

APPENDIX C: Policy-Driven Study Results

Study Area: PG&E Bulk System (2021 Load)

Only PG&E 230 kV and higher overloads are shown

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Loading, %				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
PGE-B-T-P-001	Lone tree-USWP JRW-Caeytano 230 kV	normal conditions	A		102%	96%	<95%	<95%	upgrade the line or congestion management
PGE-B-T-P-002	Table Mountain 500/230 kV bank	Table Mtn-Tesla & Table Mtn Vaca Dix 500 kV lines	C	L-2	95%	96%	95%	<95%	no violation
PGE-B-T-P-003	CC Sub-C.Costa 230 kV	Tesla-Table Mtn & Tesla-Vaca Dix 500 kV	C	L-2	99%	<95%	<95%	106%	install SPS to trip generation at Contra Costa Sub or Bird Landing or upgrade the line
		Tesla-Vaca Dixon 500 kV	B	L-1	<95%	<95%	<95%	101%	
PGE-B-T-P-004	Delevan-Cortina 230 kV	Table Mtn-Tesla & Table Mtn Vaca Dix 500 kV lines	C	L-2	97%	97%	95%	<95%	loading depends on SPS, may need to add Colusa gen to SPS
PGE-B-T-P-005	Eight mile-Lodi 230 kV	Table Mtn-Tesla & Table Mtn Vaca Dix 500 kV lines	C	L-2	<95%	<95%	<95%	96%	no violation

Study Area: PG&E Bulk System - 2021 renewable portfolios

Voltage Concerns

See individual area studies

Study Area: PG&E Bulk System - 2021 renewable portfolios

Voltage Deviations

negative - voltage goes down

positive - voltage goes up

NONE

Study Area: PG&E Bulk System - 2021 renewable portfolios

Transient Stability Concerns: None

Study Area: PG&E Bulk System (2021 Off-peak)

Only PG&E overloads 230 kV and higher are shown

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by Portfolios (%)								ISO Recommended Solution
					base		traject		time		envir		
					1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	
PGE-B-T-OP-001	Gates-Midway 230 kV # 1	Midway-Los Banos and Midway-Gates 500 kV lines, trip 256 MW N.Cal Id, all Helms and gen at Midway	C	L-2	105%	104%	100%	100%	112%	112%	<95%	97%	adjust RAS to trip more load
		Midway-Los Banos and Midway-Gates 500 kV lines, trip 515 MW N.Cal Id, all Helms and gen at Midway	C	L-2	102%	102%	98%	97%	109%	110%	<95%	95%	
		Midway-Los Banos and Midway-Gates 500 kV lines, trip 850 MW N.Cal Id, all Helms and gen at Midway	C	L-2	99%	98%	<95%	<95%	105%	106%	<95%	<95%	upgrade the lines in Time scenario or trip T0239
		Gates 500/230 kV bank, no SPS	B	T-1	<95%	115%	<95%	125%	<95%	111%	<95%	<95%	trip 2 Helms pumps in all portfolios except for environmental, add tripping generation at Midway in Traject
		Gates 500/230 kV bank with all Helms tripped	B	T-1	<95%	<95%	<95%	101%	<95%	<95%	<95%	<95%	need upgrade in Traj scenario, or trip generation at Midway
		Midway-Gates 500 kV	B	L-1	<95%	101%	<95%	107%	<95%	100%	<95%	<95%	trip 1 Helms pump in Base and Time, 2 inTraj
PGE-B-T-OP-002	Gates-Arco 230 kV	Gates 500/230 kV bank, no SPS	B	T-1	<95%	101%	<95%	109%	<95%	98%	<95%	<95%	need to trip 2 Helms pumps, except for env
PGE-B-T-OP-003	Panoche-Gates 230 kV # 1 and 2	Gates (or C0643)-Gregg & Gates (or C0643)-Mc Call 230 kV 1 Helms tripped	C	L-2	<95%	117%	98%	121%	<95%	116%	106%	129%	upgrade the lines or trip C0643 generation
		Gates (or C0643)-Gregg & Gates (or C0643)-Mc Call 230 kV 2 Helms tripped	C	L-2	N/A	106%	N/A	114%	N/A	107%	N/A	120%	
		Gates (or C0643)-Gregg & Gates (or C0643)-Mc Call 230 kV 3 Helms tripped	C	L-2	N/A	99%	N/A	104%	N/A	100%	N/A	113%	
		Los Banos -Gates & Los Banos-Midway 500 kV (RAS trips load, 2 Helms and Midway gen)	C	L-2	<95%	<95%	<95%	<95%	<95%	<95%	<95%	100%	
		Los Banos 500 kV stuck breaker	C	BRK	<95%	<95%	<95%	<95%	<95%	<95%	<95%	110%	
		Los Banos -Gates # 1 500 kV	B	L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	105%	
		Los Banos -Midway 500 kV	B	L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	102%	
		Los Banos 500/230 kV bank	B	T-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	101%	

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by Portfolios (%)								ISO Recommended Solution
					base		traject		time		envir		
					1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	
PGE-B-T-OP-004	Kearney-Herndon 230 kV	Gates (or C0643)-Gregg & Gates (or C0643)-Mc Call 230 kV 1 Helms tripped	C	L-2	<95%	120%	<95%	129%	<95%	116%	<95%	105%	trip at least 2 Helms pumps for Gates-Gregg, Gates-Mc Call 230 kV double outage in all portfolios, 3 pumps in Trajectory
		Gates (or C0643)-Gregg & Gates (or C0643)-Mc Call 230 kV 2 Helms tripped	C	L-2	N/A	<95%	N/A	103%	N/A	<95%	N/A	<95%	
PGE-B-T-OP-005	Warneville-Wilson 230 kV	normal conditions	A	N-0	<95%	<95%	<95%	105%	<95%	97%	<95%	<95%	upgrade the line or congestion management
		Gates-Gregg & Gates-Mc Call 230 kV, 1 Helms pump tripped	C	L-2	<95%	100%	<95%	121%	<95%	105%	<95%	<95%	trip at least 2 Helms pumps for Gates-Gregg, Gates-Mc Call 230 kV double outage
		Gates-Gregg & Gates-Mc Call 230 kV with 2 Helms tripped	C	L-2	N/A	100%	N/A	<95%	N/A	<95%	N/A	<95%	
		Gates 500/230 kV bank no SPS	B	T-1	<95%	<95%	<95%	110%	<95%	95%	<95%	<95%	trip 1 Helms pump with Gates 500/230 kV x-former outage
PGE-B-T-OP-006	Gates-Gregg 230 kV line section between HENTAP1 and GATES	Los Banos-Gates 500 kV # 1	B	L-1	<95%	98%	<95%	102%	<95%	97%	<95%	95%	upgrade the line, or trip Helms pumps
		Los Banos-Midway 500 kV	B	L-1	<95%	98%	<95%	101%	<95%	96%	<95%	94%	
		Los Banos 500/230 kV bank	B	T-1	<95%	97%	<95%	101%	<95%	95%	<95%	<95%	
		Table Mtn-Tesla & Table Mtn Vaca Dix 500 kV lines	C	L-2	<95%	97%	<95%	100%	<95%	<95%	<95%	<95%	
		Los Banos 500 kV stuck brk	C	BRK	<95%	99%	<95%	107%	<95%	98%	96%	96%	
PGE-B-T-OP-007	Gates 500/230 kV bank	Los Banos-Gates 500 kV # 1	B	L-1	<95%	102%	<95%	109%	<95%	96%	<95%	<95%	trip 1 Helms pump in base and 2 in traj
		Los Banos 500/230 kV bank	B	T-1	<95%	100%	<95%	110%	<95%	96%	<95%	<95%	trip 1 Helms pump in base and 2 in traj
		Los Banos-Gates & Los Banos-Midway 500 kV with 2 Helms tripped	C	L-2	N/A	95%	N/A	102%	N/A	91%	N/A	<95%	trip 2 Helms pumps in base and time, and 3 in traj
		Los Banos 500 kV stuck brk	C	BRK	<95%	105%	<95%	112%	<95%	99%	<95%	<95%	trip 1 Helms pump in base and 2 in traj
PGE-B-T-OP-008	Westley-Los Banos 230 kV	Los Banos-Tracy & Los Banos-Tesla 500 kV	C	L-2	<95%	<95%	<95%	<95%	<95%	<95%	122%	116%	add generation at Gates to SPS
		Los Banos 500 kV stuck brk	C	BRK	<95%	<95%	<95%	<95%	<95%	<95%	100%	<95%	trip some of C0643H generation if overload
		Los Banos-Tracy & Tracy-Tesla 500 kV	C	L-2	<95%	<95%	<95%	<95%	<95%	<95%	103%	98%	
		Los Banos-Tesla 500 kV	B	L-1	<95%	<95%	<95%	<95%	<95%	<95%	<95%	100%	

Study Area: PG&E Bulk System - 2021 renewable portfolios

Voltage concerns

ENVIRONMENTAL OFF - PEAK CASE HAD 24 MVAR REACTOR MODELED AT KILARC
HIGH VOLTAGES ON MULTIPLE BUSES IN ALL PORTFOLIOS

SEE MITIGATION SOLUTIONS IN EACH AREA STUDY

Study Area: PG&E Bulk System (2021 Load)

% Negative Value - Voltage Depression

% Positive Value - Voltage Rise

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by Portfolios (%)								ISO Recommended Solution
					base		traject		time		envir		
					1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	
PGE-B-VD-OP-001	BORDEN 230.0	Midway-Los Banos and Midway-Gates 500 kV lines, 3 Helms, trip all 3, load and gen at Midway	C	L-2	<10%	<10%	<10%	10.1%	<10%	<10%	<10%	<10%	add insertion of Gregg reactor to the SPS for this outage
PGE-B-VD-OP-002	GREGG 230.0		C	L-2	<10%	<10%	<10%	10.5%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-003	GRG_SVC 230.0		C	L-2	<10%	<10%	<10%	10.5%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-004	KEARNEY 230.0		C	L-2	<10%	<10%	<10%	10.1%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-005	HERNDON 230.0		C	L-2	<10%	<10%	<10%	10.3%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-006	FGRDN T1 230.0		C	L-2	<10%	<10%	<10%	10.4%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-007	FIGRDN 1 230.0		C	L-2	<10%	<10%	<10%	10.4%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-008	FGRDN T2 230.0		C	L-2	<10%	<10%	<10%	10.5%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-009	FIGRDN 2 230.0		C	L-2	<10%	<10%	<10%	10.5%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-010	ASHLAN 230.0		C	L-2	<10%	<10%	<10%	10.4%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-011	CANANDGA 70.0		C	L-2	<10%	<10%	<10%	10.3%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-012	BONITA 70.0		C	L-2	<10%	<10%	<10%	10.4%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-013	GLASS 70.0		C	L-2	<10%	<10%	<10%	10.3%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-014	MADERA 70.0		C	L-2	<10%	<10%	<10%	10.2%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-015	BORDEN D 12.5		C	L-2	<10%	<10%	<10%	10.3%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-016	TRIGO 70.0		C	L-2	<10%	<10%	<10%	10.2%	<10%	<10%	<10%	<10%	

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by Portfolios (%)								ISO Recommended Solution
					base		traject		time		envir		
					1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	1 pump	3 pumps	
PGE-B-VD-OP-017	TRIGO J 70.0		C	L-2	<10%	<10%	<10%	10.3%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-018	BORDEN 70.0		C	L-2	<10%	<10%	<10%	10.1%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-019	EL PECO 70.0		C	L-2	<10%	<10%	<10%	10.3%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-020	BIOLA 70.0		C	L-2	<10%	<10%	<10%	10.4%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-021	BOWLES 70.0		C	L-2	<10%	<10%	<10%	10.3%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-022	KEARNEY 70.0		C	L-2	<10%	<10%	<10%	10.2%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-023	OLDKERN 70.0		C	L-2	<10%	<10%	<10%	10.2%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-024	FRESNOWW 70.0		C	L-2	<10%	<10%	<10%	10.2%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-025	FRESNOWW 12.5		C	L-2	<10%	<10%	<10%	10.4%	<10%	<10%	<10%	<10%	
PGE-B-VD-OP-026	CARUTHRS 70.0		C	L-2	<10%	<10%	<10%	10.6%	<10%	<10%	<10%	<10%	

Study Area: PG&E Bulk System - 2021 renewable portfolios

Transient concerns: None

Study Area: Humboldt Area (2021 Peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-P-001	Humboldt-Trinity 115 kV line	Cottonwood - Bridgeville 115 kV Line	B	L-1	<95%	<95%	109%	<95%	dispatch more Humb Bay 115 kV generation in the time peak
PGE-N-T-P-002	Cottonwood -Trinity 115 kV between Cottonwood and Jess tap	Humboldt- Bridgeville 115 kV line	B	L-1	<95%	<95%	<95%	114%	trip generation at Trinity
PGE-N-T-P-003	Cottonwood -Trinity 115 kV between Jess tap and Trinity	Humboldt- Bridgeville 115 kV line	B	L-1	<95%	<95%	<95%	102%	trip generation at Trinity
PGE-N-T-P-004	Rio Dell Jct-Bridgeville 60 kV between Carlotta-Rio Dell Tap 60 kV	Humboldt-Bridgeville 115 kV	B	L-1	<95%	<95%	<95%	120%	Install SPS to trip new gen at Rio Dell, Rio Dell Jct and/or Pacific Lumber generation for overload.
		Humboldt Bay-Rio Dell Jct 60 KV (Newburg-Rio Del Jct)	B	L-1	131%	<95%	<95%	<95%	
		Humboldt Bay-Rio Dell Jct 60 KV (Humb Bay-Eel Rvr)	B	L-1	104%	<95%	<95%	<95%	
		Humboldt 60 kV Bus	C	BUS	<95%	<95%	<95%	166%	Upgrade Humboldt 60 kV bus to a breaker-and-a-half, PG&E maintenance project
		Humboldt 115 kV bus	C	BUS	<95%	<95%	150%	<95%	dispatch Humboldt Bay 60 kV generation
PGE-N-T-P-005	Rio Dell Jct-Bridgeville 60 kV between Carlotta-Swns Flat - Bridgeville 60 kV	Humboldt - Bridgeville 115 kV Line	B	L-1	<95%	<95%	<95%	118%	Install SPS to trip new gen at Rio Dell and Rio Dell Jct for overload.
		Humboldt Bay - Rio Dell Jct 60 kV Line (HMBLT BY - EEL RIVR)	B	L-1	102%	<95%	<95%	<95%	
		Humboldt Bay-Rio Dell Jct 60 KV (Newburg-Rio Del Jct)	B	L-1	128%	<95%	<95%	<95%	
		Humboldt 60 kV Bus	C	BUS	<95%	<95%	<95%	164%	Upgrade Humboldt 60 kV bus to a breaker-and-a-half, PG&E maintenance project
		Humboldt 115 kV bus	C	BUS	<95%	<95%	150%	<95%	dispatch Humboldt Bay 60 kV generation
PGE-N-T-P-006	Bridgeville-Garberville 60 kV between Bridgville-Frut Ld Jct 60 kV	NORMAL CONDITIONS	A	N-0	<95%	<95%	<95%	106%	re-rate the line or build Bridgevl-Garbervl 115 kV line (PG&E proposed project). Trip Pacific Lumber for the outage
		Cottonwood - Bridgeville 115 kV Line	B	L-1	<95%	<95%	<95%	109%	
PGE-N-T-P-007	Bridgeville-Garberville 60 kV between Fruitvil- Fort Seward	Cottonwood - Bridgeville 115 kV Line	B	L-1	<95%	<95%	<95%	105%	
PGE-N-T-P-008	Bridgeville-Garberville 60 kV between Fort Seward-Garberville 60 kV	Cottonwood - Bridgeville 115 kV Line	B	L-1	<95%	<95%	<95%	102%	
PGE-N-T-P-009	Humboldt-Trinity 60 kV line between Trinity - Ridge Cabin-Maple Creek	Humboldt 115 kV Bus	C	BUS	<95%	<95%	132%	<95%	

Study Area: North Coast and North Bay Areas (2021 Peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-P-010	Fulton-Hopland 60 kV between Hopland and Cloverdale Jct	Eagle Rock-Fulton-Silverado 115kV & Geysers #17-Fulton 230kV Lines	C	L-2	96%	<95%	<95%	100%	trip Geysers 5-6 generation or renewable gen at Mendocino with Eagle Rk-Fulton-Silverado outage
			C	L-2	104%	<95%	<95%	109%	
PGE-N-T-P-011	Fulton-Hopland 60 kV between Cloverdale Jct -Geyserville-Fitch Mtn	Eagle Rock-Fulton-Silverado 115kV & Geysers #9-Lakeville 230kV Lines	C	L-2	98%	<95%	<95%	102%	
PGE-N-T-P-012	Bridgeville - Garberville 60 kV Line #1 Between BRDGVLLLE - FRUTLDJT	NORMAL CONDITIONS	A	N-0	<95%	<95%	<95%	106%	re-rate the line or build Bridgevl-Garbervl 115 kV (PG&E-proposed project)
PGE-N-T-P-013	Mendocino -Philo -Hopland 60 kV Between Philo Jct-Hopland Jct	Mendocino 115 kV bus	C	BUS	<95%	110%	111%	<95%	trip Philo and Elk load
PGE-N-T-P-014	Fulton-Calistoga 60 kV between Middletwn and Calistoga	Eagle Rock-Fulton-Silverado 115kV	B	L-1	102%	<95%	<95%	110%	trip Mendocino or Geysers 5-6 generation for Eagle Rk-Fulton-Silverado outage
		Eagle Rock-Fulton-Silverado 115kV & Geysers #17-Fulton 230kV Lines	C	L-2	111%	<95%	<95%	119%	
		Eagle Rock-Fulton-Silverado 115kV & Geysers #9-Lakeville 230kV Lines	C	L-2	120%	<95%	<95%	128%	

Study Area: North Valley Area (2021 Peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-P-015	Cottonwood 230/115 kV bank #1	Cottonwood No.4 230/115 kV Transformer	B	T-1	<95%	<95%	<95%	105%	SPS to trip gen at Trinity, Wildwood 115 kV or re-rate
PGE-N-T-P-016	Keswick-Cascade (CASCADE-STLLWATR) 60 kV line #1	Trinity-Cottonwood 115 kV Line	B	L-1	<95%	<95%	108%	120%	
PGE-N-T-P-017	Keswick-Cascade (CASCADE-STLLWATR) 60 kV line #1	Cottonwood 115 kV Bus 1	C	Bus	<95%	<95%	108%	102%	

PGE-N-T-P-018	Keswick-Cascade (KESWICK-STLLWATR) 60 kV line #1	Trinity-Cottonwood 115 kV Line	B	L-1	<95%	<95%	<95%	156%	SPS to trip gen at Trinity 60 & 115 kV.
PGE-N-T-P-019	Keswick-Cascade (KESWICK-STLLWATR) 60 kV line #1	Cottonwood 115 kV Bus 1	C	Bus	<95%	<95%	96%	141%	
PGE-N-T-P-020	Keswick-Trinity-Weaverville (FRNCHGLH-KESWICK) 60 kV line #1	Trinity-Cottonwood 115 kV Line	B	L-1	<95%	<95%	<95%	143%	
		Cottonwood 115 kV Bus 1	C	Bus	<95%	<95%	<95%	131%	
PGE-N-T-P-021	Keswick-Trinity-Weaverville (TRINITY-FRNCHGLH) 60 kV line #1	Trinity-Cottonwood 115 kV Line	B	L-1	<95%	<95%	<95%	147%	
		Cottonwood 115 kV Bus 1	C	Bus	<95%	<95%	<95%	135%	
PGE-N-T-P-022	Kilarc-Deschutes (COWCK TP-DESCHUTS) 60 kV line #1	NORMAL CONDITIONS	A	N-0	<95%	<95%	<95%	167%	Reconductor
		Trinity-Cottonwood 115 kV Line	B	N-1	<95%	<95%	<95%	150%	
		Cottonwood 115 kV Bus 1	C	Bus	<95%	<95%	<95%	148%	
		Round Mnt-Cottonwood(E) #2 and #3 230 kV Lines	C	DCTL	<95%	<95%	<95%	149%	
PGE-N-T-P-023	Kilarc-Deschutes (TKO TAP-COWCK TP) 60 kV line #1	NORMAL CONDITIONS	A	N-0	<95%	<95%	<95%	157%	Reconductor
		Trinity-Cottonwood 115 kV Line	B	N-1	<95%	<95%	<95%	141%	
		Cottonwood 115 kV Bus 1	C	Bus	<95%	<95%	<95%	140%	
		Round Mnt-Cottonwood(E) #2 and #3 230 kV Lines	C	DCTL	<95%	<95%	<95%	140%	
PGE-N-T-P-024	Trinity-Cottonwood (JESSTAP-COTWDPGE) 115 kV line #1	Bridgeville-Cottonwood 115 kV Line	B	L-1	<95%	<95%	99%	113%	SPS to trip gen at Trinity 115 kV.
PGE-N-T-P-025	Trinity-Cottonwood (TRINITY-JESSTAP) 115 kV line #1		B	L-1	<95%	<95%	<95%	101%	

Study Area: Central Valley Area (2021 Peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-P-026	Drum-Rio Oso # 1 115 kV line	Drum-Bell 115 kV Line (Higgins-Bell)	B	N-1	<95%	<95%	<95%	101%	SPS to trip Drum area generation
PGE-N-T-P-027	Drum-Higgins 115 kV line	Drum-Rio Oso #1 and # 2 115 kV Lines	C	DCTL	99%	95%	95%	113%	

Study Area: Greater Bay Area (2021 Peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	

PGE-N-T-P-028	Christie-Sobrante 115 kV 115 kV line	Sobrante-G # 1 & 2 115 kV lines	C	DCTL	119%	115%	113%	110%	Re-rate or reconductor line. SPS to drop load
PGE-N-T-P-029	Lone Tree-Cayetano 230 kV line between LONETREE -USWP JRW	NORMAL CONDITIONS	A	N-0	102%	96%	<95%	<95%	congestion management, re-rate or upgrade
		Contra Costa-Las Positas 230 kV line	B	L-1	106%	<95%	<95%	<95%	SPS to trip Contra Costa generation or line upgrade
		Contra Costa-Moraga # 1 & 2 230 kV lines	C	DCTL	110%	104%	101%	<95%	
PGE-N-T-P-030	CC SUB - C.COSTA 230kV Line	Birds Landing-Contra Costa PP 230kV Line	B	L-1	104%	<95%	<95%	107%	SPS to trip generation at Birds Landing
		Lambie -Birds Landing and Peabody-Birds Landing 230 kV lines	C	DCTL	115%	<95%	<95%	99%	SPS to trip generation at CC SUB
PGE-N-T-P-031	Moraga - Lakewood 115 kV Line	Lakewood-Clayton and Lakewood-Meadow Lane-Clayton 115 kV lines	C	DCTL	139%	139%	135%	136%	SPS to trip load at Lakewood 115 kV

Study Area: Humboldt Area (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
No voltage concerns									

Study Area: North Coast and North Bay Areas (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-V-P-001	COVELO 60 kV	Willits - Laytonville 60 kV Line	B	L-1	0.89	0.89	0.89	0.92	install reactive support on Laytonville or new Garberville-Bridgeville 115 kV line
PGE-N-V-P-002	EGLE RCK 60 kV	NORMAL CONDITIONS	A	N-0	1.05	1.05	1.05	1.05	adjust Eagle Rock 115/60 kV x-former taps
PGE-N-V-P-003	FULTON 60 kV		A	N-0	1.05	1.05	1.06	1.05	adjust Fulton 115/60 kV x-former taps
PGE-N-V-P-004	INDIN VL 115 kV		A	N-0	1.06	1.04	1.04	1.05	adjust Mendocino 115/60 kV x-former taps
PGE-N-V-P-005	LOWR LKE 60 kV		A	N-0	1.04	1.04	1.04	1.05	require 0.95 power factor for renewables in the area and adjust taps at Mendocino 115/60 kV
PGE-N-V-P-006	LYTNVLE 60 kV	Willits - Laytonville 60 kV Line	B	L-1	0.90	0.90	0.90	0.92	install reactive support on Laytonville or new Garberville-Bridgeville 115 kV line
PGE-N-V-P-007	MENDOCNO 60 kV	Mendocino 115/60 kV Bank #3	B	L-1	1.05	1.05	1.05	1.06	adjust Mendocino 115/60 kV x-former taps
		NORMAL CONDITIONS	A	N-0	1.07	1.05	1.06	1.06	
PGE-N-V-P-008	MIDDLTWN 60 kV		A	N-0	1.05	1.05	1.05	1.05	require 0.95 power factor for renewables in the area, adjust taps at Middletown 115/60 kV
PGE-N-V-P-009	PTTR VLY 60 kV	NORMAL CONDITIONS	A	N-0	1.06	1.05	1.06	1.06	adjust Mendocino 115/60 kV x-former taps
PGE-N-V-P-010	UPPR LKE 60 kV	Hartley - Clearlake 60 kV Line	B	L-1	1.02	1.00	1.02	1.05	require 0.95 power factor for renewables in the area and adjust taps at Mendocino 115/60 kV

Study Area: North Valley Area (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-V-P-011	BIG BAR 60 kV	Cottonwood 115 kV Bus 1	C	Bus	1.06	1.06	1.02	1.12	0.95 power factor for renewables in the area and shunt reactor at Kilarc in environmental case
PGE-N-V-P-012	CEDR CRK 60 kV	NORMAL CONDITIONS	A	N-0	1.02	1.02	1.02	1.22	install shunt reactor at Kilarc in environmental case
		Cottonwood 115 kV Bus 1	C	Bus	1.03	1.02	1.02	1.22	
		Rock Creek-Poe 230 kV Line and Cresta-Rio Oso 230 kV Line	C	DCTL	1.02	1.02	1.02	1.22	
PGE-N-V-P-013	CHALLNGE 60 kV	NORMAL CONDITIONS	A	N-0	0.99	0.99	0.99	1.06	0.95 power factor for renewables in the area
PGE-N-V-P-014	CLMN FSH 60 kV		A	N-0	1.05	1.05	1.05	1.02	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
PGE-N-V-P-015	COLEMAN 60 kV	NORMAL CONDITIONS	A	N-0	1.05	1.05	1.05	1.03	0.95 power factor for renewables in the area
PGE-N-V-P-016	INSKIP 60 kV		A	N-0	1.05	1.04	1.04	1.03	
PGE-N-V-P-017	KILARC 60 kV	NORMAL CONDITIONS	A	N-0	1.03	1.02	1.02	1.23	install shunt reactor at Kilarc in environmental
		Cottonwood 115 kV Bus 1	C	Bus	1.03	1.03	1.03	1.22	
		Rock Creek-Poe 230 kV Line and Cresta-Rio Oso 230 kV Line	C	DCTL	1.03	1.02	1.02	1.23	
PGE-N-V-P-018	TRINITY 115 kV	Cottonwood 115 kV Bus 1	C	Bus	1.05	1.05	1.01	1.16	0.95 power factor for renewables in the area and shunt reactor at Kilarc in environmental case
PGE-N-V-P-019	TRINITY 60 kV		C	Bus	1.05	1.05	1.01	1.16	
PGE-N-V-P-020	WHITMORE 60 kV	NORMAL CONDITIONS	A	N-0	1.03	1.02	1.02	1.20	install shunt reactor at Kilarc in environmental
		Cottonwood 115 kV Bus 1	C	Bus	1.03	1.03	1.03	1.20	
		Rock Creek-Poe 230 kV Line and Cresta-Rio Oso 230 kV Line	C	DCTL	1.02	1.02	1.02	1.20	

Study Area: Central Valley Area (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
PGE-N-V-P-021	PIKE CTY 60 kV	NORMAL CONDITIONS	A	N-0	0.99	0.99	0.99	1.05	0.95 power factor for renewables in the area or shunt reactor at ALLEGHNY in Environmental
PGE-N-V-P-022	ALLEGHNY 60 kV		A	N-0	0.98	0.99	0.98	1.09	

Study Area: Greater Bay Area (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
PGE-N-V-P-023	USWP-WKR 60kV	NORMAL CONDITIONS	A	N-0	1.05	1.05	1.05	1.06	0.95 power factor for renewables in the area
PGE-N-V-P-024	ALTAMONT 60kV		A	N-0	1.05	1.05	1.05	1.06	
PGE-N-V-P-025	EVERGREEN 60 kV		A	N-0	1.06	1.06	1.07	1.07	adjust transformer tap on Evergreen 115/60 kV
PGE-N-V-P-026	MARSH 60kV		A	N-0	1.04	1.04	1.04	1.07	0.95 power factor for renewables in the area
PGE-N-V-P-027	BRIONES 60kV		A	N-0	1.03	1.03	1.03	1.07	
PGE-N-V-P-028	BALFOUR 60kV		A	N-0	1.04	1.04	1.04	1.06	

Study Area: Humboldt Area (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-VD-P-001	BRIDGEVILLE 60 kV	BRDGVLL E No.1 115/60/12 kV XFMR	B	T-1	<5%	-6.6%	-6.0%	-7.8%	install additional reactive support at Garberville, or build Bridgeville-Garberville 115 kV line (PG&E proposed project)
PGE-N-VD-P-002	BRIDGEVILLE 115 kV	Humboldt - Bridgeville 115 kV Line	B	L-1	<5%	<5%	<5%	-5.1%	
PGE-N-VD-P-003	FRUITLND 60 kV	BRDGVLL E No.1 115/60/12 kV XFMR	B	T-1	<5%	-5.4%	-5.3%	-6.5%	
PGE-N-VD-P-004	FORT SEWARD 60 kV		B	T-1	<5%	-5.1%	-5.1%	-6.1%	
PGE-N-VD-P-005	GRBRVLL E 60 kV		B	T-1	<5%	<5%	<5%	-5.6%	
PGE-N-VD-P-006	KEKAWAKA 60 kV	Bridgeville - Garberville 60 kV Line	B	L-1	<5%	<5%	<5%	-5.3%	
PGE-N-VD-P-007	COVELO 60 kV		B	L-1	<5%	-5.0%	<5%	<5%	
PGE-N-VD-P-008	SWNS FLT 60 kV	BRDGVLL E No.1 115/60/12 kV XFMR	B	T-1	<5%	-5.4%	<5%	-6.5%	

North Coast and North Bay Areas

ID	Substation	Worst Contingency	Category	Category Description	Post Cont Voltage Deviation %				ISO Proposed Solution
					base	traject	time	envir	
PGE-N-VD-P-009	CORONA 115 kV	Corona - Lakeville 115kV Line	B	L-1	-5.1%	<5%	-5.1%	<5%	install reactive support on Corona 115 kV or 0.95 power factor for renewable gen at Bellevue
PGE-N-VD-P-010	COVELO 60 kV	Willits - Laytonville 60 kV Line	B	L-1	-13.3%	-11.6%	-12.6%	-9.8%	install reactive support on Laytonville or new Garberville-Bridgeville 115 kV line
PGE-N-VD-P-011	FORT SEWARD 60 kV		B	L-1	-9.0%	-7.5%	-8.1%	<5%	
PGE-N-VD-P-012	FRUITLAND 60 kV		B	L-1	-7.6%	-6.3%	-6.7%	<5%	
PGE-N-VD-P-013	GARBerville 60 kV		B	L-1	-10.8%	-9.1%	-9.9%	-5.9%	
PGE-N-VD-P-014	KEKAWAKA 60 kV		B	L-1	-11.3%	-9.7%	-10.5%	-6.8%	
PGE-N-VD-P-015	LAYTONVILLE 60 kV		B	L-1	-13.2%	-11.5%	-12.4%	-9.7%	

PGE-N-VD-P-016	ST.HELENA 60 kV	Lakeville #1 60 kV Line (to Dunbar)	B	L-1	-5.2%	-5.1%	-5.1%	-4.7%	install reactive support at St.Helena
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Study Area: North Valley Area (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-VD-P-017	TRINITY 115 kV	Cottonwood 115 kV Bus 1	C	Bus	<5%	<5%	<5%	12%	0.95 power factor for renewables in Trinity area.
PGE-N-VD-P-018	TRINITY 60 kV		C	Bus	<5%	<5%	<5%	12%	

Central Valley Area

ID	Substation	Worst Contingency	Category	Category Description	Post Cont Voltage Deviation %				ISO Proposed Mitigation
					Base	Traj	Time	Env	
	FORST HL 60 kV	OXBOW F 9.11 Unit ID 1	B	G-1	-5%	-5%	-5%	-4%	New Drum-Placer 115 kV line reliability project.
PGE-N-VD-P-019	GRSS VLY 60 kV	Colgate-Grass Valley 60 kV Line	B	L-1	<5%	-5%	<5%	<5%	
PGE-N-VD-P-020	OXBOW 60 kV	Weimar No. 1 60 kV Line	B	L-1	<5%	6%	<5%	<5%	
PGE-N-VD-P-021	MRYSVLE 60 kV	Pease 115/60 kV Transformer # 2	B	T-1	<5%	<5%	<5%	-5%	0.95 power factor for renewable at HARTER
PGE-N-VD-P-022	PEASE 115 kV		B	T-1	5%	<5%	<5%	6%	
PGE-N-VD-P-023	PEASE 60 kV		B	T-1	-4%	<5%	<5%	-5%	
PGE-N-VD-P-024	LINCLN 115 kV	Rio Oso-Lincoln 115 kV Line	B	L-1	<5%	<5%	-5%	-5%	0.95 power factor for renewable at Lincoln 115 kV and adjust Rio Oso 230/115 kV x-former tap.

Study Area: Greater Bay Area (2021 Peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-VD-P_025	NONE								

Study Area: Humboldt Area (2021 Off-peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-OP-001	Rio Dell Jct-Bridgeville 60 kV between Carlotta-Rio Dell Tap 60 kV	Humboldt Bay-Rio Dell Jct 60 KV (Newburg-Rio Del Jct)	B	L-1	117%	<95%	107%	<95%	Install SPS to trip new gen at Rio Dell Jct or Rio Dell and/or Pacific Lumber generation for overload
PGE-N-T-OP-002	Rio Dell Jct-Bridgeville 60 kV between Carlotta-Swns Flat - Bridgeville 60 kV		B	L-1	110%	<95%	105%	<95%	

Study Area: North Coast and North Bay Areas (2021 Off-peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-OP-003	Fulton-Hopland 60 kV between Hopland and Cloverdale Jct	Eagle Rock - Fulton - Silverado (Rincon) 115kV	B	L-1	<95%	<95%	<95%	104%	trip Geyser 5-6 generation or renewable gen at Mendocino with Eagle Rk-Fulton-Silverado outage
		Eagle Rock-Fulton-Silverado 115kV & Geysers #17-Fulton 230kV Lines	C	L-2	98%	<95%	<95%	110%	
		Eagle Rock-Fulton-Silverado 115kV & Geysers #9-Lakeville 230kV Lines	C	L-2	106%	<95%	<95%	118%	
PGE-N-T-OP-004	Fulton-Hopland 60 kV between Cloverdale Jct -Geyserville-Fitch Mtn	Eagle Rock-Fulton-Silverado 115kV & Geysers #17-Fulton 230kV Lines	C	L-2	<95%	<95%	<95%	103%	
		Eagle Rock-Fulton-Silverado 115kV & Geysers #9-Lakeville 230kV Lines	C	L-2	100%	<95%	<95%	112%	
PGE-N-T-OP-005	Eagle Rock-Cortina 115 kV between Eagle Rock and Homestake	Eagle Rock - Fulton - Silverado 115kV	B	L-1	111%	<95%	<95%	116%	
PGE-N-T-OP-006	Eagle Rock-Cortina 115 kV between Homestake and Highlands		B	L-1	<95%	<95%	<95%	101%	
PGE-N-T-OP-007	Mendocino -Philo -Hopland 60 kV Between Mendocino-Ukiah Jct	Mendocino 115 kV bus	C	L-1-1	109%	<95%	<95%	<95%	
PGE-N-T-OP-008	Mendocino -Philo -Hopland 60 kV Between Ukiah Jct-Philo Jct		C	L-1-1	109%	<95%	<95%	<95%	
PGE-N-T-OP-009	Fulton-Calistoga 60 kV between Middletwn and Calistoga	Eagle Rock-Fulton-Silverado 115kV	B	L-1	<95%	<95%	<95%	101%	
		Eagle Rock-Fulton-Silverado 115kV & Geysers #17-Fulton 230kV Lines	C	L-2	95%	<95%	<95%	107%	
		Eagle Rock-Fulton-Silverado 115kV & Geysers #9-Lakeville 230kV Lines	C	L-2	104%	<95%	<95%	116%	
PGE-N-T-OP-010	Fulton-Calistoga 60 kV between St. Helena and Calistoga	Eagle Rock-Fulton-Silverado 115kV & Geysers #9-Lakeville 230kV Lines	C	L-2	<95%	<95%	<95%	103%	

Study Area: North Valley Area (2021 Off-peak Load)

24MVAR shunt reactor at Kilarc modeled in the Environmental Portfolio

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-OP-011	Deschute-Kilarc 60 kV line (OLSEN JT - KILARC)	NORMAL CONDITIONS	A	N-0	<95%	<95%	<95%	197%	Reconductor
PGE-N-T-OP-012	Deschute-Kilarc 60 kV line (WHITMORE -OLSEN JT)		A	N-0	<95%	<95%	<95%	196%	
PGE-N-T-OP-013	Deschute-Kilarc 60 kV line (WHITMORE -TKO TAP)		A	N-0	<95%	<95%	<95%	195%	
PGE-N-T-OP-014	Deschute-Kilarc 60 kV line (COWCK TP -DESCHUTS)		A	N-0	<95%	<95%	<95%	273%	
PGE-N-T-OP-015	Deschute-Kilarc 60 kV line (TKO TAP - COWCK TP)		A	N-0	<95%	<95%	<95%	265%	
PGE-N-T-OP-016	Colgate-Challenge 60 kV line (CHLLNGEA -CHALLNGE)		A	N-0	<95%	<95%	<95%	128%	Reconductor
PGE-N-T-OP-017	Palermo-Big Bend # 2 115 kV line (PALERMO -WYANDJT2)	Caribou-Table Mountain 230 kV Line	B	L-1	<95%	<95%	<95%	102%	0.95 power factor for DG at Big Bend and Grizzly
PGE-N-T-OP-018	Palermo-Big Bend # 2 115 kV line (WYANDJT2 -BIG BEND)		B	L-1	<95%	<95%	<95%	102%	
PGE-N-T-OP-019	Cascade-Deschutes 60 kV line (CASCADE -OREGNTRL)	Cascade-Benton-Deschutes 60 kV Line	B	L-1	<95%	<95%	<95%	109%	SPS to trip renewables in Kilarc area
PGE-N-T-OP-020	Cascade-Deschutes 60 kV line (OREGNTRL -LOMS JCT)		B	L-1	<95%	<95%	<95%	109%	
PGE-N-T-OP-021	Coleman-Red Bluff 60 kV line (CLMN JCT -RED BLFF)	Coleman-Cottonwood 60 kV Line	B	L-1	<95%	<95%	<95%	108%	SPS to trip generation at Coleman

Study Area: Central Valley Area (2021 Off-peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-OP-022	Colgate-Challenge 60 kV line (DOBBINS -CHLLNGEA)	NORMAL CONDITIONS	A	N-0	<95%	<95%	<95%	127%	Reconductor
PGE-N-T-OP-023	Colgate-Challenge 60 kV line (COLGATEA -DOBBINS)		A	N-0	<95%	<95%	<95%	121%	Reconductor
PGE-N-T-OP-024	Colgate-Challenge 60 kV line (CHLLNGEA -CHALLNGE)		A	N-0	<95%	<95%	<95%	128%	Reconductor
PGE-N-T-OP-025	Colgate-Alleghany 60 kV line (CLMBA HL -PIKE CTY)		A	N-0	<95%	<95%	<95%	106%	Reconductor
PGE-N-T-OP-026	Colgate-Alleghany 60 kV line (PIKE CTY -ALLEGHNY)		A	N-0	<95%	<95%	<95%	107%	Reconductor
PGE-N-T-OP-027	Colgate-Smartville # 2 60 kV line (COLGATE -NRRWS2TP)	Colgate-Smartville # 1 60 kV Line	B	L-1	<95%	<95%	<95%	126%	SPS to trip generation at Narrows
PGE-N-T-OP-028	Cortina 230/60 kV transformer # 1	Cortina 230/115 kV Transformer # 4	B	T-1	<95%	<95%	<95%	112%	SPS to trip Cortina 60 kV generation
PGE-N-T-OP-029	River Bank Jct-Manteca 115 kV line	Bellota-Riverbank-Melones Sw Sta 115 kV Line	B	L-1	<95%	<95%	<95%	119%	SPS to trip generation at Stanislaus, Stockton or/and Donnelis
		Stanislaus-Melones-Manteca #1 & Stanislaus-Manteca #2 115 kV lines	C	L-2	<95%	<95%	<95%	157%	
PGE-N-T-OP-030	Stanislaus-Melones-Manteca #1 115 kV	Stanislaus-Manteca #2 & Riverbank Jct-Manteca 115 kV lines	C	L-2	<95%	<95%	<95%	139%	
PGE-N-T-OP-031	Stanislaus-Melones 115 kV	Stanislaus-Melones-Manteca #1 & Stanislaus-Manteca #2 115 kV lines	C	L-2	<95%	<95%	<95%	132%	

Study Area: Greater Bay Area (2021 Off-peak Load)

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-T-OP-032	NONE								

Study Area: Humboldt Area (2021 Off-peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
No voltage concerns									

Study Area: North Coast and North Bay Areas (2021 Off-peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-V-OP-001	ANNAPOLS 60 kV	NORMAL CONDITIONS	A	N-0	1.06	1.03	1.03	1.04	adjust taps on Mendocino 115/60 kV banks
PGE-N-V-OP-002	CALPELLA 115 kV		A	N-0	1.04	1.05	1.03	1.06	adjust taps on Lakeville 230/115 kV banks
PGE-N-V-OP-003	CLER LKE 60 kV		A	N-0	1.03	1.04	1.04	1.06	require 0.95 pf for DG gen and adjust taps on Mendocino
PGE-N-V-OP-004	CLOVRDLE 115 kV		A	N-0	1.04	1.05	1.04	1.05	adjust taps on Lakeville 230/115 kV banks
PGE-N-V-OP-005	CLOVRDLE 60 kV		A	N-0	1.04	1.05	1.04	1.05	require 0.95 pf for DG gen and adjust taps on Mendocino
PGE-N-V-OP-006	CORONA 115 kV		A	N-0	1.05	1.05	1.05	1.05	adjust taps on Lakeville 230/115 kV banks
PGE-N-V-OP-007	COVELO 60 kV		A	N-0	1.03	1.04	1.04	1.05	require 0.95 pf for DG gen and adjust taps on Mendocino
PGE-N-V-OP-008	EGLERCK 60 kV		A	N-0	1.05	1.04	1.05	1.05	adjust Eagle Rock 115/60 kV bank taps
PGE-N-V-OP-009	EGLERCK 115 kV		A	N-0	1.05	1.05	1.05	1.05	adjust Eagle Rock 115/60 kV bank taps
PGE-N-V-OP-010	FORT RSS 60 kV		A	N-0	1.06	1.04	1.03	1.04	adjust taps on Mendocino 115/60 kV banks
PGE-N-V-OP-011	FTCH MTN 60 kV		A	N-0	1.04	1.04	1.04	1.05	adjust taps on Fulton 115/60 kV banks
PGE-N-V-OP-012	FULTON 60 kV		A	N-0	1.05	1.05	1.05	1.05	adjust taps on Fulton 115/60 kV banks
PGE-N-V-OP-013	GARCIA 60 kV		A	N-0	1.03	1.04	1.03	1.06	adjust taps on Mendocino 115/60 kV banks
PGE-N-V-OP-014	GRANITE 60 kV		A	N-0	1.04	1.05	1.04	1.06	require 0.95 pf for DG gen and adjust taps on Mendocino
PGE-N-V-OP-015	GUALALA 60 kV		A	N-0	1.06	1.03	1.02	1.03	adjust taps on Mendocino 115/60 kV banks
PGE-N-V-OP-016	GYSR 1-2 60 kV		A	N-0	1.04	1.04	1.04	1.05	

PGE-N-V-OP-017	GYSRVLLE 60 kV		A	N-0	1.03	1.04	1.03	1.06	require 0.95 pf for DG gen and adjust taps on Mendocino	
PGE-N-V-OP-018	HARTLEY 60 kV	Hartley - Clearlake 60 kV Line	B	L-1	1.03	1.05	1.03	1.11		
PGE-N-V-OP-019	HIGHLAND 115 kV	NORMAL CONDITIONS	A	N-0	1.03	1.05	1.03	1.07	adjust taps on Mendocino 115/60 kV banks	
PGE-N-V-OP-020	HOMEGRND 115 kV		A	N-0	1.05	1.05	1.05	1.06		
PGE-N-V-OP-021	HOMEPROC 115 kV		A	N-0	1.05	1.05	1.05	1.06		
PGE-N-V-OP-022	HOPLAND 60 kV		A	N-0	1.04	1.05	1.04	1.07		
PGE-N-V-OP-023	HOPLAND 115 kV		A	N-0	1.04	1.05	1.04	1.06	require 0.95 pf for DG gen and adjust taps on Mendocino	
PGE-N-V-OP-024	INDIN VL 115 kV		A	N-0	1.06	1.06	1.05	1.06	adjust taps on Mendocino 115/60 kV banks	
PGE-N-V-OP-025	KONOCTI 60 kV		A	N-0	1.04	1.04	1.04	1.06	adjust taps on Middle town 115/60 kV bank	
PGE-N-V-OP-026	LAKEVLLE 115 kV		A	N-0	1.05	1.06	1.05	1.06	adjust taps on Lakeville 230/115 kV banks	
PGE-N-V-OP-027	LOWR LKE 60 kV		A	N-0	1.04	1.04	1.04	1.07	require 0.95 pf for DG gen and adjust taps on Mendocino	
PGE-N-V-OP-028	LUCERNE 115 kV		A	N-0	1.05	1.05	1.04	1.06	adjust taps on Mendocino 115/60 kV banks	
PGE-N-V-OP-029	LYTNVLLE 60 kV		A	N-0	1.04	1.04	1.04	1.05	require 0.95 pf for DG gen and adjust taps on Mendocino	
PGE-N-V-OP-030	MASONITE 60 kV		A	N-0	1.05	1.06	1.05	1.07		
PGE-N-V-OP-031	MENDOCNO 60 kV		Mendocino 115/60 kV Bank #3	B	L-1	1.06	1.10	1.07	1.10	adjust taps on Mendocino 115/60 kV banks
PGE-N-V-OP-032	MENDOCNO 115 kV		A	N-0	1.05	1.07	1.05	1.08		
PGE-N-V-OP-033	MIDDLTWN 60 kV	NORMAL CONDITIONS	A	N-0	1.04	1.05	1.03	1.06		
PGE-N-V-OP-034	MIRABEL 60 kV		A	N-0	1.04	1.04	1.05	1.05	require 0.95 pf for DG gen and adjust taps on Mendocino	
PGE-N-V-OP-035	MNTCLOPH 115 kV		A	N-0	1.05	1.05	1.05	1.05	adjust taps on Mendocino 115/60 kV banks	
PGE-N-V-OP-036	MONTCLLO 115 kV		A	N-0	1.04	1.05	1.04	1.05		
PGE-N-V-OP-037	MONTE RO 60 kV		A	N-0	1.04	1.04	1.04	1.05		
PGE-N-V-OP-038	MPE 115 kV		A	N-0	1.05	1.04	1.04	1.04		
PGE-N-V-OP-039	PHILO 60 kV		NORMAL CONDITIONS	A	N-0	1.04	1.05	1.04	1.07	require 0.95 pf for DG gen and adjust taps on

PGE-N-V-OP-XXXX	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base peak	Trajectory peak	Time peak	Environmental peak	
PGE-N-V-OP-040	PNT ARNA 60 kV	NORMAL CONDITIONS	A	N-0	1.03	1.04	1.03	1.06	Mendocino
PGE-N-V-OP-041	PTTR VLY 60 kV	Mendocino 115/60 kV Bank #3	B	T-1	1.06	1.10	1.07	1.10	adjust taps on Mendocino 115/60 kV banks
PGE-N-V-OP-042	REDBUD 115 kV		A	N-0	1.05	1.07	1.05	1.08	
PGE-N-V-OP-043	SLMN CRK 60 kV	NORMAL CONDITIONS	A	N-0	1.04	1.05	1.04	1.06	require 0.95 pf for DG gen and adjust taps on Mendocino
PGE-N-V-OP-044	SONOMA 115 kV		A	N-0	1.06	1.04	1.03	1.04	
PGE-N-V-OP-045	ST.HELNA 60 kV		A	N-0	1.04	1.05	1.04	1.06	
PGE-N-V-OP-046	TRNTN_JC 60 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-047	UKIAH 115 kV	Hartley - Clearlake 60 kV Line	A	N-0	1.04	1.05	1.04	1.06	require 0.95 pf for DG gen and adjust taps on Mendocino
PGE-N-V-OP-048	UPPR LKE 60 kV		B	L-1	1.03	1.06	1.03	1.11	
PGE-N-V-OP-049	WILLITS 60 kV		A	N-0	1.04	1.05	1.04	1.08	
PGE-N-V-OP-050	WOHLER 60 kV	NORMAL CONDITIONS	A	N-0	1.04	1.06	1.04	1.07	
			A	N-0	1.05	1.05	1.05	1.05	

Study Area: North Valley Area (2021 Off-peak Load)

24 MVAR shunt reactor at Kilarc modeled in the Environmental Portfolio

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base peak	Trajectory peak	Time peak	Environmental peak	
PGE-N-V-OP-051	ANDERSON 60 kV	NORMAL CONDITIONS	A	N-0	<1.05	1.07	1.07	1.06	adjust taps on Cottonwood 230/60 kV
PGE-N-V-OP-052	BENTON 60 kV		A	N-0	<1.05	1.06	1.06	<1.05	adjust taps on Cottonwood 230/60 kV
PGE-N-V-OP-053	CASCADE 60 kV		A	N-0	<1.05	1.05	<1.05	<1.05	adjust taps on Cottonwood 230/60 kV
PGE-N-V-OP-054	CEDR CRK 60 kV		A	N-0	<1.05	1.07	1.07	1.07	install shunt reactor at Kilarc
PGE-N-V-OP-055	CLMN FSH 60 kV		A	N-0	<1.05	1.07	1.08	1.06	adjust taps on Cottonwood 230/60 kV
PGE-N-V-OP-056	COLEMAN 60 kV		A	N-0	<1.05	1.07	1.08	1.06	adjust taps on Cottonwood 230/60 kV

PGE-N-V-OP-057	COTTONWD 60 kV
PGE-N-V-OP-058	COTWDPGE 115 kV
PGE-N-V-OP-059	CR CANAL 60 kV
PGE-N-V-OP-060	DESCHUTS 60 kV
PGE-N-V-OP-061	DIRYVLL 60 kV
PGE-N-V-OP-062	FRNCHGLH 60 kV
PGE-N-V-OP-063	FRSTGLEN 115 kV
PGE-N-V-OP-064	GERBER 60 kV
PGE-N-V-OP-065	GIRVAN 60 kV
PGE-N-V-OP-066	GLENN 60 kV
PGE-N-V-OP-067	HONCUT 115 kV
PGE-N-V-OP-068	INSKIP 60 kV
PGE-N-V-OP-069	KESWICK 60 kV
PGE-N-V-OP-070	KILARC 60 kV
PGE-N-V-OP-071	LP FB SP 60 kV
PGE-N-V-OP-072	MALACHA1 115 kV
PGE-N-V-OP-073	MALACHA2 115 kV
PGE-N-V-OP-074	MTN GATE 60 kV
PGE-N-V-OP-075	NEO REDT 60 kV
PGE-N-V-OP-076	NewBus 60 kV
PGE-N-V-OP-077	OREGNTRL 115 kV
PGE-N-V-OP-078	OREGNTRL 60 kV
PGE-N-V-OP-079	PALERMO 115 kV
PGE-N-V-OP-080	PANRAMA 115 kV
PGE-N-V-OP-081	RED BLFF 60 kV

NORMAL CONDITIONS

A	N-0	<1.05	1.08	1.09	1.07	adjust taps on Cottonwood 230/60 kV
A	N-0	1.06	1.06	1.06	<1.05	adjust taps on Cottonwood 230/115 kV
A	N-0	<1.05	1.06	1.07	1.06	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	1.05	<1.05	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	1.05	1.06	1.08	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Cottonwood 230/115 kV
A	N-0	<1.05	1.05	1.07	1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	1.06	1.06	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	1.06	<1.05	<1.05	adjust taps on Geln 230/60 kV
A	N-0	1.06	1.06	<1.05	<1.05	adjust taps on Palermo 230/115 kV
A	N-0	<1.05	1.06	1.07	1.06	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	1.05	1.08	1.07	1.08	install shunt reactor at Kilarc
A	N-0	<1.05	1.06	1.07	1.05	adjust taps on New Bus 230/60 kV
A	N-0	1.06	1.06	1.06	1.06	adjust taps on Malacha 230/115 kV
A	N-0	<1.05	<1.05	1.05	<1.05	adjust taps on Malacha 230/115 kV
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	1.06	1.07	1.06	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	1.06	1.07	1.06	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	1.05	<1.05	<1.05	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	1.05	<1.05	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Palermo 230/115 kV
A	N-0	1.05	1.06	1.06		adjust taps on Cottonwood 230/115 kV
A	N-0	<1.05	1.06	1.07	1.06	adjust taps on New Bus 230/60 kV

PGE-N-V-OP-082	SMPSN-AN 115 kV
PGE-N-V-OP-083	SOUTH 60 kV
PGE-N-V-OP-084	SPI_AND 115 kV
PGE-N-V-OP-085	STLLWATR 60 kV
PGE-N-V-OP-086	TRINITY 60 kV
PGE-N-V-OP-087	TRINITY 115 kV
PGE-N-V-OP-088	TYLER 60 kV
PGE-N-V-OP-089	VINA 60 kV
PGE-N-V-OP-090	VOLTA 60 kV
PGE-N-V-OP-091	WHEELBR 115 kV
PGE-N-V-OP-092	WHITMORE 60 kV
PGE-N-V-OP-093	WILDWOOD 115 kV
PGE-N-V-OP-094	WNTU PMS 60 kV

A	N-0	1.05	1.06	1.06	<1.05	adjust taps on Cottonwood 230/115 kV
A	N-0	<1.05	1.06	1.07	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	1.06	1.05	<1.05	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	1.05	<1.05	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	<1.05	<1.05	1.06	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	<1.05	<1.05	1.06	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	1.06	1.07	1.06	adjust taps on New Bus 230/60 kV
A	N-0	<1.05	<1.05	1.06	1.08	adjust taps on Cottonwood 230/60 kV
A	N-0	<1.05	1.06	1.06	<1.05	adjust taps on Cottonwood 230/60 kV
A	N-0	1.05	1.06	1.06	<1.05	adjust taps on Cottonwood 230/115 kV
A	N-0	<1.05	1.07	1.07	1.07	install shunt reactor at Kilarc
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Cottonwood 230/115 kV
A	N-0	<1.05	1.06	1.05	<1.05	adjust taps on Cottonwood 230/60 kV

Study Area: Central Valley Area (2021 Off-peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
PGE-N-V-OP-095	ALLEGHNY 60 kV		A	N-0	<1.05	<1.05	<1.05	1.09	install shunt reactor at Alleghany
PGE-N-V-OP-096	APPLE HL 115 kV		A	N-0	<1.05	<1.05	<1.05	1.05	adjust taps on Goldhill 230/60 kV x-formers
PGE-N-V-OP-097	ATLANTIC 115 kV		A	N-0	<1.05	<1.05	<1.05	1.11	adjust taps on Atlantic 230/115 kV x-formers
PGE-N-V-OP-098	BRNSWALT 115 kV		A	N-0	<1.05	<1.05	<1.05	1.05	adjust taps on Summit 120/115 kV
PGE-N-V-OP-099	BRNSWCKP 115 kV		A	N-0	<1.05	<1.05	<1.05	1.06	adjust taps on Summit 120/115 kV
PGE-N-V-OP-100	BRUNSWCK 115 kV		A	N-0	<1.05	<1.05	<1.05	1.06	adjust taps on Summit 120/115 kV
PGE-N-V-OP-101	CHCGO PK 115 kV		A	N-0	<1.05	<1.05	1.05	1.06	adjust taps on Summit 120/115 kV

PGE-N-V-OP-102	CLRKSULE 115 kV
PGE-N-V-OP-103	CLRKSULT 115 kV
PGE-N-V-OP-104	CPM 115 kV
PGE-N-V-OP-105	DIMOND_1 115 kV
PGE-N-V-OP-106	DRUM 115 kV
PGE-N-V-OP-107	DTCH FL1 115 kV
PGE-N-V-OP-108	DTCH FL2 115 kV
PGE-N-V-OP-109	FORMICA 115 kV
PGE-N-V-OP-110	FRNCH MS 60 kV
PGE-N-V-OP-111	GOLDHILL 115 kV
PGE-N-V-OP-112	HIGGINS 115 kV
PGE-N-V-OP-113	HORSESHE 115 kV
PGE-N-V-OP-114	HORSHE1 115 kV
PGE-N-V-OP-115	HORSHE2 115 kV
PGE-N-V-OP-116	LINCLN 115 kV
PGE-N-V-OP-117	MDDLE FK 60 kV
PGE-N-V-OP-118	MIZOU_T1 115 kV
PGE-N-V-OP-119	PLCRVLT1 115 kV
PGE-N-V-OP-120	PLSNT GR 115 kV
PGE-N-V-OP-121	SHPRING 115 kV
PGE-N-V-OP-122	SHPRING1 115 kV
PGE-N-V-OP-123	SHPRING2 115 kV
PGE-N-V-OP-124	SPICAMIN 115 kV
PGE-N-V-OP-125	ULTR-RCK 115 kV
PGE-N-V-OP-126	HARINTON 60 kV

NORMAL CONDITIONS

A	N-0	1.05	1.05	1.06	1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	1.06	1.06	1.06	1.06	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	1.06	1.06	1.06	1.06	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	1.05	1.05	1.05	1.06	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	1.05	1.05	1.05	1.06	adjust taps on Summit 120/115 kV
A	N-0	1.05	1.05	1.05	1.06	adjust taps on Middle Fork 230/60 kV
A	N-0	1.05	1.05	1.05	1.06	adjust taps on Middle Fork 230/60 kV
A	N-0	<1.05	<1.05	<1.05	1.09	adjust taps on Atlantic 230/115 kV x-formers
A	N-0	1.05	1.05	1.05	1.05	adjust taps on Middle Fork 230/60 kV
A	N-0	1.06	1.06	1.06	1.06	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	1.05	1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	1.07	adjust taps on Atlantic 230/115 kV x-formers
A	N-0	1.05	1.05	1.05	1.05	adjust taps on Middle Fork 230/60 kV
A	N-0	<1.05	1.05	1.05	1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	1.05	1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	1.10	adjust taps on Atlantic 230/115 kV x-formers
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	1.05	1.05	1.06	1.06	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	<1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	1.05	adjust taps on Goldhill 230/60 kV x-formers
A	N-0	<1.05	<1.05	<1.05	1.09	adjust taps on Atlantic 230/115 kV x-formers
A	N-0	<1.05	<1.05	<1.05	1.06	0.95 power factor for renewables at Cortina

PGE-N-V-OP-127	ARBUCKLE 60 kV	NORMAL CONDITIONS	A	N-0	<1.05	<1.05	<1.05	1.05	0.95 power factor for renewables at Cortina
PGE-N-V-OP-128	DRAKE 60 kV		A	N-0	<1.05	<1.05	<1.05	1.06	0.95 power factor for renewables at Cortina
PGE-N-V-OP-129	DUNNIGAN 60 kV		A	N-0	<1.05	<1.05	<1.05	1.05	0.95 power factor for renewables at Cortina
PGE-N-V-OP-130	CORTINA 115 kV		A	N-0	1.05	1.06	1.07	1.06	adjust taps on Cortina 230/115 kV x-former
PGE-N-V-OP-131	FROGTOWN 115 kV	NORMAL CONDITIONS	A	N-0	1.05	1.04	1.05	1.06	0.95 power factor for renewables in Stockton
PGE-N-V-OP-132	INE PRSN 60 kV		A	N-0	1.00	1.00	1.04	1.05	
PGE-N-V-OP-133	METTLER 60 kV		A	N-0	1.03	1.03	1.03	1.05	
PGE-N-V-OP-134	MI-WUK 115 kV		A	N-0	1.05	1.04	1.04	1.05	

Greater Bay Area

ID	Substation	Worst Contingency	Category	Category Description	Min. Post Contingency Voltage (PU)				ISO Proposed Mitigation
					Base	Traj	Time	Env	
PGE-N-V-OP-135	CC SUB 115 kV	NORMAL CONDITIONS	A	N-0	1.05	1.04	1.05	1.04	adjust taps on Contra Costa 230/115 kv and 115/60 kv
PGE-N-V-OP-136	DOMTAR 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-137	CROWN Z 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-138	FIBRJCT1 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-139	FIBRJCT2 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-140	RVEC 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-141	CC SUB 60 kV		A	N-0	1.06	1.05	1.06	1.06	
PGE-N-V-OP-142	DU PONT 60 kV		A	N-0	1.06	1.05	1.06	1.05	
PGE-N-V-OP-143	MARSH 60 kV		A	N-0	1.04	1.03	1.04	1.08	
PGE-N-V-OP-144	BRIONES 60 kV		A	N-0	1.03	1.03	1.04	1.07	
PGE-N-V-OP-145	BALFOUR 60 kV		A	N-0	1.05	1.04	1.05	1.06	
PGE-N-V-OP-146	BIXLER 60 kV		A	N-0	1.01	1.04	1.04	1.04	
PGE-N-V-OP-147	ANTIOCH 60 kV		A	N-0	1.06	1.05	1.06	1.05	
PGE-N-V-OP-148	PITTSBRG 60 kV		A	N-0	1.05	1.04	1.05	1.04	

PGE-N-V-OP-149	SHLL CHM 60 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-150	PCBRICK 60 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-151	SHLLCHMT 60 kV		A	N-0	1.05	1.04	1.05	1.05	
PGE-N-V-OP-152	UNIN CHM 60 kV	NORMAL CONDITIONS	A	N-0	1.05	1.05	1.06	1.06	adjust taps on Christie 115/60 kV x-formers
PGE-N-V-OP-153	CHRISTIE 60 kV		A	N-0	1.05	1.05	1.06	1.06	
PGE-N-V-OP-154	PRT CSTA 60 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-155	FRANKLIN 60 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-156	SEQUOIA 60 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-157	FRKLNALT 60 kV		A	N-0	1.05	1.05	1.06	1.06	
PGE-N-V-OP-158	CLY LND 115kV		NORMAL CONDITIONS	A	N-0	1.04	1.04	1.05	
PGE-N-V-OP-159	SNTH LNE 60kV	A		N-0	1.05	1.05	1.05	1.06	adjust taps on Martin 115/60 kV x-former
PGE-N-V-OP-160	MARTIN 60 kV	A		N-0	1.06	1.06	1.06	1.07	
PGE-N-V-OP-161	IBM-CTLE 115 kV	NORMAL CONDITIONS	A	N-0	1.05	1.05	1.05	1.05	adjust taps on Metcalf230/115 kV x-formers
PGE-N-V-OP-162	EDENVALE 115 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-163	IBM-HRRS 115 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-164	IBM-BALY 115 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-165	MTCALF D 115 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-166	MTCALF E 115 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-167	CYTE PMP 115 kV		A	N-0	1.05	1.05	1.05	1.05	
PGE-N-V-OP-168	MRGN HIL 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-169	GILROY 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-170	LLAGAS 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-171	GILROY F 115 kV		A	N-0	1.05	1.04	1.05	1.04	
PGE-N-V-OP-172	PIERCY 115 kV		A	N-0	1.04	1.04	1.05	1.04	
PGE-N-V-OP-173	GILROYPK 115 kV		A	N-0	1.05	1.04	1.05	1.04	

PGE-N-V- OP-174	EVERGREN 60 kV	A	N-0	1.07	1.07	1.07	1.07	adjust taps on Evergreen 115/60 kV x-former
PGE-N-V- OP-176	ALMADEN 60 kV	A	N-0	1.06	1.06	1.06	1.06	

Study Area: Humboldt Area (2021 Off-peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltage by Portfolio				ISO Recommended Solution
					Base peak	Traj peak	Time peak	Env peak	
PGE-N-VD-OP-001	GRBRVLL 60 kV	Bridgeville - Garberville 60 kV Line	B	L-1	<5%	<5%	<5%	-6.3%	install additional reactive support at Garberville, or build Bridgeville-Garberville 115 kV line (PG&E proposed project)
PGE-N-VD-OP-002	KEKAWAKA 60 kV	Bridgeville - Garberville 60 kV Line	B	L-1	<5%	<5%	<5%	-5.6%	

North Coast and North Bay Areas

ID	Substation	Worst Contingency	Category	Category Description	Post Contingency Voltage Deviation (%)				ISO Proposed Solution
					base	traject	time	envir	
PGE-N-VD-OP-003	COVELO 60 kV	Willits - Laytonville 60 kV Line	B	L-1	<5%	<5%	<5%	-7.8%	install reactive support on Laytonville (5.4 MVAR shunt cap) or build new Bridgeville-Garberville 115 kV line (proposed proejct)
PGE-N-VD-OP-004	KEKAWAKA 60 kV		B	L-1	<5%	<5%	<5%	-5.5%	
PGE-N-VD-OP-005	LAYTNVLL 60 kV		B	L-1	<5%	<5%	<5%	-7.8%	

Study Area: North Valley Area (2021 Off-peak Load)

24 MVAR shunt reactor at Kilarc modeled in the Environmental Portfolio

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltage by Portfolio				ISO Recommended Solution
					Base peak	Traj peak	Time peak	Env peak	
PGE-N-VD-OP-006	TRINITY 115 kV	Trinity No.1 115/60 kV Transformer	B	L-1	-5%	-5%	<5%	-5.6%	0.95 power factor for renewables in Trinity area.
PGE-N-VD-OP-007	TRINITY 60 kV		B	L-1	<5%	<5%	<5%	6.5%	

Study Area: Central Valley Area (2021 Off-peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltage by Portfolio				ISO Recommended Solution
					Base peak	Traj peak	Time peak	Env peak	

PGE-N-VD-OP-008	CHCGO PK 115 kV	Drum-Bell 115 kV Line (Drum-Higgins)	B	L-1	-5%	-5%	<5%	-5.8%	0.95 power factor for renewables in Drum area.
PGE-N-VD-OP-009	BRUNSWCK 115 kV	Drum-Rio Oso No. 2 115 kV Line	B	L-1	<5%	<5%	<5%	-5.8%	
PGE-N-VD-OP-010	CORT_D 115 kV	Delevan-Cortina 230 kV Line	B	L-1	<5%	<5%	-5.2%	<5%	0.95 power factor for renewables at Cortina and adjust Cortina 230/115 kV x-former tap
PGE-N-VD-OP-011	HARINTON 60 kV	Cortina No. 1 60 kV Line	B	L-1	<5%	<5%	<5%	-5.9%	
PGE-N-VD-OP-012	DUNNIGAN 60 kV	Cortina No. 1 60 kV Line	B	L-1	<5%	<5%	<5%	-5.3%	

Study Area: Greater Bay Area (2021 Off-peak Load)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltage by Portfolio				ISO Recommended Solution
					Base	Traj	Time	Env	
					peak	peak	peak	peak	
PGE-N-VD-OP-013	NONE								

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by Portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environment	
					peak	peak	peak	peak	
PGE-T-01	Kerman-Agrcjt	Base system (n-0)	A	N-0	114%	113%	114%	109%	TPP reconductor project will mitigate the problem.
PGE-T-02	Giffen Junction to West Land Junction	None	A	N-0	144%	169%	155%	151%	SPS for renewables.
		PANOCHÉ 230kV - HELM 230kV #1	B	N-1	126%	151%	137%	134%	
		Herndon 230kV CB 202	C2	Breaker	127%	151%	138%	0%	
		Panoche - Kearney & Panoche - Helm 230 kV Lines	C5	DCTL	127%	151%	137%	134%	
		PANOCHÉ 230 KV BUS 2	C1	Bus	126%	151%	137%	134%	
PGE-T-03	Helm to San Joquain Junction 70 kV	None	A	N-0	100%	118%	110%	105%	SPS for renewables.
		PANOCHÉ 230kV - HELM 230kV #1	B	N-1	87%	103%	96%	91%	
		Herndon 230kV CB 202	C2	Breaker	87%	103%	96%	Not Solved	
		Panoche - Kearney & Panoche - Helm 230 kV Lines	C5	DCTL	87%	103%	96%	91%	
		PANOCHÉ 230 KV BUS 2	C1	Bus	87%	103%	96%	91%	
PGE-T-04	San Joquain Junction to	None	A	N-0	170%	201%	187%	179%	SPS for renewables.
		PANOCHÉ 230kV - HELM 230kV #1	B	N-1	150%	179%	166%	158%	
		Herndon 230kV CB 202	C2	Breaker	150%	180%	166%	0%	

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by Portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environment	
					peak	peak	peak	peak	
PGE-T-04	San Joaquin Junction to Giffen Junction 70 kV	Panoche - Kearney & Panoche - Helm 230 kV Lines	C5	DCTL	150%	180%	166%	158%	
		PANOCH 230 KV BUS 2	C1	Bus	150%	179%	166%	158%	
PGE-T-05	Legrand Exchequer 115 kV line	Merced 115/70 Bank # 2	B	N-1	82%	82%	82%	117%	Reconductor/ Modify Exchequer S PS if possible.
PGE-T-06	Exchequer-Mcswain Junction 70 kV	Legrand 115 kV bus outage	C1	Bus	161%	161%	161%	209%	Exchequer SPS may mitigate the problem.
PGE-T-07	Mcswain-Merced Falls 70 kV line		C1	Bus	138%	138%	138%	174%	
PGE-T-08	Merced 115/70 Bank # 2		C1	Bus	108%	108%	108%	158%	
PGE-T-09	Merced-Merced Falls 70 kV line		C1	Bus	119%	119%	119%	187%	
PGE-T-10	Lerdo-Ogle Junction 115 kV line	Midway-Kern No. 3 & Midway-Kern No. 4 230 kV Lines	C5	DCTL	100.3%	104.2%	103.6%	101.6%	SPS for renewables.
		Midway-Kern No. 3 & Midway-Kern No. 1 230 kV Lines	C5	DCTL	101.9%	106.3%	105.6%	103.3%	
		Midway-Kern No. 1 & Midway-Kern No. 4 230 kV Lines	C5	DCTL	103.1%	107.5%	106.9%	104.6%	
PGE-T-11	Morro Bay-Q166 230 kV	Morro Bay-Q166 230 kV #2 Line	B	L-1	83%	92%	101%	Not Rec	Intall SPS to trip generation/Rerate
PGE-T-12	Morro Bay-Q166 230 kV	Morro Bay-Q166 230 kV #1 Line	B	L-1	83%	92%	101%	Not Rec	Intall SPS to trip generation/Rerate

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltage by Portfolio				ISO Recommended Solution
					Base	Traj	Time	Env	
					peak	peak	peak	peak	
PGE-V-01	CORSGOLD 115	Kerckhoff PH2 115kV Bus	C1	Bus	0.87	0.83	0.83	0.87	Oakhurst & Coarsegold UVLS
PGE-V-02	LIVNGSTN 115	Wilson 115kV CB 102	C2	Breaker	0.84	0.84	0.84	0.87	Cressey-North Merced project /SPS
PGE-V-03	GALLO 115	Wilson 115kV CB 102	C2	Breaker	0.84	0.83	0.84	0.86	Cressey-North Merced project /SPS
PGE-V-04	CRESSEY 115	Wilson 115kV CB 102	C2	Breaker	0.86	0.86	0.87	0.89	Cressey-North Merced project /SPS
PGE-V-05	MERCED 115	Wilson 115kV CB 102	C2	Breaker	0.85	0.90	0.86	0.91	Cressey-North Merced project /SPS
PGE-V-06	MERCED 70	Wilson 115kV CB 102	C2	Breaker	0.90	0.90	0.91	0.91	Cressey-North Merced project /SPS
PGE-V-07	OGLE TAP 115	N-0	A	Normal	1.04	1.04	1.04	1.05	Power factor control required for renewable generators
PGE-V-08	TAFT A 70	N-0	A	Normal	1.03	1.04	1.06	1.04	Power factor control required for renewable generators
PGE-V-09	TAFT A_J 70	N-0	A	Normal	1.03	1.04	1.05	1.03	Power factor control required for renewable generators
PGE-V-10	BRY_PTLM 70	N-0	A	Normal	1.03	1.04	1.05	1.03	Power factor control required for renewable generators
PGE-V-11	SLR_TANH 70	N-0	A	Normal	1.03	1.04	1.05	1.03	Power factor control required for renewable generators

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by Portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environment	
					peak	peak	peak	peak	
PGE-DV-01	TRIGO	BORDEN 230kV - GREGG 230kV #1	B	N-1	-6.6%	-6.3%	-6.6%	-6.2%	Borden 230 kV voltage support (TPP proposed mitigation)
PGE-DV-02	GLASS	BORDEN 230kV - GREGG 230kV #1	B	N-1	-6.6%	-6.3%	-6.6%	-6.2%	Borden 230 kV voltage support(TPP proposed mitigation)
PGE-DV-03	EL PECO	BORDEN 230kV - GREGG 230kV #1	B	N-1	-6.7%	-6.4%	-6.7%	-6.3%	Borden 230 kV voltage support(TPP proposed mitigation)
PGE-DV-04	DINUBA	REEDLEY 70kV - DNUBAJCT 70kV #1	B	N-1	-8.1%	-8.2%	-8.1%	-6.3%	Reedley 70 kV reinforcement(TPP proposed mitigation)
PGE-DV-05	CORCORAN	34434 34420 2	B	N-1	-5.1%	-4.6%	-5.2%	-5.0%	Reedley 70 kV reinforcement(TPP proposed mitigation)
PGE-DV-06	CANANDGA	BORDEN 230kV - GREGG 230kV #1	B	N-1	-6.6%	-6.3%	-6.6%	-6.2%	Borden 230 kV voltage support(TPP proposed mitigation)
PGE-DV-07	BORDEN	BORDEN 230kV - GREGG 230kV #1	B	N-1	-6.5%	-6.1%	-6.5%	-6.1%	Borden 230 kV voltage support(TPP proposed mitigation)
PGE-DV-08	BONITA	BORDEN 230kV - GREGG 230kV #1	B	N-1	-6.7%	-6.4%	-6.7%	-6.3%	Borden 230 kV voltage support(TPP proposed mitigation)
PGE-DV-09	OGLE TAP	FAMOSO 115kV - CAWELO C 115kV #1	B	N-1	-4.3%	-3.8%	-4.2%	-5.1%	Power factor control required for renewable generators

ID	Overloaded Facility Name	Worst Contingency	Category	Category Desc.	Facility Loading by Portfolio (%)								ISO Recommended Solution
					Base		Trajectory		Time		Environmental		
					Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	
PGE-T-13	Derrick-Tornado 70 kV	None	A	N-0	69.9%	64.8%	68.7%	62.7%	76.5%	70.3%	115.2%	109.9%	Reconductor
		Losbanos-Midway 500 kV	B	N-1	<100%	<100%	<100%	<100%	73.0%	<100%	107.9%	101.4%	
		Gates-Panoche #1 and #2	C5	DCTL	72.8%	<100%	72.5%	<100%	78.9%	71.4%	114.6%	108.1%	
PGE-T-14	Gates 500/230 T/F bank	Los Banos 500/230 T/F	B	N-1	100.7%	83.4%	110.8%	93.5%	96.0%	78.4%	<100%	<100%	Modify RAS/Rerate the T/F
PGE-T-13	Gates-Midway 230 kV line	Gates 500/230 T/F	B	N-1	100.5%	91.5%	109.9%	91.0%	96.3%	86.9%	<100%	<100%	Modify RAS/Rerate the Transmission line/short term rarting if possible
PGE-T-15	GFFNJCT-WSTLDJCT 70 kV	None	A	N-0	132.4%	131.0%	83.6%	83.9%	159.0%	156.4%	197.3%	195.6%	SPS for renewables.
		Losbanos-Midway 500 kV	B	N-1	115.9%	115.4%	72.2%	73.0%	139.5%	138.4%	173.4%	172.4%	
		Gates-Gregg 230 kV Panoche-Kearney 230 kV	C5	DCTL	115.9%	115.2%	73.3%	73.4%	139.5%	138.2%	173.1%	172.5%	
		Los Banos 230 KV BUS 2	C1	Bus	116.4%	115.4%	73.6%	73.5%	140.4%	138.6%	173.7%	172.4%	
PGE-T-16	Helm-SNJQJCT 70 kV	None	A	N-0	106.8%	105.2%	54.7%	54.9%	131.9%	129.3%	154.8%	152.9%	SPS for renewables.
		Losbanos-Midway 500 kV	B	N-1	91.6%	90.6%	<100%	<100%	113.4%	111.9%	133.4%	131.9%	
		Gates-Gregg 230 kV Panoche-Kearney 230 kV	C5	DCTL	91.5%	90.5%	<100%	<100%	113.4%	111.7%	133.0%	132.0%	
		Los Banos 230 KV BUS 2	C1	Bus	92.4%	90.7%	<100%	<100%	114.6%	112.0%	133.7%	131.8%	

PGE-T-17	SNJQJCT-GFFNJCT 70 kV	None	A	N-0	181.3%	178.7%	97.1%	97.4%	223.1%	218.9%	265.0%	261.9%	SPS for renewables.
		Losbanos-Midway 500 kV	B	N-1	159.0%	157.4%	83.9%	84.8%	196.0%	193.7%	233.5%	230.9%	
		Gates-Gregg 230 kV Panoche-Kearney 230 kV	C5	DCTL	158.8%	157.2%	85.2%	85.2%	196.1%	193.5%	232.8%	231.1%	
		Los Banos 230 KV BUS 2	C1	Bus	ec798010	157.5%	85.5%	85.4%	197.9%	193.9%	233.9%	230.8%	
PGE-T-18	Kearney-Herndon 230 kV line	Gates-Gregg & Gregg-Ashlan 230 kV	C5	DCTL	99.6%	72.5%	105.1%	78.3%	95.9%	<100%	80.1%	<100%	Modify RAS/reconductor/congestion management
		Mccall 230 kV Bus 1	C1	Bus	97.0%	<100%	103.0%	<100%	94.2%	<100%	<100%	<100%	Modify RAS/reconductor/Congestion management
PGE-T-19	Panoche 230-Gates 230 kV # 1 & # 2	Los Banos 500/230 T/F	B	N-1	85.1%	73.4%	87.6%	75.7%	88.8%	76.1%	102.1%	90.0%	Modify RAS/reconductor/Congestion management
		Gates-Gregg Gates-Mccall 230 kV	C5	DCTL	111.0%	93.1%	117.6%	99.5%	113.5%	94.5%	123.7%	107.1%	Modify RAS/reconductor/Congestion management
		Gates 230 kV bus 1D	C1	Bus	90.6%	77.9%	95.6%	82.0%	94.6%	80.8%	107.0%	94.1%	Modify RAS/reconductor/Congestion management
PGE-T-19	Warnerville-Wilson 230 kV	None	A	N-0	93.3%	42.9%	104.7%	53.9%	97.8%	47.9%	37.7%	10.3%	Reconductor/Congestion management.
		Gates-Gregg 230 kV Panoche-Kearney 230 kV	C5	DCTL	86.3%	<100%	100.8%	<100%	89.9%	<100%	<100%	<100%	Modify RAS/Congestion management.
PGE-T-20	Cawelo C- Ogle Jct 115 kV	Lerdo 115 kV - Lerdo Junction 115 kV line	B	N-1	100.2%	100.2%	98.8%	98.7%	98.7%	98.8%	102.2%	102.1%	SPS for renewables.
		Live Oak-Kern Oil & Kern-Lerdo-Kern Oil 1 115 kV Lines	C5	DCTL	100.2%	100.2%	98.8%	98.7%	98.7%	98.8%	102.2%	102.1%	
PGE-T-21	Fameso-Cawelo C 115 kV	Lerdo 115 kV - Lerdo Junction 115 kV line	B	N-1	100.8%	100.8%	99.4%	99.3%	99.3%	99.4%	102.9%	102.8%	

		Live Oak-Kern Oil & Kern-Lerdo-Kern Oil 1 115 kV Lines	C5	DCTL	100.8%	100.8%	99.4%	99.3%	99.3%	99.4%	102.9%	102.8%	SPS for renewables.
PGE-T-22	Cymric-Texaco 115 kV line	Midway-Taft 115 kV	B	N-1	Not Rec	Not Rec	Not Rec	Not Rec	Not Rec	Not Rec	118.3%	118.6%	Reconductor/Rerate the transmission lines
	FellowsG - Morgan 115 kV Line		B	N-1	71.9%	72.4%	Not Rec	Not Rec	Not Rec	Not Rec	118.7%	118.8%	Reconductor/Rerate the transmission lines
	Midsun-FellowsG 115 kVline		B	N-1	Not Rec	Not Rec	Not Rec	Not Rec	Not Rec	Not Rec	121.2%	121.3%	Reconductor/Rerate the transmission lines
	Midway-Cymric 115 kV line		B	N-1	74.4%	74.0%	Not Rec	Not Rec	Not Rec	Not Rec	124.4%	124.8%	Reconductor/Rerate the transmission lines
	Morgan-Midset 115 kV line		B	N-1	Not Rec	Not Rec	Not Rec	Not Rec	Not Rec	Not Rec	112.9%	113.0%	Reconductor/Rerate the transmission lines
PGE-T-23	Live Oak to Kern Power 115 kV Line	KRN OL J 115kV - MAGUNDEN 115kV #1	B	N-1	91.5%	95.4%	81.2%	81.4%	87.7%	87.5%	107.4%	107.7%	Reconductor/Rerate the transmission lin
		Kern-Magunden-Witco & Westpark-Magunden 115 kV Lines	C5	DCTL	91.0%	95.0%	80.7%	81.0%	87.3%	87.1%	107.2%	107.4%	

ID	Substation	Worst Contingency	Category	Category Desc.	Per Unit Voltage by Portfolio								ISO Recommended Solution
					Base		Trajectory		Time		Environmental		
					Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	
PGE-V-11	SHARON 115	Base system (n-0)	A	N-0	Not Rec	1.03	Not Rec	1.0279	Not Rec.	1.0258	Not Rec.	1.0505	Power factor control required for renewable generators
PGE-V-12	GALLO 115	Base system (n-0)	A	N-0	1.01	Not Rec	1.0029	Not Rec.	1.0059	Not Rec.	0.999	Not Rec.	Power factor control required for renewable generators
PGE-V-13	LUIS_#3 115	Base system (n-0)	A	N-0	1.04	1.04	1.0405	1.0339	1.034	1.0292	1.0513	1.0516	Power factor control required for renewable generators
PGE-V-14	INDN FLT 70	Base system (n-0)	A	N-0	1.02	1.02	1.0156	1.0196	1.0165	1.0184	1.0734	1.0839	Power factor control required for renewable generators

PGE-V-15	YOSEMITE	70	Base system (n-0)	A	N-0	1.01	1.02	1.0137	1.0178	1.0147	1.0165	1.0717	1.0822	Power factor control required for renewable generators
PGE-V-16	AIRWAYS	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0487	Not Rec.	1.0465	Not Rec.	1.0515	Power factor control required for renewable generators
PGE-V-17	CLOVIS-1	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0505	Not Rec.	1.0492	Not Rec.	1.0563	Power factor control required for renewable generators
PGE-V-18	CLOVIS-2	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0482	Not Rec.	1.047	Not Rec.	1.0541	Power factor control required for renewable generators
PGE-V-19	SANGER	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0507	Not Rec.	1.0498	Not Rec.	1.0561	Power factor control required for renewable generators

PGE-V-20	LASPALMS	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0469	Not Rec.	1.0448	Not Rec.	1.0511	Power factor control required for renewable generators
PGE-V-21	MC CALL	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0532	Not Rec.	1.0533	Not Rec.	1.0585	Power factor control required for renewable generators
PGE-V-22	SCWAX	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0511	Not Rec.	1.0509	Not Rec.	1.0561	Power factor control required for renewable generators
PGE-V-23	MALAGA	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0512	Not Rec.	1.0509	Not Rec.	1.0562	Power factor control required for renewable generators
PGE-V-24	RANCHRS	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0511	Not Rec.	1.0509	Not Rec.	1.0562	Power factor control required for renewable generators

PGE-V-25	PPG	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0512	Not Rec.	1.0509	Not Rec.	1.0562	Power factor control required for renewable generators
PGE-V-26	AIRPROD	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0517	Not Rec.	1.0515	Not Rec.	1.0567	Power factor control required for renewable generators
PGE-V-27	MALAGATP	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0514	Not Rec.	1.0512	Not Rec.	1.0564	Power factor control required for renewable generators
PGE-V-28	KRCDP	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0512	Not Rec.	1.0509	Not Rec.	1.0562	Power factor control required for renewable generators
PGE-V-29	WAHTOKE	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0487	Not Rec.	1.0483	Not Rec.	1.055	Power factor control required for renewable generators

PGE-V-30	KNGSCOGN	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0474	Not Rec.	1.0475	Not Rec.	1.0529	Power factor control required for renewable generators
PGE-V-31	SUNMAID	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.047	Not Rec.	1.0471	Not Rec.	1.0523	Power factor control required for renewable generators
PGE-V-32	RAINBW	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0493	Not Rec.	1.0484	Not Rec.	1.0552	Power factor control required for renewable generators
PGE-V-33	DANISHCM	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0459	Not Rec.	1.046	Not Rec.	1.0534	Power factor control required for renewable generators
PGE-V-34	BALCH	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0496	Not Rec.	1.0487	Not Rec.	1.055	Power factor control required for renewable generators

PGE-V-35	CAL AVE	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0457	Not Rec.	1.0458	Not Rec.	1.0529	Power factor control required for renewable generators
PGE-V-36	WST FRSO	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0443	Not Rec.	1.0446	Not Rec.	1.0516	Power factor control required for renewable generators
PGE-V-37	BARTON	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0494	Not Rec.	1.0466	Not Rec.	1.0511	Power factor control required for renewable generators
PGE-V-38	MANCHSTR	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0486	Not Rec.	1.0454	Not Rec.	1.0519	Power factor control required for renewable generators
PGE-V-39	HERNDON	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0541	Not Rec.	1.0482	Not Rec.	1.0535	Power factor control required for renewable generators

PGE-V-40	PNEDLE	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0516	Not Rec.	1.046	Not Rec.	1.0514	Power factor control required for renewable generators
PGE-V-41	WOODWARD	11	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.0539	Not Rec.	1.0502	Not Rec.	1.0567	Power factor control required for renewable generators
PGE-V-42	BULLARD	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec.	1.052	Not Rec.	1.0465	Not Rec.	1.052	Power factor control required for renewable generators
PGE-V-43	CHLDHOSP	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0537	Not Rec.	1.0491	Not Rec.	1.0552	Power factor control required for renewable generators
PGE-V-44	GRDN GLS	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0476	Not Rec.	1.0477	Not Rec.	1.0527	Power factor control required for renewable generators

PGE-V-45	GIFFEN	70	Base system (n-0)	A	N-0	1.01	1.03	1.0559	1.061	1.0077	1.0278	0.9938	1.0072	Power factor control required for renewable generators
PGE-V-46	TVY VLLY	70	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0481	Not Rec.	1.0466	Not Rec.	1.0553	Power factor control required for renewable generators
PGE-V-47	KERMAN	70	Base system (n-0)	A	N-0	0.99	Not Rec	1.0369	Not Rec.	0.9749	Not Rec.	0.9495	Not Rec.	Power factor control required for renewable generators
PGE-V-48	SNGRCOGN	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0493	Not Rec.	1.0485	Not Rec.	1.0551	Power factor control required for renewable generators
PGE-V-49	PARLIER	115	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0469	Not Rec.	1.0462	Not Rec.	1.0534	Power factor control required for renewable generators

PGE-V-50	AUBERRY	70	Base system (n-0)	A	N-0	Not Rec	1.02	Not Rec	1.0224	Not Rec.	1.0194	Not Rec.	1.0556	Power factor control required for renewable generators
PGE-V-51	DUNLAP	70	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0463	Not Rec.	1.0456	Not Rec.	1.0553	Power factor control required for renewable generators
PGE-V-52	SANDCRK	70	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0485	Not Rec.	1.0479	Not Rec.	1.057	Power factor control required for renewable generators
PGE-V-53	STONCRRL	70	Base system (n-0)	A	N-0	Not Rec	1.05	Not Rec	1.0503	Not Rec.	1.0496	Not Rec.	1.0582	Power factor control required for renewable generators
PGE-V-54	FAMOSO	115	Base system (n-0)	A	N-0	1.0497	1.0485	1.0508	1.0482	1.051	1.0506	1.053	1.051	Power factor control required for renewable generators

PGE-V-55	OGLE TAP	115	Base system (n-0)	A	N-0	1.0594	1.0584	1.0601	1.0583	1.0607	1.0598	1.0616	1.0604	Power factor control required for renewable generators
PGE-V-56	OGLE JCT	115	Base system (n-0)	A	N-0	1.0558	1.0547	1.0565	1.0546	1.0573	1.0563	1.0582	1.0569	Power factor control required for renewable generators
PGE-V-57	CAWELO C	115	Base system (n-0)	A	N-0	Not Rec.	Not Rec.	Not Rec.	Not Rec.	Not Rec.	Not Rec.	Not Rec.	Not Rec.	Power factor control required for renewable generators

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by Portfolio (%)								ISO Recommended Solution
					Base		Trajectory		Time		Environmental		
					Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	Ofpk- 3 pump	Ofpk- 1 pump	
PGE-DV-10	BORDEN	Panoche-Kearney 230 kV	B	N-1	3.5%	Not Rec	5.1%	Not Rec	3.8%	Not Rec	3.2%	Not Rec	Borden Reactive support
PGE-DV-11	GREGG	Panoche-Kearney 230 kV	B	N-1	3.7%	Not Rec	5.4%	Not Rec	4.0%	Not Rec	3.3%	Not Rec	Borden Reactive support
		Gates-Mccall 230 kV	B	N-1	3.8%	Not Rec	5.2%	Not Rec	4.9%	Not Rec	4.2%	Not Rec	Borden Reactive support



ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by Portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environment	
					peak	peak	peak	peak	
SCE-T-01	Barre - Elis 220 kV line	North Gila - Imperial Valley 500 kV line while one San Onofre unit is out of service	B	G-1/L-1	<100%	99%	108%	100%	The proposed reliability project involving looping of the Elis - Del Amo 220 kV line into Barre will address the overload.
		San Onofre to Santiago d/c lines	C	L-2	116%	116%	110%	107%	
SCE-T-02	Lugo #1 or #2 500/220 kV Transformer	One Lugo 500/220 kV Transformer	B	T-1	142%	102%	105%	127%	Existing High Desert RAS mitigates the overloading by tripping generation.
SCE-T-03	Holgate - Cramer 115 kV line	All elements in service	A	N-0	<100%	<100%	100%	112%	Overload is due to DG at Holgate in the environmentally constrained scenario and would require upgrading existing line.
SCE-T-04	Inyokern - Kramer #3 115 kV line	Kramer - Inyokern - Randsburg #1 115 kV line	B	L-1	<100%	<100%	<100%	110%	Kramer 115 kV RAS mitigates this overload.
SCE-T-05	Control #1 or #3 115/55 kV transformer	One Control 115/55 kV transformer	B	T-1	<100%	<100%	<100%	103%	Install SPS to trip generation following the contingencies.
SCE-T-06	Inyo 115 kV PST	Kramer - Inyokern - Randsburg #1 and #3 115 kV lines	C	L-2	Not solved	Not solved	Not solved	Not solved	Modify the Kramer 115 kV RAS to include this contingency.

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltage by Portfolio				ISO Recommended Solution
					Base peak	Traj peak	Time peak	Env peak	
SCE-V-01	Red Bluff 500 kV	All elements in service	A	N-0	1.071	1.064	1.062	1.068	The ISO has accepted SCE's proposal to exempt SCE's 500 kV buses from the ISO high voltage standard for normal conditions and instead use 550 kV or 1.1 p.u.as the high voltage limit.
	Colorado River 500 kV	All elements in service	A	N-0	1.069	1.065	1.060	1.066	

ID	Substation	Worst Contingency	Category	Category y Descript	Voltage Deviation by Portfolio (%)				ISO Recommended Solution
					Base peak	Trajectory peak	Time peak	Environment peak	
SCE-DV-01	Inyokern 115 kV	Inyokern - Kramer #3 115 kV line	B	L-1	-4.25%	-4.73%	-4.71%	-6.63%	Expand the Kramer 115 kV RAS to include this contingency.

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by Portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environment	
					off-peak	off-peak	off-peak	off-peak	
SCE-T-07	Lugo #1 or #2 500/220 kV Transformer	One Lugo 500/220 kV Transformer	B	T-1	155%	<100%	101%	<100%	Existing High Desert RAS mitigates the overloading by tripping generation.
SCE-T-08	Inyo 115 kV PST	Kramer - Inyokern - Randsburg #1 and #3 115 kV lines	C	L-2	137%	136%	133%	Not solved	Modify the Kramer 115 kV RAS to include this contingency.

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltage by Portfolio				ISO Recommended Solution
					Base	Traj	Time	Env	
					off-peak	off-peak	off-peak	off-peak	
SCE-V-02	Red Bluff 500 kV	All elements in service	A	N-0	1.081	1.077	1.072	1.080	The ISO has accepted SCE's proposal to exempt SCE's 500 kV buses from the ISO high voltage standard for normal conditions and instead use 550 kV or 1.1 p.u.as the high voltage limit.
	Colorado River 500 kV	All elements in service	A	N-0	1.083	1.080	1.073	1.083	

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by Portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environment	
					off-peak	off-peak	off-peak	off-peak	
SCE-DV-02	Inyokern 115 kV	Inyokern - Kramer #3 115 kV line	B	L-1	-4.94%	-4.97%	-4.85%	-7.94%	Expand the Kramer 115 kV RAS to include this contingency.

ID	Contingency	System Performance	ISO Recommended Solution
	No transient stability violations were identified		

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
SDGE-T-01	22540 NARROWS 69 - 22884 WARNERS 69 - ckt 1	Base system (n-0)	A	N-0	44.57%	21.51%	35.06%	133.38%	Reconductor or curtail gen (including DGs)
SDGE-T-02	22084 BORREGO 69 - 22540 NARROWS 69 - ckt 1	Base system (n-0)	A	N-0	51.78%	29.67%	49.10%	115.72%	Reconductor or curtail gen (including DGs)
SDGE-T-03	22208 EL CAJON 69 - 22408 LOSCOCHS 69 - ckt 1	Base system (n-0)	A	N-0	61.19%	48.27%	73.05%	110.12%	Reconductor or curtail gen (including DGs)
SDGE-T-04	22336 GRANITE 69 - 22340 GRANITTP 69 - ckt 1	Base system (n-0)	A	N-0	83.40%	78.27%	86.06%	100.90%	Reconductor or curtail gen (including DGs)
SDGE-T-05	22208 EL CAJON 69 - 22408 LOSCOCHS 69 - ckt 1	LD_GR OPEN 632 PK JM/EC/GA	B	N-1	90.51%	Not Rec	103.51%	140.90%	Reconductor or curtail gen (including DGs)
SDGE-T-06	22700 SAMPSON 69 - 22172 DIVISION 69 - ckt 1	TL23026 SILVERGT - BAY BLVD ck 1	B	N-1	103.61%	100.36%	Not Rec	83.25%	Reconductor or Miguel 230kV Tap reconfig can eliminate this issue. (pending C1C2 LGIA)
SDGE-T-07	22820 SWEETWTR 69 - 22520 MONTGYTP 69 - ckt 1	TL23026 SILVERGT - BAY BLVD ck 1	B	N-1	126.06%	124.27%	102.99%	107.54%	Reconductor or Miguel 230kV Tap reconfig can eliminate this issue. (pending C1C2 LGIA)
SDGE-T-08	22820 SWEETWTR 69 - 22824 SWTWTRTP 69 - ckt 1	TL23026 SILVERGT - BAY BLVD ck 1	B	N-1	132.30%	128.36%	101.77%	106.72%	Reconductor or Miguel 230kV Tap reconfig can eliminate this issue. (pending C1C2 LGIA)
SDGE-T-09	22828 SYCAMORE 69 - 22756 SCRIPPS 69 - ckt 1	TL23042A OTAYMESA - BAY BLVD ck 1	B	N-1	100.11%	96.47%	92.14%	97.87%	Reconductor or Miguel 230kV Tap reconfig can eliminate this issue. (pending C1C2 LGIA)
SDGE-T-10	22831 SYCAMORE 138 - 22124 CHCARITA 138 - ckt 1	EA BK 60 230/138	B	N-1	110.43%	105.51%	100.81%	106.17%	Reconductor or dispatch generation at Encina (generation may not be available in 2021)
SDGE-T-11	22064 BLDCRKTP 69 - 22168 DESCANSO 69 - Ckt 1	Loveland 69kV Bus	C	Bus	Not Rec	94.38%	Not Rec	103.22%	Reconductor or curtail gen (including DGs)
SDGE-T-12	22064 BLDCRKTP 69 - 22736 SANTYSBL 69 - Ckt 1	Loveland 69kV Bus	C	Bus	Not Rec	94.51%	Not Rec	137.81%	Reconductor or curtail gen (including DGs)
SDGE-T-13	22076 BORDER 69 - 22080 BORDERTP 69 - Ckt 1	ML-SW-SU-PD + ML-BD	C	N-2	101.72%	98.97%	Not Rec	Not Rec	Reconductor or curtail Generation at Border
SDGE-T-14	22076 BORDER 69 - 22080 BORDERTP 69 - Ckt 1	Miguel 69kV S Bus	C	Bus	101.63%	98.84%	Not Rec	Not Rec	Reconductor or curtail Generation at Border
SDGE-T-15	22076 BORDER 69 - 22080 BORDERTP 69 - Ckt 1	Bus_ML69S TRIP ML BK71 SPS8.3	C	Bus	101.60%	98.80%	Not Rec	Not Rec	Reconductor or curtail Generation at Border
SDGE-T-16	22208 EL CAJON 69 - 22408 LOSCOCHS 69 - Ckt 1	Murray 69kV N Bus	C	Bus	89.21%	Not Rec	107.48%	142.77%	Addressed as a category B overload
SDGE-T-17	22336 GRANITE 69 - 22340 GRANITTP 69 - Ckt 1	Murray 69kV N Bus	C	Bus	82.17%	Not Rec	88.68%	104.05%	Reconductor or dispatch generation at El Cajon
SDGE-T-18	22740 SANYSDRO 69 - 22616 OTAYLKTP 69 - Ckt 1	Otay 69kV E Bus	C	Bus	117.22%	112.11%	Not Rec	Not Rec	Reconductor or curtail Generation at Border
SDGE-T-19	22828 SYCAMORE 69 - 22756 SCRIPPS 69 - Ckt 1	OMGP-ML-SG & GRNTHIL-TC	C	N-2	102.92%	98.87%	94.54%	100.51%	Addressed as a category B overload
SDGE-T-20	22828 SYCAMORE 69 - 22756 SCRIPPS 69 - Ckt 1	MIGUEL 230 kV 7T A CB	C	CB	100.11%	96.47%	92.14%	97.87%	Addressed as a category B overload
SDGE-T-21	22831 SYCAMORE 138 - 22124 CHCARITA 138 - Ckt 1	ENCINA 230 kV 1E CB	C	CB	111.09%	106.30%	101.87%	107.18%	Addressed as a category B overload
SDGE-T-22	22884 WARNERS 69 - 22736 SANTYSBL 69 - Ckt 1	Rincon 69kV N Bus	C	Bus	Not Rec	Not Solved	Not Rec	141.07%	Reconductor or curtail gen (including DGs)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
SDGE-V-01	BORREGO 69kV	Base system (n-0)	A	N-0	1.00	1.04	1.00	1.08	Same mitigation proposed for Off-peak voltage issues.
SDGE-V-02	BOULEVRD 138kV	Base system (n-0)	A	N-0	1.05	1.03	1.04	1.05	
SDGE-V-03	CAMERNTP 69kV	Base system (n-0)	A	N-0	1.02	1.00	1.01	1.05	
SDGE-V-04	CRESTWD 69kV	Base system (n-0)	A	N-0	1.02	1.00	1.01	1.06	
SDGE-V-05	ECO 138kV	Base system (n-0)	A	N-0	1.05	1.03	1.04	1.05	
SDGE-V-06	KUMEYAAY 69kV	Base system (n-0)	A	N-0	1.02	1.00	1.01	1.06	
SDGE-V-07	NARROWS 69kV	Base system (n-0)	A	N-0	1.01	1.04	1.01	1.07	
SDGE-V-08	SUNCREST 500kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05	
SDGE-V-09	CAMERNTP 69	Barrett 69kV Bus	C	Bus	1.01	0.98	0.99	1.11	
SDGE-V-10	KUMEYAAY 69	Cameron 69kV Bus	C	Bus	1.03	1.00	1.00	1.07	

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					peak	peak	peak	peak	
SDGE-DV-01	BARRETT 69kV	TL06957 LL-BAR ck 1	B	N-1	-3.94%	-0.82%	-4.40%	10.98%	+0.95 to -0.95 power factor control on DGs and/or voltage control equipment
SDGE-DV-02	BORREGO 69kV	TL0686 WARNERS-NARROWS ck 1	B	N-1	-0.30%	-4.09%	-0.50%	-8.04%	
SDGE-DV-03	BOULEVRD 138kV	ECO BK 80 230/500	B	N-1	-4.91%	-3.47%	-4.38%	-5.28%	
SDGE-DV-04	CAMERON 69kV	TL06957 LL-BAR ck 1	B	N-1	-3.26%	-1.09%	-3.53%	8.99%	
SDGE-DV-05	CRESTWD 69kV	TL0629 BU-CW-CN-GC ck 1	B	N-1	-1.87%	0.30%	-0.88%	-5.87%	
SDGE-DV-06	IMPRLVLY 230kV	TL50001A SPS+IV Gens+23050 SPS6.2A	B	N-1	-3.78%	-2.21%	-5.16%	-4.21%	
SDGE-DV-07	INTB 230kV	TL50001A SPS+IV Gens+23050 SPS6.2A	B	N-1	-4.05%	-2.32%	-5.43%	-4.45%	
SDGE-DV-08	IV-GEN 230kV	TL50001A SPS+IV Gens+23050 SPS6.2A	B	N-1	-3.97%	-2.29%	-5.36%	-4.38%	
SDGE-DV-09	JAP MESA 69kV	TL0690 SA-OS-STU-LP ck 1	B	N-1	-4.74%	-4.86%	-5.01%	-4.75%	
SDGE-DV-10	KUMEYAAY 69kV	TL0629 BU-CW-CN-GC ck 1	B	N-1	-1.90%	0.29%	-0.89%	-5.91%	
SDGE-DV-11	LRP-U1-A 230kV	TL50001A SPS+IV Gens+23050 SPS6.2A	B	N-1	-4.06%	-2.34%	-5.45%	-4.47%	
SDGE-DV-12	NARROWS 69kV	TL0686 WARNERS-NARROWS ck 1	B	N-1	-1.11%	-5.63%	-1.42%	-6.72%	
SDGE-DV-13	SUNCREST 230kV	TL50001 SPS+IVGens+23040 SPS6.2B	B	N-1	-4.03%	-5.44%	-5.77%	-5.40%	
SDGE-DV-14	SUNCREST 500kV	TL50001A SPS+IV Gens+23050 SPS6.2A	B	N-1	-5.72%	-4.26%	-7.76%	-6.83%	
SDGE-DV-15	ARTESN 69 kV	ARTESIAN 69 kV BUS	C	Bus	1.44%	2.46%	2.34%	1.45%	+0.95 to -0.95 power factor control on DGs and/or SPS and/or voltage control equipment
SDGE-DV-16	BARRETT 69 kV	Loveland 69kV Bus	C	Bus	-3.20%	-1.91%	-1.39%	18.52%	
SDGE-DV-17	CAMERNTP 69 kV	Loveland 69kV Bus	C	Bus	-2.97%	-1.63%	-0.91%	14.82%	
SDGE-DV-18	BORREGO 69 kV	NARROWS 69 kV BUS	C	Bus	-0.30%	-4.09%	-0.50%	-8.04%	
SDGE-DV-19	CAMERON 69 kV	Cameron 69kV Bus	C	Bus	-1.46%	1.63%	-1.07%	-4.86%	
SDGE-DV-20	CAMERON 69 kV	Loveland 69kV Bus	C	Bus	-3.24%	-2.15%	-1.25%	16.54%	
SDGE-DV-21	DESCANSO 69 kV	Loveland 69kV Bus	C	Bus	-2.07%	-1.52%	-0.53%	8.95%	
SDGE-DV-22	GLENCLIF 69 kV	Loveland 69kV Bus	C	Bus	-2.67%	-1.72%	-0.81%	12.70%	
SDGE-DV-23	GLNCLFTP 69 kV	Loveland 69kV Bus	C	Bus	-2.66%	-1.72%	-0.81%	12.70%	

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base peak	Trajectory peak	Time peak	Environmental peak	
SDGE-DV-24	NARROWS 69 kV	NARROWS 69 kV BUS	C	Bus	-1.11%	-5.63%	-1.42%	-6.72%	
SDGE-DV-25	PICO 138 kV	PICO 138kV BT CB	C	CB	-2.59%	-0.68%	-0.78%	-2.86%	
SDGE-DV-26	PRCTRVLY 138 kV	Proctor Valley 138kV Bus	C	Bus	-2.05%	1.66%	-1.14%	-2.60%	
SDGE-DV-27	TELECYN 138 kV	13809/13824 PV-TC & LC-MLT-TC ML60	C	N-2	-2.35%	-2.86%	-5.41%	-2.83%	
SDGE-DV-28	TRABUCO 138 kV	TRABUCO 138kV BT CB	C	CB	-2.26%	-0.75%	-0.85%	-2.53%	
SDGE-DV-29	CRESTWD 69 kV	Loveland 69kV Bus	C	Bus	-2.87%	-0.74%	-0.49%	14.76%	
SDGE-DV-30	KUMEYAAY 69 kV	CRESTWOOD 69 kV Bus	C	Bus	-1.90%	0.29%	-0.89%	-5.91%	
SDGE-DV-31	KUMEYAAY 69 kV	Loveland 69kV Bus	C	Bus	-2.86%	-0.73%	-0.50%	14.75%	

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-T-23	22040 BARRETT 69 - 22104 CAMERON 69 - ckt 1	Base system (n-0)	A	N-0	30.20%	33.85%	42.70%	121.09%	Reconductor or curtail gen (including DGs)
SDGE-T-24	22040 BARRETT 69 - 22416 LOVELAND 69 - ckt 1	Base system (n-0)	A	N-0	26.38%	27.48%	42.37%	152.37%	
SDGE-T-25	22072 CAMERNTP 69 - 22328 GLNCLFTP 69 - ckt 1	Base system (n-0)	A	N-0	43.60%	49.95%	53.55%	111.77%	
SDGE-T-26	22416 LOVELAND 69 - 22168 DESCANSO 69 - ckt 1	Base system (n-0)	A	N-0	18.76%	20.44%	38.93%	149.20%	
SDGE-T-27	22416 LOVELAND 69 - 22004 ALPINE 69 - ckt 1	Base system (n-0)	A	N-0	22.90%	19.88%	30.21%	101.53%	
SDGE-T-28	22168 DESCANSO 69 - 22328 GLNCLFTP 69 - ckt 1	Base system (n-0)	A	N-0	36.96%	43.31%	46.90%	105.60%	
SDGE-T-29	22084 BORREGO 69 - 22540 NARROWS 69 - ckt 1	Base system (n-0)	A	N-0	65.42%	59.02%	61.71%	217.14%	Reported as a peak problem
SDGE-T-30	22540 NARROWS 69 - 22884 WARNERS 69 - ckt 1	Base system (n-0)	A	N-0	63.22%	49.40%	52.31%	236.72%	Reported as a peak problem
SDGE-T-31	22736 SANTYSBL 69 - 22152 CREELMAN 69 - ckt 1	Base system (n-0)	A	N-0	12.01%	10.84%	31.00%	136.05%	Reconductor or curtail gen (including DGs)
SDGE-T-32	22880 WARENCYN 69 - 22876 WARCYNTP 69 - ckt 1	Base system (n-0)	A	N-0	6.50%	14.72%	14.33%	122.73%	
SDGE-T-33	22884 WARNERS 69 - 22688 RINCON 69 - ckt 1	Base system (n-0)	A	N-0	44.55%	28.11%	58.86%	155.89%	

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-T-34	22884 WARNERS 69 - 22736 SANTYSBL 69 - ckt 1	Base system (n-0)	A	N-0	13.69%	15.99%	16.19%	117.63%	
SDGE-T-35	22072 CAMERNTP 69 - 22104 CAMERON 69 - ckt 1	TL06957 LL-BAR ck 1	B	N-1	Not Rec	Not Rec	Not Rec	172.29%	Reconductor or curtail gen (including DGs)
SDGE-T-36	22064 BLDCRKTP 69 - 22168 DESCANSO 69 - ckt 1	TL0637 SANTYSBL - CREELMAN ck 1	B	N-1	Not Rec	Not Rec	Not Rec	108.65%	Reconductor or curtail gen (including DGs)
SDGE-T-37	22064 BLDCRKTP 69 - 22736 SANTYSBL 69 - ckt 1	TL0625 DE-LL ck 1	B	N-1	Not Rec	Not Rec	Not Rec	130.22%	Reconductor or curtail gen (including DGs)
SDGE-T-38	22168 DESCANSO 69 - 22328 GLNCLFTP 69 - ckt 1	TL06923 BARRETT - CAMERON ck 1	B	N-1	Not Rec	87.58%	101.34%	271.91%	Reconductor or curtail gen (including DGs)
SDGE-T-39	22168 DESCANSO 69 - 22328 GLNCLFTP 69 - ckt 1	TL06957 LL-BAR ck 1	B	N-1	Not Rec	Not Rec	100.57%	316.89%	Reconductor or curtail gen (including DGs)
SDGE-T-40	22408 LOSCOCHS 69 - 22004 ALPINE 69 - ckt 1	TL06914 LOVELAND- LOSCHS ck 1	B	N-1	Not Rec	Not Rec	Not Rec	131.87%	Reconductor or curtail gen (including DGs)
SDGE-T-41	22408 LOSCOCHS 69 - 22416 LOVELAND 69 - ckt 1	TL06904 LOVELAND- ALPINE ck 1	B	N-1	Not Rec	Not Rec	Not Rec	114.72%	Reconductor or curtail gen (including DGs)
SDGE-T-42	22208 EL CAJON 69 - 22408 LOSCOCHS 69 - ckt 1	LD_GR OPEN 632 PK JM/EC/GA	B	N-1	103.60%	97.87%	106.07%	130.56%	Reported as a peak problem Dispatch generation at El Cajon or reconductor
SDGE-T-43	22064 BLDCRKTP 69 - 22168 DESCANSO 69 - Ckt 1	Creelman 69kV E Bus	C	Bus	Not Rec	Not Rec	Not Rec	107.70%	Reconductor or curtail gen (including DGs)
SDGE-T-44	22064 BLDCRKTP 69 - 22736 SANTYSBL 69 - Ckt 1	Loveland 69kV Bus	C	Bus	Not Rec	Not Rec	107.19%	Not Solved	Caused by DGs --> Reconductor or curtail gen

ID	Overloaded Facility Name	Worst Contingency	Category	Category Description	Facility Loading by portfolios (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-T-45	22072 CAMERNTP 69 - 22104 CAMERON 69 - Ckt 1	Descanso 69kV Bus	C	Bus	Not Rec	97.89%	101.69%	148.50%	Caused by DGs --> Reconductor or curtail gen
SDGE-T-46	22072 CAMERNTP 69 - 22902 CRESTWD 69 - Ckt 1	Descanso 69kV Bus	C	Bus	Not Rec	Not Rec	Not Rec	100.33%	Caused by DGs --> Reconductor or curtail gen
SDGE-T-47	22408 LOSCOCHS 69 - 22004 ALPINE 69 - Ckt 1	EC-LC + LL-LC	C	N-2	Not Rec	Not Rec	Not Rec	130.91%	Reconductor or curtail gen (including DGs)
SDGE-T-48	22408 LOSCOCHS 69 - 22004 ALPINE 69 - Ckt 1	Los Coches 69kV W Bus	C	Bus	Not Rec	Not Rec	Not Rec	135.92%	Reconductor or curtail gen (including DGs)
SDGE-T-49	22408 LOSCOCHS 69 - 22416 LOVELAND 69 - Ckt 1	Los Coches 69kV E Bus	C	Bus	Not Rec	Not Rec	Not Rec	100.66%	Reconductor or curtail gen (including DGs)

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-11	ALPINE 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.06	* +-0.95 pf for DGs * +- 0.95 pf for DGs does not eliminate all the voltage issues. Certain locations on 69kV system were identified for reactors which can eliminate all these high voltage issues. (Torrey Pines, Mission, Miramar, Bay Blvd, Sweetwater, Los Coches, Del Mar, Talega 69kV buses)
SDGE-V-12	ARTESN 69kV	Base system (n-0)	A	N-0	1.04	1.05	1.04	1.05	
SDGE-V-13	B 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-14	BARRETT 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.08	1.05	
SDGE-V-15	BATIQTOS 138kV	Base system (n-0)	A	N-0	1.04	1.04	1.04	1.05	
SDGE-V-16	BATIQTP 138kV	Base system (n-0)	A	N-0	1.04	1.04	1.04	1.05	
SDGE-V-17	BAY BLVD 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-18	BERNDOTP 69kV	Base system (n-0)	A	N-0	1.05	1.06	1.05	1.06	
SDGE-V-19	BLDCRKTP 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.07	1.07	
SDGE-V-20	BOLDRCRK 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.07	1.07	
SDGE-V-21	BORDER 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-22	BORDERTP 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-23	BORREGO 69kV	Base system (n-0)	A	N-0	1.08	1.07	1.08	1.05	
SDGE-V-24	BOULEVRD 138kV	Base system (n-0)	A	N-0	1.04	1.04	1.04	1.04	
SDGE-V-25	CALPK_BD 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-26	CALPK_EC 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-27	CAMERNTP 69kV	Base system (n-0)	A	N-0	1.09	1.09	1.09	1.07	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-28	CAMERON 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.08	1.05	
SDGE-V-29	CANNON 138kV	Base system (n-0)	A	N-0	1.04	1.05	1.04	1.05	
SDGE-V-30	CAPSTRNO 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.07	
SDGE-V-31	CHCARITA 138kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.06	
SDGE-V-32	CHOLLAS 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-33	CLAIRMNT 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-34	CLARMTTP 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-35	CORONADO 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-36	CREELMAN 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.05	
SDGE-V-37	CRESTWD 69kV	Base system (n-0)	A	N-0	1.09	1.09	1.09	1.07	
SDGE-V-38	DEL MAR 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-39	DELMARTP 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-40	DESCANSO 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.07	1.06	
SDGE-V-41	DIVISION 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-42	DOUBLET 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-43	DOUBLTTP 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-44	DUNHILL 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-45	DUNHILTP 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-46	EASTGATE 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-47	EC GEN2 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-48	ECO 138kV	Base system (n-0)	A	N-0	1.04	1.04	1.05	1.04	
SDGE-V-49	ECO 500kV	Base system (n-0)	A	N-0	1.05	1.06	1.06	1.06	
SDGE-V-50	EL CAJON 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-51	ELLIOTT 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.08	
SDGE-V-52	ENCINA 138kV	Base system (n-0)	A	N-0	1.04	1.05	1.04	1.05	
SDGE-V-53	ENCNITAS 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-54	F 69kV	Base system (n-0)	A	N-0	1.08	1.09	1.07	1.09	
SDGE-V-55	FENTON 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-56	FENTONTP 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-57	GARFIELD 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-58	GENESEE 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-59	GLENCLIF 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.08	1.06	
SDGE-V-60	GLNCLFTP 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.08	1.06	
SDGE-V-61	GRANITE 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-62	GRANITTP 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.06	1.07	
SDGE-V-63	IMPRLBCH 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.06	1.08	
SDGE-V-64	JAMACHA 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-65	KEAMDGT2 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.08	
SDGE-V-66	KEAMDGT3 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.08	
SDGE-V-67	KEARNY 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.08	
SDGE-V-68	KETTNER 69kV	Base system (n-0)	A	N-0	1.05	1.06	1.05	1.06	
SDGE-V-69	KUMEYAAY 69kV	Base system (n-0)	A	N-0	1.09	1.09	1.09	1.07	
SDGE-V-70	KYOCERA 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.08	
SDGE-V-71	KYOCRATP 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.08	
SDGE-V-72	LA JOLLA 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-73	LAGNA NL 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.06	
SDGE-V-74	Lkhodges 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.05	1.06	
SDGE-V-75	LOSCOCHS 69kV	Base system (n-0)	A	N-0	1.09	1.09	1.08	1.08	
SDGE-V-76	LRKSP_BD 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-77	MARGARTA 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.07	
SDGE-V-78	MELROSE 69kV	Base system (n-0)	A	N-0	1.04	1.04	1.04	1.05	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-79	MELRSETP 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05	
SDGE-V-80	MESA RIM 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-81	MESAHGTS 69kV	Base system (n-0)	A	N-0	1.08	1.08	1.07	1.08	
SDGE-V-82	MIGUEL 138kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-83	MIGUEL 500kV	Base system (n-0)	A	N-0	1.04	1.05	1.06	1.05	
SDGE-V-84	MIGUEL 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-85	MIGUEL60 138kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-86	MIGUELMP 500kV	Base system (n-0)	A	N-0	1.05	1.05	1.06	1.05	
SDGE-V-87	MIGUELTP 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-88	MIRAMAR 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-89	MIRAMAR1 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-90	MIRAMRTP 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-91	MIRASNT0 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-92	MISSION 69kV	Base system (n-0)	A	N-0	1.08	1.09	1.07	1.09	
SDGE-V-93	ML60 TAP 138kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-94	MONTGMRY 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-95	MONTGYTP 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-96	MURRAY 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.06	1.08	
SDGE-V-97	NARROWS 69kV	Base system (n-0)	A	N-0	1.08	1.06	1.08	1.04	
SDGE-V-98	NATNLCTY 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-99	NAVSTMTR 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.07	
SDGE-V-100	NOISLMTR 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-101	NORTHCTY 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-102	OCEANSDE 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05	
SDGE-V-103	OCNSDETP 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05	
SDGE-V-104	OMWD 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05	
SDGE-V-105	OTAY 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.06	1.08	
SDGE-V-106	OTAY TP 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.06	1.08	
SDGE-V-107	OTAYLAKE 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-108	OTAYLKTP 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-109	OY GEN 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.06	1.08	
SDGE-V-110	PACFCBCH 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.06	
SDGE-V-111	PALOMAR 138kV	Base system (n-0)	A	N-0	1.04	1.05	1.04	1.05	
SDGE-V-112	PARADISE 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-113	PENDLETN 69kV	Base system (n-0)	A	N-0	1.04	1.04	1.04	1.05	
SDGE-V-114	PENSQTOS 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08	
SDGE-V-115	PICO 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.07	
SDGE-V-116	POMERADO 69kV	Base system (n-0)	A	N-0	1.05	1.06	1.05	1.06	
SDGE-V-117	POWAY 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05	
SDGE-V-118	PRCTRVLY 138kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-119	R.CARMEL 69kV	Base system (n-0)	A	N-0	1.04	1.05	1.04	1.05	
SDGE-V-120	R.MSNVJO 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.07	
SDGE-V-121	R.SNTAFE 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-122	R.SNTTP1 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-123	ROSCYNTP 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-124	ROSE CYN 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-125	SAMPSON 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-126	SANLUSRY 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.06	
SDGE-V-127	SANMATEO 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.07	
SDGE-V-128	SANTEE 138kV	Base system (n-0)	A	N-0	1.04	1.05	1.04	1.05	
SDGE-V-129	SANTYSBL 69kV	Base system (n-0)	A	N-0	1.07	1.06	1.07	1.07	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-V-130	SANYSDRO 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-131	SCRIPPS 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07	
SDGE-V-132	SHADOWR 138kV	Base system (n-0)	A	N-0	1.04	1.05	1.04	1.05	
SDGE-V-133	SILVERGT 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07	
SDGE-V-134	SNCRSTMP 500kV	Base system (n-0)	A	N-0	1.07	1.08	1.08	1.09	
SDGE-V-135	SPRNGVLY 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-136	STREAMVW 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-137	STUART 69kV	Base system (n-0)	A	N-0	1.04	1.04	1.04	1.05	
SDGE-V-138	STUARTTP 69kV	Base system (n-0)	A	N-0	1.04	1.04	1.04	1.05	
SDGE-V-139	SUNCREST 230kV	Base system (n-0)	A	N-0	1.05	1.05	1.05	1.06	
SDGE-V-140	SUNCREST 500kV	Base system (n-0)	A	N-0	1.07	1.08	1.08	1.09	
SDGE-V-141	SUNYSDTP 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-142	SUNYSIDE 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07	
SDGE-V-143	SWEETWTR 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-144	SWTWTRTP 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08	
SDGE-V-145	SYCAMORE 138kV	Base system (n-0)	A	N-0	1.05	1.06	1.05	1.06	
SDGE-V-146	SYCAMORE 69kV	Base system (n-0)	A	N-0	1.05	1.06	1.05	1.06	

ID	Substation	Worst Contingency	Category	Category Description	Per Unit Voltages by portfolio				ISO Recommended Solution	
					Base	Trajectory	Time	Environmental		
					off-peak	off-peak	off-peak	off-peak		
SDGE-V-147	TALEGA 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.07		
SDGE-V-148	TELECYN 138kV	Base system (n-0)	A	N-0	1.06	1.06	1.05	1.07		
SDGE-V-149	TOREYPNS 69kV	Base system (n-0)	A	N-0	1.07	1.08	1.07	1.08		
SDGE-V-150	TRABUCO 138kV	Base system (n-0)	A	N-0	1.06	1.05	1.05	1.07		
SDGE-V-151	UCM 69kV	Base system (n-0)	A	N-0	1.07	1.07	1.06	1.08		
SDGE-V-152	URBAN 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.05	1.07		
SDGE-V-153	WABASH 69kV	Base system (n-0)	A	N-0	1.06	1.07	1.06	1.07		
SDGE-V-154	WARCYNTP 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05		
SDGE-V-155	WARENCYN 69kV	Base system (n-0)	A	N-0	1.05	1.05	1.04	1.05		
SDGE-V-156	WARNERS 69kV	Base system (n-0)	A	N-0	1.06	1.06	1.07	1.04		
SDGE-V-157	CAMERNTP 69 kV	Barrett 69kV Bus	C	Bus	1.10	1.10	1.11	1.02		Same mitigation as Cat-B voltage issues
SDGE-V-158	KUMEYAAY 69 kV	Cameron 69kV Bus	C	Bus	1.10	1.11	1.11	1.17		

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-DV-32	BLDCRKTP 69kV	TL0626 ST-BC-DE ck 1	B	N-1	-6.91%	-5.37%	-7.37%	-7.16%	+0.95 to -0.95 power factor control on DGs and/or voltage control equipment
SDGE-DV-33	BOLDRCRK 69kV	TL0626 ST-BC-DE ck 1	B	N-1	-6.91%	-5.12%	-7.37%	-7.16%	
SDGE-DV-34	BORDERTP 69kV	TL0649 BD-OY-SYO ck 1	B	N-1	-4.55%	-5.06%	-3.97%	-5.31%	
SDGE-DV-35	BORREGO 69kV	TL0686 WARNERS-NARROWS ck 1	B	N-1	-8.07%	-6.66%	-8.05%	-4.82%	
SDGE-DV-36	CAMERNTP 69kV	TL0629 BU-CW-CN-GC ck 1	B	N-1	-7.34%	-7.54%	-7.55%	-5.29%	
SDGE-DV-37	CANNON 138kV	TL13801 CANNON-ENCINA ck 1	B	N-1	-5.11%	-5.41%	-5.11%	-5.24%	
SDGE-DV-38	CLARMTTP 69kV	TL0600 CM-KY-RN ck 1	B	N-1	-4.90%	-5.41%	-4.30%	-5.73%	
SDGE-DV-39	CRESTWD 69kV	TL0629 BU-CW-CN-GC ck 1	B	N-1	-8.66%	-8.99%	-9.03%	-7.36%	
SDGE-DV-40	DELMARTP 69kV	TL0666 PQ-DM-DB-DH-TP ck 1	B	N-1	-4.42%	-4.83%	-3.88%	-5.35%	
SDGE-DV-41	DESCANSO 69kV	TL06957 LL-BAR ck 1	B	N-1	-0.19%	-0.37%	-0.18%	-10.10%	
SDGE-DV-42	GLENCLIF 69kV	TL0629 BU-CW-CN-GC ck 1	B	N-1	-6.80%	-6.91%	-6.88%	-4.61%	
SDGE-DV-43	GLNCLFTP 69kV	TL0629 BU-CW-CN-GC ck 1	B	N-1	-6.81%	-6.91%	-6.88%	-4.61%	
SDGE-DV-44	KUMEYAAY 69kV	TL0629 BU-CW-CN-GC ck 1	B	N-1	-8.60%	-8.95%	-8.99%	-7.32%	
SDGE-DV-45	KYOCERA 69kV	TL0672 KY-KA-MSH ck1	B	N-1	-4.83%	-5.37%	-4.21%	-5.61%	
SDGE-DV-46	KYOCRATP 69kV	TL0672 KY-KA-MSH ck1	B	N-1	-6.68%	-7.22%	-6.06%	-7.46%	
SDGE-DV-47	LRP-U1-A 230kV	TL50001A SPS+IV Gens+23050 SPS6.2A	B	N-1	1.52%	2.05%	2.44%	2.60%	
SDGE-DV-48	MESA RIM 69kV	LD_MRM OPEN 675 PEAK MRM/MR/SS	B	N-1	-6.15%	-6.14%	-6.07%	-6.19%	

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution	
					Base	Trajectory	Time	Environmental		
					off-peak	off-peak	off-peak	off-peak		
SDGE-DV-49	ML60 TAP 138kV	TL13824 LOSCOCHS-TELCYN-ML60 ck 1	B	N-1	-4.45%	-5.22%	-3.51%	-5.48%		
SDGE-DV-50	MONTGYTP 69kV	TL0642 MG - SW - BAY BLVD ck 1	B	N-1	-4.51%	-5.06%	-3.92%	-5.42%		
SDGE-DV-51	NARROWS 69kV	TL0686 WARNERS-NARROWS ck 1	B	N-1	-7.56%	-7.89%	-7.65%	-4.28%		
SDGE-DV-52	OTAY TP 69kV	TL0623 IB-OY-SYO ck 1	B	N-1	-4.76%	-5.30%	-4.17%	-5.65%		
SDGE-DV-53	OTAYLAKE 69kV	TL0649 BD-OY-SYO ck 1	B	N-1	-4.55%	-5.06%	-3.96%	-5.31%		
SDGE-DV-54	OTAYLKTP 69kV	TL0649 BD-OY-SYO ck 1	B	N-1	-4.86%	-5.39%	-4.27%	-5.72%		
SDGE-DV-55	OY GEN 69kV	TL06929 OTAY to OY GEN 69 ck 1	B	N-1	-4.77%	-5.31%	-4.19%	-5.66%		
SDGE-DV-56	ROSCYNTP 69kV	TL0617 PB-RN-LJ ck 1	B	N-1	-6.62%	-7.11%	-6.05%	-7.50%		
SDGE-DV-57	SANTYSBL 69kV	TL06957 LL-BAR ck 1	B	N-1	-0.17%	-0.25%	-0.25%	-5.58%		
SDGE-DV-58	WARENCYN 69kV	TL0634 ESCO-WC-POW ck 1	B	N-1	-4.61%	-2.75%	-4.11%	-5.42%		
SDGE-DV-59	WARNERS 69kV	TL0687 BORREGO-NARROWS ck 1	B	N-1	0.17%	0.22%	0.24%	7.13%		
SDGE-DV-60	ARTESN 69 kV	ARTESIAN 69 kV BUS	C	Bus	-4.46%	-3.68%	-2.74%	-5.05%		+0.95 to -0.95 power factor control on DGs and/or SPS and/or voltage control equipment
SDGE-DV-61	BARRETT 69 kV	Barrett 69kV Bus	C	Bus	-8.04%	-6.28%	-7.70%	-5.34%		
SDGE-DV-62	BATIQTOS 138 kV	BATIQTOS 138 kV BT CB	C	CB	-4.21%	-4.48%	-3.73%	-5.11%		
SDGE-DV-63	BLDCRKTP 69 kV	DE-ST-BC + CRE-ST	C	N-2	-6.91%	-5.37%	-7.37%	Not Solved		
SDGE-DV-64	BOLDRCRK 69 kV	DE-ST-BC + CRE-ST	C	N-2	-6.91%	-5.12%	-7.37%	Not Solved		
SDGE-DV-65	CAMERNTP 69 kV	Descanso 69kV Bus	C	Bus	-1.36%	-1.65%	-2.16%	-9.15%		

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-DV-66	BORREGO 69 kV	NARROWS 69 kV BUS	C	Bus	-8.07%	-6.66%	-8.05%	-4.82%	
SDGE-DV-67	CAMERON 69 kV	Cameron 69kV Bus	C	Bus	-8.08%	-6.61%	-8.01%	-3.90%	
SDGE-DV-68	CANNON 138 kV	EA-CAN & EA-BQ-PQ	C	N-2	-5.10%	-5.41%	-5.10%	-5.23%	
SDGE-DV-69	CHCARITA 138 kV	CHICARITA 138 kV BT CB	C	CB	-4.68%	-5.13%	-4.22%	-5.53%	
SDGE-DV-70	CLARMTTP 69 kV	CM-KY-RN + KY-KA-MSH	C	N-2	-4.90%	-5.41%	-4.30%	-5.73%	
SDGE-DV-71	DESCANSO 69 kV	Descanso 69kV Bus	C	Bus	-7.38%	-5.85%	-7.24%	-5.51%	
SDGE-DV-72	GARFIELD 69 kV	GARFIELD 69 kV BUS	C	Bus	-4.84%	-5.43%	-4.14%	-5.20%	
SDGE-DV-73	GLENCLIF 69 kV	Descanso 69kV Bus	C	Bus	-0.98%	-1.18%	-1.65%	-8.65%	
SDGE-DV-74	GLNCLFTP 69 kV	Descanso 69kV Bus	C	Bus	-0.99%	-1.18%	-1.65%	-8.65%	
SDGE-DV-75	KYOCERA 69 kV	CM-KY-RN + KY-KA-MSH	C	N-2	-4.83%	-5.37%	-4.21%	-5.61%	
SDGE-DV-76	KYOCRATP 69 kV	CM-KY-RN + KY-KA-MSH	C	N-2	-6.68%	-7.22%	-6.06%	-7.46%	
SDGE-DV-77	LAGNA NL 138 kV	LAGUNA NIGUEL 138kV BT	C	CB	-5.64%	-3.36%	-3.57%	-6.43%	
SDGE-DV-78	LOVELAND 69 kV	Loveland 69kV Bus	C	Bus	-7.92%	-5.30%	-7.12%	Not Solved	
SDGE-DV-79	MARGARTA 138 kV	MARGARITA 138kV BT CB	C	CB	-5.71%	-5.13%	-5.34%	-6.51%	
SDGE-DV-80	MIRAMAR1 69 kV	PQ-MR1-RN + FE-MR1-MR	C	N-2	-4.66%	-5.13%	-4.15%	-5.54%	
SDGE-DV-81	MONTGMRY 69 kV	Montgomery 69kV Bus	C	Bus	-4.51%	-5.06%	-3.93%	-5.42%	
SDGE-DV-82	MURRAY 69 kV	Murray 69kV N Bus	C	Bus	-2.38%	-2.32%	-2.48%	-2.93%	

ID	Substation	Worst Contingency	Category	Category Description	Voltage Deviation by portfolio (%)				ISO Recommended Solution
					Base	Trajectory	Time	Environmental	
					off-peak	off-peak	off-peak	off-peak	
SDGE-DV-83	NARROWS 69 kV	NARROWS 69 kV BUS	C	Bus	-7.56%	-7.89%	-7.65%	-4.28%	
SDGE-DV-84	OTAY 69 kV	Otay 69kV E Bus	C	Bus	-6.97%	-4.01%	-2.89%	-7.86%	
SDGE-DV-85	OTAY TP 69 kV	IB-OY-SYO + OT-OT GEN	C	N-2	-4.76%	-5.30%	-4.17%	-5.65%	
SDGE-DV-86	OY GEN 69 kV	IB-OY-SYO + OT-OT GEN	C	N-2	-4.77%	-5.31%	-4.19%	-5.66%	
SDGE-DV-87	PICO 138 kV	PICO 138kV BT CB	C	CB	-5.80%	-3.23%	-3.42%	-6.59%	
SDGE-DV-88	PRCTRVLV 138 kV	Proctor Valley 138kV Bus	C	Bus	-6.03%	-5.32%	-3.57%	-7.17%	
SDGE-DV-89	SANTEE 138 kV	SANTEE 138kV BT CB	C	CB	-4.49%	-5.05%	-3.90%	-5.06%	
SDGE-DV-90	SANTYSBL 69 kV	Santa Ysabel 69kV Bus	C	Bus	-6.52%	-4.92%	-7.20%	Not Solved	
SDGE-DV-91	TRABUCO 138 kV	TRABUCO 138kV BT CB	C	CB	-5.72%	-3.54%	-3.75%	-6.52%	
SDGE-DV-92	WARNERS 69 kV	NARROWS 69 kV BUS	C	Bus	-0.23%	0.05%	0.05%	6.03%	
SDGE-DV-93	WARNERS 69 kV	Warners 69kV Bus	C	Bus	-5.96%	-4.24%	-6.69%	-4.13%	
SDGE-DV-94	CRESTWD 69 kV	Descanso 69kV Bus	C	Bus	-1.35%	-1.63%	-2.14%	-8.73%	
SDGE-DV-95	KUMEYAAY 69 kV	CRESTWOOD 69 kV Bus	C	Bus	-8.60%	-8.95%	-8.99%	-7.32%	
SDGE-DV-96	ML60 TAP 138 kV	13809/13824 PV-TC & LC-ML	C	N-2	-4.45%	-5.22%	-3.51%	-5.48%	

ID	Contingency	System Performance	ISO Recommended Mitigation
SDGE-S-01	Otay Mesa PP + Southwest Power Link (SWPL)	* Voltage Collapse (Base portfolio) * Voltage deviation issues in remaining portfolio	Reactive support and/or a minimum internal generation within San Diego area