuck BRK- line to Table Mtn # 2 & transformer	P2/P6	L-1/T-1	<95%	<95%	<95%	<95%	101.5%	<95%	<95%	<95%	<95%	95.9%	
	Round Mtn 500 kV stuck BRK- line to Malin # 1 & transformer	P2/P6	BRK	<95%	<95%	<95%	<95%	101.3%	<95%	<95%	<95%	<95%	<95%	
	Round Mt -Table Mt # 1 and Round Mt 500/230	P2/P6	BRK	<95%	<95%	<95%	<95%	101.5%	96.3%	<95%	<95%	<95%	96.9%	
	Olinda-Tracy 500 kV and Olinda 500/230 kV transformer	P6	L-1/T-1	<95%	<95%	<95%	<95%	101.4%	95.6%	<95%	<95%	<95%	<95%	
	Table Mtn-Vaca Dix and Table Mtn-Tesla 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	104.1%	97.7%	<95%	<95%	<95%	<95%	
	Table Mtn-Tesla and Vaca Dix-Tesla 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	102.1%	<95%	<95%	<95%	<95%	<95%	
TESLA 500/230 kV # 6 transformer	Tesla-Metcalf and MossIndg-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	98.3%	<95%	<95%	sensitivity only
METCALF 500/230 kV transformer #11, 12 or 13	Metcalf 500/230 kV Tranformers #11 & #12 or #13	P6	T-1/T-1	99.0%	97.4%	101.7%	104.2%	<95%	<95%	<95%	142.3%	100.4%	<95%	- Increase generation in the area after 1st contingency, - load tripping still might be required to address the P6 overload.
LOS BANOS 500/230 kV transformer	Gates 500/230 kV # 11 and # 12 transformers	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	117.6%	<95%	<95%	<95%	<95%	reduce generation in the area
	Gates 500/230 kV # 12 transformer	P1	T-1	<95%	<95%	<95%	<95%	113.7%	146.3%	<95%	119.9%	<95%	122.6%	

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GATES 500/230 kV # 11 transformer	Gates-Diablo 500 kV and Gates 500/230 # 12	P6	L-1/T-1	<95%	<95%	<95%	<95%	<P1	<P1	<95%	123.9%	<95%	131.5%	reduce generation in the area or install SPS to trip generation at Gates.
	LOSBANOS 230/500kV & GATES 230/500kV # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	125.6%	165.5%	<95%	129.2%	<95%	133.9%	
	MIDWAY 230/500 kV # 11, 12 or 13 & GATES 230/500kV #12	P6	T-1/T-1	<95%	<95%	<95%	<95%	118.7%	155.8%	<95%	127.1%	<95%	130.3%	
	Any two MIDWAY 230/500kV transformers	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	101.0%	<95%	<95%	<95%	<95%	
	Gates 500/230 kV # 12 transformer and Diablo unit	P3	G-1/T-1	<95%	N/A	<95%	<95%	N/A	N/A	N/A	125.1%	<95%	128.9%	
GATES 500/230 kV # 12 transformer	Gates 500/230 kV # 11 transformer	P1	T-1	<95%	<95%	<95%	<95%	115.6%	151.9%	<95%	124.0%	<95%	127.3%	reduce generation in the area or install SPS to trip generation at Gates.
	Los Banos 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	<95%	105.4%	<95%	<95%	<95%	<95%	
	Midway 500/230 kV transformer # 11,12 or 13	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	100.1%	<95%	<95%	<95%	<95%	
	Gates-Diablo 500 kV and Gates 500/230 # 11	P6	L-1/T-1	<95%	<95%	<95%	<95%	<P1	<P1	<95%	128.1%	<95%	131.5%	
	LOSBANOS 230/500kV & GATES 230/500kV #11	P6	T-1/T-1	<95%	<95%	<95%	<95%	128.0%	171.5%	<95%	133.4%	<95%	138.9%	
	MIDWAY 230/500kV & GATES 230/500kV #11	P6	T-1/T-1	<95%	<95%	<95%	<95%	121.0%	161.7%	<95%	131.4%	<95%	135.2%	
	Any two MIDWAY 230/500kV transformers	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	112.4%	<95%	<95%	<95%	95.9%	
	Gates 500/230 kV # 11 transformer and Diablo unit	P3	G-1/T-1	<95%	<95%	<95%	<95%	N/A	N/A	N/A	129.9%	<95%	134.2%	
MIDWAY 500/230 kV transformer # 11, 12 or 13	Any two MIDWAY 230/500kV transformers	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	107.2%	<95%	<95%	<95%	<95%	reduce generation at Midway after first contingency, or use Midway SPS
230 kV LINES														
COTTONWD E-ROUND MTN 230kV #2	Table Mtn-Vaca Dix and Table Mtn-Tesla 500 kV	P6	L-1/L-1	<95%	<95%	98.5%	<95%	<95%	<95%	<95%	107.5%	<95%	<95%	Reduce COI flow according to seasonal nomogram, or upgrade the lines if economic.
COTTONWD E-ROUND MTN 230kV #3	Table Mtn-Vaca Dix and Table Mtn-Tesla 500 kV	P6	L-1/L-1	104.8%	102.4%	108.6%	<95%	<95%	<95%	<95%	118.5%	102.2%	<95%	
TABLE MTN-RIO OSO 230 kV	Tbl Mtn-Vaca Dix 500 kV and Table Mtn-Palermo 230 kV	P6	L-1/L-1	101.1%	101.4%	111.5%	<95%	<95%	<95%	<95%	<95%	101.9%	<95%	Project: Rio Oso 230 kV BAAH Bus Upgrade Project ISD: Dec 2022, currently delayed, not modeled Short term: COI Nomogram, or redispatch generation after first contingency
	Table Mtn-Vaca Dix and Table Mtn-Tesla 500 kV	P6	L-1/L-1	104.7%	103.2%	112.9%	<95%	<95%	<95%	<95%	101.8%	103.5%	<95%	
CAYETANO- LONETREE 230 kV	Tesla-Vaca Dix 500 kV and Diablo unit	P3	G-1/L-1	95.5%	N/A	N/A	<95%	N/A	N/A	N/A	<95%	N/A	<95%	
	Tesla-Metcalf 500 kV and Diablo unit	P3	G-1/L-1	96.0%	N/A	N/A	<95%	N/A	N/A	N/A	<95%	N/A	<95%	
	Tesla-Metcalf 500 kV and Tesla 500/230 # 2	P2/P6	BRK/or N-2	96.2%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Metcalf and Metcalf-Moss Landing 500 kV	P6	L-1/L-1	100.7%	<95%	98.2%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	

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	Tesla-Metcalf & Mossland-LosBanos 500 kV	P6	L-1/L-1	100.7%	<95%	97.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	Also, P6 500 kV and 230 kV lines. Reduce generation in the area
	Tesla-Metcalf & Tesla-Los Banos 500kV	P6	L-1/L-1	96.5%	<95%	95.18%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Vaca Dix-Tesla & Tesla-Metcalf 500 kV	P6	L-1/L-1	100.1%	<95%	98.9%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
LAS POSITAS-NEWARK 230 KV	Tesla-Metcalf and Metcalf-Moss Lading 500 kV	P6	L-1/L-1	95.2%	<95%	99.2%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Vaca Dix-Tesla & Tesla-Metcalf 500 kV	P6	L-1/L-1	95.4%	<95%	100.5%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Metcalf & Mossland-LosBanos 500 kV	P6	L-1/L-1	96.1%	<95%	98.6%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
NEWARK-LOS ESTEROS 230 KV	Tesla-Metcalf and MossIndg-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	diverged	<95%	<95%	dispatch generation in San Jose(Los Esteros) after first contingency. Use Metcalf SPS to avoid voltage collapse
	Tesla-Metcalf and MossIndg-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	95.1%	<95%	<95%	<95%	<95%	109.9%	<95%	<95%	
NEWARK-E-F BRK (to LOS ESTEROS) 230 KV	Tesla-Metcalf and MossIndg-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	96.5%	<95%	<95%	<95%	<95%	diverged	<95%	<95%	
	Tesla-Metcalf and MossIndg-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	97.8%	<95%	<95%	<95%	<95%	109.5%	<95%	<95%	
NEWARK-TESLA # 2 230 KV	Tesla-Metcalf and MossIndg-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	98.3%	<95%	<95%	
GOLDHILL-EIGHT MILE 230 KV	Table Mtn 500/230 kV	P1	T-1	<95%	<95%	<95%	<95%	<95%	97.7%	<95%	<95%	<95%	<95%	Winter ratings used for the Winter case. Use Table Mtn SPS. Table Mtn SPS modeled for off-peak cases. Reduce Ralston and Middle Fork generation if still overloads
	Table Mtn and Round Mtn 500/230 kV transformer	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	95.5%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Eight Mile-Lodi 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	130.6%	141.3%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Bellota-Weber 230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	101.2%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Bellota-Tesla 230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	101.5%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Tesla-Weber 230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	101.7%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Goldhill-Lodi 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	131.0%	141.3%	<95%	<95%	<95%	<95%	
GOLDHILL-LODI 230 KV	Table Mtn 500/230 kV	P1	T-1	<95%	<95%	<95%	<95%	<95%	98.1%	<95%	<95%	<95%	<95%	Winter ratings used for the Winter case. Use Table Mtn SPS. Table Mtn SPS modeled for off-peak cases. Reduce Ralston and Middle Fork generation if still overloads
	Table Mtn and Round Mtn 500/230 kV transformer	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	96.0%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Tesla-Weber 230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	102.2%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Tesla-Bellota 230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	102.0%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Bellota-Weber 230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	101.7%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Gold Hill-Eight Mile 230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	132.4%	142.9%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	107.8%	121.6%	<95%	<95%	<95%	<95%	

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EIGHT MILE -TESLA 230 kV	Diablo unit and Table Mtn 500/230 kV transformer	P3	G-1/T-1	<95%	N/A	N/A	<95%	N/A	N/A	N/A	<95%	<95%	96.1%	Winter ratings used for the Winter case. Table Mtn SPS modeled for off-peak cases. Summer rating is limited by substation bus or jumper. Consider upgrage of this equipment to eliminate P1 overload. Reduce Ralston and Middle Fork generation and/or separate the system if still overloads
	Table Mtn and Round Mtn 500/230 kV transformer	P6	T-1/T-1	<95%	<95%	<95%	<95%	110.3%	124.2%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 and Table Mtn-Statcom # 1 or 2 500 kV	P2/P6	BRK	N/A	<95%	<95%	N/A	108.0%	121.4%	<95%	N/A	<95%	N/A	
	Table Mtn 500/230 kV and Bellota-Weber 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	116.8%	132.1%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Tesla-Weber 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	118.1%	132.9%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Tesla-Bellota 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	117.6%	132.5%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Stagg-Eight Mile 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	160.6%	177.3%	111.7%	<95%	<95%	112.9%	
	Table Mtn 500/230 kV and Stagg-Tesla 230 kV, or Stagg BRK	P6	T-1/L-1	<95%	<95%	<95%	<95%	165.1%	167.8%	102.0%	<95%	<95%	97.8%	
STAGG-EIGHT MILE 230 kV	Table Mtn 500/230 kV and Eight Mile-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	139.7%	152.3%	107.0%	<95%	<95%	104.0%	
STAGG H - STAGG F BRK 230 kV		P6	T-1/L-1	<95%	<95%	<95%	<95%	114.9%	125.6%	105.2%	<95%	<95%	<95%	
STAGG D - STAGG F BRK 230 kV		P6	T-1/L-1	<95%	<95%	<95%	<95%	114.3%	127.2%	102.8%	<95%	<95%	<95%	
STAGG-TESLA E 230 kV		P6	T-1/L-1	<95%	<95%	<95%	<95%	145.8%	166.3%	<95%	<95%	<95%	<95%	
STAGG-TESLA E 230 kV	Table Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	<95%	97.1%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV transformer and Tesla-Weber 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	102.6%	<95%	<95%	<95%	<95%	
BELLOTA-BRIGHTON 230 kV	Table Mtn 500/230 kV transformer and Diablo unit	P3	G-1/T-1	<95%	N/A	N/A	<95%	N/A	N/A	N/A	<95%	N/A	96.1%	no violation, monitor
BELLOTA-COTTLE 230 kV	Gates 500/230 # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	100.8%	<95%	<95%	sensitivity only
BELLOTA-WEBER 230 kV	Table Mtn 500/230 kV and Bellota-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	105.3%	120.7%	<95%	<95%	<95%	<95%	Table Mtn 500/230 kV SPS assumed for off peak cases. Reduce generation from Collerville, Electra and Valley Springs
	Table Mtn 500/230 kV and Eight Mile-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	103.8%	<95%	<95%	<95%	<95%	
TESLA-WEBER 230 kV	Table Mtn 500/230 kV and Bellota-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	115.5%	127.0%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Gold Hill-Eight Mile 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	103.4%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	<95%	96.2%	<95%	<95%	<95%	<95%	
	Table Mtn and Round Mtn 500/230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	100.1%	<95%	<95%	<95%	<95%	
BELLOTA-TESLA 230 kV	Table Mtn and Round Mtn 500/230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	97.7%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Bellota-Weber 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	109.5%	123.3%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Gold Hill-Eight Mile 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	101.1%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV and Eight Mile-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	101.4%	<95%	<95%	<95%	<95%	

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	Table Mtn 500/230 kV and Tesla-Weber 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	113.0%	125.5%	<95%	<95%	<95%	<95%	
DELEVAN-CORTINA 230 KV	Olinda-Tracy 500 kV	P1	L-1	97.3%	<95%	98.03%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	Reduce generation in the area
	Table Mtn-Vaca Dix 500 kV	P1	L-1	95.8%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Olinda-Tracy 500 kV and Diablo unit	P3	G-1/L-1	103.8%	N/A	N/A	<95%	N/A	N/A	N/A	<95%	N/A	<95%	
	Table Mtn-Vaca Dix 500 kV and Diablo unit	P3	G-1/L-1	102.0%	N/A	N/A	<95%	N/A	N/A	N/A	<95%	N/A	<95%	
	Table-VacaDix and Table Mt-Round Mt # 1 500 kV	P2/P6	BRK/or L-2	98.0%	<95%	99.3%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Vaca Dix -Table Mtn 500 kV and VacaDix 500/230 # 11	P2/P6	BRK/or N-2	96.2%	<95%	99.1%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table-Vaca Dix and Table Mt-Round Mtn #2 500 kV	P6	L-1/L-1	98.1%	<95%	99.1%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table Mtn-Vaca Dix and Vaca Dix-Tesla 500 kV	P6	L-1/L-1	98.0%	<95%	97.9%	<95%	<95%	<95%	<95%	<95%	95.6%	<95%	
	Round Mtn Statcom-Round Mtn 500 kV #2 and Malin-Round Mtn # 2 500 kV	P6	L-1/L-1	N/A	97.7%	<95%	N/A	<95%	<95%	<95%	N/A	99.4%	N/A	
	Round Mtn-Table Mtn 500 kV #1 and #2 500 kV	P6	L-1/L-1	104.0%	N/A	N/A	<95%	N/A	N/A	N/A	<95%	N/A	<95%	
	Round Mtn Statcom-Table Mtn 500 kV #1 and #2 500 kV	P6	L-1/L-1	N/A	98.0%	105.4%	N/A	<95%	<95%	<95%	N/A	99.5%	N/A	
	Round Mtn-Round Mtn Statcom 500 kV #1 and #2 500 kV	P6	L-1/L-1	N/A	98.0%	105.3%	N/A	<95%	<95%	<95%	N/A	99.5%	N/A	
	Table Mtn-Vaca Dix and Table Mtn-Tesla 500 kV	P6	L-1/L-1	108.5%	103.3%	112.3%	<95%	<95%	<95%	<95%	<95%	104.7%	<95%	
WARNERVILLE-WILSON 230 kV	Gates 500/230 kV # 11 and 12	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	123.1%	<95%	<95%	<95%	<95%	insert Wilson series reactor
MELONES-COTTLE 230 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	<95%	<95%	100.1%	<95%	<95%	Sensitivity only
	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	109.1%	<95%	<95%	
DOS AMIGOS-PANOCHÉ #2 230 kV	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	132.0%	<95%	120.1%	Reduce generation in the area(Tranquility and/or Pine Flat, Balch)
	Los Banos-Gates # 1 and # 3 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	97.1%	<95%	<95%	
LOS BANOS-DOS AMIGOS 230 kV	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	107.2%	<95%	105.4%	<95%	<95%	
PADRE FLAT-PANOCHÉ 230 kV	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	101.4%	<95%	<95%	
LOS BANOS-PANOCHÉ #2 230 kV	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	98.7%	122.5%	<95%	120.8%	<95%	109.2%	
MUSTANG SS-SWITCH STA 230 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	<95%	<95%	110.4%	<95%	<95%	Sensitivity only, reduce generation in the area. Radial line
	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	99.9%	98.9%	<95%	119.1%	<95%	<95%	

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MOSSLANDING-LAS AGUILAS 230 kV	Tesla-Metcalf 500 kV	P1	L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	107.1%	<95%	<95%	Turning off generation in the area for P6 may not eliminate overloads without turning on Moss Landing generation in some cases.
	Mosslanding-Los Banos 500 kV	P1	L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	111.6%	<95%	<95%	
	Mosslanding-Los Banos and Tracy-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	103.5%	<95%	<95%	118.1%	<95%	<95%	
	Tesla-Metcalf and Tesla-Table Mtn 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	109.5%	<95%	<95%	
	Moss Landing-Los Banos 500 kV and Los Banos 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	99.1%	<95%	<95%	114.8%	<95%	<95%	
	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	103.6%	109.1%	<95%	121.9%	<95%	98.6%	
	Moss Landing-Los Banos and Los Banos-Gates 500 kV# 1	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	115.2%	<95%	<95%	
	Moss Landing-Los Banos and Los Banos-Gates 500 kV# 3	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	113.1%	<95%	<95%	
	Tesla-Los Banos & Mosslanding-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	107.8%	<95%	<95%	122.0%	<95%	<95%	
	Mosslanding-Los Banos 500 kV & Tesla-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	127.2%	101.1%	<95%	diverged	<95%	96.3%	
HENRIETTA-HENTAP (to Mustang and Gregg) 230 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	104.7%	<95%	<95%	<95%	<95%	reduce generation in the area (Henrietta 230 kV)
	Los Banos 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	<95%	106.1%	<95%	<95%	<95%	<95%	
230/115 kV TRANSFORMERS and 230/70 kV														
NEWARK 230/115 kV #11	Tesla-Metcalf and Metcalf-Moss Landing 500 kV	P6	L-1/L-1	<95%	<95%	95.3%	<95%	<95%	<95%	<95%	95.6%	<95%	<95%	Adjust NRS phase shifter and/or increasing generation in the area.
	Tesla-Metcalf 500 kV and Newark -Los Esteros 230 kV	P6	L-1/L-1	103.4%	101.1%	113.2%	<95%	<95%	<95%	<95%	106.1%	101.0%	<95%	
	Tesla-Metcalf 500 kV and Newark E-F 230 kV kV bus tie (to Los Esteros)	P6	L-1/BRK	108.7%	105.8%	117.8%	<95%	<95%	<95%	<95%	110.8%	105.7%	<95%	
115 kV LINES														
DELTA - CASCADE 115 kV	Malin-Round Mtn #1 and #2 500 kV	P6	L-1/L-1	98.7%	<95%	97.4%	107.4%	<95%	<95%	<95%	98.3%	<95%	<95%	adjust Weed Phase Shifter or limit COI flow within seasonal nomogram
	Round Mtn-Table Mtn # 1 and # 2 500 kV	P6	L-1/L-1	<95%	<95%	<95%	98.4%	<95%	<95%	<95%	<95%	<95%	<95%	
NEWARK D-NRS 400 115 kV	Tesla-Metcalf 500 kV and Newark- Newark brk (to Los Esteros) 115 kV	P6	L-1/BRK	96.3%	<95%	143.2%	<95%	<95%	<95%	<95%	114.0%	113.6%	<95%	Adjust NRS phase shifter and/or increasing generation in the area. In 2031, install additional reactive support in San Jose
	Tesla-Metcalf 500 kV and Newark -Los Esteros 230 kV kV	P6	L-1/L-1	<95%	<95%	135.1%	<95%	<95%	<95%	<95%	105.6%	105.2%	<95%	
NEWARK F-NRS 300 115 kV	Tesla-Metcalf 500 kV and Newark- Newark brk (to Los Esteros) 115 kV	P6	L-1/BRK	<95%	<95%	108.4%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Metcalf 500 kV and Newark -Los Esteros 230 kV kV	P6	L-1/L-1	<95%	<95%	102.2%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
NEWARK E-TANKER-KIEFER 115 kV	Tesla-Metcalf 500 kV and Newark- Newark brk (to Los Esteros) 230 kV	P6	L-1/L-1	<95%	<95%	103.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	

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NEWARK - ZANKER RIVER 115 kV	Tesla-Metcalf 500 kV and Newark -Los Esteros 230 kV kV	P6	L-1/L-1	<95%	<95%	100.6%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
NEWARK-LOCKHID J2 (APPLIED MATERIALS) # 1 115 kV	Tesla-Metcalf and Metcalf-Moss Landing 500 kV	P6	L-1/L-1	101.1%	<95%	96.1%	<95%	<95%	<95%	<95%	105.3%	<95%	<95%	Dispatch generation in San Jose (Metcalf) after first contingency, or adjust phase-shifter at NRS
	Tesla-Metcalf & Mossland-LosBanos 500 kV	P6	L-1/L-1	102.5%	<95%	<95%	<95%	<95%	<95%	<95%	diverged	<95%	<95%	
LOS ESTEROS - NORTECH 115 kV	Normal conditions	P0	normal	<95%	<95%	100.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	also other P1 contingencies in San Jose and P6 contingencies in the area in the 2031 Summer peak case. Rating limited by substation Bus or Jumper Conductor rating. Consider replacing the jumper. Install additional reactive support for low voltages, this will also mitigate overloads
	Table Mtn-Vaca Dix 500 kV	P1	L-1	<95%	<95%	103.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table Mtn-Tesla 500 kV	P1	L-1	<95%	<95%	103.3%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Metcalf-Tesla 500 kV	P1	L-1	<95%	<95%	102.8%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Olinda-Tracy 500 kV	P1	L-1	<95%	<95%	102.8%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Vaca Dix-Tesla 500 kV	P1	L-1	<95%	<95%	101.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table Mtn-Tesla 500 kV and Los Esteros-Trimble 115 kV	P6	L-1/L-1	<95%	<95%	109.6%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Metcalf and Metcalf-Moss Landing 500 kV	P6	L-1/L-1	<95%	<95%	106.8%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Metcalf & Mossland-LosBanos 500 kV	P6	L-1/L-1	<95%	<95%	105.8%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Bi-pole PDCI	P7	HVDC	<95%	<95%	105.5%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table Mtn-Tesla and Tesla-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	105.1%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table Mtn-Tesla and Tesla-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	104.3%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Metcalf and Tesla-Losbanos 500 kV	P6	L-1/L-1	<95%	<95%	104.2%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Table Mtn-Vaca Dix and Vaca Dix-Tesla 500 kV	P6	L-1/L-1	<95%	<95%	104.1%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Olinda-Tracy and Tracy-Tesla 500 kV	P6	L-1/L-1	<95%	<95%	104.1%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Table Mt and Tesla- Tracy 500 kV	P6	L-1/L-1	<95%	<95%	104.0%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
NORTECH-NRS 300 115 kV	Table-Vaca and Table Mt-DRS #1 or # 2 500 kV	P6	L-1/L-1	<95%	<95%	103.9%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	not a violation, monitor
	Vaca Dix- Tesla and Tesla-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	103.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
SPRING GAP-Mi WUK 115 kV	Tesla-Metcalf and Metcalf-Mosslanding 500 kV	P6	L-1/L-1	<95%	<95%	95.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	not a violation, monitor
KERN FRNT-POSO MTN JCT-LIVE OAK 115 kV	Normal conditions	P0	normal	99.1%	106.2%	<95%	<95%	<95%	<95%	<95%	<95%	107.0%	<95%	reduce generation in the area (Live Oaks)
	Tracy-Los Banos and Los Banos-Gates # 3 500 kV	P6	L-1/L-1	<95%	97.7%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
EXCHEQUER-LE GRAND 115 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	97.3%	<95%	<95%	100.1%	<95%	<95%	reduce generation in the area (Exchequer)

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MENDOTA-NORTH STAR 115 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	<95%	<95%	113.9%	<95%	<95%	reduce generation in the area (Northstar)
HERNDON-WOODWARD 115 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	98.2%	115.3%	<95%	<95%	<95%	<95%	reduce generation in the area (Kerkhoff)
	Gates 500/230 kV # 11 and 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	103.1%	<95%	<95%	<95%	<95%	
	Los Banos-Gates # 1 and Gates-Midway 500 kV	P2/P6	BRK	<95%	<95%	<95%	<95%	<95%	98.5%	<95%	<95%	<95%	<95%	
MENDOTA-PANOCHÉ 115 kV	Table Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	<95%	97.5%	<95%	<95%	<95%	<95%	reduce generation in the area (Northstar) if overload
	Table Mtn 500/230 and Tesla 500/230 # 2, 4 or 6	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	98.5%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 and Round Mtn 500/230	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	98.0%	<95%	<95%	<95%	<95%	
BELRDGE - MIDWAY 115 kV	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	104.3%	<95%	<95%	<95%	<95%	110.1%	Reduce generation in the area (Pump Jack)
CHENY T-PANOCHÉ 115 kV	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	100.8%	Reduce generation in the area (Exelsior)
CONTADNA-JACKSON SW 115 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	102.2%	<95%	<95%	<95%	<95%	reduce generation in the area (Connected to Jackson Switching station)
MANTECA-AVENAL-MELONES 115 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	104.9%	<95%	<95%	<95%	<95%	reduce generation in the area (Tulloch or/and Sandbar)
	Table Mtn and Round Mtn 500/230 kV transformer	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	103.3%	<95%	<95%	<95%	<95%	
	Table Mtn and Tesla 500/230 kV transformer	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	104.5%	<95%	<95%	<95%	<95%	
	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	95.4%	<95%	<95%	<95%	<95%	
	Table Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	<95%	101.6%	<95%	<95%	<95%	<95%	
MANTECA-RIPON 115 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	96.2%	106.8%	<95%	<95%	<95%	<95%	reduce generation in the area (Tulloch or/and Sandbar)
	Table Mtn 500/230 kV transformer	P1	T-1	<95%	<95%	<95%	<95%	<95%	102.7%	<95%	<95%	<95%	<95%	
	Round Mtn and Table Mnt 500/230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	104.3%	<95%	<95%	<95%	<95%	
	Gates 500/230 kV # 11 and # 12	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	96.8%	<95%	<95%	<95%	<95%	
	TABLE MTN 500/230 and TESLA 500/230 # 2	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	105.4%	<95%	<95%	<95%	<95%	
70 kV LINES (normal conditions only)														
KETTLEMAN-GATES 70 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	150.9%	<95%	<95%	<95%	<95%	Mitigation in Fresno local area studies
AVENAL-SUN CITY 70 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	119.9%	<95%	<95%	<95%	<95%	Mitigation in Fresno local area studies
SCHINDLER-CRESCENT 70 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	102.2%	<95%	<95%	<95%	<95%	Mitigation in Fresno local area studies

2021-2022 ISO Reliability Assessment - Study Results

Study Area: PG&E Bulk
Thermal Overloads



TAFT-TAFT SWITCH STA 70 kV	Normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	121.1%	<95%	109.6%	<95%	<95%	Mitigation in Fresno local area studies
60 kV LINES (normal conditions only)														
UOP- WSTLNE SW (West Lane) 60 kV	Normal conditions	P0	normal	145.5%	<95%	<95%	96.2%	<95%	<95%	<95%	105.3%	<95%	<95%	Mitigation in Stockton local area studies
Bridgeville-Garberville 60 kV	Normal conditions	P0	normal	113.3%	<95%	<95%	<95%	<95%	<95%	<95%	108.6%	<95%	<95%	Mitigation in North Coast local area studies. Reduce generation from Humboldt. Overload in 2023 and 2031 Summer peak with contingencies up to 10%
Vaca Dix-Winters 60 kV	Normal conditions	P0	normal	112.0%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	96.9%	<95%	Mitigation in Sacramento local area studies
Plain Field-Winters 60 kV	Normal conditions	P0	normal	119.2%	102.1%	<95%	<95%	<95%	<95%	<95%	<95%	106.2%	<95%	Mitigation in Sacramento local area studies
OTHER ISSUES														
Insufficient reactive margin	Mosslanding-Los Banos 500 kV & Tesla-Metcalf 500 kV										voltage instability			dispatch more generation in the Moss landing area aftr first contingency

Study Area: PG&E Bulk

High/Low Voltages



Substation	Contingency (All and Worst P6)	Category	Category Description	Post Cont. Voltage, kV (Baseline Scenarios)							Post Cont. Voltage, kV (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
				2023 Summer Peak	2026 Summer Peak	2031 Summer Peak	2023 Spring Off-Peak	2026 Spring Off-Peak	2031 Spring Off-Peak	2031 Winter Off-Peak	2023 SP Heavy Renewable & Min Gas Gen	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
DIABLO 500 kV	Normal Conditions	P0	normal	within limits	1.083	1.088	within limits	1.082	within limits	1.080	within limits	1.086	within limits	install reactive support to absorb VARs on Gates, modeled starting from 2026. Reduce scheduled voltage on Gates and /or turn on reactors in the Midway tertiary to bring Diablo voltage within the limits. The upper limit is 1.09 under normal and contingency conditions.
	Two Statcoms on Gates	P6	S-1/S-1	N/A	1.101	1.090	N/A	1.100	<1.08	1.095	N/A	1.102	N/A	
GATES 500 kV	Two Statcoms on Gates	P6	S-1/S-1	N/A	1.088	1.080	N/A	1.088	<1.08	1.084	N/A	1.089	N/A	within limits for P6 contingency
MIDWAY 500 kV	Two Statcoms on Gates	P6	S-1/S-1	N/A	1.082	<1.08	N/A	1.081	<1.08	<1.08	N/A	1.084	N/A	within limits for P6 contingency
Low voltages in the Las Aguilas-Moss Landing area	Mosslanding-Los Banos 500 kV & Tesla-Metcalf 500 kV	P6	L-1/L-1								insufficient reactive margin			
Low voltages in the San Jose area	Normal Conditions and contingencies	P0, P1-P7				<0.9								consider installation of reactive support. Mitigation in the local Bay area studies

Study Area: PG&E Bulk

Voltage Deviation



Substation	Contingency (All and Worst P6)	Category	Category Description	Voltage PU (Baseline Scenarios)							Voltage PU (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
				2023 Summer Peak	2026 Summer Peak	2031 Summer Peak	2023 Spring Off-Peak	2026 Spring Off-Peak	2031 Spring Off-Peak	2031 Winter Off-Peak	2023 SP Heavy Renewable & Min Gas Gen	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
NONE over 8%														

Transient Stability

UNITS GENERATING LESS THAN 1 MW NOT INCLUDED
ONLY GENERATION AND LOAD IN CALIFORNIA ISO AREA SHOWN
Transient Stability Performance (Tripped generation and load)



AREA	BUS NUMBER	NAME/ POI	TYPE	Contin- gency Category	Contingency	2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	reason for tripping	Mitigation/Comments
Generation Trip													
SCE	24340	CHARMIN/Santa Clara 66 kV	synchr gen	P1, P6, P7	3 ph fault on Midway	19 MW at 2.5 sec	19 MW at 2.5 sec	not tripped	modeled off	19 MW at 2.5 sec	not tripped	high voltage	high voltage due to composite load reduction in the SCE area. Investigate composite load parameters
				P1, P6, P7	3 ph fault on Los Banos or Gates	19 MW at 2 sec	19 MW at 2 sec	not tripped	modeled off	not tripped	not tripped	high voltage	
SCE	25079	PRIDGE B/Gold Finger 66 kV	solar PV	P1, P6, P7	3 ph fault Tesla, Los Banos, Gates, Diablo or Midway	modeled off	modeled off	modeled off	20 MW tripped with fault	modeled off	modeled off	high voltage	high voltage w/fault, instant trip at 1.2 p.u. Possible modeling error, need to check the model
				P2	1 ph fault Midway w/delayed clearing	modeled off	modeled off	modeled off		modeled off	modeled off	high voltage	
SCE	25092	MOJAVE/ Sun Spot 66 kV	solar PV	P1, P2, P4, P6, P7	1ph w/delayed clearing or 3ph normal on Midway, or 3 ph fault on Los Banos, Moss landing, Gates, Metcalf, RM Statcom, Round Mtn or Table Mtn	modeled off	modeled off	19 MW not tripped	19 MW tripped w/fault	modeled off	modeled off	high voltage	high voltage w/fault, instant trip at 1.2 p.u. Possible modeling error, need to check the model
SCE	25169	PRIDGE C/ Gold Finger 66 kV	solar PV	P1, P6, P7	3ph fault on Tracy, Tesla, Los Banos, Gates, Midway, Diablo	modeled off	modeled off	modeled off	12 MW tripped w/fault	modeled off	modeled off	high voltage	high voltage w/fault, instant trip at 1.2 p.u. Possible modeling error, need to check the model
SCE	29308	Center 66 kV	peaker	P1, P6, P7	3 ph fault on Midway	47 MW at 2 sec	47 MW at 2 sec	modeled off	modeled off	47 MW at 2 sec	modeled off	high voltage	high voltage due to composite load reduction in the SCE area. Investigate composite load parameters
SCE	29307	Mira Loma 66 kV	peaker	P1, P6, P7	3 ph w/normal or 1 ph w/delayed clearing fault on	47 MW at 2 sec	47 MW at 2 sec	modeled off	modeled off	47 MW at 2 sec	modeled off		
SCE	29309	Barre 66 kV	peaker	P1, P6, P7	3 ph w/normal or 1 ph w/delayed clearing fault on	47 MW at 2 sec	47 MW at 2 sec	modeled off	modeled off	47 MW at 2 sec	modeled off		
SCE	29340	Clear Water ST/ Mira Loma 66 kV	co-gen	P1, P6, P7	3ph fault Los Banos, Gates, Midway	7 MW not tripped	8 MW at 8 or 19 sec	8 MW not tripped	modeled off	7 MW not tripped	8 MW not tripped	out of step generic realy	large reduction in composite load in SCE. Investigate composite load parameters
SCE	29536	SS1T2_G1 0.34	solar PV	P1, P6, P7	3ph fault Midway, any contingency	modeled off	modeled off	50 MW at 4 sec	78 MW not tripped	modeled off	50 MW not tripped	low voltage	voltage doesn't recover above 0.8 pu after the fault.Tripped in accordance with PRC-024
SCE	29537	SS1T2_G2 0.34	solar PV	P1, P6, P7	3ph fault Midway, any contingency	modeled off	modeled off	50 MW at 4 sec	78 MW not tripped	modeled off	50 MW not tripped	low voltage	
SCE	29391	Camino solar/ Manzana 230 kV	solar PV	P1, P6, P7	3 ph on Gates or Midway	modeled off	modeled off	not in the case	43 MW w/fault	modeled off	not in the case	high voltage	high voltage w/fault, possible modeling error, instant trip at 1.2 p.u.
SCE	29590	Voyager1_G 0.64	wind	P1, P2, P6, P7	3ph fault Midway, or 1ph with delayed clearing	52 MW not tripped	52 MW not tripped	not in the case	45 MW w/fault	53 MW not tripped	not in the case	high voltage	high voltage w/fault, possible modeling error, instant trip at 1.2 p.u.
SCE	29606	AVSR_A_G2 0.31	solar PV	P1, P6, P7	3ph fault Midway	modeled off	modeled off	modeled off	50 MW w/fault	modeled off	25 MW not tripped	high voltage	high voltage w/fault, possible modeling error, instant trip at 1.2 p.u.
SCE	29610	AVSR_B_G4 0.31	solar PV	P1, P6, P7	3ph fault Midway	modeled off	modeled off	modeled off	86 MW w/fault	modeled off	45 MW not tripped	high voltage	high voltage w/fault, possible modeling error, instant trip at 1.2 p.u.
SCE	29724	BSKY_G_ABSR 0.38, BIG SKY 230 kV connect to Antelope 230 kV	solar PV	P1, P6, P7	3ph fault Vaca Dixon, Tracy, Tesla, Moss Landing, Metcalf, Los Banos, Gates, Midway, Diablo	modeled off	modeled off	modeled off	19 MW with fault	modeled off	not tripped, 15 MW	high voltage	high voltage w/fault, possible modeling error, instant trip at 1.2 p.u.

Transient Stability

UNITS GENERATING LESS THAN 1 MW NOT INCLUDED

ONLY GENERATION AND LOAD IN CALIFORNIA ISO AREA SHOWN

Transient Stability Performance (Tripped generation and load)



AREA	BUS NUMBER	NAME/ POI	TYPE	Contin- gency Category	Contingency	2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	reason for tripping	Mitigation/Comments
Generation Trip													
PG&E	31846	COVE RD 13.8	hydro	P7	3 phase fault on Tesla	6 MW at 19 sec	modeled off	stable	stable	6 MW at 19 sec	stable	out of step	small unit, possible modeling error
PG&E	31847	ROAMONG 13.8	hydro	P7	3 phase fault on Tesla	2 MW at 18 sec	modeled off	stable	stable	2 MW at 18 sec	stable	out of step	small unit, possible modeling error
PG&E	32181	SHILOH 1/ Birds Landing 230 kV	wind type 3	P1, P6, P7	3ph Fault Tesla	63 MW at 1.3 sec	63 MW at 1.3 sec	30 MW not tripped	not tripped	63 MW at 1.3 sec	96 MW not tripped	low voltage	Under-over voltage relay settings don't meet PRC-024 Standard. Need to change relay settings.
				P1	3ph fault Midway transformer	63 MW at 2 sec	not tripped		not tripped	not tripped		high voltage	
				P1, P6, P7	3ph fault Table Mtn or Los Banos	not tripped	not tripped		30 MW at 1.2 sec	not tripped		high voltage	
PG&E	33868	Q709RPWRP2/ Tesla 115 kV	wind	P1, P6, P7	3 ph Malin, Round Mt, RM Statcom, Midway	19MW not tripped	19MW not tripped	9 MW not tripped	9 MW tripped w/fault	19 MW not tripped	29 MW not tripped	high voltage	instant tripping at 1.2 p.u. voltage, high initial voltage off-peak
				P2	1 ph fault on Tesla w/delayed clearing,	19 MW not tripped	19MW not tripped	9 MW not tripped	9 MW tripped w/fault	19 MW not tripped	29 MW not tripped	high voltage	instant tripping at 1.2 p.u. voltage, high initial voltage off-peak
PG&E	34629	KETTLEMANS/ Henrietta 70 kV	solar PV	P1, P2, P6	1ph fault w/delayed clearing on Tesla, Los Banos, Gates or Midway, 3 ph Gates	modeled off	modeled off	modeled off	19 MW w/fault	modeled off	20 MW not tripped	high voltage	instant tripping at 1.2 p.u. voltage. Possible modeling error
PG&E	34683	MUSTANG 230 kV	solar PV	P2	1 ph fault on Tesla, or Mosslanding w/delayed clearing	modeled off	modeled off	modeled off	modeled off	modeled off	102 MW at 2 sec	high voltage	over-voltage and under-frequency relay settings don't meet PRC -024 Standard, high voltage with contingency. Need to reduce scheduled voltage in the base case. Frequency below relay settings due to Diablo generation loss
				P4-1	1 ph fault on Diablo w/delayed clearing						102 MW at 6 sec	low frequency	
PG&E	34694	KENT_S/ Henrietta 70 kV	solar PV	P1, P6, P7	3 ph fault on Midway	modeled off	modeled off	modeled off	19 MW w/fault	modeled off	20 MW not tripped	high voltage	voltage spike with fault, possible modeling error
				P6	3 ph fault on Gates	modeled off	modeled off	modeled off	19 MW w/fault	modeled off	20 MW not tripped	high voltage	voltage spike with fault, possible modeling error
PG&E	35082	ORION 0.44	solar PV	P1, P6, P7	3ph fault Midway	modeled off	modeled off	modeled off	19 MW w/fault	modeled off	20 MW not tripped	high voltage	voltage spike with fault, possible modeling error
PG&E	35883	MEC STG1	Steam turbine	P1, P6, P7	3 ph fault Tesla	222 MW not tripped	237 MW at 4 sec	222 MW not tripped	modeled off	222 MW not tripped	modeled off	low voltage	Low voltage due to induction motor stalling, low voltage in the base case
PG&E	36411	DIABLO 1 25 kV	nuclear	P4-1	3ph fault Stuck breaker on Diablo 500 kV	N/A	N/A	1190 MW at 2 sec	N/A	N/A	1190 MW at 2 sec	out of step	extreme contingency, unit tripped by out of step relay. Allowed for extreme events. The system was stable
PG&E	36413	UNION OIL 13.8 kV	synchr gen	P1	3 ph fault Gates 500/230 kV # 11 or 12	stable	stable	6 MW at 18 sec	stable	stable	stable	out of step	small unit, possible modeling error
PG&E	38207	MCH_PV_1 0.34	solar PV	P6, P7	3 ph fault Tesla, Tracy	24 MW at 3 sec	24 MW not tripped	24 MW not tripped	24 MW not tripped	24 MW at 3 sec	24 MW not tripped	low voltage	low voltage due to induction motor stalling
PG&E	38552	DONPEDRO2	hydro	P1, P6	3 ph fault Metcalf, or Tesla	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	30 MW, possible modeling error
PG&E	38554	DONPEDRO4	hydro	P1, P6	3 ph fault Metcalf, or Tesla	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	25 MW possible modeling error

Transient Stability

UNITS GENERATING LESS THAN 1 MW NOT INCLUDED

ONLY GENERATION AND LOAD IN CALIFORNIA ISO AREA SHOWN

Transient Stability Performance (Tripped generation and load)



AREA	BUS NUMBER	NAME/ POI	TYPE	Contin- gency Category	Contingency	2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	reason for tripping	Mitigation/Comments
Generation Trip													
PG&E	38562	DAWSON/ Tuolumne 70 kV	hydro	P1, P6	3 ph fault Metcalf, or Tesla	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	undamped oscillations	small unit (2 MW), possible modeling error
PG&E	365534	Q954 0.27 on Gates 230 kV	solar PV	P1, P6, P7	3ph fault on Tracy, Tesla, Gates, Los Banos, Midway	modeled off	modeled off	modeled off	modeled off	modeled off	149 MW w/fault	high voltage	voltage spike with fault, possible modeling error
PG&E	365540	STANDARD OIL 12.47 kV Sobrante 115 kV	synchr gen	P1. P6, P7	3ph fault on Tesla	18 MW at 12 sec	18 MW at 13 sec	18 MW not tripped	18 MW not tripped	18 MW at 12 sec	18 MW not tripped	out of step	large loss of composite load with three-phase faults on Tesla in peak cases
PG&E	365659	Q622BSPV 0.44	solar PV	P1, P6, P7	3ph fault Gates, Diablo or Midway	modeled off	modeled off	modeled off	19 MW at 1.2 sec	modeled off	20 MW w/fault	high voltage	instant trip at 1.2 p.u. Possible modeling error
				P2	1ph fault w/delayed clearing on Midway	modeled off	modeled off	modeled off	19 MW w/fault	modeled off	not tripped	high voltage	
				P1, P6, P7	3ph fault Los Banos,	modeled off	modeled off	modeled off	not tripped	modeled off	20 MW w/fault	high voltage	
PG&E	366394	Q1454B 0.69 KV, connected to Metcalf 115 kV	battery	P1, P6, P7	3ph fault on Round Mtn, RM Statcom, Table Mtn	76 MW at 2 sec	modeled off	modeled off	-77 MW at 3 sec	76 MW at 2 sec	modeled off	high voltage	large loss of composite load with three-phase faults in peak cases
				P1, P6, P7	3ph fault on Tracy, Tesla or Metcalf	76 MW at 12 sec			-77 MW at 8 sec	76 MW at 12 sec			
				P1	3ph fault on Los Banos	not tripped			-77 MW at 3 sec	not tripped			
				P2	1 ph on Tesla or Metcalf w/ delayed clearing	76 MW at 3sec			-77 MW at 4 sec	76 MW at 3sec			
				P1, P6, P7	3ph fault on Vaca Dix	76 MW at 3sec			-77 MW at 4 sec	76 MW at 3sec			
PG&E	366711	Q1472BESS1 34.5	battery	P1, P6, P7	3ph fault on Tesla-Metcalf, or Tracy-Tesla	104 MW at 13 sec	modeled off	104 MW not tripped	104 MW not tripped	104 MW at 13 sec	104 MW not tripped	high voltage	large loss of composite load with three-phase faults on Tesla or Tracy in peak cases
				P2_3	1 ph fault w/delayed clearing on Tesla, Metcalf or Mosslanding	104 MW at 2 sec	modeled off	104 MW not tripped	104 MW not tripped	104 MW at 2 sec	104 MW not tripped	high voltage	
PG&E	366712	Q1472BESS2 34.5	battery	P1, P6, P7	3ph fault on Tesla-Metcalf, or Tracy-Tesla	104 MW at 13 sec	modeled off	104 MW not tripped	104 MW not tripped	104 MW at 13 sec	104 MW not tripped	high voltage	large loss of composite load with three-phase faults on Tesla or Tracy in peak cases
				P2_3	1 ph fault w/delayed clearing on Tesla, Metcalf or Mosslanding	104 MW at 2 sec	modeled off	104 MW not tripped	104 MW not tripped	104 MW at 2 sec	104 MW not tripped	high voltage	
PG&E	366713	Q1472BESS3 34.5	battery	P1, P6, P7	3ph fault on Tesla-Metcalf, or Tracy-Tesla	101 MW at 13 sec	modeled off	101 MW not tripped	101 MW not tripped	101 MW at 13 sec	101 MW not tripped	high voltage	large loss of composite load with three-phase faults on Tesla or Tracy in peak cases
				P2_3	1 ph fault w/delayed clearing on Tesla, Metcalf or Mosslanding	101 MW at 2 sec	modeled off	101 MW not tripped	101 MW not tripped	101 MW at 2 sec	101 MW not tripped	high voltage	
LOAD TRIP													

Transient Stability

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Transient Stability Performance (Tripped generation and load)



AREA	BUS NUMBER	NAME/ POI	TYPE	Contin- gency Category	Contingency	2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	reason for tripping	Mitigation/Comments
Generation Trip													
PG&E	36012	WATSONVILLE # 1	net load	P1, P6, P7	3 ph fault on Tesla 500 kV, any contingency	7.6 MW, at 4 sec	7.7 MW, at 4 sec	7.4 MW not tripped	-2 MW not tripped	8.2 MW, at 4 sec	3.7 MW not tripped	undervoltage	0.9 p.u. 3 sec relay settings for under-voltage load tripping
				P1, P6, P7	3 ph fault on Metcalf 500 kV, any contingency	7.6 MW, not tripped	7.7 MW, at 4 sec	7.4 MW not tripped	-2 MW not tripped	8.2 MW, at 4 sec	3.7 MW not tripped	undervoltage	0.9 p.u. 3 sec relay settings for under-voltage load tripping
				P1, P6, P7	3 ph fault Moss Landing 500 kV, any contingency	7.6 MW, not tripped	7.7 MW, at 4 sec	7.4 MW not tripped	-2 MW not tripped	8.2 MW, not tripped	3.7 MW not tripped	undervoltage	0.9 p.u. 3 sec relay settings for under-voltage load tripping
PG&E	36857	Mission 60.0 # 1	net load	P1, P6, P7	3 ph fault RM Statcom, Table Mtn, Vaca Dix	reduced to 84% w/fault	not tripped	not tripped	not tripped	reduced to 84% w/fault	not tripped	overfrequency	Frequency drop with fault, possible modeling error
PG&E	36860	Palm 60.0 # 1	net load	P6, P7	3 ph fault RM Statcom, Table Mtn	reduced to 68% w/fault	not tripped	not tripped	not tripped	reduced to 68% w/fault	not tripped	overfrequency	Frequency drop with fault, possible modeling error
PG&E	36860	Palm 60.0 # 2	net load	P6, P7	3 ph fault RM Statcom, Table Mtn	reduced to 58% w/fault	not tripped	not tripped	not tripped	reduced to 58% w/fault	not tripped	overfrequency	Frequency drop with fault, possible modeling error
PG&E	36890	Walsh 60.0 # 1	net load	P6, P7	3 ph fault Round Mtn, RM Statcom, Table Mtn, Tracy	reduced to 96% w/fault	not tripped	not tripped	not tripped	reduced to 96% w/fault	not tripped	overfrequency	Frequency drop with fault, possible modeling error
PG&E	36891	Zeno 60.0 # 2	net load	P1, P6, P7	3 ph fault Round Mtn, RM Statcom, Table Mtn, Tracy, Vaca Dix	reduced to 74% w/fault	not tripped	not tripped	not tripped	reduced to 74% w/fault	not tripped	overfrequency	Frequency drop with fault, possible modeling error
PG&E	38905	Kenneth 60.0 # 1	net load	P6, P7	3 ph fault Round Mtn, RM Statcom, Table Mtn	reduced to 41% w/fault	not tripped	not tripped	not tripped	reduced to 41% w/fault	not tripped	overfrequency	Frequency drop with fault, possible modeling error
PG&E	38146	LEAVITT	net load	P6	Table Mt-DRS # 1 and Table MT 500/230	not tripped	not tripped	not tripped	not tripped	not tripped	reduced to 93% at 2 sec	underfrequency	large frequency swing

Transient Stability**ONLY CONTINGENCIES WITH POTENTIAL VIOLATIONS ARE LISTED**

			Transient Stability Performance (Number of voltage and frequency violations)						
Contingency	Category	Category Description	Baseline scenarios				Sensitivity		Potential Mitigation Solutions/ Comments
			2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
P1_2-0. RPS-MOSSLAND #1 500kV, fault on MOSSLANDING	P1	L-1	no issues	Potential WECC/NERC criteria violation	no issues	no issues	no issues	no issues	Change UVLS relay settings on Watsonville load (Peak cases).
P1_2-1, or P1_2-2. ROUND MTN-TABLE MTN 500 kV, fault on TABLE MTN	P1	L-1	Potential WECC/NERC criteria violation	no issues	no issues	no issues	Potential WECC/NERC criteria violation	no issues	Review UVLS settings in Northwest so that load would not trip
P1_2-3. TABLE MTN-VACA DIX 500 kV , fault on TABLE MTN	P1	L-1	Potential WECC/NERC criteria violation	no issues	no issues	no issues	Potential WECC/NERC criteria violation	no issues	Review for possible modelling errors for UFLS in San Jose with the fault
P1_2-4. TABLE MTN-TESLA 500 kV, fault on TABLE MTN	P1	L-1	Potential WECC/NERC criteria violation	no issues	no issues	no issues	Potential WECC/NERC criteria violation	no issues	Review for possible modelling errors for UFLS in San Jose with the fault
P1_2-6. VACA DIX-TESLA 500 kV, fault on VACA DIX	P1	L-1	Potential WECC/NERC criteria violation	no issues	no issues	no issues	Potential WECC/NERC criteria violation	no issues	Review for possible modelling errors for UFLS in San Jose with the fault
P1_2-7. TRACY-TESLA 500 kV, fault on TRACY	P1	L-1	Potential WECC/NERC criteria violation	no issues	no issues	no issues	Potential WECC/NERC criteria violation	no issues	Change UVLS relay settings on Watsonville load (Peak cases). Review Dawson and San Pedro #2 and #4 units models because of undamped oscillations, also in other cases. Review for possible modelling errors for UFLS in San Jose with the fault . May need additional dynamic reactive support in the Bay Area
P1_2-8. TRACY-LOS BANOS 500 kV, fault on TRACY	P1	L-1	Potential WECC/NERC criteria violation	no issues	no issues	no issues	no issues	no issues	
P1_2-9. TESLA-METCALF 500 kV,fault on TESLA	P1	L-1	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Change UVLS relay settings on Watsonville load (Peak cases). Review steam unit at Sobrante Standard Oil models for errors because of out-of-step tripping. Review Dawson and San Pedro #2 and #4 units models because of undamped

Transient Stability

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			Transient Stability Performance (Number of voltage and frequency violations)						
Contingency	Category	Category Description	Baseline scenarios				Sensitivity		Potential Mitigation Solutions/ Comments
			2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
P1-2-10 TESLA - LOSBANOS 500 kV, fault on TESLA	P1	L-1	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	oscillations, also in other cases. May need additional dynamic reactive support in the Bay Area
P1-2-11 METCALF - MOSSLAND 500 kV, fault on METCALF	P1	L-1	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Potential WECC/NERC criteria violation	Change UVLS relay settings on Watsonville load (Peak cases). Review Dawson and San Pedro #2 and #4 units models because of undamped oscillations, also in other cases
P1-2-12 MOSSLANDING - LOSBANOS 500 kV, fault on MOSSLANDING	P1	L-1	no issues	Potential WECC/NERC criteria	no issues	no issues	no issues	no issues	Change UVLS relay settings on Watsonville load (Peak cases)
P1-2-13 LOSBANOS -GATES 500 kV # 3, fault on LOS BANOS	P1	L-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping
P1-2-14 LOSBANOS -GATES 500 kV # 1, fault on LOS BANOS	P1	L-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping
P1-2-15 LOSBANOS - MIDWAY 500 kV, fault on LOS BANOS	P1	L-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping
P1-2-16 GATES - DIABLO 500 kV, fault on GATES	P1	L-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping
P1_2-17 GATES - MIDWAY 500 kV, fault on GATES	P1	L-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping

Transient Stability

ONLY CONTINGENCIES WITH POTENTIAL VIOLATIONS ARE LISTED

			Transient Stability Performance (Number of voltage and frequency violations)						
Contingency	Category	Category Description	Baseline scenarios				Sensitivity		Potential Mitigation Solutions/ Comments
			2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
P1-2-20, P1_2-21 MIDWAY - VINCENT 500 kV # 1, fault on MIDWAY	P1	L-1	no issues	Potential WECC/NERC criteria violations	no issues	Potential WECC/NERC criteria violations	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping in 2031 peak. Undamped oscillations on 25378 RP_WWB_G renewable in 2031 off-peak. Possible modeling error
P1-2-22 MIDWAY-WHIRLWIND 500 kV, fault on MIDWAY	P1	L-1	no issues	Potential WECC/NERC criteria violations	no issues	Potential WECC/NERC criteria violations	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping in 2031 peak. Undamped oscillations on 25378 RP_WWB_G renewable in 2031 off-peak. Possible modeling error
P1_2-23 or P1_2-24 MALIN-ROUND MTN 500 kV, fault on MALIN	P1	L-1	Potential WECC/NERC criteria violations	no issues	no issues	no issues	Potential WECC/NERC criteria violations	no issues	Review UVLS settings in Northwest so that load would not trip
P1_2-25 CAPT JACK-OLINDA 500 kV, fault on CAPT JACK	P1	L-1	Potential WECC/NERC criteria violations	no issues	no issues	no issues	Potential WECC/NERC criteria violations	no issues	Review UVLS settings in Northwest so that load would not trip
P1_3-2 TRACY 500/230 kV transformer # 1 , fault on TRACY 500 kV	P1	T-1	no issues	no issues	no issues	no issues	no issues	no issues	May need additional dynamic reactive support in the Bay Area
P1_3-7,8,9 TESLA 500/230 kV transformer # 2, 4 or 6, fault on TESLA 500 kV	P1	T-1	Potential WECC/NERC criteria violations	Potential WECC/NERC criteria violations	Potential WECC/NERC criteria violations	Potential WECC/NERC criteria violations	Potential WECC/NERC criteria violations	Potential WECC/NERC criteria violations	Change UVLS relay settings on Watsonville load (Peak cases). Review steam unit at Sobrante Standard Oil models for errors because of out-of-step tripping. Review Dawson and San Pedro #2 and #4 units models because of undamped oscillations, also in other cases. May need additional dynamic reactive support in the Bay Area. Review steam unit at Sobrante Standard Oil models for errors because of out-of-step tripping.
P1_3-11 METCALF 500/230 kV transformer # 11, fault on METCLAF 500 kV	P1	T-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	Potential WECC/NERC criteria violations	no issues	Change UVLS relay settings on Watsonville load (Peak cases).

Transient Stability

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			Transient Stability Performance (Number of voltage and frequency violations)						
Contingency	Category	Category Description	Baseline scenarios				Sensitivity		Potential Mitigation Solutions/ Comments
			2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
P1_3-13 MOSSLANDING 500/230 kV transformer # 11, fault on MOSSLANDING 500 kV	P1	T-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Change UVLS relay settings on Watsonville load (Peak cases).
P1_3-14 LOS BANOS 500/230 kV transformer, fault on LOS BANOS 500 kV	P1	T-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping
P1_3-15 GATES 500/230 kV transformer # 11, fault on GATES 500 kV	P1	T-1	no issues	Potential WECC/NERC criteria violations	no issues	no issues	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping
P1_3-18 MIDWAY 500/230 kV transformer # 11	P1	T-1	no issues	Potential WECC/NERC criteria violations	no issues	Potential WECC/NERC criteria violations	no issues	no issues	Review Clearwater (SCE) generator model for errors because of out-of-step tripping in 2031 peak. Undamped oscillations on 25378 RP_WWB_G renewable in 2031 off-peak. Possible modeling error
P6_1_1-22 TESLA-TABLE MTN 500 kV and TESLA-TRACY 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-23 TESLA-TABLE MTN 500 kV and TESLA-METCALF 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-24 TESLA-TABLE MTN 500 kV and TESLA-LOS BANOS 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-25 TESLA-VACA DIX 500 kV and TESLA-TRACY 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-26 TESLA-VACA DIX 500 kV and TESLA-METCALF 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-27 TESLA-VACA DIX 500 kV and TESLA-LOS BANOS 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area

Transient Stability

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			Transient Stability Performance (Number of voltage and frequency violations)						
Contingency	Category	Category Description	Baseline scenarios				Sensitivity		Potential Mitigation Solutions/ Comments
			2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
P6_1_1-28 TESLA-TRACY 500 kV and TESLA-METCALF 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-29 TESLA-TRACY 500 kV and TESLA-LOS BANOS 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-30 TESLA-METCALF 500 kV and TESLA-LOS BANOS 500 kV, fault on TESLA 500 kV	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-83 TRACY-OLINDA and TRACY-LOS BANOS 500 kV, fault on TRACY	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_1-84 TRACY-TESLA and TRACY-LOS BANOS 500 kV, fault on TRACY	P6	L-1/L-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-10 TESLA - TABLE MTN 500 kV and TESLA 500/230 kV transformer	P6	L-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-11 TESLA - VACA DIX 500 kV and TESLA 500/230 kV transformer	P6	L-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-12 TESLA - METCALF 500 kV and TESLA 500/230 kV transformer	P6	L-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-13 TESLA - METCALF 500 kV and TESLA # 2 500/230 kV transformer, fault on TESLA	P6	L-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-14 TESLA - LOSBANOS 500 kV and TESLA 500/230 kV transformer, fault on TESLA 500 kV	P6	L-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-17 TESLA-METCALF #1 500kV Line & METCALF 230/500kV #11	P6	L-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-41 TRACY-OLINDA 500 kV and TRACY 500/230 kV transformer, fault on TRACY	P6	L-1/T-1	no issues	no issues	no issues	no issues	no issues	no issues	May need additional dynamic reactive support in the Bay Area
P6_1_2-42 TRACY-TESLA 500 kV and TRACY 500/230 kV transformer, fault on TRACY	P6	L-1/T-1	no issues	no issues	no issues	no issues	no issues	no issues	May need additional dynamic reactive support in the Bay Area

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			Transient Stability Performance (Number of voltage and frequency violations)						
Contingency	Category	Category Description	Baseline scenarios				Sensitivity		Potential Mitigation Solutions/ Comments
			2026 Summer Peak	2031 Summer Peak	2023 Spring Off- Peak	2031 Spring Off- Peak	2026 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	
P6_1_2-43 TRACY-LOS BANOS 500 kV and TRACY 500/230 kV transformer, fault on TRACY	P6	L-1/T-1	no issues	no issues	no issues	no issues	no issues	no issues	May need additional dynamic reactive support in the Bay Area
P6_2_2-0 TESLA 500/230 kV transformers # 2 and 4, fault on TESLA 500 kV	P6	T-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P6_2_2-5 TRACY 500/230 kV transformers # 1 and 2, fault on TRACY	P6	T-1/T-1	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area
P7_1_1-21 TESLA-TABLE MTN 500 kV and TESLA-VACA DIX 500 kV, fault on TESLA 500 kV	P7	L-2	Acceptable for P6	Acceptable for P6	no issues	no issues	Acceptable for P6	no issues	May need additional dynamic reactive support in the Bay Area

Study Area: PG&E Bulk



Single Contingency Load Drop

Worst Contingency	Category	Category Description	Amount of Load Drop (MW)										Potential Mitigation Solutions
			2021 Summer Peak	2024 Summer Peak	2029 Summer Peak	2021 Spring Off- Peak	2024 Spring Off- Peak	2029 Spring Off- Peak	2029 Winter Off- Peak	2021 SP Heavy Renewable & Min Gas Gen	2024 SP High CEC Forecast	2024 SpOP Hi Renew & Min Gas Gen	
N/A													

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

Substation	Load Served (MW)										Potential Mitigation Solutions
	2021 Summer Peak	2024 Summer Peak	2029 Summer Peak	2021 Spring Off- Peak	2024 Spring Off- Peak	2029 Spring Off- Peak	2029 Winter Off- Peak	2021 SP Heavy Renewable & Min Gas Gen	2024 SP High CEC Forecast	2024 SpOP Hi Renew & Min Gas Gen	
N/A											

No single source substation with more than 100 MW Load