

## 2012/2013 ISO Reliability Assessment - Preliminary Study Results

Study Area: **PG&E Bulk - Summer Peak**

### Post-Transient Thermal Overloads



ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2014	2017	2022	
Bulk-PTT-2	C.COSTA SUB-C.COSTA 230	Vaca Dixon-Tesla 500 kV	B	L-1	96.5%	<95%	<95%	not a violation
Bulk-PTT-5	CAYETANO-USWP JRW 230	Contra Costa-Las Positas 230 kV	B	L-1	97.5%	96.1%	100.2%	congestion management, reduce C. Cos generation or re-rate
Bulk-PTT-8	COTWDWAP-OLINDAW 230 #1&2	Captain Jack -Olinda 500 kV	B	L-1	102.9%	96.9%	<95%	WAPA project to upgrade the line
Bulk-PTT-9	CRAVIEW - WEED JPS 115	Captain Jack -Olinda 500 kV	B	L-1	104.1%	100.1%	105.9%	adjust Weed phase shifter
Bulk-PTT-10	CRAVIEW - WEED JPS 115	Malin-Round Mountain 500 kV #1	B	L-1	99.8%	96.5%	102.4%	adjust Weed phase shifter
Bulk-PTT-11	CRAVIEW - WEED JPS 115	Malin-Round Mountain 500 kV #2	B	L-1	100.5%	97.1%	103.0%	adjust Weed phase shifter
Bulk-PTT-14	DELEVAN-CORTINA 230 #1	Olinda-Tracy 500 kV	B	L-1	<95%	<95%	96.2%	not a violation
Bulk-PTT-15	DELTA - CASCADE 115	Captain Jack -Olinda 500 kV	B	L-1	98.8%	97.2%	98.6%	adjust Weed phase shifter
Bulk-PTT-20	INYO - INYO PS 115.0 #1	PDCI bi-pole outage	B	PDCI	105.6%	103.6%	103.0%	adjust Inyo phase shifter
Bulk-PTT-21	LONETREE - USWP JRW 230	Contra Costa-Las Positas 230 kV	B	L-1	97.7%	96.2%	100.3%	congestion management, reduce C. Cos generation or re-rate
Bulk-PTT-23	NRS 400 -SRS 115 #1	Tesla-Metcalf 500 kV	B	L-1	<95%	<95%	97.4%	not a violation
Bulk-PTT-27	ROUND MT-TABLE MT 500 #1	ROUND MT - TABLE MT 500 kV #2	B	L-1	97.6%	96.0%	95.4%	not a violation, COI is at the limit
Bulk-PTT-28	ROUND MT-TABLE MT 500 #2	ROUND MT -TABLE MT 500 kV #1	B	L-1	97.8%	96.1%	95.6%	not a violation, COI is at the limit
Bulk-PTT-1	C.COSTA - WND MSTR 230.0 #1	C. Costa-Las Positas & C. Cos-Lone Tree 230 kV	C	L-2	112.4%	<95%	<95%	add SPS to trip C.Cos generation, upgrade modeled from 2017
Bulk-PTT-3	C.COSTA SUB-C.COSTA 230	500 kV Double outage north of Tesla	C	L-2	100.4%	97.3%	<95%	add tripping C.Cos generation to RAS or re-rate
Bulk-PTT-6	CAYETANO-USWP JRW 230	C. Costa-Brentwood & C. Costa-Delta 230 kV	C	L-2	97.6%	95.7%	96.8%	not a violation
Bulk-PTT-12	CRAVIEW - WEED JPS 115	Malin-Round Mountain 500 kV #1 & 2	C	L-2	112.7%	107.6%	117.0%	adjust Weed phase shifter
Bulk-PTT-13	CRAVIEW - WEED JPS 115	Round Mnt -Table Mnt 500 kV # 1 & 2	C	L-2	99.7%	96.5%	105.7%	adjust Weed phase shifter

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					2014	2017	2022	
Bulk-PTT-16	DELTA - CASCADE 115	Malin-Round Mountain 500 kV #1 & 2	C	L-2	108.1%	105.1%	110.3%	adjust Weed phase shifter
Bulk-PTT-17	FGRDN T1 - ASHLAN 230.0 #1	Gregg - Herndon #1 & #2 230 kV	C	L-2	100.8%	<95%	<95%	assumed 1 Helms tripped in 2014 and 2 in 2017-22, line upgrade modeled for 2022. Trip all Helms prior to upgrade
Bulk-PTT-18	FGRDN T2 - ASHLAN 230.0 #1	Gregg - Herndon #1 & #2 230 kV	C	L-2	146.4%	110.8%	<95%	assumed 1 Helms tripped in 2014 and 2 in 2017-22, line upgrade modeled for 2022. Trip all Helms prior to upgrade
Bulk-PTT-19	GREGG - FGRDN T2 230.0 #1	Gregg - Herndon #1 & #2 230 kV	C	L-2	170.7%	136.4%	<95%	assumed 1 Helms tripped in 2014 and 2 in 2017-22, line upgrade modeled for 2022. Trip all Helms prior to upgrade
Bulk-PTT-22	LONETREE - USWP JRW 230	C. Costa-Brentwood & C. Costa-Delta 230 kV	C	L-2	97.8%	95.8%	96.9%	not a violation
Bulk-PTT-25	PEASE - E.MRY J1 115.0 #1	500 kV Double outage south of Table Mnt	C	L-2	97.6%	<95%	<95%	not a violation, upgrade modeled in 2022
Bulk-PTT-26	PEASE - E.MRY J1 115.0 #1	Tesla CB#612 stuck brk	C	BRK	99.9%	<95%	<95%	trip E. Marysvl load if overload, upgrade modeled in 2022
Bulk-PTT-29	STCKDLJ1- MIDWAY 230 #1	Midway-Kern # 3&4 230 kV	C	L-2	<95%	98.2%	111.5%	trip load in Bakersfield and Stockdale
Bulk-PTT-30	TABLE MTN 500/230 kV # 1	Double outage south of Table Mountain	C	L-2	<95%	<95%	99.7%	re-rate Table Mtn 500/230 kV x-former
Bulk-PTT-31	WIRLWIND- MIDWAY 500 #3	Midway-Vincent 500 kV # 1 & 2	C	L-2	96.3%	<95%	<95%	not a violation, Path 26 at the limit
Bulk-PTT-32	WND MSTR - DELTAPMP 230.0 #1	C. Costa-Las Positas & C. Cos-Lone Tree 230 kV	C	L-2	104.6%	<95%	<95%	add SPS to trip C.Cos generation, upgrade modeled from 2017
Bulk-PTT-4	C.COSTA SUB-C.COSTA 230	Tesla 500 kV substation	D	SUBST	104.8%	97.8%	<95%	add tripping C.Cos generation to RAS or re-rate
Bulk-PTT-7	CAYETANO-USWP JRW 230	Tesla 500 kV substation	D	SUBST	98.9%	<95%	97.5%	not a violation
Bulk-PTT-24	PANOCHÉ -GATES 230 #1&2	Los Banos 500 kV substation	D	SUBST	111.0%	112.2%	<95%	acceptable for Cat D, trip load

**Post-Transient Thermal Overloads**

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2014	2017	2022	
Bulk-PTT-33	NOT SOLVED	NE SE SEPARATION	D	sys sep	diverged	diverged	diverged	system separation according to the scheme
Bulk-PTT-34	NOT SOLVED, SOLVED WITH ADDITIONAL LOAD AND GEN TRIPPING	Midway 500 kV Substation	D	subst	diverged	diverged	no cascading outages	under review
Bulk-PTT-35	NOT SOLVED, SOLVED WITH ADDITIONAL LOAD AND GEN TRIPPING	Midway 230 kV Substation	D	subst	diverged	diverged	diverged	under review
Bulk-PTT-36	NOT SOLVED, SOLVED WITH ADDITIONAL LOAD AND GEN TRIPPING	Path 26	D	corridor	diverged	diverged	no cascading outages	under review

**Post-Transient Voltage Deviations**

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %			Potential Mitigation Solutions
					2014	2017	2022	
Bulk-TVD-1	Substations in Northwest, voltage deviation up, up to 10.5%	PDCI BI-pole outage	B	PDCI	<-5%	<-5%	<-5%	trip capacitors at wind plants, consider exemption for deviation up for PDCI outage

**Thermal Overloads**

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)				Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-1	WARNEVL-WILSON 230	normal conditions	A	base case	<95%	151.7%	<95%	<95%	upgrade the line
Bulk-OP-T-36	BELLOTA-WARNEVL 230	normal conditions	A	base case	<95%	108.8%	<95%	<95%	upgrade the line
Bulk-OP-T-6	WARNEVL-WILSON 230	Gates 500/230 kV transformer	B	T-1	<95%	151.2%	<95%	<95%	upgrade the line
Bulk-OP-T-7	WARNEVL-WILSON 230	PDCI Bi-pole	B	PDCI	<95%	149.6%	<95%	<95%	upgrade the line
Bulk-OP-T-13	WARNEVL-WILSON 230	Tesla-Los Banos 500 kV	B	L-1	<95%	141.8%	<95%	<95%	upgrade the line
Bulk-OP-T-14	WARNEVL-WILSON 230	PDCI monopole	B	PDCI	<95%	141.8%	<95%	<95%	upgrade the line
Bulk-OP-T-15	WARNEVL-WILSON 230	Tracy-Los Banos 500 kV	B	L-1	<95%	140.2%	<95%	<95%	upgrade the line
Bulk-OP-T-19	WARNEVL-WILSON 230	Los Banos-Gates 500 kV #1	B	L-1	<95%	137.6%	<95%	<95%	upgrade the line
Bulk-OP-T-20	WARNEVL-WILSON 230	One Diablo unit	B	G-1	<95%	137.2%	<95%	<95%	upgrade the line
Bulk-OP-T-21	WARNEVL-WILSON 230	One San Onofre unit	B	G-1	<95%	136.4%	<95%	<95%	upgrade the line
Bulk-OP-T-22	WARNEVL-WILSON 230	Los Banos-Midway 500 kV	B	L-1	<95%	136.3%	<95%	<95%	upgrade the line
Bulk-OP-T-23	WARNEVL-WILSON 230	Moss Landing-Los Banos 500 kV	B	L-1	<95%	134.5%	<95%	<95%	upgrade the line
Bulk-OP-T-24	WARNEVL-WILSON 230	Tesla-Metcalf 500 kV	B	L-1	<95%	133.8%	<95%	<95%	upgrade the line
Bulk-OP-T-27	WARNEVL-WILSON 230	Los Banos-Gates 500 kV #3	B	L-1	<95%	132.4%	<95%	<95%	upgrade the line
Bulk-OP-T-28	WARNEVL-WILSON 230	Los Banos 500/230 kV transformer	B	L-1	<95%	131.6%	<95%	<95%	upgrade the line

**Thermal Overloads**

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)				Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-29	WARNEVL-WILSON 230	Vaca Dixon-Tesla 500 kV	B	L-1	<95%	131.4%	<95%	<95%	upgrade the line
Bulk-OP-T-31	WARNEVL-WILSON 230	Olinda-Tracy 500 kV	B	L-1	<95%	130.8%	<95%	<95%	upgrade the line
Bulk-OP-T-33	WARNEVL-WILSON 230	Table Mountain –Tesla 500 kV	B	L-1	<95%	130.4%	<95%	<95%	upgrade the line
Bulk-OP-T-34	WARNEVL-WILSON 230	Tesla-Newark 230 kV	B	L-1	<95%	130.3%	<95%	<95%	upgrade the line
Bulk-OP-T-35	WARNEVL-WILSON 230	Olinda 500/230 kV transformer	B	T-1	<95%	130.1%	<95%	<95%	upgrade the line
Bulk-OP-T-41	BELLOTA-WARNEVL 230	PDCI Bi-pole	B	PDCI	<95%	109.4%	<95%	<95%	upgrade the line
Bulk-OP-T-42	BELLOTA-WARNEVL 230	Gates 500/230 kV transformer	B	T-1	<95%	108.2%	<95%	<95%	upgrade the line
Bulk-OP-T-47	BELLOTA-WARNEVL 230	Tesla-Los Banos 500 kV	B	L-1	<95%	103.9%	<95%	<95%	upgrade the line
Bulk-OP-T-48	BELLOTA-WARNEVL 230	PDCI monopole	B	PDCI	<95%	103.8%	<95%	<95%	upgrade the line
Bulk-OP-T-50	BELLOTA-WARNEVL 230	Tracy-Los Banos 500 kV	B	L-1	<95%	102.1%	<95%	<95%	upgrade the line
Bulk-OP-T-53	BELLOTA-WARNEVL 230	One Diablo unit	B	G-1	<95%	99.4%	<95%	<95%	upgrade the line
Bulk-OP-T-54	BELLOTA-WARNEVL 230	Olinda-Tracy 500 kV	B	L-1	<95%	98.8%	<95%	<95%	upgrade the line
Bulk-OP-T-55	BELLOTA-WARNEVL 230	One San Onofre unit	B	G-1	<95%	98.4%	<95%	<95%	upgrade the line
Bulk-OP-T-56	BELLOTA-WARNEVL 230	Moss Landing-Los Banos	B	L-1	<95%	97.4%	<95%	<95%	upgrade the line
Bulk-OP-T-57	BELLOTA-WARNEVL 230	Vaca Dixon-Tesla 500 kV	B	L-1	<95%	97.3%	<95%	<95%	upgrade the line

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Study Area: **PG&E Bulk - Summer Light Load, Summer Off-Peak & Summer Partial Peak**


## Thermal Overloads

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)				Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-58	BELLOTA-WARNEVL 230	Los Banos-Midway 500 kV	B	L-1	<95%	97.2%	<95%	<95%	upgrade the line
Bulk-OP-T-62	CRAGVIEW - WEED JPS 115 #1	Captain Jack -Olinda 500 kV	B	L-1	<95%	104.7%	<95%	<95%	adjust Weed phase shifter
Bulk-OP-T-63	CRAGVIEW - WEED JPS 115 #1	Malin-Round Mountain 500 kV #2	B	L-1	<95%	101.5%	<95%	<95%	adjust Weed phase shifter
Bulk-OP-T-64	CRAGVIEW - WEED JPS 115 #1	Malin-Round Mountain 500 kV #1	B	L-1	<95%	101.0%	<95%	<95%	adjust Weed phase shifter
Bulk-OP-T-67	DELTA - CASCADE 115 #1	Captain Jack -Olinda 500 kV	B	L-1	<95%	100.4%	<95%	<95%	adjust Weed phase shifter
Bulk-OP-T-68	COTWDWAP -OLINDAW 230 #1 &2	Captain Jack -Olinda 500 kV	B	L-1	<95%	104.7%	<95%	<95%	WAPA project to upgrade
Bulk-OP-T-71	CAYETANO - USWP-JRW 230 #1	Contra Costa-Las Positas 230 kV	B	L-1	<95%	108.7%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-73	CAYETANO - USWP-JRW 230 #1	Tesla-Metcalf 500 kV with Delta Energy Center off	B	G-1/L-1	<95%	100.8%	<95%	<95%	reduce C.Cos sub and Gateway generation or upgrade
Bulk-OP-T-74	CAYETANO - USWP-JRW 230 #1	Vaca Dixon-Tesla 500 kV	B	L-1	<95%	99.3%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-75	CAYETANO - USWP-JRW 230 #1	Tesla-Metcalf 500 kV	B	L-1	<95%	99.0%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-80	LONETREE - USWP-JRW 230.0 #1	Contra Costa-Las Positas 230 kV	B	L-1	<95%	109.0%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-82	LONETREE - USWP-JRW 230.0 #1	Tesla-Metcalf 500 kV with Delta Energy Center off	B	G-1/L-1	<95%	101.1%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-83	LONETREE - USWP-JRW 230.0 #1	Vaca Dixon-Tesla 500 kV	B	L-1	<95%	99.6%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-84	LONETREE - USWP-JRW 230.0 #1	Tesla-Metcalf 500 kV	B	L-1	<95%	99.3%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-106	GATES - MIDWAY 230.0 #1	Gates 500/230 kV transformer	B	T-1	<95%	<95%	97.0%	<95%	not a violation

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					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-107	GATES - MIDWAY 230.0 #1	Gates-Midway 500 kV	B	L-1	<95%	<95%	103.0%	<95%	trip one Helms pump
Bulk-OP-T-3	WARNEVL-WILSON 230	500 kV double outage north of Los Banos	C	L-2	<95%	173.4%	<95%	<95%	upgrade the line
Bulk-OP-T-4	WARNEVL-WILSON 230	Gates-Gregg&Gates-Mc Call 230 kV	C	L-2	<95%	158.9%	<95%	<95%	upgrade the line
Bulk-OP-T-5	WARNEVL-WILSON 230	500 kV double outage south of Los Banos	C	L-2	<95%	158.8%	<95%	<95%	upgrade the line
Bulk-OP-T-8	WARNEVL-WILSON 230	Los Banos CB#832	C	BRK	<95%	147.8%	<95%	<95%	upgrade the line
Bulk-OP-T-12	WARNEVL-WILSON 230	Haas-McCall and Balch-McCall 230 kV	C	L-2	<95%	143.5%	<95%	<95%	upgrade the line
Bulk-OP-T-16	WARNEVL-WILSON 230	500 kV double outage north of Midway	C	L-2	<95%	138.1%	<95%	<95%	upgrade the line
Bulk-OP-T-17	WARNEVL-WILSON 230	500 kV double outage south of Tracy	C	L-2	<95%	138.0%	<95%	<95%	upgrade the line
Bulk-OP-T-18	WARNEVL-WILSON 230	Diablo-Midway 500 kV #1&2	C	L-2	<95%	137.6%	<95%	<95%	upgrade the line
Bulk-OP-T-25	WARNEVL-WILSON 230	Moss Landing CB#722	C	BRK	<95%	133.1%	<95%	<95%	upgrade the line
Bulk-OP-T-26	WARNEVL-WILSON 230	Gates CB #652	C	BRK	<95%	133.0%	<95%	<95%	upgrade the line
Bulk-OP-T-30	WARNEVL-WILSON 230	Vaca Dixon CB#732	C	BRK	<95%	131.3%	<95%	<95%	upgrade the line
Bulk-OP-T-32	WARNEVL-WILSON 230	Tesla CB#612	C	BRK	<95%	130.6%	<95%	<95%	upgrade the line
Bulk-OP-T-38	BELLOTA-WARNEVL 230	500 kV double outage north of Los Banos	C	L-2	<95%	131.3%	<95%	<95%	upgrade the line
Bulk-OP-T-39	BELLOTA-WARNEVL 230	500 kV double outage south of Los Banos	C	L-2	<95%	112.4%	<95%	<95%	upgrade the line



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## Thermal Overloads

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					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-40	BELLOTA-WARNEVL 230	Gates-Gregg&Gates-Mc Call 230 kV	C	L-2	<95%	111.8%	<95%	<95%	upgrade the line
Bulk-OP-T-43	BELLOTA-WARNEVL 230	Los Banos CB#832	C	BRK	<95%	107.3%	<95%	<95%	upgrade the line
Bulk-OP-T-49	BELLOTA-WARNEVL 230	Haas-McCall and Balch-McCall 230 kV	C	L-2	<95%	102.6%	<95%	<95%	upgrade the line
Bulk-OP-T-51	BELLOTA-WARNEVL 230	500 kV double outage south of Tracy	C	L-2	<95%	101.6%	<95%	<95%	upgrade the line
Bulk-OP-T-52	BELLOTA-WARNEVL 230	Diablo-Midway 500 kV #1&2	C	L-2	<95%	99.6%	<95%	<95%	upgrade the line
Bulk-OP-T-59	BELLOTA-WARNEVL 230	Vaca Dixon CB#732	C	BRK	<95%	97.2%	<95%	<95%	upgrade the line
Bulk-OP-T-60	BELLOTA-WARNEVL 230	500 kV double outage north of Midway	C	L-2	<95%	97.0%	<95%	<95%	upgrade the line
Bulk-OP-T-61	CRAGVIEW - WEED JPS 115 #1	Malin-Round Mntain 500 kV #1 &2	C	L-2	<95%	109.5%	<95%	<95%	adjust Weed phase shifter
Bulk-OP-T-65	CRAGVIEW - WEED JPS 115 #1	Round Mnt –Table Mnt 500 kV # 1 & 2	C	L-2	<95%	99.0%	<95%	<95%	adjust Weed phase shifter
Bulk-OP-T-66	DELTA - CASCADE 115 #1	Malin-Round Mntain 500 kV #1 &2	C	L-2	<95%	105.6%	<95%	<95%	adjust Weed phase shifter
Bulk-OP-T-69	CAYETANO - USWP-JRW 230 #1	Contra Costa-Brentwood and C Costa-Delta 230 kV	C	L-2	<95%	111.6%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-72	CAYETANO - USWP-JRW 230 #1	500 kV double outage north of Tesla	C	L-2	<95%	103.4%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-76	CAYETANO - USWP-JRW 230 #1	Vaca Dixon CB#732	C	BRK	<95%	98.3%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-77	CAYETANO - USWP-JRW 230 #1	500 kV double outage north of Los Banos	C	L-2	<95%	97.7%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-78	LONETREE - USWP-JRW 230.0 #1	Contra Costa-Brentwood and C Costa-Delta 230 kV	C	L-2	<95%	111.8%	<95%	<95%	upgrade or congestion management

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					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-81	LONETREE - USWP-JRW 230.0 #1	500 kV double outage north of Tesla	C	L-2	<95%	103.7%	<95%	<95%	reduce C.Cos sub and Gateway generation or upgrade
Bulk-OP-T-85	LONETREE - USWP-JRW 230.0 #1	Vaca Dixon CB#732	C	BRK	<95%	98.6%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-86	LONETREE - USWP-JRW 230.0 #1	500 kV double outage north of Los Banos	C	L-2	<95%	98.0%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-87	WESTLEY-LOS BANOS 230.0 #1	500 kV double outage north of Los Banos	C	L-2	<95%	133.4%	115.1%	<95%	upgrade or congestion management
Bulk-OP-T-90	LOSBANOS - DS AMIGO 230.0 #1	500 kV double outage south of Los Banos	C	L-2	<95%	97.6%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-91	PEASE - E.MRY J1 115.0 #1	500 kV double outage south of Table Mtn	C	L-2	<95%	98.9%	<95%	<95%	upgrade or congestion management, upgrade modeled in 2022
Bulk-OP-T-92	CC SUB - C.COSTA 230.0 #1	500 kV double outage north of Tesla	C	L-2	<95%	101.8%	<95%	<95%	reduce C.Cos sub and Gateway generation or upgrade
Bulk-OP-T-94	ALTM MDW - DELTAPMP 230.0 #1	500 kV double outage north of Tesla	C	L-2	<95%	110.0%	<95%	<95%	reduce C.Cos sub and Gateway generation or upgrade
Bulk-OP-T-96	C.COSTA - BRENTWOD 230.0 #1	Contra Costa-Las Positas & C Cos-Lone Tree 230 kV	C	L-2	<95%	97.1%	<95%	<95%	not a violation
Bulk-OP-T-97	NDUBLIN - VINEYD_D 230.0 #1	Contra Costa-Brentwood and C Costa-Delta 230 kV	C	L-2	<95%	97.0%	<95%	<95%	not a violation
Bulk-OP-T-99	STCKDLJ1 - MIDWAY 230.0 #1	Midway-Kern 230 kV # 3 & 4	C	L-2	<95%	115.9%	<95%	<95%	trip load in Bakesfld& Stockdale
Bulk-OP-T-100	GREGG - FGRDN T2 230.0 #1	Gregg-Herndon 230 kV #1&2	C	L-2	<95%	100.3%	<95%	<95%	trip load at Ashlan or upgrade
Bulk-OP-T-108	GATES - MIDWAY 230.0 #1	500 kV double outage north of Midway	C	L-2	<95%	<95%	106.4%	<95%	drop renewables at Midway and all Helms pumps
Bulk-OP-T-109	GATES - MIDWAY 230.0 #1	Midway CB#812	C	BRK	<95%	<95%	100.3%	<95%	trip one Helms pump

# 2012/2013 ISO Reliability Assessment - Preliminary Study Results

Study Area: **PG&E Bulk - Summer Light Load, Summer Off-Peak & Summer Partial Peak**



## Thermal Overloads

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)				Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-111	ARCO - MIDWAY 230.0 #1	500 kV double outage north of Midway	C	L-2	<95%	<95%	96.8%	<95%	drop renewables at Midway and all Helms pumps
Bulk-OP-T-2	WARNEVL-WILSON 230	Los Banos 500 kV Substation	D	Subst	<95%	221.4%	<95%	118.2%	upgrade the line
Bulk-OP-T-9	WARNEVL-WILSON 230	2 Diablo units	D	G-2	<95%	146.7%	<95%	<95%	upgrade the line
Bulk-OP-T-10	WARNEVL-WILSON 230	2 Palo Verde units	D	G-2	<95%	145.1%	<95%	<95%	upgrade the line
Bulk-OP-T-11	WARNEVL-WILSON 230	2 San Onofre units	D	G-2	<95%	144.9%	<95%	<95%	upgrade the line
Bulk-OP-T-37	BELLOTA-WARNEVL 230	Los Banos 500 kV Substation	D	Subst	<95%	161.9%	<95%	<95%	upgrade the line
Bulk-OP-T-44	BELLOTA-WARNEVL 230	2 Diablo units	D	G-2	<95%	107.1%	<95%	<95%	upgrade the line
Bulk-OP-T-45	BELLOTA-WARNEVL 230	2 Palo Verde units	D	G-2	<95%	105.1%	<95%	<95%	upgrade the line
Bulk-OP-T-46	BELLOTA-WARNEVL 230	2 San Onofre units	D	G-2	<95%	105.1%	<95%	<95%	upgrade the line
Bulk-OP-T-70	CAYETANO - USWP-JRW 230 #1	Tesla 500 kV Substation	D	Subst	<95%	111.2%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-79	LONETREE - USWP-JRW 230.0 #1	Tesla 500 kV Substation	D	Subst	<95%	111.5%	<95%	<95%	upgrade or congestion management
Bulk-OP-T-88	WESTLEY-LOS BANOS 230.0 #1	Los Banos 500 kV Substation	D	Subst	<95%	144.1%	105.3%	<95%	upgrade or congestion management
Bulk-OP-T-89	WESTLEY-LOS BANOS 230.0 #1	Tesla 500 kV Substation	D	Subst	<95%	<95%	105.8%	<95%	upgrade or congestion management
Bulk-OP-T-93	CC SUB - C.COSTA 230.0 #1	Tesla 500 kV Substation	D	Subst	<95%	104.6%	<95%	<95%	reduce C.Cos sub and Gateway generation or upgrade
Bulk-OP-T-95	ALTM MDW - DELTAPMP 230.0 #1	Tesla 500 kV Substation	D	Subst	<95%	102.3%	<95%	<95%	reduce C.Cos sub and Gateway generation or upgrade

## Thermal Overloads

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)				Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-98	NDUBLIN - VINEYD_D 230.0 #1	Tesla 500 kV Substation	D	Subst	<95%	96.7%	<95%	<95%	not a violation
Bulk-OP-T-101	MOSSLND2- PANOCHE 230.0 #1	Los Banos 500 kV Substation	D	Subst	<95%	128.1%	<95%	<95%	no cascading outages
Bulk-OP-T-102	COBURN -PANOCHE 230.0 #1	Los Banos 500 kV Substation	D	Subst	<95%	99.5%	<95%	<95%	no cascading outages
Bulk-OP-T-103	PANOCHE -GATES 230.0 #1&2	Los Banos 500 kV Substation	D	Subst	<95%	132.6%	191.7%	<95%	no cascading outages
Bulk-OP-T-104	STOREY 2 -BORDEN 230.0 #1	Los Banos 500 kV Substation	D	Subst	<95%	113.0%	<95%	<95%	no cascading outages
Bulk-OP-T-105	STOREY 2 - WILSON 230.0 #1	Los Banos 500 kV Substation	D	Subst	<95%	122.5%	<95%	<95%	no cascading outages
Bulk-OP-T-110	GATES - MIDWAY 230.0 #1	Midway 500 kV Substation	D	Subst	diverged	diverged	154.9%	126.5%	no cascading outages
Bulk-OP-T-112	ARCO - MIDWAY 230.0 #1	Midway 500 kV Substation	D	Subst	diverged	diverged	137.2%	<95%	no cascading outages
Bulk-OP-T-113	GATES - ARCO 230.0 #1	Midway 500 kV Substation	D	Subst	diverged	diverged	<95%	114.6%	no cascading outages
Bulk-OP-T-114	HENTAP1 - GATES 230.0 #1 30 314 2225.59 756.42 1892.71 Amps 117.59%	Los Banos 500 kV Substation	D	Subst	<95%	<95%	117.6%	<95%	no cascading outages
Bulk-OP-T-115	GATES 500/230 # 1	Los Banos 500 kV Substation	D	Subst	<95%	<95%	178.7%	<95%	no cascading outages
Bulk-OP-T-116	NOT SOLVED	NE SE SEPARATION	D	sys sep	diverged	diverged	diverged	diverged	system separation according the the scheme
Bulk-OP-T-117	NOT SOLVED, solved with additional load and generation tripping	Midway 500 kV Substation	D	subst	diverged	diverged	no cascading outages	no cascading outages	under review
Bulk-OP-T-118	NOT SOLVED, solved with additional load and generation tripping	Midway 230 kV Substation	D	subst	diverged	diverged	diverged	diverged	under review

**Thermal Overloads**

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)				Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-T-119	NOT SOLVED, solved with additional load and generation tripping	Path 26	D	corridor	no cascading outages	diverged	no cascading outages	no cascading outages	under review

# 2012/2013 ISO Reliability Assessment - Preliminary Study Results

Study Area: **PG&E Bulk - Summer Light Load, Summer Off-Peak & Summer Partial Peak**



## Voltage Deviations

ID	Substation	Contingency	Category	Category Description	Post Cont. Voltage Deviation %				Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-V-1	Substations in Northwest , deviation up in partial peak, up to 7.7%	PDCI BI-pole outage	B	PDCI	<5%	<-5%	<5%	<5%	trip capacitors at wind plants, consider exemption for deviation up for PDCI outage

**Transient Stability**

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2014	2017	2022	N/A	
Bulk-TS-1	3-phase fault Cottonwood-Olinda # 1 230 kV	B	L-1	NEO REDB 13.8 KV frq<59.6 for 6.4 cycles	no issues	no issues		NEO REDB modeled off in other cases, consider exemption
Bulk-TS-2	3-phase fault Midway-Kern # 1 (Stockdale1) 230 kV	B	L-1	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations		trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-TS-3	3-phase fault Midway-Kern # 2 (Stockdale2) 230 kV	B	L-1	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations		trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-TS-4	3-phase fault Midway-Gates 230 kV or any other outage with 3-phase fault on Midway 230 kV	B	L-1	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations		trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-TS-5	3-phase fault Contra Costa-Las Positas 230 kV or any outage with three-phase fault on Contra Costa	B	L-1	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage		these are existing wind generators that don't have Low Voltage Ride Through capability
Bulk-TS-6	3-phase fault Gates-Gregg 230 kV or any other outage with a 3-phase fault on Gates 230 kV	B	L-1	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV		get detailed load model at Gates 115 kV. If detailed studies confirm the issue, install SVC at Gates 115 kV or move load to 70 kV
Bulk-TS-7	PDCI bi-pole outage	B	PDCI	under-freq load trip bus 50141	no issues	under-freq load trip bus 50141		change relay setting
Bulk-TS-8	3-phase fault 500 kV double outage south of Table Mountain	C	L-2	under-freq load trip bus 50141	no issues	no issues		change relay setting

**Transient Stability**

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2014	2017	2022	N/A	
Bulk-TS-9	3-phase fault Gates-Gregg, Gates-Mc Call or any other single or double outage with a three-phase fault on Gates 230 kV	C	L-2	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV		get detailed load model at Gates 115 kV. If detailed studies confirm the issue, install SVC at Gates 115 kV or move load to 70 kV
Bulk-TS-10	3-phase fault Contra Costa-Las Positas & C Cos-Lone Tree 230 kV or any contingency with a three-phase fault at Contra Costa 230 kV	C	L-2	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage		these are existing wind generators that don't have Low Voltage Ride Through capability
Bulk-TS-11	3-phase fault Contra Costa-Brentwood and C Costa-Delta 230 kV or any contingency with a three-phase fault at Contra Costa 230 kV	C	L-2	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage		these are existing wind generators that don't have Low Voltage Ride Through capability
Bulk-TS-12	3-phase fault Gates-Arco and Gates-Midway 230 kV or any contingency with a three-phase fault at Gates 230 kV	C	L-2	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV		get detailed load model at Gates 115 kV. If detailed studies confirm the issue, install SVC at Gates 115 kV or move load to 70 kV
Bulk-TS-13	3-phase fault Midway-Kern #3 and 4 230 kV or any contingency with a three-phase fault at Midway230 kV	C	L-2	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations	oscillations on Windgap pumps, freq violations		trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-TS-14	3-phase fault Gregg - Herndon #1 & #2 230 kV	C	L-2	Helms 3 tripped for under frequency	Helms 3 tripped for under frequency	Helms 3 tripped for under frequency		add tripping of all Helms units to SPS
Bulk-TS-15	3-phase fault Two Diablo generation units	D	G-2	under-voltage load tripping in NW	no issues	no issues		requires more reactive support in NW in 2014
Bulk-TS-16	3-phase fault Two Palo Verde generation units	D	G-2	under-voltage load tripping in NW	no issues	no issues		requires more reactive support in NW in 2014



**Transient Stability**

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2014	2017	2022	N/A	
Bulk-TS-17	3-phase fault Northeast-Southeast separation	D	corridor	system separation, under and over-voltage and frequency load shedding and generation tripping	system separation, under and over-voltage and frequency load shedding and generation tripping	system separation, under and over-voltage and frequency load shedding and generation tripping		no cascading outages
Bulk-TS-18	3-phase fault Path 26 outage	D	corridor	load and generation tripping, large vlt and freq dips	load and generation tripping, large vlt and freq dips	no issues		under review
Bulk-TS-19	Outage of Midway 500 kV substation with 3-phase fault	D	substation	load and generation tripping, large vlt and freq dips	load and generation tripping, large vlt and freq dips	large frequency dips		under review
Bulk-TS-20	Outage of Midway 230 kV substation with 3-phase fault	D	substation	load and generation tripping, large vlt and freq dips	load and generation tripping, large vlt and freq dips	unstable, stable w/d tripping		under review
Bulk-TS-21	Outage of Los Banos 500 kV substation with 3-phase fault	D	substation	load and generation tripping, large vlt dips	no violations with RAS	no issues		no cascading outages

**Transient Stability**

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-TS-1	3-phase fault Cottonwood-Olinda # 1 230 kV	B	L-1	wind type 2 on Rio Dell tap tripped for under-vlt	no issues	no issues	no issues	the unit modeled as type 2 without Low Voltage Ride Through capability
Bulk-OP-TS-2	3-phase fault Newark-Ravenswood 230 kV	B	L-1	1 unit wind type 2 at Brds Lndg tripped for under-vlt	no issues	no issues	no issues	the existing unit doesn't have Low Voltage Ride Through capability
Bulk-OP-TS-3	3-phase fault Midway-Kern # 1 (Stockdale1) 230 kV or any other outage with three-phase fault on Midway 230 kV	B	L-1	freq violations, solar plants at Midway off	freq violations, solar plants at Midway off	freq violations, solar plants at Midway off	freq violations, one solar plant at Midway off	trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-OP-TS-4	3-phase fault Midway-Kern # 2 (Stockdale2) 230 kV or any other outage with three-phase fault on Midway 230 kV	B	L-1	freq violations, solar plants at Midway off	freq violations, solar plants at Midway off	freq violations, solar plants at Midway off	freq violations, one solar plant at Midway off	trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-OP-TS-5	3-phase fault Midway-Gates 230 kV or any Cat B contingency with three-phase fault on Midway 230 kV	B	L-1	freq violations, solar plants at Midway off	freq violations, solar plants at Midway off	freq violations, solar plants at Midway off	freq violations, one solar plant at Midway off	trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-OP-TS-6	3-phase fault Contra Costa-Las Positas 230 kV or any outage with three-phase fault on Contra Costa	B	L-1	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	3 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	these are existing wind generators that don't have Low Voltage Ride Through capability
Bulk-OP-TS-7	3-phase fault Tesla-Newark	B	L-1	1 unit wind type 2 at Brds Lndg tripped for under-vlt	no issues	no issues	no issues	the existing unit doesn't have Low Voltage Ride Through capability
Bulk-OP-TS-8	3-phase fault Gates-Gregg 230 kV or any other outage with a three-phase fault on Gates 230 kV	B	L-1	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	get detailed load model at Gates 115 kV. If detailed studies confirm the issue, install SVC at Gates 115 kV or move load to 70 kV

**Transient Stability**

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-TS-9	3-phase fault Gates-Gregg, Gates-Mc Call or any other single or double outage with a three-phase fault on Gates 230 kV	C	L-2	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	get detailed load model at Gates 115 kV. If detailed studies confirm the issue, install SVC at Gates 115 kV or move load to 70 kV
Bulk-OP-TS-10	3-phase fault Contra Costa-Las Positas & C Cos-Lone Tree 230 kV or any contingency with a three-phase fault at Contra Costa 230 kV	C	L-2	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	3 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	these are existing wind generators that don't have Low Voltage Ride Through capability
Bulk-OP-TS-11	3-phase fault Contra Costa-Brentwood and C Costa-Delta 230 kV or any contingency with a three-phase fault at Contra Costa 230 kV	C	L-2	4 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	3 wind type 2 units at Birds Landing tripped for undervoltage	4 wind type 2 units at Birds Landing tripped for undervoltage	these are existing wind generators that don't have Low Voltage Ride Through capability
Bulk-OP-TS-12	3-phase fault Gates-Arco and Gates-Midway 230 kV or any contingency with a three-phase fault at Gates 230 kV	C	L-2	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	underfreq Id trip and freq violations at Gates 115 kV	get detailed load model at Gates 115 kV. If detailed studies confirm the issue, install SVC at Gates 115 kV or move load to 70 kV
Bulk-OP-TS-13	3-phase fault Midway-Kern #3 and 4 230 kV or any Cat C contingency with a three-phase fault at Midway 230 kV	C	L-2	no issues, solar plants at Midway off	no issues, solar plants at Midway off	no issues, solar plants at Midway off	oscillations on Windgap pumps, freq violations	trip Solar plants at Midway 230 with a fault on Midway 230, consider exemption for slow frequency recovery or install dynamic device
Bulk-OP-TS-14	3-phase fault Northeast-Southeast separation	D	corridor	system separation, under and over-voltage and frequency load shedding and generation tripping	system separation, under and over-voltage and frequency load shedding and generation tripping	system separation, under and over-voltage and frequency load shedding and generation tripping	system separation, under and over-voltage and frequency load shedding and generation tripping	no cascading outages
Bulk-OP-TS-15	Path 26 outage with 3-phase fault	D	corridor	no issues, North to South flow	N-S flow, unstable, stable w/load and gen trip, under-freq & under-vlt Id trip	low vlt in Idaho & Sierra, S to N flow	no issues, North to South flow	under review

## 2012/2013 ISO Reliability Assessment - Preliminary Study Results

Study Area: **PG&E Bulk - Summer Light Load, Summer Off-Peak & Summer Partial Peak**



### Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2014 Summer Light Load	2017 Summer Partial Peak	2017 Summer Off-Peak	2022 Summer Light Load	
Bulk-OP-TS-16	Outage of Midway 500 kV substation with 3-phase fault	D	substation	no cascading outages	unstable	generation tripping in BC, unstable	no cascading outages	under review
Bulk-OP-TS-17	Outage of Midway 230 kV substation with 3-phase fault	D	substation	load and generation tripping, large vlt and freq dips	unstable	unstable	unstable	under review
Bulk-OP-TS-18	Outage of Los Banos 500 kV substation with 3-phase fault	D	substation	no cascading outages	large voltage dips, no cascading outages	large voltage dips, no cascading outages	no cascading outages	no cascading outages