



Overloaded Facility	Contingency (All and Worst P6)	Category	Category Description	Loading % (Baseline Scenarios)							Loading % (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
500 kV LINES														
MALIN-ROUND MTN # 2 500 kV	Captain Jack-Olinda 500 kV and Diablo unit	P3	G-1/L-1	99%	99%	N/A	<95%	<95%	N/A	N/A	102%	<95%	105%	Sensitivity Only
	Malin-Round Mtn # 1 500 kV and Diablo unit	P3	G-1/L-1	98%	98%	N/A	<95%	<95%	N/A	N/A	107%	<95%	111%	
ROUND MTN –TABLE MTN #1 or #2 500 kV	Rnd Mtn –Table Mtn #2 or # 1 500 kV	P1	L-1	98%	100%	102%	<95%	<95%	<95%	<95%	102%	<95%	103%	Reduce COI flow according to seasonal nomogram or bypass ser caps on the remaining Round Mtn-Table Mtn 500 kV line if overload
ROUND MTN-TABLE MTN # 2 or # 1 500 KV	Round Mtn-Table Mtn # 1 or # 2 and Table Mtn 500/230 kV	P6	L-1/T-1	100%	102%	101%	<95%	<95%	<95%	<95%	105%	<95%	104%	
ROUND MTN-TABLE MTN # 1 500 KV	Round Mtn-Table Mtn # 2 and Table Mtn 500/230 kV	P2	BRK	100%	102%	102%	<95%	<95%	<95%	<95%	105%	<95%	104%	
ROUND MTN-TABLE MTN # 1 or # 2 500 KV	Round Mtn-Table Mtn # 2 or # 1 500 KV and Diablo unit	P3	G-1/L-1	110%	112%	N/A	<95%	<95%	<95%	<95%	111%	<95%	117%	
CAPTAIN JACK-OLINDA 500 kV	Malin- Round Mtn #1 and #2 500 kV	P7	L-2	105%	105%	104%	<95%	<95%	<95%	<95%	108%	<95%	108%	Reduce COI flow according to seasonal nomogram
	Round Mtn-Table Mtn # 1 & # 2 500 kV	P7	L-2	105%	105%	105%	<95%	<95%	<95%	<95%	109%	<95%	109%	
	Round Mtn-Table Mtn # 2 & Round Mtn-Malin # 2 or # 1 500 kV	P6	L-1/L-1	105%	105%	105%	<95%	<95%	<95%	<95%	109%	<95%	109%	
MIDWAY-VINCENT # 1 500 kV	Midway-Vincent # 2 and Midway-Whirlwind	P6	L-1/L-1	<95%	<95%	<95%	112%	<95%	<95%	<95%	<95%	119%	117%	Reduce flow on Path 26
MIDWAY-VINCENT # 2 500 kV	Midway-Vincent # 1 and Midway-Whirlwind	P6	L-1/L-1	98%	<95%	<95%	114%	<95%	<95%	<95%	96%	121%	119%	
MIDWAY-WHIRLWIND # 3 500 kV	Midway-Vincent 1 and # 2 500 kV	P7	L-2	<95%	<95%	<95%	105%	<95%	<95%	<95%	<95%	112%	110%	
500/230 kV TRANSFORMERS														
OLINDA 500/230 kV x-former	Table Mtn 500/230 kV and Round Mtn 500/230 kV	P6	T-1/T-1	<95%	<95%	<95%	98%	97%	100%	100%	<95%	96%	<95%	
	Olinda-Tracy 500 kV and Round Mtn 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	100%	<95%	<95%	<95%	<95%	<95%	<95%	
	Olinda-Tracy 500 kV and Cottonwood-Round Mtn # 1, 2 or 3 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	109%	<95%	Trip or reduce area generation
	Malin-Round Mtn # 1 and # 2 500 kV	P7	L-2	<95%	<95%	<95%	104%	100%	97%	<95%	<95%	117%	<95%	
TABLE MTN 500/230 kV x-former	Table Mtn-Vac Dix and Table Mtn-Tesla 500 kV	P7	L-2	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	105%	<95%	Continue to monitor in longer term, generation redispatch to mitigate
	Malin-Round Mtn 500 kV #1 or 2 or Round Mtn 500/230 kV and Eight Mile-Lodi 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	101%	<95%	<95%	<95%	
METCALF 500/230 kV x-former #11, 12 or 13	Metcalf 500/230 kV Tranformers #11 & #12 or #13	P6	T-1/T-1	<95%	<95%	103%	<95%	<95%	<95%	<95%	<95%	<95%	103%	Continue to monitor in longer term, generation redispatch to mitigate
GATES 500/230 kV # 1 or 2 x-former	Gates 500/230 kV # 1 or 2 x-former	P1	T-1	<95%	<95%	<95%	<95%	<95%	96%	<95%	<95%	104%	<95%	Continue to monitor in longer term, generation redispatch to mitigate
	Gates 500/230 kV # 1 or 2 and Los Banos 500/230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	107%	<95%	<95%	117%	<95%	
	Gates 500/230 kV # 1 or 2 and Midway #11,12 or 13 500/230 kV	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	101%	<95%	<95%	111%	<95%	
	Diablo-Gates 500 kV and Gates 500/230 kV # 1 or 2	P6	L-1/T-1	<95%	<95%	<95%	<95%	<95%	95%	<95%	<95%	107%	<95%	



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				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
230 kV LINES														
COTTONWD E-ROUND MTN 230kV #3	Captain Jack-Olinda 500 kV and Diablo unit	P3	G-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	103%	<95%	<95%	Reduce COI flow according to seasonal nomogram, or upgrade the line if economic
	Tbl Mtn-Vaca Dix 500 kV and Cottonwood-Round Mtn # 1 or #2 230 kV	P6	L-1/L-1	<95%	105%	112%	<95%	<95%	<95%	<95%	115%	<95%	108%	
	Capt Jack-Olinda 500 kV and Cottonwood-Round Mtn # 1 or #2 230 kV	P6	L-1/L-1	<95%	102%	114%	<95%	<95%	<95%	<95%	110%	<95%	104%	
	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	102%	111%	116%	<95%	<95%	<95%	<95%	124%	<95%	110%	
	Olinda 500/230 kV and Cottonwood-Round Mtn 230 kV # 1 or # 2	P6	T-1/L-1	<95%	<95%	<95%	<95%	103%	<95%	<95%	<95%	105%	<95%	flow from Cottonwood to Round Mtn, reduce Colusa generation if overload
COTTONWD E-ROUND MTN 230kV #2	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	<95%	100%	105%	<95%	<95%	<95%	<95%	113%	<95%	100%	Reduce COI flow according to seasonal nomogram
	Capt Jack-Olinda 500 kV and Cottonwood-Round Mtn # 1 or #3 230 kV	P6	L-1/L-1	<95%	96%	101%	<95%	<95%	<95%	<95%	98%	<95%	<95%	
	Tbl Mtn-Vaca Dix 500 kV and Cottonwood-Round Mtn # 1 or #3 230 kV	P6	L-1/L-1	<95%	<95%	100%	<95%	<95%	<95%	<95%	103%	<95%	96%	
COTTONWD E-ROUND MTN 230kV #1	Capt Jack-Olinda 500 kV and Cottonwood-Round Mtn # 2 or #3 230 kV	P6	L-1/L-1	<95%	<95%	101%	<95%	<95%	<95%	<95%	97%	<95%	<95%	
	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	<95%	97%	102%	<95%	<95%	<95%	<95%	109%	<95%	97%	
	Tbl Mtn-Vaca Dix 500 kV and Cottonwood-Round Mtn # 2 or #3 230 kV	P6	L-1/L-1	<95%	<95%	98%	<95%	<95%	<95%	<95%	101%	<95%	<95%	
CAYETANO- LONETREE 230 kV	Tesla-Metcalf and Mossindg-Los Banos 500 kV	P6	L-1/L-1	<95%	95%	101%	<95%	<95%	<95%	<95%	98%	<95%	<95%	
	Tesla-Metcalf 500 kV and C. Costa-Las Positas 230 kV	P6	L-1/L-1	<95%	105%	109%	<95%	<95%	<95%	<95%	109%	<95%	<95%	
	Tesla-Metcalf 500 kV and ADCC-Newark 230 kV	P6	L-1/L-1	<95%	100%	104%	<95%	<95%	<95%	<95%	105%	<95%	<95%	
	Vaca Dix-Tesla 500 kV and C. Costa-Las Positas 230 kV	P6	L-1/L-1	<95%	102%	106%	<95%	<95%	<95%	<95%	104%	<95%	<95%	
LAS POSITAS-NEWARK 230 kV	Tesla-Metcalf 500 kV and CONTRA COSTA-LONE TREE 230kV	P6	L-1/L-1	<95%	101%	101%	<95%	<95%	<95%	<95%	104%	<95%	<95%	Continue to monitor in longer term
	Tesla-Metcalf 500 kV and NORTH DUBLIN-CAYETANO 230kV	P6	L-1/L-1	<95%	100%	101%	<95%	<95%	<95%	<95%	103%	<95%	<95%	
	Tesla-Metcalf 500 kV and LONE TREE-CAYETANO 230kV	P6	L-1/L-1	<95%	100%	101%	<95%	<95%	<95%	<95%	102%	<95%	<95%	
CAYETANO- N. DUBLIN 230 kV	Tesla-Metcalf 500 kV and C. Costa-Las Positas 230 kV	P6	L-1/L-1	<95%	99%	102%	<95%	<95%	<95%	<95%	102%	<95%	<95%	reduce generation in Contra Costa area, if overload
GOLD HILL-LODI 230 kV	Table Mtn 500/230 kV and Gold Hill-Eight Mile 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	110%	112%	<95%	<95%	114%	<95%	Generation redispatch
GOLD HILL-EIGHT MILE 230 kV	Table Mtn 500/230 kV and Eight Mille-Lodi 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	113%	115%	102%	<95%	117%	<95%	Generation redispatch
	Table Mtn 500/230 kV and Goldhill-Lodi Stig 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	110%	111%	<95%	<95%	113%	<95%	



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				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
RANCHO SECO-BELLOTA 230 kV # 1 or # 2	RANCHO SECO-BELLOTA 230 kV #2 or # 1 and Tracy 500/230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	104%	Sensitivity Only
	RANCHO SECO-BELLOTA 230 kV #2 or # 1 and Gates 500/230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	104%	
	RANCHO SECO-BELLOTA 230 kV #2 or # 1 and other 500 kV facilities	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	>100%	
BELLOTA-WEBER 230 kV	Table Mtn 500/230 kV and Bellota-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	117%	<95%	<95%	<95%	Continue to monitor in longer term, generation reduction to mitigate
	Table Mtn -Vaca Dix 500 kV and Bellota-Tesla 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	107%	<95%	<95%	<95%	
	Table Mtn -Tesla 500 kV and Bellota-Tesla 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	105%	<95%	<95%	<95%	
	Olinda 500/230 kV and Bellota-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	103%	<95%	<95%	<95%	
WEBER-TESLA 230 kV	Table Mtn 500/230 kV and Bellota-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	101%	<95%	<95%	<95%	<95%	Continue to monitor in longer term
BELLOTA-TESLA 230 kV	Table Mtn 500/230 kV and Bellota-Weber 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	100%	111%	<95%	<95%	<95%	Continue to monitor in longer term
	Table Mtn 500/230 kV and Tesla-Weber 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	101%	107%	<95%	<95%	<95%	
	Table Mtn -Vaca Dix 500 kV and Bellota-Weber 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	101%	<95%	<95%	<95%	
	Table Mtn - Vaca Dix 500 kV and Tesla-Weber 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	103%	<95%	<95%	<95%	
BELLOTA-WARNERVILLE 230 kV	Table Mtn 500/230 kV and Cottle-Melones 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	103%	Sensitivity Only
	Tesla 500/230 kV and Cottle-Melones 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	111%	
	Tesla 500/230 kV and Bellota-Cottle 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	107%	
	other 500 kV facilities and 230 kV lines between Bellota and Melones	P6	T-1, L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	>100%	
RANCHO SECO-CAMANACHE-BELLOTA 230 kV (Bellota-Rancho Seco # 2)	Rancho Seco-Bellota 230 kV and Capt Jack-Olinda 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	105%	Sensitivity Only
	Rancho Seco-Bellota 230 kV and Tracy 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	104%	
	other 500 kV facilities and Rancho Seco-Bellota 230 kV	P6	T-1, L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	>100%	
WARNERVILLE-WILSON 230 kV	Gates 500/230 kV and Cottle-Melones 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	106%	Sensitivity Only
	Tesla 500/230 kV and Cottle-Melones 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	106%	
	other 500 kV facilities and Cottle-Melones 230 kV	P6	T-1, L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	>100%	
EIGHT MILE-TESLA 230 kV	Table Mtn 500/230 kV and Stagg-Eight Mile 230 kV	P6	T-1/L-1	<95%	<95%	<95%	112%	136%	138%	118%	<95%	141%	<95%	Generation redispatch
	Table Mtn 500/230 kV and Stagg-Tesla 230 kV, or Stagg BRK	P6	T-1/L-1	<95%	<95%	<95%	103%	131%	136%	111%	<95%	137%	<95%	
	Table Mtn - Vac Dix 500 kV and Stagg-Eight Mile 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	104%	<95%	<95%	<95%	
	Table Mtn - Tesla 500 kV and Stagg-Eight Mile 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	101%	<95%	<95%	<95%	



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				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
STAGG-EIGHT MILE 230 kV	Table Mtn 500/230 kV and Eight Mile-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	101%	122%	123%	122%	<95%	125%	<95%	Generation redispatch
	Table Mtn -Vaca Dix 500 kV and Eight Mile-Tesla 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	102%	101%	<95%	<95%	
STAGG H - STAGG F BRK 230 kV	Table Mtn 500/230 kV and Eight Mile-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	121%	<95%	<95%	<95%	Continue to monitor in longer term
	Table Mtn -Vaca Dix 500 kV and Eight Mile-Tesla 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	105%	<95%	<95%	<95%	
	Table Mtn -Tesla 500 kV and Eight Mile-Tesla 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	102%	<95%	<95%	<95%	
STAGG D - STAGG F BRK 230 kV	Table Mtn 500/230 kV and Eight Mile-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	118%	<95%	<95%	<95%	
	Table Mtn -Vaca Dix 500 kV and Eight Mile-Tesla 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	105%	<95%	<95%	<95%	
	Table Mtn -Tesla 500 kV and Eight Mile-Tesla 230 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	103%	<95%	<95%	<95%	
STAGG-TESLA E 230 kV	Table Mtn 500/230 kV and Eight Mile-Tesla 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	115%	120%	110%	<95%	120%	<95%	Generation redispatch
PANOCHÉ DS AMIGO 230 kV	Gates 500/230 kV # 1 and 2	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	97%	<95%	<95%	111%	<95%	Sensitivity Only
LOS BANOS-PANOCHÉ #1 230 kV	Gates 500/230 kV # 1 and 2	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	111%	<95%	
LOS BANOS-PANOCHÉ #2 230 kV	Gates 500/230 kV # 1 and 2	P6	T-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	103%	<95%	
MOSSLANDING-LAS AGUILAS 230 kV	Mosslanding-Los Banos 500 kV & Tesla-Metcalf 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	105%	Sensitivity Only
	Los Banos 500/230kV and Westley-Quinto 230 kV	P6	T-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	103%	<95%	Sensitivity Only
MOSSLANDING-METCALF 230 kV # 1 or 2	Mosslanding 500/230 kV and Mosslanding-Metcalf 230 kV # 2 or 1	P6	T-1/L-1	<95%	<95%	<95%	112%	<95%	<95%	<95%	<95%	<95%	<95%	Generation redispatch
BORDEN-GREGG 230 kV # 1	Borden-Gregg 230 kV # 2 and Gates 500/230 kV	P6	L-1/L-1, T-1	<95%	103%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	123%	Generation redispatch
	Borden-Gregg 230 kV # 2 and Tesla 500/230 kV	P6	L-1/L-1, T-1	<95%	104%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	119%	
	Borden-Gregg 230 kV # 2 and other 500 kV facilities	P6	L-1/L-1, T-1	<95%	>100%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	>100%	
BORDEN-GREGG 230 kV # 2	Borden-Gregg 230 kV # 1 and Gates 500/230 kV	P6	L-1/L-1, T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	114%	Sensitivity Only
	Borden-Gregg 230 kV # 1and Tesla 500/230 kV	P6	L-1/L-1, T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	114%	
	Borden-Gregg 230 kV # 1 and other 500 kV facilities	P6	L-1/L-1, T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	>100%	
230/115 kV TRANSFORMERS and 230/70 kV														
HENRIETTA 230/115 kV	Mustang-Mc Call 230 kV and Los Banos 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	<95%	103%	<95%	<95%	105%	<95%	Continue to monitor, generation redispatch to mitigate
	Mustang-Mc Call 230 kV and Diablo unit	P3	L-1/G-1	<95%	<95%	<95%	<95%	<95%	N/A	<95%	<95%	104%	<95%	
	Mustang-Mc Call 230 kV and Midway 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	<95%	<95%	102%	<95%	<95%	103%	<95%	



Overloaded Facility	Contingency (All and Worst P6)	Category	Category Description	Loading % (Baseline Scenarios)							Loading % (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
CORTINA 230/60 kV	Olinda-Tracy 500 kV and Cortina 230/115 kV	P6	L-1/T-1	97%	114%	149%	<95%	<95%	124%	<95%	119%	122%	<95%	Existing operating procedure
	Table Mtn-Vaca Dlx 500 kV and Cortina 230/115 kV	P6	L-1/T-1	<95%	111%	142%	<95%	<95%	122%	<95%	117%	121%	<95%	
	Table Mtn-Tesla 500 kV, also other 500 kV lines and Cortina 230/115 kV	P6	L-1/T-1	<95%	109%	142%	<95%	<95%	121%	<95%	114%	121%	<95%	
115 kV LINES														
DELTA - CASCADE 115 kV	Malin- Round Mtn #1 and #2 500 kV	P7	L-2	105%	105%	99%	<95%	<95%	<95%	<95%	104%	<95%	105%	adjust Weed Phase Shifter or limit COI flow within seasonal nomogram
	Round Mtn-Table Mtn # 2 & Round Mtn-Malin # 2 500 kV	P6	L-1/L-1	96%	<95%	<95%	<95%	<95%	<95%	<95%	102%	<95%	<95%	
PEASE-E.MRSVLE-OLIVH 115 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	102%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	Project: South of Palermoject. Prior to the project: limit COI import within nomogram
	Tbl Mtn-Vaca Dix 500 kV and Colgate -Rio Oso 230 kV	P6	L-1/L-1	106%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tbl Mtn-Vaca Dix 500 kV and Table Mtn-Rio Oso 230 kV	P6	L-1/L-1	106%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	
PALERMO-WYANDET 115 kV	normal conditions	P0	normal	99%	99%	101%	<95%	<95%	<95%	<95%	99%	<95%	<95%	Continue to monitor, may require future line upgrade in local area assessments
DRUM-BRUNSWICK -RIO OSO 115 kV	Round Mtn-Table Mtn # 2 & Round Mtn-Malin # 2 or # 1 500 kV	P6	L-1/L-1	<95%	99%	<95%	<95%	<95%	<95%	<95%	98%	<95%	109%	Sensitivity Only
	Malin-Round Mtn # 1 and 2 500 kV	P7	L-2	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	104%	
	Round Mtn-Table Mtn # 1 and 2 500 kV	P7	L-2	<95%	99%	<95%	<95%	<95%	<95%	<95%	98%	<95%	110%	
DRUM-BRUNSWICK -Dutch Flat 115 kV	Round Mtn-Table Mtn # 2 & Round Mtn-Malin # 2 or # 1 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	101%	
	Round Mtn-Table Mtn # 1 and 2 500 kV	P7	L-2	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	101%	
NEWARK-NRS 115 kV	Tesla-Metcalf 500 kV and Newark E-F 230 kV bus tie	P6	L-1/BRK	<95%	111%	115%	<95%	<95%	<95%	112%	133%	<95%	<95%	Continue to monitor future load forecast
	Tesla-Metcalf 500 kV and Newark -Los Esteros 230 kV	P6	L-1/L-1	<95%	104%	107%	<95%	<95%	<95%	109%	126%	<95%	<95%	
	Metcalf 500/230 kV and Newark E-F 230 kV bus tie	P6	T-1/BRK	<95%	96%	101%	<95%	<95%	<95%	100%	106%	<95%	<95%	
WILSON-LE GRAND 115 kV	normal conditions	P0	normal	<95%	<95%	<95%	110%	<95%	<95%	<95%	<95%	<95%	<95%	Project: Wilson-Le Grand 115 kV upgrade In-Service Date: Short term: Action plan
	Gates 500/230 kV # 1 and 2	P6	T-1/T-1	<95%	<95%	<95%	106%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla-Los Banos and Tracy-Los Banos 500 kV	P6	L-1/L-1	<95%	<95%	<95%	103%	<95%	<95%	<95%	<95%	<95%	<95%	
	Mosslanding and Los Banos 500/230 kV	P6	T-1/T-1	<95%	<95%	<95%	102%	<95%	<95%	<95%	<95%	<95%	<95%	
	Gates 500/230 kV # 1 or 2 and Los Banos 500/230kV	P6	T-1/T-1	<95%	<95%	<95%	101%	<95%	<95%	<95%	<95%	<95%	<95%	
	Los Banos-Gates # 1 500 kV and Los Banos 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	100%	<95%	<95%	<95%	<95%	<95%	<95%	
	Tesla (or Tracy)-Los Banos 500 kV and Los Banos 500/230 kV	P6	L-1/T-1	<95%	<95%	<95%	100%	<95%	<95%	<95%	<95%	<95%	<95%	
	Los Banos 500/230 and Westely-Quinto 230 kV	P6	T-1/L-1	<95%	<95%	<95%	118%	<95%	<95%	<95%	<95%	<95%	<95%	



Overloaded Facility	Contingency (All and Worst P6)	Category	Category Description	Loading % (Baseline Scenarios)							Loading % (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
	Los Banos 500/230 and Los Banos-Quinto 230 kV	P6	T-1/L-1	<95%	<95%	<95%	114%	<95%	<95%	<95%	<95%	<95%	<95%	
	Los Banos 500/230 and Herndon-Kearney 230 kV	P6	T-1/L-1	<95%	<95%	<95%	112%	<95%	<95%	<95%	<95%	<95%	<95%	
	other 500 kV and 230 kV contingencies	P6	T-1, L-1/L-1	<95%	<95%	<95%	>100%	<95%	<95%	<95%	<95%	<95%	<95%	
SMYRNA- ATWELL ISL 115 kV	normal conditions	P0	normal	<95%	<95%	<95%	101%	98%	<95%	<95%	<95%	98%	<95%	Generation redispatch
HENRIETTA-LEPRINO JCT 115 kV	Mustang-Mc Call 230 kV and Diablo unit	P3	L-1/G-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	101%	<95%	Sensitivity Only
	Mustang -Mc Call 230 kV and Midway 500/230 kV # 11,12 or 13	P3	L-1/T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	100%	<95%	
70 kV LINES														
BLACKWELL-LOST HILLS 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	128%	134%	136%	<95%	<95%	141%	110%	reduce generation at Blackwell and Carneros if overload. Radial lines, non-BES
ARCO-TWISSELMAN JCT 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	105%	108%	112%	<95%	<95%	113%	<95%	
KETTLEMAN-GATES 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	149%	138%	143%	<95%	<95%	141%	130%	reduce generation at Suncity and Sunddrag. Radial from Gates, non-BES
AVENAL- AVENAL PARK 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	104%	<95%	<95%	<95%	<95%	<95%	100%	
GIFFEN-GIFFEN JCT (Helm-Westland) 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	108%	<95%	129%	<95%	<95%	<95%	100%	reduce generation from Giffen. Radial system, non-BES
GUERSNEY-JACOBS CORNER 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	115%	<95%	<95%	<95%	<95%	reduce distributed gen from Guersney. Radial system, non-BES
HELM-STROUD 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	107%	<95%	<95%	101%	<95%	reduce distributed gen from Stroud. Radial system, non-BES
60 kV LINES														
CASCADE-OREGON TRAIL 60 kV	normal conditions	P0	normal	<95%	101%	99%	<95%	<95%	<95%	<95%	<95%	<95%	<95%	limit COI within seasonal nomogram
	Captain Jack-Olinda 500 kV and Diablo unit	P3	G-1/L-1	<95%	100%	N/A	<95%	<95%	<95%	<95%	99%	<95%	<95%	
	Malin- Round Mtn #1 and #2 500 kV	P7	L-2	106%	110%	108%	<95%	<95%	<95%	<95%	101%	<95%	<95%	
	Round Mtn-Table Mtn # 1 & # 2 500 kV	P7	L-2	101%	104%	102%	<95%	<95%	<95%	<95%	101%	<95%	<95%	
	Round Mtn-Table Mtn # 2 & Round Mtn-Malin # 2 or # 1 500 kV	P6	L-1/L-1	101%	104%	102%	<95%	<95%	<95%	<95%	107%	<95%	<95%	
FITCH MTN-HELDSBURG 60 kV	normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	<95%	<95%	101%	<95%	<95%	Sensitivity Only
PLAIN FIELD-WINTERS 60 kV	normal conditions	P0	normal	<95%	105%	108%	<95%	<95%	<95%	<95%	113%	<95%	<95%	Load forecast in under review.
VACA DIX-WINTERS 60 kV	normal conditions	P0	normal	<95%	99%	101%	<95%	<95%	<95%	<95%	104%	<95%	<95%	
COLONY-LODI 60 kV	normal conditions	P0	normal	107%	103%	98%	<95%	<95%	<95%	<95%	109%	<95%	102%	Lockeford-Lodi 230 kV Project
ROGH-RDY- STOCKTON 60 kV	normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	<95%	<95%	102%	<95%	<95%	Sensitivity Only
MORMON-WEBER 60 kV	normal conditions	P0	normal	<95%	<95%	<95%	<95%	<95%	<95%	<95%	103%	<95%	<95%	Sensitivity Only

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
				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
MAXWELL 500 kV	Normal Conditions	P0	normal	<540	<540	<540	<540	547	<540	540	<540	542	<540	Install reactive support in the north of the 500 kV system to produce and absorb VARs. Turn off shunt reactors on the Captain Jack-Olinda and Olinda-Maxwell lines
	Round Mtn-Table Mnt #1 and # 2 500 kV	P7	L-2	487	491	>500	>500<540	>500<540	>500<540	>500<540	488	>500<540	488	
	Malin-Round Mtn # 1 and # 2 500 kV	P7	L-2	500	497	>500	>500<540	>500<540	>500<540	>500<540	498	>500<540	499	
	Malin-Round Mtn # 1 or 2 and Diablo unit	P3	L-1/G-1	<550	<550	<550	<550	<550	NA	NA	<550	553	<550	
VACA DIXON 500 kV	Normal Conditions	P0	normal	<540	<540	<540	<540	<540	<540	<540	<540	540	<540	
TRACY 500 kV	Normal Conditions	P0	normal	<540	<540	<540	540	542	<540	<540	<540	543	<540	turn off shunt at Olinda, doesn't bring voltage below 540 kV
GATES 500 kV	Normal Conditions	P0	normal	546	546	548	542	544	547	548	542	544	<540	install reactive support to absorb VARs on Gates or Diablo
	Los Banos 500/230 kV	P1	T-1	<550	<550	<550	<550	<550	550	<550	<550	<550	<550	
	Moss Lndg-Los Banos 500 kV and Los Banos 500/230 kV	P6	L-1/T-1	<550	<550	<550	<550	<550	552	<550	<550	<550	<550	
	Tesla-Los Banos 500 kV and Los Banos 500/230 kV	P6	L-1/T-1	<550	<550	550	<550	<550	551	<550	<550	<550	<550	
	Tesla or Tracy 500/230 kV and Los Banos 500/230 kV	P6	T-1/T-1	<550	<550	<550	<550	<550	551	<550	<550	<550	<550	
	Moss Lndg 500/230 kV and Los Banos 500/230 kV	P6	T-1/T-1	<550	<550	<550	<550	<550	551	<550	<550	<550	<550	
	Gates 500/230 kV # 1 or 2 and Metcalf 500/230 kV # 11,12 or 13	P6	T-1/T-1	<550	<550	551	<550	<550	550	<550	<550	<550	<550	
	Gates 500/230 kV and Los Banos 500/230 kV	P6	T-1/T-1	<550	<550	551	<550	<550	551	<550	<550	<550	<550	
DIABLO 500 kV	Normal Conditions	P0	normal	<540	<540	551	<540	<540	552	552	<540	<540	<540	install reactive support to absorb VARs on Diablo or Gates
	Diablo-Midway # 2 or # 3 500 kV	P1	L-1	<550	<550	<550	<550	<550	554	552	<550	<550	<550	
	Captain Jack-Olinda	P1	L-1	<550	<550	<550	<550	<550	554	<550	<550	<550	<550	
	Los Banos-Tracy 500 kV and Los Banos 500/230 kV	P6	L-1/T-1	<550	<550	<550	<550	<550	555	<550	<550	<550	<550	
	Metcalf-Moss Lndg 500 kV and Moss Lndg 500/230 kV	P6	L-1/T-1	<550	<550	<550	<550	<550	553	<550	<550	<550	<550	
	Los Banos-Midway 500 kV and Los Banos 500/230 kV	P6	L-1/T-1	<550	<550	<550	<550	<550	554	<550	<550	<550	<550	
	Malin-Round Mtn # 1 and 2 500 kV	P7	L-2	<550	<550	<550	<550	<550	553	<550	<550	<550	<550	
	Metcalf-Mossing and Mossiang-Los Banos 500 kV and other 500 kV L-1/I-1	P6	L-1/L-1	<550	<550	<550	<550	<550	553	<550	<550	<550	<550	
	Diablo-Midway # 1 and # 2 500 kV	P7	L-2	<550	<550	<550	<550	<550	553	553	<550	<550	<550	
MIDWAY 500 kV	Normal Conditions	P0	normal	<540	<540	541	<540	<540	542	542	<540	<540	<540	
High voltages in the 115/70 kV system in Fresno and Kern under normal conditions in all off-peak cases and cases with high renewables														

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
				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2028 Spring Off-Peak	2028 Winter Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
High voltages in the 115 kV system around Vaca Dixon for area contingencies in the 2023 Spring off-peak case with high renewables														

Study Area: PG&E Bulk

Voltage Deviation



Substation	Contingency (All and Worst P6)	Category	Category Description	Post Cont. Voltage Deviation % (Baseline Scenarios)								Post Cont. Voltage Deviation % (Sensitivity Scenarios)				Project & Potential Mitigation Solutions
				2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Winter Peak	2023 Winter Peak	2028 Winter Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	2028 Retirement of QF Generations	
NONE over 8%																

Study Area: PG&E Bulk

Transient Stability



Transient Stability Performance (Number of voltage and frequency violations)

Generator/Load	Contingency	Category	Category Description	Contingencies			Sensitivity		Potential Mitigation Solutions
				2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
Tripped Generation									
renewable generator bus 365534 Q954 0.27 at Gates 230 kV bus	3 phase fault on DIABLO 500 kV generator or Diablo-Gates 500 kV outage, or 1 phase fault on GATES or MIDWAY 500KV BUS with delayed clearing	P1 or P2	G-1, or bus section	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	tripped due to high voltage >1.2 p.u with fault, 149 MW	tripping with fault may be a numerical issue. Need to adjust the models and protection settings
	3 phase fault on LOS BANOS 500 kV	P1	L-1, T-1	tripped due to high voltage >1.2 p.u with fault, 13.5 MW	tripped due to high voltage >1.2 p.u with fault, 1.5 MW	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	tripped due to high voltage >1.2 p.u with fault, 149 MW	
	3 phase fault on LOS BANOS, GATES, or MIDWAY 500 kV	P1, P6,P7	any	tripped due to high voltage >1.2 p.u with fault, 13.5 MW	tripped due to high voltage >1.2 p.u with fault, 1.5 MW	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	tripped due to high voltage >1.2 p.u with fault, 149 MW	
	3 phase fault on VACA DIX, METCALF, TRACY, TESLA, or MOSSLANDING 500 kV	P1, P6,P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	tripped due to high voltage >1.2 p.u with fault, 147.5 MW	not tripped with these contingencies	
renewable generator bus 365554 Q946 0.27 on Midway-Wheeler Ridge 230 kV line	1 Phase fault on MIDWAY 500KV BUS - delayed clearing	P2	bus section	not tripped with these contingencies		tripped due to high voltage >1.2 p.u. with fault, 98.5 MW	tripped due to high voltage >1.2 p.u. with fault, 98.5 MW	not tripped with these contingencies	tripping with fault may be a numerical issue. Need to adjust the models and protection settings
	3 Phase Fault LOS BANOS, GATES 500 kV	P1-P7	any	not tripped with these contingencies	tripped due to high voltage >1.2 p.u. with fault, 1 MW	tripped due to high voltage >1.2 p.u. with fault, 98.5 MW	tripped due to high voltage >1.2 p.u. with fault, 98.5 MW		
	3 Phase Fault MIDWAY 500 kV	P1-P7	any	not tripped with these contingencies		tripped due to high voltage >1.2 p.u. with fault, 98.5 MW	tripped due to high voltage >1.2 p.u. with fault, 98.5 MW		
renewable generator bus 34683 Q643W 0.38 at Mustang 230 kV bus	1 Phase fault on TESLA or MOSSLANDING 500KV BUS - delayed clearing	P2	bus section	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.1 p.u. with fault , 100.5 MW	tripped due to high voltage >1.1 p.u. with fault , 100.5 MW	not tripped with these contingencies	need to investigate and check relay settings
	3 Phase fault on TESLA 500 kV BUS, Tesla-Table Mtn 500 kV outage	P1	L-1	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.1 p.u. with fault , 100.5 MW	not tripped with these contingencies	not tripped with these contingencies	
	3 Phase fault on TESLA 500 KV,Table Mtn-Tesla and Vaca Dix-Tesla	P7	L-2	tripped for low freq after 4 sec, 9.2 MW	Tripped for low freq after 4 sec, 1 MW	not tripped for these contingencies	not tripped with these contingencies	not tripped with these contingencies	

Transient Stability



Transient Stability Performance (Number of voltage and frequency violations)

Generator/Load	Contingency	Category	Category Description	Contingencies			Sensitivity		Potential Mitigation Solutions
				2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
renewable generator bus 365524 Q1036S 0.36 at Mustang 230 kV bus	1 Phase fault on TESLA or MOSSLANDING 500KV BUS - delayed clearing	P2	bus section	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.1 p.u. with fault, 153.1 MW	tripped due to high voltage >1.1 p.u. with fault, 153.1 MW	tripped due to high voltage >1.1 p.u. with fault, 154.6 MW	tripping with fault may be a numerical issue. Need to adjust the models and protection settings and investigate tripping after 4 sec
	1 Phase fault on LOS BANOS 500KV BUS - delayed clearing	P2	bus section	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.1 p.u. with fault, 154.6 MW	
	3 Phase fault on ROUND MTN or OLINDA 500 kV	P1, P6, P7	any	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.1 p.u. with fault, 154.6 MW	
	3 Phase fault on TESLA 500 kV BUS, Tesla-Table Mtn 500 kV outage	P1	L-1	not tripped with this contingency	not tripped with these contingencies	tripped due to high voltage >1.1 p.u. with fault, 153.1 MW	not tripped with these contingencies	not tripped with this contingency	
	3 Phase fault on TESLA 500 kV BUS	P6	L-1/L-1	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped due to low frequency after 4 sec, 154.6 MW	
	3 Phase fault on TESLA 500 kV, Table Mtn-Tesla and Vaca Dix-Tesla	P7	L-2	Tripped for low freq after 4 sec, 14.1 MW	Tripped for low freq after 4 sec, 1.6 MW	not tripped with this contingency	not tripped with this contingency	tripped due to low frequency after 4 sec, 154.6 MW	
renewable generators # 1 and 2 bus 365585 [Q829P12SPV] 0.42 at Las Aguilas 230 kV bus	3 phase fault on ROUND MTN or MALIN 500 kV	P1,P6, P7	L-1\1	not tripped for these contingencies	not tripped for these contingencies	tripped due to low freq <57 Hz with fault, 122 MW	not tripped for these contingencies	tripped for low frequency <57 Hz with fault, 123.2 MW	tripping with fault may be a numerical issue. Need to adjust the models and protection settings
	3 phase fault on METCALF, TRACY, TESLA, MOSSLANDING, LOS BANOS, GATES, or MIDWAY 500 kV	P1, P3, P6, P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.2 p.u. with fault, 122 MW	tripped due to high voltage >1.2 p.u. with fault, 122 MW	not tripped with these contingencies	
	3 phase fault on OLINDA, or TABLE MTN 500 kV	P1, P3, P6, P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to low freq <57 Hz with fault, 122 MW	not tripped for these contingencies	not tripped with these contingencies	
	3 phase fault on METCALF or MIDWAY 500 kV	P1, P3, P6, P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.2 p.u. with fault, 117.1 MW	not tripped for these contingencies	not tripped for these contingencies	

Study Area: PG&E Bulk

Transient Stability



Transient Stability Performance (Number of voltage and frequency violations)

Generator/Load	Contingency	Category	Category Description	Contingencies			Sensitivity		Potential Mitigation Solutions
				2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
renewable generator #3 bus 365586 [Q829P3SPV] 0.42 at Las Aguilas 230 kV bus	3 phase fault on TRACY, TESLA, MOSSLANDING, LOS BANOS, GATES, 500 kV	P1, P3, P6, P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to high voltage >1.2 p.u. with fault, 117.1 MW	tripped due to high voltage >1.2 p.u. with fault, 117.1 MW	not tripped for these contingencies	tripping with fault may be a numerical issue. Need to adjust the models and protection settings
	3 phase fault on OLINDA, ROUND MTN, CAPT JACK, or MALIN 500 kV	P1, P3, P6, P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to low freq <57 Hz with fault, 122 MW	tripped due to low freq <57 Hz with fault, 117.1 MW	tripped due to low freq <57 Hz with fault, 118.3 MW	
	3 phase fault on TABLE MTN 500 kV	P1, P3, P6, P7	any	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped due to low freq <57 Hz with fault, 117.1 MW	not tripped with these contingencies	
renewable generator bus 34694 KENT_S 0.80 at Henrietta 70 kV bus	3 Phase Fault LOS BANOS 500 kV	P1-P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to high freq >60.5 Hz with fault, 19.6 MW	tripped due to high freq >60.5 Hz with fault, 19.6 MW	not tripped with these contingencies	tripping with fault may be a numerical issue. Need to adjust the models and protection settings
	3 Phase Fault GATES or MIDWAY 500 kV	P1-P7	any	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped due to high freq >60.5 Hz with fault, 19.6 MW	not tripped with these contingencies	
renewable generator bus 35019 REGULUS 0.38 at Lamont 115 kV bus	3 Phase Fault GATES 500 kV	P1-P7	any	not tripped with these contingencies	not tripped with these contingencies	tripped due to high freq >60.5 Hz with fault, 59.3 MW	not tripped with these contingencies	not tripped with these contingencies	tripping with fault may be a numerical issue. Need to adjust the models and protection settings
	3 Phase Fault MIDWAY 500 kV with two 500 kV lines out	P6, P7	L-1/L-2, L-2	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped due to high freq >60.5 Hz with fault, 59.3 MW	not tripped with these contingencies	
renewable generator bus 33102 COLUMBIA 0.36 (East Bay)	3 Phase Fault TRACY, TESLA, VACA DIX, 500 kV	P1, P6-7	any	tripped due to high voltage >1.1 p.u after 10 sec, 1.7 MW	tripped due to high voltage >1.1 p.u after 9 sec, 0.2 MW	modeled off in this case	tripped due to high voltage >1.1 p.u at 8.6 sec, 18.8 MW	tripped due to high voltage >1.1 p.u after 10 sec, 19 MW	high voltage (1.09 pu) in the base cases. Turn off shunt capacitor. Consider installing reactors due to high voltages in the area
	3 Phase Fault METCALF 500 kV, line outages	P1, P6	any	tripped due to high voltage >1.1 p.u after 10 sec, 1.7 MW	not tripped with these contingencies	modeled off in this case	not tripped with these contingencies	not tripped with these contingencies	
	3 Phase Fault MOSSLANDING 500 kV, transformer outages	P1	T-1	tripped due to high voltage >1.1 p.u after 10 sec, 1.7 MW	not tripped with these contingencies	modeled off in this case	tripped due to high voltage >1.1 p.u at 8.6 sec, 18.8 MW	not tripped with these contingencies	
	3 phase fault MIDWAY 500 kV, Midway-Gates and Midway-Los Banos 500kV out	P7	L-2	tripped for low voltage <0.9 p.u at 4.1 sec, 22 MW	tripped for low voltage <0.9 p.u at 4.1 sec, 2.5 MW	not tripped with these contingencies	tripped due to low voltage <0.9 p.u at 4.1 sec, 240.1 MW	tripped for low voltage <0.9 p.u at 4.1 sec, 246.2 MW	

Study Area: PG&E Bulk

Transient Stability



Transient Stability Performance (Number of voltage and frequency violations)

Generator/Load	Contingency	Category	Category Description	Contingencies			Sensitivity		Potential Mitigation Solutions
				2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
renewable generator bus TOPAZ B2 0.69 kV	3 Phase fault GATES 500 kV	P1, P6, P7	L-1, T-1, L-1/L-1	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped for low voltage <0.9 p.u at 4.1 sec, 246.2 MW	low voltages due to stalling of induction motor load. High voltages due to high generation and low load. Installing SVS capable of absorbing VARs in the area (Gates 500 kV substation) may help also for these issues
	3 Phase fault MIDWAY 500 kV	P1, P6, P7	L-1, T-1, L-1/L-1	tripped for low voltage <0.9 p.u at 4.1 sec, 22 MW	tripped for low voltage <0.9 p.u at 4.1 sec, 2.5 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for low voltage <0.9 p.u at 4.1 sec, 246.2 MW	
renewable generator bus TOPAZ B1 0.69 kV	3 Phase fault MIDWAY 500 kV	P1, P6, P7	L-1, T-1, L-1/L-1	not tripped with these contingencies	tripped for low voltage <0.9 p.u at 4.1 sec, total TOPAZ 5.6 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for low voltage <0.9 p.u at 4.1 sec, 35.6 MW	
TOPAZ A1, A2 0.69 kV or 0.32 kV	3 Phase fault MIDWAY 500 kV	P1, P6, P7	L-1, T-1, L-1/L-1	not tripped with these contingencies	tripped for low voltage <0.9 p.u at 4.1 sec, total TOPAZ 5.6 MW	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	
renewable generator bus 365563 Q885 0.36 kV at S. KERN	3 Phase fault MIDWAY 500 kV	P1-P7	L-1, T-1, L-1/L-1	modeled off in this case	tripped for low voltage <0.9 p.u at 4.1 sec, 0.1 MW	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	
generator 31847 ROARMONG 13.8 kV	3 phase fault ROUND MTN 500 kV	P6, P7	L-2	went out of step, 2.5 MW	went out of step, 2.5 MW	not tripped with these contingencies	went out of step, 2.5 MW	went out of step, 2.5 MW, also for P1	small unit at Cove Road, 2.5 MW, underexcitation due to high voltage
	3 phase fault on TRACY or TESLA 500 kV	P1, P6	L-1, T-1, L-1/-1	went out of step, 2.5 MW	went out of step, 2.5 MW	not tripped with these contingencies	not tripped with these contingencies	went out of step, 2.5 MW	
	3 phase fault on OLINDA, 500 kV	P6	L-1/-1	went out of step, 2.5 MW	went out of step, 2.5 MW	not tripped with these contingencies	not tripped with these contingencies	went out of step, 2.5 MW	
GUERNSEY_D 1 and 2 distributed gen	3 phase fault on GATES, LOS BANOS	P1, P6, P7	any	tripped for low voltage <0.88 p.u after 3 sec, 1.8 MW	tripped for low voltage <0.88 p.u after 3 sec, 0.2 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for low voltage <0.88 p.u after 3 sec, 19.8 MW	low voltages due to stalling of induction motor load. Installing SVS in the area (Gates 500 kV substation) may help also for these issues
	3 phase fault on MIDWAY	P1	L-1, T-1	not tripped with these contingencies	tripped for low voltage <0.88 p.u after 3 sec, 0.2 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for low voltage <0.88 p.u after 3 sec, 19.8 MW	
	3 phase fault on MIDWAY	P6, P7	L-2	tripped for low voltage <0.88 p.u after 3 sec, 1.8 MW	tripped for low voltage <0.88 p.u after 3 sec, 0.2 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for low voltage <0.88 p.u after 3 sec, 19.8 MW	
HURON_D 1 and 2 distributed gen	3 Phase fault MIDWAY 500 kV, outage of 2 lines	P6, P7	L-2	not tripped with these contingencies	tripped for low voltage <0.88 p.u after 4 sec, 0.2 MW	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	
GATES 1 and 2 distributed gen	3 Phase fault MIDWAY 500 kV, outage of 2 lines	P6, P7	L-2	not tripped with these contingencies	tripped for low voltage <0.88 p.u after 4 sec, 0.3 MW	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	

Study Area: PG&E Bulk

Transient Stability



Transient Stability Performance (Number of voltage and frequency violations)

Generator/Load	Contingency	Category	Category Description	Contingencies			Sensitivity		Potential Mitigation Solutions
				2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
generator 35024 DEXEL 13.8 kV	3 Phase fault on MIDWAY 500 kV, contingencies between Midway and Vincent	P1,P6	L-1, L-1/-1	tripped by branch overcurrent relay after 6 sec, 20.3 MW		not tripped with these contingencies		ripped by branch overcurrent relay after 6 sec, 20.3 MW	need to investigate and check relay settings
generator 30532 0162-WD 21 kV from Cayetano	3 Phase fault on TESLA 500 kV Tesla-Metcalf or P6 outages from Tesla	P1, P6	L-1, L-1/-1	not tripped with these contingencies	tripped for overcurrent, 4.3 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for overcurrent, 4.3 MW	small unit, may be modeling issue
	3 Phase fault on TESLA 500 kV Table Mtn-Tesla and Tesla-Metcalf outage	P6	L-1/L-1	tripped for overcurrent, 4.3 MW	tripped for overcurrent, 4.3 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for overcurrent, 4.3 MW	
hydro generator 32510 CHILI BAR 4.2 kV	3 Phase fault on TESLA 500 kV	P1, P6, P7	L-1/L-1 (T-1)	not tripped with these contingencies	went out of step, 2.4 MW	not tripped with these contingencies	not tripped with these contingencies	went out of step, 2.4 MW	high voltages, underexcitation
generator 35861 SJ-SCL W 4.2 kV, at ZANKER 115 kV	3 Phase fault on TESLA 500 kV	P1, P6, P7	L-1/L-1 (T-1)	not tripped with these contingencies	tripped for over-volt after 9 sec, 6.5 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for over-volt after 11 sec, 6.5 MW	high voltage due to reduction of load by composite load model
renewable 35098 Q557 0.48 on Atwell-Alpaugh 115 kV	3 Phase fault on MIDWAY 500 kV	P1, P6, P7	L-1/L-1 (T-1)	not tripped with these contingencies	tripped for hi volt >1.1 after 9 sec, 0.2 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for hi volt >1.1 after 9 sec, 20.1 MW, only for P6,7	High voltages due to Diablo retirement and large amount of distributed generation. Installing SVS capable of absorbing VARs in the area (Gates 500 kV substation) may help also for these issues
renewable generator bus 365568 Q557BESS 0.48 at Atwell-Alpaugh 115 kV	3 Phase fault on MIDWAY 500 kV	P1, P6, P7	L-1/L-1 (T-1)	tripped for hi volt after 8 sec, 2MW	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	tripped for hi volt after 8 sec, 2MW	high voltage due to reduction of load by composite load model
generator 31840 BLACKBUTT 9.1 kV	3 Phase fault on TABLE MTN, OLINDA, TRACY 500 kV	P1, P6, P7	L-1/L-1 (T-1)	not tripped with these contingencies	tripped for over-current, 3.5 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for over-current, 3.5 MW	small unit, may be modeling issue
	3 Phase fault on TESLA 500 kV	P1, P6, P7	L-1/L-1 (T-1)	went out of step, 3.5 MW	tripped for over-current, 3.5 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for over-current, 3.5 MW	
	3 Phase fault on ROUND MTN, or MALIN 500 kV	P6, P7	L-1/L-1	went out of step, 3.5 MW	tripped for over-current, 3.5 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for over-current, 3.5 MW	
	3 Phase fault on TABLE MTN, OLINDA, TRACY 500 kV	P6, P7	L-1/L-1	not tripped with these contingencies	tripped for over-current, 3.5 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for over-current, 3.5 MW	
renewable 38380 MTHSE_G 0.34 kV from Tracy 69 kV	3 Phase fault on TESLA or TRACY 500 kV	P1, P6	L-1, T-1, L-1/-1	tripped for low volt <0.88 after 3 sec, 19 MW	tripped for low volt <0.88 after 3 sec, 19 MW	not tripped with these contingencies	not tripped with these contingencies	tripped for low volt <0.88 after 3 sec, 19 MW	low voltages due to stalling of induction motor load. Installing dynamic reactive support in the area may help also for these issues
renewable 33868 Q709RPWRP2 0.69 from Tesla 115 kV	3 Phase fault on TESLA or TRACY 500 kV	P1, P6	L-1, T-1, L-1/-1	tripped for hi volt >1.1 after 7 sec 17.5 MW	tripped for hi volt >1.1 after 10 sec, 30.8 MW	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	High voltages due to Diablo retirement and large amount of distributed generation. Installing SVS capable of absorbing VARs in the area (Gates 500 kV substation) may help also for these issues

Study Area: PG&E Bulk

Transient Stability



Transient Stability Performance (Number of voltage and frequency violations)

Generator/Load	Contingency	Category	Category Description	Contingencies			Sensitivity		Potential Mitigation Solutions
				2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
generator 31828 KILARC 9.1 kV, 2 units	3 Phase fault on TESLA 500 kV, Tesla-Los Banos, or Metcalf or double outages	P1, P6, P7	L-1/L-1 (T-1)	not tripped with these contingencies	went out of step, 2.2 MW	not tripped with these contingencies	not tripped with these contingencies	went out of step, 3.2 MW	small unit, may be modeling issue
generator 31856 COW CREEK, 2 units	3 Phase fault on TESLA 500 kV, Tesla-Los Banos, or Metcalf or double outages	P1, P6, P7	L-1/L-1 (T-1)	not tripped with these contingencies	went out of step, 1 MW	not tripped with these contingencies	not tripped with these contingencies	went out of step, 1.8 MW	small unit, may be modeling issue
generator 31872 CLOVER 9.1	3 Phase fault on TESLA or TRACY 500 kV	P6	L-1/L-1	not tripped with these contingencies	went out of step, 0.4 MW	not tripped with these contingencies	not tripped with these contingencies	went out of step, 0.4 MW	small unit, may be modeling issue
Tripped load, load reduced by composite load model not included									
45070 BRYANT 69.00	3 phase fault ROUND MTN, MALIN, CAPT JACK 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	Low voltage due to stalling of induction motors. Installation of dynamic reactive support at Round Mtn 500 kV substation may also help for these issues
45070 BRYANT 69.00	3 phase fault TABLE MTN 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	not tripped with these conitngencies	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
45016 BELKNAP 69.00	3 phase fault ROUND MTN, MALIN, CAPT JACK 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
45407 MERLIN 115.00	3 phase fault ROUND MTN, MALIN, CAPT JACK 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
45389 EASY VLY 115.00	3 phase fault ROUND MTN, MALIN, CAPT JACK 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
45271 SAGEROAD 115.00	3 phase fault ROUND MTN, MALIN, CAPT JACK 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
45533 WINCHSTR 115.00	3 Phase fault Malin-Round Mtn 500 kV # 1 or 2, or Capt Jack-Olinda	P1	L-1	not tripped with these contingencies	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	Low voltage due to stalling of induction motors. Consider installation of dynamic reactive support
36012 WTSNVLL 60.00	3 phase fault on METCALF, TRACY or TESLA 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
	3 phase fault on LOS BANOS 500 kV	P6, P7	L-1/-1	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
	3 phase fault on MOSS LANDING 500 kV	P1	L-1, T-1	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	Low voltage due to stalling of induction motors. Installation of dynamic reactive support at Round Mtn 500 kV substation may also help for these issues
38086 HARDROCK 60 kV, 38078 BASLN 60 kV , 38072 FTHILL 60 kV, 38070 PARKEAST 60 kV,	3 phase fault ROUND MTN 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	under-vlt load shedding	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	
	3 phase fault METCALF, GATES, MIDWAY or TRACY 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	not tripped with these contingencies	under-vlt load shedding	
36890 Walsh 60.00	3 phase fault on TRACY 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	UFLS	UFLS	not tripped with these contingencies	not tripped with these contingencies	UFLS	
Kenneth 60 kV	3 phase fault on TRACY 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	UFLS	UFLS	not tripped with these contingencies	not tripped with these contingencies	UFLS	possible modeling error due to renewale generation in the area. Need

Study Area: PG&E Bulk

Transient Stability



Transient Stability Performance (Number of voltage and frequency violations)

Generator/Load	Contingency	Category	Category Description	Contingencies			Sensitivity		Potential Mitigation Solutions
				2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
Palm 60 kV	3 phase fault on TRACY 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	not tripped	UFLS	not tripped with these contingencies	not tripped with these contingencies	UFLS	to check UFLS relay settings
Mission 60 kV	3 phase fault on TRACY 500 kV	P1, P6, P7	L-1, T-1, L-1/-1	not tripped	UFLS	not tripped with these contingencies	not tripped with these contingencies	UFLS	
Criteria Violaions									
NONE									

Study Area: PG&E Bulk



Single Contingency Load Drop

Worst Contingency	Category	Category Description	Amount of Load Drop (MW)										Potential Mitigation Solutions
			Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	
N/A													

Study Area: PG&E Bulk



Single Source Substation with more than 100 MW Load

Substation	Load Served (MW)										Potential Mitigation Solutions
	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	
N/A											