2013/2014 ISO Reliability Assessment - Study Results

Study Area: PG&E BULK SYSTEM

Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance			Potential Mitigation Solutions
				2015 Summer Peak	2018 Summer Peak	2023 Summer Peak	
PGE_Bulk-SP-TS-1	3-Phase 6-cycle fault on the Gates 230 kV bus, cleared by opening any line	B	L-1	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	local issue, may be modeling error
PGE_Bulk-SP-TS-2	3-Phase 6-cycle fault on the Midway 230 kV bus, cleared by opening any line	B	L-1	oscillations on Midway pumps, pumps tripped by under-frequency protection, UFLS at Smyrna 115 kV, vlt and freq violations	UFLS at Smyrna 115 kV, vlt and freq violations on Midway pumps and around Midway	UFLS at Smyrna 115 kV, vlt and freq violations on Midway pumps and around Midway	need to have fast-acting protection at Midway pumps, may need to change relay settings at Smyrna
PGE_Bulk-SP-TS-3	3 phase fault on Contra Costa cleared by opening C. Cos-Las Positas or any other 230 kV line	B	L-1	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	these are existing units, don't have Low Voltage Ride Through
PGE_Bulk-SP-TS-4	3 phase fault on Contra Costa cleared by opening C. Cos-Brentwood and C. Cos-Delta 230 kV or any other 2 lines	C	L-2	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	these are existing units, don't have Low Voltage Ride Through
PGE_Bulk-SP-TS-5	3-Phase 6-cycle fault on the Gates 230 kV bus, cleared by opening any 2 lines	C	L-2	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	local issue, may be modeling error
PGE_Bulk-SP-TS-6	3-Phase 6-cycle fault on the Midway 230 kV bus, cleared by opening any 2 lines	C	L-2	oscillations on Midway pumps, pumps tripped by under-frequency protection, UFLS at Smyrna 115 kV, vlt and freq violations	UFLS at Smyrna 115 kV, vlt and freq violations around Midway	UFLS at Smyrna 115 kV, vlt and freq violations around Midway	need to have fast-acting protection at Midway pumps, may need to change relay settings at Smyrna

Study Area: **PG&E BULK SYSTEM**

Post-Transient Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2015 Summer Peak	2018 Summer Peak	2023 Summer Peak	
Bulk-SP-PTT-1	Cayetano-USWP-JRW 230 kV	normal conditions	A	Normal	<95%	100.7%	100.9%	reduce area generation or upgrade the line
Bulk-SP-PTT-2	Oro Loma 115/70 # 2	normal conditions	A	Normal	116.8%	<95%	<95%	mitigation in the area studies
Bulk-SP-PTT-3	Canal Tap-Raisin Jct 60 kV	normal conditions	A	Normal	<95%	102.9%	103.3%	mitigation in the area studies
Bulk-SP-PTT-4	Rnd Mtn –Table Mtn #1 or #2 500 kV	Rnd Mtn –Table Mtn #2 or #1 500 kV	B	L-1	102.9%	101.8%	101.8%	bypass ser caps on the remaining Round Mtn-Table Mtn 500 kV line or Tbl Mtn-Vaca Dix or reduce COI flow according to seasonal nomogram
Bulk-SP-PTT-2	Oro Loma 115/70 # 2	Los Banos 500/230 kV	B	T-1	103.8%	<95%	<95%	mitigation in the area studies
Bulk-SP-PTT-2	Oro Loma 115/70 # 2	Tbl Mtn-Vaca Dix 500 kV	B	L-1	102.4%	<95%	<95%	mitigation in the area studies
Bulk-SP-PTT-1	Cayetano-USWP-JRW 230 kV	Tesla-Metclf 500 kV w/Delta Energy Center off	B	G-1/L-1	<95%	102.2%	101.8%	reduce area generation or upgrade the line
Bulk-SP-PTT-1	Cayetano-USWP-JRW 230 kV	Tesla-Metcalf 500 kV	B	L-1	<95%	99.6%	99.5%	reduce area generation or upgrade the line
Bulk-SP-PTT-1	Cayetano-USWP-JRW 230 kV	Contra Costa-Las Positas 230 kV	B	L-1	<95%	105.0%	105.1%	reduce area generation or upgrade the line
Bulk-SP-PTT-1	Cayetano-USWP-JRW 230 kV	Tesla-Newark 230 kV	B	L-1	<95%	<95%	97.1%	reduce area generation or upgrade the line
Bulk-SP-PTT-5	Cayetano-N.Dublin 230 kV	Contra Costa-Las Positas 230 kV	B	L-1	<95%	100.0%	98.9%	reduce area generation or upgrade the line
Bulk-SP-PTT-6	Delevan-Cortina 230 kV	Olinda-Tracy 500 kV	B	L-1	<95%	<95%	97.8%	upgrade the line, reduce COI import or reduce generation if overload

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Post-Transient Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2015 Summer Peak	2018 Summer Peak	2023 Summer Peak	
Bulk-SP-PTT-8	Captain Jack-Olinda 500 kV	Malin- Round Mtn #1 and #2 500 kV	C	L-2	99.1%	95.0%	95.3%	may require limiting COI flow
Bulk-SP-PTT-8	Captain Jack-Olinda 500 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	C	L-2	99.9%	<95%	<95%	may require limiting COI flow
Bulk-SP-PTT-9	Copco-Weed Jct 115 kV	Malin- Round Mtn #1 and #2 500 kV	C	L-2	109.7%	<95%	<95%	adjust Weed phase shifter
Bulk-SP-PTT-9	Copco-Weed Jct 115 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	C	L-2	101.4%	<95%	<95%	adjust Weed phase shifter
Bulk-SP-PTT-10	Delta-Cascade 115 kV	Malin- Round Mtn #1 and #2 500 kV	C	L-2	117.1%	<95%	<95%	adjust Weed phase shifter
Bulk-SP-PTT-10	Delta-Cascade 115 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	C	L-2	107.2%	<95%	<95%	adjust Weed phase shifter
Bulk-SP-PTT-11	Cragview-Weed 115 kV	Malin- Round Mtn #1 and #2 500 kV	C	L-2	107.3%	<95%	<95%	adjust Weed phase shifter
Bulk-SP-PTT-11	Cragview-Weed 115 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	C	L-2	98.5%	<95%	<95%	adjust Weed phase shifter
Bulk-SP-PTT-12	Cragview-Delta 115 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	C	L-2	97.5%	<95%	<95%	adjust Weed phase shifter
Bulk-SP-PTT-6	Delevan-Cortina 230 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	C	L-2	100.3%	101.3%	104.3%	upgrade the line, or modify RAS to trip other generation
Bulk-SP-PTT-6	Delevan-Cortina 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito tripped	C	L-2	101.3%	101.9%	105.1%	upgrade the line, or modify RAS to trip other generation
Bulk-SP-PTT-6	Delevan-Cortina 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	103.8%	104.3%	107.3%	upgrade the line, or modify RAS to trip other generation
Bulk-SP-PTT-13	Cottonwd E-Round Mtn 230kV #3	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito tripped	C	L-2	97.0%	<95%	<95%	assumed Feather Rivr gen tripping, OL w/out it
Bulk-SP-PTT-13	Cottonwd E-Round Mtn 230kV #3	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	107.0%	103.8%	103.9%	if CDWR trip not available, upgrade the line, or limit COI import or modify RAS to trip other generation and do switching

Study Area: **PG&E BULK SYSTEM**

Post-Transient Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2015 Summer Peak	2018 Summer Peak	2023 Summer Peak	
Bulk-SP-PTT-7	Pease-E.Marysville Jct 115 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	104.2%	<95%	<95%	South of Palermo Project. Prior to the project: if CDWR trip not available, modify RAS to trip other generation and do switching, or limit COI import
Bulk-SP-PTT-18	E. Marysvl Jct-Olivehurst 115 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	109.1%	<95%	<95%	South of Palermo Project. Prior to the project: if CDWR trip not available, modify RAS to trip other generation and do switching, or limit COI import
Bulk-SP-PTT-19	Olivehurst-Rio Oso 115 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	108.9%	<95%	<95%	South of Palermo Project. Prior to the project: if CDWR trip not available, modify RAS to trip other generation and do switching, or limit COI import
Bulk-SP-PTT-14	Table Mtn 500/230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito tripped	C	L-2	<95%	96.2%	99.5%	may need to change South of Table Mtn RAS to trip less generation from Feather Rvr
Bulk-SP-PTT-15	Cottonwd E-Round Mtn 230kV #2	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	96.9%	<95%	<95%	if CDWR trip not available, upgrade the line, or limit COI import or modify RAS to trip other generation and do switching
Bulk-SP-PTT-16	Table Mtn-Rio Oso 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	104.9%	<95%	<95%	Upgrade terminal equipment on this line. Otherwise, up to 100 MW of load tripping may be required if CDWR RAS is not available
Bulk-SP-PTT-17	Eight Mile-Lodi 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito not tripped	C	L-2	104.5%	106.5%	103.4%	if CDWR trip not available, modify RAS to trip other generation or install series reactor on this line, or upgrade the line
Bulk-SP-PTT-17	Eight Mile-Lodi 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV w/ Hyatt& Thermalito tripped	C	L-2	97.2%	98.7%	95.7%	if CDWR trip not available, modify RAS to trip other generation or install series reactor on this line, or upgrade the line
Bulk-SP-PTT-2	Oro Loma 115/70 # 2	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	C	L-2	107.8%	<95%	<95%	mitigation in area studies

Study Area: **PG&E BULK SYSTEM**

Post-Transient Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2015 Summer Peak	2018 Summer Peak	2023 Summer Peak	
Bulk-SP-PTT-1	Cayetano-USWP-JRW 230 kV	Tbl Mtn-Tesla and Vaca Dix -Tesla 500 kV, Hyatt and Thermalito not tripped	C	L-2	<95%	102.5%	99.4%	reduce area generation or upgrade the line
Bulk-SP-PTT-1	Cayetano-USWP-JRW 230 kV	C. Costa-Brentwd and C Costa-Delta 230 kV	C	L-2	<95%	101.4%	100.9%	reduce area generation or upgrade the line
Bulk-SP-PTT-5	Cayetano-N.Dublin 230 kV	C. Costa-Brentwd and C Costa-Delta 230 kV	C	L-2	<95%	96.4%	<95%	reduce area generation or upgrade the line

Study Area: **PG&E BULK System**

Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2015 summer off-peak	2018 summer light load	2023 summer off-peak	2018 Partial Peak	
PGE_Bulk-NP-TS-1	3 phase fault on Contra Costa cleared by opening C. Cos-Las Positas or any other 230 kV line	B	L-1	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	these are existing units, don't have Low Voltage Ride Through
PGE_Bulk-NP-TS-2	3-Phase 6-cycle fault on the Gates 230 kV bus, cleared by opening any line	B	L-1	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV, slow frq recovery in Midway 70 kV system	local issue, may be modeling error
PGE_Bulk-NP-TS-3	3-Phase 6-cycle fault on the Midway 230 kV bus, cleared by opening any line	B	L-1	oscillations on Midway pumps, pumps tripped by under-frequency protection, UFLS at Smyrna 115 kV, vlt and freq violations	slow frq recovery, frq violations around Midway	oscillations on Midway pumps, pumps tripped by under-frequency protection, UFLS at Smyrna 115 kV, vlt and freq violations	UFLS at Smyrna 115 kV, vlt and freq violations on Midway pumps and 115/70 kV system	need to have fast-acting protection at Midway pumps, may need to change relay settings at Smyrna
PGE_Bulk-NP-TS-4	3-Phase 6-cycle fault on the Tesla 230 kV bus, cleared by opening Newark-Tesla line	B	L-1	no issues	3 wind generators, type 2 tripped with the fault	no issues	no issues	these are existing units, don't have Low Voltage Ride Through
PGE_Bulk-NP-TS-5	3-Phase 6-cycle fault on the Newark 230 kV bus, cleared by opening Newark-Ravenswood line	B	L-1	no issues	3 wind generators, type 2 tripped with the fault	no issues	no issues	these are existing units, don't have Low Voltage Ride Through
PGE_Bulk-NP-TS-6	3 phase fault on Contra Costa cleared by opening C. Cos-Brentwood and C. Cos-Delta 230 kV or any other 2 lines	C	L-2	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	4 wind generators, type 2 tripped with the fault	these are existing units, don't have Low Voltage Ride Through
PGE_Bulk-NP-TS-7	3-Phase 6-cycle fault on the Midway 230 kV bus, cleared by opening any 2 lines	C	L-2	oscillations on Midway pumps, pumps tripped by under-frequency protection, UFLS at Smyrna 115 kV, vlt and freq violations	freq violations around Midway	oscillations on Midway pumps, pumps tripped by under-frequency protection, UFLS at Smyrna 115 kV, vlt and freq violations	UFLS at Smyrna 115 kV, vlt and freq violations on Midway pumps and 115/70 kV system	need to have fast-acting protection at Midway pumps, may need to change relay settings at Smyrna

Study Area: **PG&E BULK System**

Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance				Potential Mitigation Solutions
				2015 summer off-peak	2018 summer light load	2023 summer off-peak	2018 Partial Peak	
PGE_Bulk-NP-TS-8	3-Phase 6-cycle fault on the Gates 230 kV bus, cleared by opening any 2 lines	C	L-2	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	UFLS from Gates 115 kV, frequency violation on Gates 115 kV	local issue, may be modeling error

Study Area: PG&E Bulk System

Post-Transient Thermal Overloads

ID	Overloaded Facility	Contingency	Category	Category Description	Loading (%)				Potential Mitigation Solutions
					2015 off-peak	2018 Light Load	2023 off-peak	2018 Part peak	
BULK-NP-PTT-1	Gates-Midway 500 kV	normal conditions	A	normal	<95%	<95%	99.6%	<95%	may need to limit Path 15 if overload
BULK-NP-PTT-2	Warnerville -Wilson 230 kV	normal conditions	A	normal	<95%	<95%	<95%	119.8%	insert series reactor (approved project), with series reactor 62.6% loading
BULK-NP-PTT-3	Los Banos -2C577SS 230 kV	Los Banos-Tesla and Los Banos-Tracy 500 kV	C	L-2	97.5%	<95%	<95%	<95%	no overload with appropriate RAS
BULK-NP-PTT-4	Panoche-Gates 230 kV # 1 & 2	Los Banos-Gates #1 and Los Banos-Midway 500 kV	C	L-2	99.2%	<95%	<95%	<95%	no overload with appropriate RAS
BULK-NP-PTT-5	Olinda 500/230 kV	Malin-Round Mtn # 1 and # 2 500 kV	C	L-2	100.8%	<95%	102.9%	<95%	use Colusa SPS if overload
BULK-NP-PTT-6	Gates-Midway 230 kV	Midway-Gates and Midway-Los Banos 500 kV	C	L-2	<95%	<95%	99.4%	<95%	may need to limit Path 15 if overload
BULK-NP-PTT-7	Table Mtn 500/230 kV	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	C	L-2	<95%	<95%	<95%	105.7%	revise RAS for this contingency to trip less of Feather River generation
BULK-NP-PTT-8	Oro Loma-El Nido 115 kV	Gates-Gregg and Gates-Mc Call 230 kV	C	L-2	<95%	<95%	<95%	138.7%	build second Gates-Gregg 230 kV line, dispatch Helms gen prior to the project or upgrade the line
BULK-NP-PTT-9	El Nido-Wilson B 115 kV	Gates-Gregg and Gates-Mc Call 230 kV	C	L-2	<95%	<95%	<95%	111.4%	build second Gates-Gregg 230 kV line, dispatch Helms gen prior to the project or upgrade the line
BULK-NP-PTT-10	Hammonds-Panoche J 115 kV	Gates-Gregg and Gates-Mc Call 230 kV	C	L-2	<95%	<95%	<95%	107.7%	build second Gates-Gregg 230 kV line, dispatch Helms gen prior to the project or upgrade the line

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

Post-Transient Voltage Deviations

ID	Substation	Contingency	Category	Category Description	Post Cont. Voltage Deviation %				Potential Mitigation Solutions
					2015 off-peak	2018 Light Load	2023 off-peak	2018 Part peak	

No contingencies resulted in voltage deviation outside the criteria.