Study Area: PG&E Central Valley

Thermal Overloads

California ISO

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-T-1	Vaca-Plainfield 60 kV line	Normal	P0	Normal	102	NA	NA	40	NA	107	NA	NA	NA	NA	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-2	Nicolaus - Marysville 60 kV Line (Plumas-East Nicolaus)	Normal	P0	Normal	65	79	102	28	29	69	78	79	106	101	Reconductor
CVLY-T-3	Cortina 230/115/60 kV Transformer No. 1	CORTINA 230/115kV TB 4	P1	N-1	105	104	101	58	46	116	102	110	100	115	Existing operating procedure
CVLY-T-4	Cortina 60 kV Line No. 2	CORTINA #1 60kV	P1	N-1	94	85	88	39	34	101	85	85	97	89	Preferred resource
CVLY-T-5	Vaca 115/60 kV transformer #5	VACA-DIX 115/60kV TB 9	P1	N-1	115	NA	NA	66	NA	119	NA	NA	NA	NA	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-6	East Nicolaus 115/60 kV Transformer No. 2	E.NICOLS 115/60kV TB 3	P1	N-1	73	81	96	32	31	78	82	81	104	96	Preferred resource
CVLY-T-7	East Nicolaus 115/60 kV Transformer No. 3	E.NICOLS 115/60kV TB 2	P1	N-1	73	81	96	32	31	78	82	81	104	96	Preferred resource
CVLY-T-8	Placer - Del Mar 60 kV Line (Penryn-Sierra Pine)	PLACER-DEL MAR 60kV	P1	N-1	93	81	92	37	29	102	83	81	106	92	Preferred resource
CVLY-T-9	Valley Springs - Martell 60 kV Line No. 1	VALLEY SPRINGS-CLAY 60kV	P1	N-1	119	111	111	71	58	124	116	110	119	111	Disable automatics
CVLY-T-10	Manteca 115/60 kV Transformer No. 3	KASSON 115/60kV TB 1	P1	N-1	174	165	178	93	78	180	178	165	191	178	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-11	Manteca - Louise 60 kV Line	KASSON 115/60kV TB 1	P1	N-1	126	121	136	72	63	131	131	121	148	135	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-12	Kasson - Louise 60 kV Line	KASSON 115/60kV TB 1	P1	N-1	94	91	107	48	40	98	96	91	117	106	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-13	Missouri Flat - Gold Hill 115 kV No. 1 Line	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	90	68	79	22	17	114	74	69	101	78	Transfer trip to open other end
CVLY-T-14	Dixon-Vaca #2 60 kV	DIXON-VACA #1 60kV [6730] (VACA-DXN-VACA-JT1)	P2-1	Line section w/o fault	112	NA	NA	72	NA	116	NA	NA	NA	NA	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-15	Drum - Rio Oso 115 kV No. 2 Line	DRUM-HIGGINS 115kV [4393] (CHCGO PK-HIGGINS)	P2-1	Line section w/o fault	113	112	100	105	47	116	111	109	100	98	Drum operating procedure
CVLY-T-16	Drum - Rio Oso 115 kV No. 1 Line	DRUM-HIGGINS 115kV [4393] (CHCGO PK-HIGGINS)	P2-1	Line section w/o fault	102	103	90	103	44	103	102	100	87	88	Drum operating procedure
CVLY-T-17	Eldorado - Missouri Flat 115 kV No. 2 Line	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	200	153	174	60	47	252	165	154	221	173	Transfer trip to open other end

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CVLY-T-18	Eldorado - Missouri Flat 115 kV No. 1 Line	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	179	135	155	43	34	225	147	136	200	155	Transfer trip to open other end
CVLY-T-19	Valley Springs - Martell 60 kV Line No. 1	VALLEY SPRINGS-CLAY 60kV [8264] (CLAY-BUENA_TP)	P2-1	Line section w/o fault	120	111	112	71	59	124	116	118	119	111	Disable automatics
CVLY-T-20	Stagg - Hammer 60 kV Line No. 1	HAMMER-COUNTRY CLUB 60kV [7010] (CNTRY CB-UOP)	P2-1	Line section w/o fault	119	42	57	57	20	122	44	43	60	56	Short Term : Action Plan; Long Term : Missouri Flat-Gold Hill 115 kV line project.
CVLY-T-21	Lockeford - Industrial 60 kV Line	LOCKEFORD-LODI #2 60kV [7440] (LOCKEFRD-VICTOR)	P2-1	Line section w/o fault	100	78	NA	69	68	101	79	77	NA	NA	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-22	Brighton - Davis 115 kV Line	RIO OSO 115kV - Section 1D & 2D	P2	Bus-tie breaker	119	39	31	51	38	129	36	40	38	39	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-23	Cortina 230/115/60 kV Transformer No. 1	CORTINA 230kV - Ring R2 & R3	P2	Non-bus-tie breaker	107	91	99	44	60	100	91	110	106	115	Existing operating procedure
CVLY-T-24	Cortina 60 kV Line No. 2	CORTINA - MA 60kV & CORTINA #1 line	P2	Non-bus-tie breaker	94	84	88	39	34	100	84	84	97	88	Preferred resource
CVLY-T-25	Bogue - Rio Oso 115 kV Line	RIO OSO 230kV - Section 2D & 1D	P2	Bus-tie breaker	122	107	55	52	36	128	101	101	56	55	Short Term : Action Plan; Long Term : South of Palermo 115 kV Reinforcement Project
CVLY-T-26	Drum - Rio Oso 115 kV No. 1 Line	DRUM 115kV - Ring R4 & R3	P2	Non-bus-tie breaker	184	187	104	206	42	188	186	187	102	101	Drum operating procedure
CVLY-T-27	Drum 115/60 kV Transformer No. 1	DRUM 115kV - Ring R4 & R3	P2	Non-bus-tie breaker	144	149	55	179	20	149	147	149	53	52	Drum operating procedure
CVLY-T-28	Stanislaus-Melones-Manteca 115 kV Line No. 1	TESLA 115kV - Section 2D & 1D	P2	Bus-tie breaker	98	36	57	Diverge	131	118	52	46	83	57	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-29	Riverbank Jct - Manteca 115 kV Line	TESLA 115kV - Section 2D & 1D	P2	Bus-tie breaker	126	52	74	Diverge	116	145	68	62	101	74	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-30	Bellota-Riverbank-Melones 115 kV Line	TESLA 115kV - Section 2D & 1D	P2	Bus-tie breaker	107	19	31	Diverge	109	136	28	28	75	43	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-31	Stagg - Hammer 60 kV Line No. 1	CNTRY CB 60kV Section 1E	P2	Bus	119	42	57	57	21	122	45	43	60	56	Short Term : Action Plan; Long Term : Stagg – Hammer 60 kV Line project.

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CVLY-T-32	Hammer - Country Club 60 kV	STAGG 60kV - Section ME & MD	P2	Bus-tie breaker	<90	133	<90	<90	<90	<90	182	132	<90	<90	Operating solution
CVLY-T-33	Lockeford No. 1 60 kV Line	STAGG 60kV - Section ME & MD	P2	Bus-tie breaker	<90	108	<90	<90	<90	<90	193	108	<90	<90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-34	Manteca - Louise 60 kV Line	KASSON 115kV Section 1D	P2	Bus	128	122	137	73	63	133	132	122	150	137	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-35	Kasson - Louise 60 kV Line	KASSON - 1D 115kV & SCHULTE SW STA-KASSON-MANTECA line	P2	Non-bus-tie breaker	95	94	109	49	41	100	98	94	119	109	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-36	Stanislaus - Melones Sw 115 kV Line	TESLA 115kV - Section 2D & 1D	P2	Bus-tie breaker	127	52	74	Diverge	116	145	69	62	102	74	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-37	Brighton - Davis 115 kV Line	WOODLAND 14kV Gen Unit 1 & WEST SACRAMENTO-BRIGHTON 115kV [4110]	P3	G-1/N-1	99	<90	<90	<90	<90	103	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-38	Vaca Dixon 230/115 kV Transformer No. 3	WOLFSKIL 14kV Gen Unit 1 & VACA-DIX 230/115kV TB 4	P3	G-1/N-1	100	<90	<90	<90	<90	104	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-39	Vaca Dixon 230/115 kV Transformer No. 4	WOLFSKIL 14kV Gen Unit 1 & VACA-DIX 230/115kV TB 3	P3	G-1/N-1	100	<90	<90	<90	<90	104	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-40	Cortina 230/115/60 kV Transformer No. 1	WADHAM 9kV Gen Unit 1 & CORTINA 230/115kV TB 4	P3	G-1/N-1	122	111	115	<90	<90	132	113	111	125	107	Existing operating procedure
CVLY-T-41	Vaca 115/60 kV transformer #5	WOLFSKIL 14kV Gen Unit 1 & VACA-DIX 115/60kV TB 9	P3	G-1/N-1	115	<90	<90	<90	<90	119	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-42	Pease - Rio Oso 115 kV Line	WOODLAND 14kV Gen Unit 1 & PALERMO-NICOLAUS 115kV [3210]	P3	G-1/N-1	<90	90	<90	<90	<90	100	<90	<90	<90	<90	Short Term : Action Plan; Long Term : South of Palermo 115 kV Reinforcement Project
CVLY-T-43	Drum - Higgins 115 kV Line	DTCHFLT1 11kV Gen Unit 1 & CHI.PARK 12kV Gen Unit 1	P3	G-1/N-1	99	100	<90	<90	<90	101	100	100	<90	<90	Drum operating procedure
CVLY-T-44	Stockton 'A' - Weber 60 kV Line No. 1	COG.NTNL 14kV Gen Unit 1 & STOCKTON A-WEBER #2 60kV [8130]	P3	G-1/N-1	102	<90	<90	<90	<90	105	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Stockton 'A' –Weber 60 kV Line Nos. 1 and 2 Reconductor Project
CVLY-T-45	Manteca 115/60 kV Transformer No. 3	GWFTRCY3 14kV Gen Unit 1 & KASSON 115/60kV TB 1	P3	G-1/N-1	174	166	178	<90	<90	180	178	166	192	178	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-46	Manteca - Louise 60 kV Line	GWFTRCY3 14kV Gen Unit 1 & KASSON 115/60kV TB 1	P3	G-1/N-1	127	<90	137	<90	<90	133	132	120	149	136	Short Term : Action Plan; Long Term : Kasson SPS

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CVLY-T-47	Kasson - Louise 60 kV Line	GWFTRCY3 14kV Gen Unit 1 & KASSON 115/60kV TB 1	P3	G-1/N-1	95	92	107	<90	<90	99	97	92	118	107	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-48	Cortina 230/115/60 kV Transformer No. 1	Cortina 115kV BAAH Bus #2 (failure of non-redundent relay)	P5	Non-redndant relay (bus)	<90	<90	<90	<90	<90	<90	<90	110	<90	<90	Existing operating procedure
CVLY-T-49	RIO OSO-SPI JCT 115 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5	Non-redndant relay (bus)	129	109	50	41	33	142	114	121	54	52	Short Term : Action Plan; Long Term : Rio Oso – Atlantic 230 kV Line Project
CVLY-T-50	Lincoln - Pleasant Grove 115 kV Line	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5	Non-redndant relay (bus)	134	112	83	44	36	148	117	124	92	97	Short Term : Action Plan; Long Term : Rio Oso – Atlantic 230 kV Line Project
CVLY-T-51	Tesla - Tracy 115 kV Line	Schulte 115kV BAAH Bus #1 (failure of non-redundent relay)	P5	Non-redndant relay (bus)	103	70	77	34	23	108	75	73	84	78	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-52	Birds Landing - Contra Costa PP 230 kV Line	LAMBIE SW STA-BIRDS LANDING SW STA 230kV [5820] & BIRDS LANDING SW STA-CONTRA COSTA SUB 230kV [6161]	P6	N-1/N-1	<90	<90	<90	99	100	<90	<90	<90	<90	<90	Reduce generation in Birds Landing area following the first contingency.
CVLY-T-53	Woodland-Davis 115 kV line	WEST SACRAMENTO-DAVIS 115kV [4120] & BRIGHTN-DAVIS-BRKR SLG 115kV [0]	P6	N-1/N-1	128	<90	<90	<90	<90	138	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-54	Brighton 230/115 kV Transformer No. 9	WDLND_BM-WOODLD-DAVIS 115kV [4210] & BRIGHTON 230/115kV TB 10	P6	N-1/N-1	95	<90	<90	<90	<90	100	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-55	Brighton - Davis 115 kV Line	WDLND_BM-WOODLD-DAVIS 115kV [4210] & WEST SACRAMENTO-DAVIS 115kV [4120]	P6	N-1/N-1	122	<90	<90	<90	<90	130	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-56	Vaca Dixon 230/115 kV Transformer No. 3	VACA-DIX 230/115kV TB 4 & WOLFSKIL 14kV Gen Unit 1	P6	N-1/N-1	109	96	100	<90	<90	115	100	100	103	100	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-57	Vaca Dixon 230/115 kV Transformer No. 4	VACA-DIX 230/115kV TB 3 & WOLFSKIL 14kV Gen Unit 1	P6	N-1/N-1	109	96	100	<90	<90	115	100	100	103	100	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-58	Gold Hill 230/115 kV Transformer No. 1	GOLDHILL 230/115kV TB 2 & DRUM-HIGGINS 115kV [4393]	P6	N-1/N-1	100	92	<90	<90	<90	109	96	93	<90	<90	Short Term : Action Plan; Long Term : Atlantic-Placer 115 kV line project.
CVLY-T-59	Gold Hill 230/115 kV Transformer No. 2	GOLDHILL 230/115kV TB 1 & DRUM-HIGGINS 115kV [4393]	P6	N-1/N-1	100	92	<90	<90	<90	110	96	93	<90	<90	Short Term : Action Plan; Long Term : Atlantic-Placer 115 kV line project.

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CVLY-T-60	Missouri Flat - Gold Hill 115 kV No. 1 Line	MISSOURI FLAT-GOLD HILL #2 115kV [2670] & GOLD HILL-CLARKSVILLE 115kV [9430]	P6	N-1/N-1	116	<90	<90	<90	<90	127	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Missouri Flat-Gold Hill 115 kV line project.
CVLY-T-61	Cortina 230/115/60 kV Transformer No. 1	CORTINA 115/60kV TB 5 & WADHAM 9kV Gen Unit 1	P6	N-1/N-1	122	111	115	<90	<90	132	113	116	125	121	Existing operating procedure
CVLY-T-62	Vaca 115/60 kV transformer #5	VACA-DIX 115/60kV TB 9 & DIXON-VACA #2 60kV [6740]	P6	N-1/N-1	137	<90	<90	<90	<90	142	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-63	Rio Oso 230/115 kV Bank No. 1	RIO OSO-BRIGHTON 230kV [5600] & RIO OSO 230/115kV TB 2	P6	N-1/N-1	102	<90	<90	<90	<90	103	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Rio Oso 230/115 kV Transformer Upgrades Project
CVLY-T-64	Rio Oso 230/115 kV Bank No. 2	RIO OSO 230/115kV TB 1 & RIO OSO-BRIGHTON 230kV [5600]	P6	N-1/N-1	100	<90	<90	<90	<90	100	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Rio Oso 230/115 kV Transformer Upgrades Project
CVLY-T-65	Drum - Rio Oso 115 kV No. 1 Line	DRUM-RIO OSO #2 115kV [1431] & PLACER-HIGGINS 115kV [1412]	P6	N-1/N-1	159	168	172	191	<90	156	167	171	103	104	Drum operating procedure
CVLY-T-66	Drum - Rio Oso 115 kV No. 2 Line	DRUM-RIO OSO #1 115kV [4393] & PLACER-HIGGINS 115kV [1412]	P6	N-1/N-1	100	100	<90	203	<90	100	100	98	<90	<90	Drum operating procedure
CVLY-T-67	RIO OSO-SPI JCT 115 kV	RIO OSO-ATLANTIC 230kV [5590] & ATLANTIC-GOLD HILL 230kV [4330]	P6	N-1/N-1	97	<90	<90	<90	<90	108	<90	92	<90	<90	Short Term : Action Plan; Long Term : Rio Oso – Atlantic 230 kV Line Project
CVLY-T-68	Drum - Higgins 115 kV Line	GOLDHILL 230/115kV TB 1 & GOLDHILL 230/115kV TB 2	P6	N-1/N-1	<90	91	100	<90	<90	95	<90	<90	<90	100	Drum operating procedure
CVLY-T-69	Drum 115/60 kV Transformer No. 1	DRUM-RIO OSO #2 115kV [1431] & PLACER-HIGGINS 115kV [1412]	P6	N-1/N-1	144	148	146	178	<90	151	147	148	<90	<90	Drum operating procedure
CVLY-T-70	Table Mountain-Pease 60 kV Line (Peachton-Gridley)	WEST SACRAMENTO-BRIGHTON 115kV [4110] & PEAS RG 60/60kV TB 1	P6	N-1/N-1	101	<90	<90	<90	<90	96	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Pease 115/60 kV Transformer Addition and Bus Upgrade project.
CVLY-T-71	East Nicolaus 115/60 kV Transformer No. 2	RIO OSO-NICOLAUS 115kV [3440] & E.NICOLS 115/60kV TB 3	P6	N-1/N-1	<90	<90	118	<90	<90	<90	<90	<90	127	118	Replace transformer
CVLY-T-72	East Nicolaus 115/60 kV Transformer No. 3	RIO OSO-NICOLAUS 115kV [3440] & E.NICOLS 115/60kV TB 2	P6	N-1/N-1	<90	<90	118	<90	<90	<90	<90	<90	127	118	Replace transformer
CVLY-T-73	Lincoln - Pleasant Grove 115 kV Line	RIO OSO-ATLANTIC 230kV [5590] & ATLANTIC-GOLD HILL 230kV [4330]	P6	N-1/N-1	101	<90	<90	<90	<90	112	<90	94	<90	<90	Short Term : Action Plan; Long Term : Rio Oso – Atlantic 230 kV Line Project
CVLY-T-74	Drum - Grass Valley - Weimar 60 kV Line	RIO OSO-WEST SACRAMENTO 115kV [3450] & COLGATE-GRASS VALLEY 60kV [6490]	P6	N-1/N-1	101	<90	<90	<90	<90	103	<90	<90	98	<90	Drum operating procedure

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CVLY-T-75	Placer 115/60 kV Transformer No. 1	PLACER 115/60kV TB 2 & HALSEY 60/6.6kV TB 1	P6	N-1/N-1	<90	<90	<90	<90	<90	101	<90	<90	104	<90	Short Term : Action Plan; Long Term : Pease 115/60 kV Transformer Addition and Bus Upgrade project.
CVLY-T-76	Placer - Del Mar 60 kV Line (Penryn-Sierra Pine)	ATLANTC SVD=v & PLACER-DEL MAR 60kV [7800] (Placer-Penryn Sec)	P6	N-1/N-1	<90	<90	<90	<90	<90	95	<90	<90	100	<90	Preferred resource
CVLY-T-77	Schulte - Kasson - Manteca 115 kV Line	TESLA-TRACY 115kV [4020] & SCHULTE SW STA-LAMMERS 115kV [3993]	P6	N-1/N-1	120	<90	<90	<90	<90	126	91	<90	98	92	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-78	Vierra - Tracy - Kasson 115 kV Line	SCHULTE SW STA-LAMMERS 115kV [3993] & SCHULTE SW STA-KASSON-MANTECA 115kV [7472]	P6	N-1/N-1	115	<90	<90	<90	<90	121	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-79	Tesla - Tracy 115 kV Line	SCHULTE SW STA-LAMMERS 115kV [3993] & SCHULTE SW STA-KASSON-MANTECA 115kV [7472]	P6	N-1/N-1	117	<90	<90	<90	<90	123	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Vierra 115 kV Looping Project
CVLY-T-80	Stagg - Country Club 60 kV Line No. 1	STAGG-COUNTRY CLUB #2 60kV [8090] & STAGG-HAMMER 60kV [8100]	P6	N-1/N-1	135	<90	<90	<90	<90	141	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Stagg – Hammer 60 kV Line project.
CVLY-T-81	Stagg - Country Club 60 kV Line No. 2	STAGG-COUNTRY CLUB #1 60kV [8080] & STAGG-HAMMER 60kV [8100]	P6	N-1/N-1	135	<90	<90	<90	<90	141	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Stagg – Hammer 60 kV Line project.
CVLY-T-82	Stagg - Hammer 60 kV Line No. 1	STAGG-COUNTRY CLUB #1 60kV [8080] & STAGG-COUNTRY CLUB #2 60kV [8090]	P6	N-1/N-1	136	<90	<90	<90	<90	142	<90	<90	<90	<90	Short Term : Action Plan; Long Term : Stagg – Hammer 60 kV Line project.
CVLY-T-83	Hammer - Country Club 60 kV	STAGG-COUNTRY CLUB #1 60kV [8080] & STAGG-COUNTRY CLUB #2 60kV [8090]	P6	N-1/N-1	96	<90	92	<90	<90	101	<90	<90	98	91	Operating solution
CVLY-T-84	Lockeford 230/60 kV Transformer No. 2	HAMMER-COUNTRY CLUB 60kV [7010] & LOCKFORD 230/60kV TB 3	P6	N-1/N-1	97	102	<90	<90	<90	94	104	102	<90	<90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-85	Lockeford 230/60 kV Transformer No. 3	HAMMER-COUNTRY CLUB 60kV [7010] & LOCKFORD 230/60kV TB 2	P6	N-1/N-1	97	102	<90	<90	<90	94	104	102	<90	<90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-86	Lockeford - Lodi 60 kV Line No. 1	LOCKEFORD-INDUSTRIAL 60kV [7420] & LOCKEFORD-LODI #2 60kV [7440]	P6	N-1/N-1	115	108	NA	96	NA	117	110	108	NA	NA	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.

Study Area: PG&E Central Valley

Thermal Overloads

California ISO

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-T-87	Lockeford - Lodi 60 kV Line No. 2	LODI-INDUSTRIAL 60kV [6755] & LOCKEFORD-INDUSTRIAL 60kV [7420]	P6	N-1/N-1	121	116	NA	NA	110	122	117	116	NA	NA	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-88	Lockeford - Lodi 60 kV Line No. 3	LOCKEFORD-INDUSTRIAL 60kV [7420] & LOCKEFORD-LODI #2 60kV [7440]	P6	N-1/N-1	149	140	NA	128	127	151	143	140	NA	NA	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-89	Lockeford - Industrial 60 kV Line	LOCKEFORD-LODI #2 60kV [7440] & LODI-INDUSTRIAL 60kV [6755]	P6	N-1/N-1	109	105	NA	102	105	109	105	104	NA	NA	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-90	Kasson 115/60 kV Transformer No. 1	MANTECA-VIERRA 115kV [2190] & SCHULTE SW STA-KASSON-MANTECA 115kV [7472]	P6	N-1/N-1	99	<90	94	<90	<90	99	<90	<90	100	96	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-T-91	Lodi - Industrial 60 kV Line	LOCKEFORD-LODI #2 60kV [7440] & LOCKEFORD-INDUSTRIAL 60kV [7420]	P6	N-1/N-1	115	111	NA	108	109	116	111	110	NA	NA	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-T-92	Delevan-Cortina 230 kV Line	Delevan-Vaca Dixon No.2 230 kV Line & Delevan-Vaca Dixon No.3 230 kV Line	P7	DCTL	70	107	68	42	48	72	72	69	69	71	Preferred resource
CVLY-T-93	Brighton - Davis 115 kV Line	Rio Oso-West Sacramento 115 kV Line & West Sacramento-Brighton 115 kV Line	P7	DCTL	97	40	35	41	41	105	38	39	41	39	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-T-94	Pease - Rio Oso 115 kV Line	Colgate-Rio Oso 230 kV Line & Table Mountain-Rio Oso 230 kV Line	P7	DCTL	105	119	61	23	50	114	107	107	61	52	Short Term : Action Plan; Long Term : South of Palermo 115 kV Reinforcement Project
CVLY-T-95	Bogue - Rio Oso 115 kV Line	Colgate-Rio Oso 230 kV Line & Table Mountain-Rio Oso 230 kV Line	P7	DCTL	106	112	55	38	39	112	103	102	54	55	Short Term : Action Plan; Long Term : South of Palermo 115 kV Reinforcement Project
CVLY-T-96	RIO OSO-SPI JCT 115 kV	Rio Oso-Atlantic 230 kV Line & Rio Oso-Gold Hill 230 kV Line	P7	DCTL	95	114	60	52	52	98	111	111	62	61	Short Term : Action Plan; Long Term : Rio Oso – Atlantic 230 kV Line Project
CVLY-T-97	Drum - Higgins 115 kV Line	Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line	P7	DCTL	106	117	83	75	42	110	112	107	83	80	Drum operating procedure
CVLY-T-98	Lincoln - Pleasant Grove 115 kV Line	Rio Oso-Atlantic 230 kV Line & Rio Oso-Gold Hill 230 kV Line	P7	DCTL	98	117	83	55	56	101	114	114	92	97	Short Term : Action Plan; Long Term : Rio Oso – Atlantic 230 kV Line Project
CVLY-T-99	Valley Springs - Martell 60 kV Line No. 1	VALLEY SPRINGS-CLAY 60kV [8252] & VALLEY SPRINGS #2 60kV [8231]	P7	DCTL	119	110	111	71	58	124	116	110	119	111	Disable automatics

Study Area: PG&E Central Valley

Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-T-100	Stagg - Hammer 60 kV Line No. 1	STAGG-COUNTRY CLUB #1 60kV [8080] & STAGG-COUNTRY CLUB #2 60kV [8090]	P7	DCTL	150	54	71	71	26	156	57	55	75	71	Short Term : Action Plan; Long Term : Stagg – Hammer 60 kV Line project.
CVLY-T-101	Hammer - Country Club 60 kV	STAGG-COUNTRY CLUB #1 60kV [8080] & STAGG-COUNTRY CLUB #2 60kV [8090]	P7	DCTL	106	67	101	51	28	111	70	68	107	100	Operating solution

Study Area: PG&E Central Valley

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-VD-1	BANTA 60 kV	KASSON 115/60kV TB 1	P1	N-1	5.9	5.5	6.5	2.1	0.7	6.2	6.0	5.5	7.2	6.5	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-VD-2	BARRY 60 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	4.8	7.8	6.9	1.0	-2.1	5.1	8.6	7.8	8.8	7.7	Nicolaus 60 kV voltage support
CVLY-VD-3	CALVO 60 kV	KASSON 115/60kV TB 1	P1	N-1	5.2	4.9	5.8	1.8	0.6	5.5	5.3	4.8	6.4	5.8	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-VD-4	CARBONA 60 kV	KASSON 115/60kV TB 1	P1	N-1	6.0	5.6	6.6	2.1	0.7	6.3	6.1	5.6	7.4	6.6	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-VD-5	CATLETT 60 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	4.7	7.7	6.8	1.0	-2.1	5.0	8.5	7.8	8.7	7.6	Nicolaus 60 kV voltage support
CVLY-VD-6	COLONY 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	10.2	1.7	0.2	1.4	1.2	11.2	0.9	1.4	0.3	0.3	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-7	CORT_D 115 kV	CORTINA 230/115kV TB 4	P1	N-1	0.2	2.5	1.0	-1.9	1.1	0.1	1.1	5.3	1.7	5.3	Cortina area voltage support
CVLY-VD-8	DEEPWATR 115 kV	WEST SACRAMENTO-BRIGHTON 115kV	P1	N-1	6.7	2.3	0.6	-0.6	0.5	7.6	1.8	2.1	2.1	2.0	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-9	DIST1500 60 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	4.7	7.6	6.8	1.0	-2.1	5.0	8.4	7.7	8.6	7.6	Nicolaus 60 kV voltage support
CVLY-VD-10	DIST2047 60 kV	CORTINA #1 60kV	P1	N-1	7.3	6.5	6.8	2.8	1.5	8.0	6.5	6.5	7.7	6.9	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-11	E.MRYSVE 115 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	2.6	5.3	6.1	0.6	-1.3	2.8	5.0	4.6	7.1	6.2	Nicolaus 60 kV voltage support
CVLY-VD-12	E.NICOLS 60 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	4.7	7.6	6.8	1.0	-2.1	5.0	8.4	7.7	8.6	7.6	Nicolaus 60 kV voltage support
CVLY-VD-13	GRSS VLY 60 kV	COLGATE-GRASS VALLEY 60kV	P1	N-1	4.9	3.7	4.9	3.1	5.0	5.1	4.7	4.4	5.7	4.8	Short Term : Action Plan; Long Term : Preferred resource.
CVLY-VD-14	LODI 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	10.4	1.7	0.4	1.4	1.1	11.4	0.9	1.4	0.2	0.3	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-15	LYOTH-SP 60 kV	KASSON 115/60kV TB 1	P1	N-1	5.9	5.5	6.5	2.1	0.7	6.2	6.0	5.5	7.2	6.5	Short Term : Action Plan; Long Term : Kasson SPS
CVLY-VD-16	MARTELL 60 kV	VALLEY SPRINGS-MARTELL #1 60kV	P1	N-1	5.1	4.5	4.6	2.7	1.5	5.2	4.9	7.2	5.0	4.7	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-17	MONDAVI 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	10.4	1.7	0.4	1.4	1.1	11.4	0.9	1.4	0.2	0.3	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-18	NEW HOPE 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	10.6	1.7	0.4	1.4	1.2	11.6	0.9	1.4	0.3	0.3	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-19	PENRYN 60 kV	PLACER-DEL MAR 60kV	P1	N-1	8.1	3.4	3.3	-0.7	-6.0	9.3	3.0	2.8	4.3	3.3	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project

Study Area: PG&E Central Valley

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-VD-20	PLUMAS 60 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	4.8	7.9	7.1	1.0	-2.1	5.1	8.7	7.9	9.0	7.9	Nicolaus 60 kV voltage support
CVLY-VD-21	PNE GRVE 60 kV	WEST PNT 12kV Gen Unit 1	P1	N-1	5.4	3.3	3.2	3.0	-1.6	5.7	3.3	3.2	3.4	3.1	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-22	POST 115 kV	WEST SACRAMENTO-BRIGHTON 115kV	P1	N-1	6.5	2.2	0.6	-0.6	0.6	7.4	1.8	2.0	2.2	2.0	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-23	SCHMLBCH 115 kV	VACA-SUISUN 115kV	P1	N-1	4.4	5.4	4.5	1.4	0.7	4.6	4.9	4.9	4.8	4.6	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-24	SUISUN 115 kV	VACA-SUISUN 115kV	P1	N-1	4.7	5.7	4.8	1.5	0.7	4.9	5.2	5.2	5.1	4.9	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-25	TUDOR 60 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	4.7	7.7	6.9	1.0	-2.1	5.1	8.5	7.8	8.7	7.7	Nicolaus 60 kV voltage support
CVLY-VD-26	VICTOR 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	10.2	1.7	0.1	1.4	1.2	11.2	0.9	1.4	0.3	0.3	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-27	W.SCRMNO 115 kV	WEST SACRAMENTO-BRIGHTON 115kV	P1	N-1	6.5	2.2	0.5	-0.7	0.6	7.4	1.8	2.0	2.1	1.9	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-28	WEST PNT 60 kV	WEST PNT 12kV Gen Unit 1	P1	N-1	6.7	4.3	4.3	3.9	-1.7	6.9	4.4	4.2	4.5	4.2	Short Term : Action Plan; Long Term : West Point – Valley Springs 60 kV Line project.
CVLY-VD-29	WHEATLND 60 kV	RIO OSO-NICOLAUS 115kV	P1	N-1	4.9	8.1	7.2	1.0	-2.1	5.2	8.9	8.1	9.2	8.1	Nicolaus 60 kV voltage support
CVLY-VD-30	WILKINS 60 kV	CORTINA #1 60kV	P1	N-1	7.3	6.5	6.8	2.8	1.5	8.0	6.5	6.5	7.7	6.9	Cortina area voltage support
CVLY-VD-31	BRKR SLG 115 kV	BRIGHTN - ME 115kV & BRIGHTN-DAVIS-BRKR SLG line	P2	Non-bus-tie breaker	9.5	2.7	1.5	0.7	-0.1	11.2	2.1	2.4	2.1	2.1	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-32	CAMPUS 115 kV	BRIGHTN - ME 115kV & BRIGHTN-DAVIS-BRKR SLG line	P2	Non-bus-tie breaker	8.7	1.8	0.9	0.6	0.0	10.2	1.4	1.6	1.5	1.5	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-33	CNTRY CB 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	13.3	91.2	0.0	0.3	7.8	17.7	92.1	91.8	0.6	0.7	Operating action plan
CVLY-VD-34	COLONY 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	18.9	3.5	4.8	1.5	1.2	21.2	11.8	3.0	5.7	5.5	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-35	CORT_D 115 kV	CORTINA 230kV - Ring R2 & R3	P2	Non-bus-tie breaker	11.9	11.1	13.6	4.8	7.4	12.1	12.4	14.6	12.3	16.6	Cortina area voltage support
CVLY-VD-36	DAVIS 115 kV	BRIGHTN - ME 115kV & BRIGHTN-DAVIS-BRKR SLG line	P2	Non-bus-tie breaker	8.6	1.9	0.9	0.6	0.0	10.2	1.5	1.7	1.6	1.6	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project

Study Area: PG&E Central Valley

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-VD-37	DEEPWATR 115 kV	BRIGHTN - ME 115kV & BRIGHTN-DAVIS-BRKR SLG line	P2	Non-bus-tie breaker	9.5	3.3	1.4	0.4	0.5	11.3	2.6	3.0	3.0	2.8	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-38	EIGHT MI 230 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	15.1	2.2	3.9	2.3	-0.7	18.0	5.7	5.2	2.9	3.1	Operating action plan
CVLY-VD-39	ENCINAL 60 kV	PEASE - MA 60kV & PEASE-HARTER line	P2	Non-bus-tie breaker	9.5	12.5	10.9	4.4	4.2	9.7	11.1	11.4	11.3	10.7	Pease 60 kV voltage support
CVLY-VD-40	HAMMER 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	13.5	90.5	0.0	0.3	7.7	18.0	91.4	91.2	0.6	0.7	Operating action plan
CVLY-VD-41	KNIGHTLD 115 kV	RIO OSO 115kV - Section 1D & 2D	P2	Bus-tie breaker	6.1	9.6	8.5	3.8	0.0	7.3	9.8	11.2	10.5	11.5	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-42	LIVE OAK 60 kV	PEASE - MA 60kV & PEASE-HARTER line	P2	Non-bus-tie breaker	9.0	11.9	10.4	4.1	4.0	9.2	10.5	10.8	10.7	10.1	Pease 60 kV voltage support
CVLY-VD-43	METTLER 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	13.7	88.0	0.0	0.3	7.4	18.4	88.8	88.6	0.6	0.7	Operating action plan
CVLY-VD-44	MSHR 60V 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	14.1	73.1	0.0	0.3	6.1	18.9	73.6	73.6	0.6	0.7	Operating action plan
CVLY-VD-45	NEW HOPE 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	19.6	3.6	8.7	1.5	1.2	22.0	12.1	3.0	9.7	9.4	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-46	POST 115 kV	BRIGHTN - ME 115kV & BRIGHTN-DAVIS-BRKR SLG line	P2	Non-bus-tie breaker	9.4	3.2	1.3	0.5	0.5	11.1	2.7	2.9	2.8	2.7	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-47	SEBASTIA 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	13.6	91.9	0.0	0.3	8.1	18.2	92.6	92.6	0.6	0.7	Operating action plan
CVLY-VD-48	STAGG 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	13.1	91.7	0.0	0.3	7.9	17.5	92.7	92.4	0.6	0.7	Operating action plan
CVLY-VD-49	TERMNOUS 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	13.5	91.9	0.0	0.3	8.0	18.1	92.7	92.6	0.6	0.7	Operating action plan
CVLY-VD-50	UOP 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	13.3	91.0	0.0	0.3	7.7	17.8	92.0	91.7	0.6	0.7	Operating action plan
CVLY-VD-51	VICTOR 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	18.8	3.5	0.3	1.5	1.2	21.0	11.7	3.0	0.5	0.5	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-52	W.SCRMNO 115 kV	BRIGHTN - ME 115kV & BRIGHTN-DAVIS-BRKR SLG line	P2	Non-bus-tie breaker	9.4	3.2	1.3	0.3	0.5	11.1	2.6	2.9	2.9	2.8	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-53	WOODLD 115 kV	RIO OSO 115kV - Section 1D & 2D	P2	Bus-tie breaker	6.2	8.4	7.4	3.2	0.1	7.4	8.6	10.0	9.3	10.3	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project

Study Area: PG&E Central Valley

Voltage Deviations

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-VD-54	ZAMORA 115 kV	RIO OSO 115kV - Section 1D & 2D	P2	Bus-tie breaker	6.1	9.6	8.5	3.8	0.0	7.3	9.8	11.2	10.5	11.6	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-55	AM FORST 60 kV	VALLEY SPRINGS-MARTELL #1 60kV [8240] (VLLY SPS-AMFOR_SW)	P2-1	Line section w/o fault	5.4	4.9	5.0	3.0	1.8	5.5	5.3	7.7	5.3	5.1	Transfer trip to open other end
CVLY-VD-56	APPLE HL 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	14.6	7.7	9.7	1.2	0.7	22.3	8.7	7.9	14.7	9.6	Transfer trip to open other end
CVLY-VD-57	BRUNSWCK 115 kV	DRUM-RIO OSO #2 115kV [1430] (DRUM-BRNSWCKP)	P2-1	Line section w/o fault	5.4	3.2	3.6	2.2	1.5	5.8	3.2	3.4	3.6	3.5	Transfer trip to open other end
CVLY-VD-58	CLAY 60 kV	VALLEY SPRINGS-CLAY 60kV [8264] (CLAY-BUENA_TP)	P2-1	Line section w/o fault	5.4	5.2	5.1	3.7	3.0	5.6	5.3	4.0	5.4	5.1	Transfer trip to open other end
CVLY-VD-59	CRWS LDG 60 kV	SALADO-NEWMAN #2 60kV [7870] (PATTERSN-CRWS LDJ)	P2-1	Line section w/o fault	5.9	5.4	6.1	-0.2	0.0	6.4	5.7	5.9	7.1	6.1	Transfer trip to open other end
CVLY-VD-60	DMND SPR 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	22.6	13.5	16.4	2.9	1.6	33.4	15.1	13.7	23.8	16.2	Transfer trip to open other end
CVLY-VD-61	ELDORAD 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	16.8	9.1	11.5	1.6	0.9	25.4	10.3	9.3	17.1	11.2	Transfer trip to open other end
CVLY-VD-62	ENCINAL 60 kV	ENCL TAP-PEASE 60kV [0] No Fault	P2-1	Line section w/o fault	9.5	12.6	11.0	4.4	4.3	9.7	11.2	11.4	11.4	10.7	Transfer trip to open other end
CVLY-VD-63	FORST HL 60 kV	WEIMAR #1 60kV [7560] (ENVRO_HY-FORST HL)	P2-1	Line section w/o fault	5.8	5.6	5.7	2.7	2.3	5.8	5.6	5.6	5.8	5.7	Transfer trip to open other end
CVLY-VD-64	INE PRSN 60 kV	VALLEY SPRINGS-CLAY 60kV [8264] (CLAY-BUENA_TP)	P2-1	Line section w/o fault	5.1	4.9	4.8	3.5	2.8	5.3	5.0	3.8	5.1	4.8	Transfer trip to open other end
CVLY-VD-65	LIVE OAK 60 kV	ENCL TAP-PEASE 60kV [0] No Fault	P2-1	Line section w/o fault	9.1	12.0	10.4	4.2	4.0	9.2	10.6	10.9	10.8	10.2	Transfer trip to open other end

Study Area: PG&E Central Valley

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-VD-66	MARTELL 60 kV	VALLEY SPRINGS-MARTELL #1 60kV [8240] (VLLY SPS-AMFOR_SW)	P2-1	Line section w/o fault	5.4	4.8	4.9	3.0	1.7	5.5	5.2	7.7	5.3	5.0	Transfer trip to open other end
CVLY-VD-67	METTLER 60 kV	HAMMER-COUNTRY CLUB 60kV [7010] (HMMR JCT-MORADAJT)	P2-1	Line section w/o fault	0.0	5.5	0.0	0.0	0.8	0.0	6.2	5.7	0.0	0.0	Transfer trip to open other end
CVLY-VD-68	NEWMAN 60 kV	SALADO-NEWMAN #2 60kV [7870] (PATTERSN-CRWS LDJ)	P2-1	Line section w/o fault	4.6	4.2	4.7	0.0	0.1	5.0	4.5	4.8	5.6	4.7	Transfer trip to open other end
CVLY-VD-69	PLCRVLB2 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	21.8	12.8	15.7	2.6	1.5	32.3	14.4	13.0	22.9	15.5	Transfer trip to open other end
CVLY-VD-70	PLCRVLB3 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	21.8	12.8	15.7	2.6	1.5	32.3	14.4	13.0	22.9	15.5	Transfer trip to open other end
CVLY-VD-71	RIPON 115 kV	RIVERBANK JCT SW STA-MANTECA 115kV [3841] (RPN JNCN-MANTECA)	P2-1	Line section w/o fault	4.9	4.5	5.3	0.1	0.6	5.2	4.9	5.1	5.8	5.6	Transfer trip to open other end
CVLY-VD-72	SCHMLBCH 115 kV	VACA-SUISUN 115kV [4070] (WEC-SUISUN)	P2-1	Line section w/o fault	4.4	5.2	4.4	1.4	0.6	4.6	4.8	4.8	4.7	4.5	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-73	SHPRING 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	24.0	14.6	17.7	3.5	1.7	35.0	16.3	14.8	25.3	17.5	Transfer trip to open other end
CVLY-VD-74	SPICAMIN 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	14.6	7.7	9.7	1.2	0.7	22.3	8.7	7.9	14.7	9.6	Transfer trip to open other end
CVLY-VD-75	SUISUN 115 kV	VACA-SUISUN 115kV [4070] (WEC-SUISUN)	P2-1	Line section w/o fault	4.6	5.5	4.7	1.4	0.7	4.8	5.1	5.0	5.0	4.8	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-76	TRAVIS 60 kV	DIXON-VACA #1 60kV [6730] (VACA-DXN-VACA-JT1)	P2-1	Line section w/o fault	5.9	<5.0	<5.0	<5.0	<5.0	6.0	<5.0	<5.0	<5.0	<5.0	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-VD-77	TRVS_HPT 60 kV	DIXON-VACA #1 60kV [6730] (VACA-DXN-VACA-JT1)	P2-1	Line section w/o fault	5.9	<5.0	<5.0	<5.0	<5.0	6.0	<5.0	<5.0	<5.0	<5.0	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project

Study Area: PG&E Central Valley

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-VD-78	DEL MAR 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	12.7	<10.0	<10.0	<10.0	<10.0	15.8	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-79	PLSNT GR 115 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	9.8	<10.0	<10.0	<10.0	<10.0	12.1	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-80	ROCKLIN 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	12.5	<10.0	<10.0	<10.0	<10.0	15.5	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-81	SIERRAPI 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	12.7	<10.0	<10.0	<10.0	<10.0	15.8	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-82	TAYLOR 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	12.4	<10.0	<10.0	<10.0	<10.0	15.4	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-VD-83	BELL PGE 115 kV	Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line	P7	DCTL	<10.0	<10.0	<10.0	<10.0	<10.0	10.5	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Atlantic-Placer 115 kV line project.
CVLY-VD-84	COLONY 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	13.4	<10.0	<10.0	<10.0	<10.0	15.1	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-85	EIGHT MI 230 kV	EIGHT MILE ROAD-TESLA 230kV [4660] & STAGG-TESLA 230kV [5680]	P7	DCTL	12.9	<10.0	<10.0	<10.0	<10.0	14.9	5.6	<10.0	<10.0	<10.0	Operating action plan
CVLY-VD-86	ENCINAL 60 kV	Palermo-Pease 115 kV Line amd Pease-Rio Oso 115 kV Line	P7	DCTL	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	12.0	Increase Pease 60 kV generation
CVLY-VD-87	LIVE OAK 60 kV	Palermo-Pease 115 kV Line amd Pease-Rio Oso 115 kV Line	P7	DCTL	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	11.7	Increase Pease 60 kV generation
CVLY-VD-88	LODI 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	13.7	<10.0	<10.0	<10.0	<10.0	15.4	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-89	MONDAVI 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	13.7	<10.0	<10.0	<10.0	<10.0	15.4	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-90	MRYSVLE 60 kV	Palermo-Pease 115 kV Line amd Pease-Rio Oso 115 kV Line	P7	DCTL	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	13.0	Increase Pease 60 kV generation
CVLY-VD-91	MRYSVLLE 60 kV	Palermo-Pease 115 kV Line amd Pease-Rio Oso 115 kV Line	P7	DCTL	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	13.0	Increase Pease 60 kV generation

Study Area: PG&E Central Valley

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-VD-92	NEW HOPE 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	13.9	<10.0	<10.0	<10.0	<10.0	15.7	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-VD-93	PEASE 115 kV	Palermo-Pease 115 kV Line amd Pease-Rio Oso 115 kV Line	P7	DCTL	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	14.3	Increase Pease 60 kV generation
CVLY-VD-94	PLACER 115 kV	Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line	P7	DCTL	10.1	<10.0	<10.0	<10.0	<10.0	11.0	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Atlantic-Placer 115 kV line project.
CVLY-VD-95	VICTOR 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	13.4	<10.0	<10.0	<10.0	<10.0	15.0	<10.0	<10.0	<10.0	<10.0	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-1	ALTA-CGE 60 kV	Base Case	P0	Normal	1.04	<1.05	<1.05	1.06	<1.05	1.04	<1.05	<1.05	<1.05	<1.05	Check voltage settings in the area
CVLY-V-2	AMERIGAS 115 kV	Base Case	P0	Normal	1.04	1.00	1.03	1.06	1.05	1.04	1.02	1.01	1.03	1.02	Cortina area voltage support
CVLY-V-3	B.BTHNY- 60 kV	Base Case	P0	Normal	1.04	<1.05	<1.05	1.06	<1.05	1.04	<1.05	<1.05	<1.05	<1.05	Check voltage settings in the area
CVLY-V-4	BRNSWALT 115 kV	Base Case	P0	Normal	1.02	<1.05	<1.05	1.06	<1.05	1.02	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-5	BRNSWCKP 115 kV	Base Case	P0	Normal	1.02	<1.05	<1.05	1.06	<1.05	1.01	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-6	BRUNSWCK 115 kV	Base Case	P0	Normal	1.01	<1.05	<1.05	1.06	<1.05	1.01	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-7	CHCGO PK 115 kV	Base Case	P0	Normal	1.03	<1.05	<1.05	1.07	<1.05	1.03	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-8	CHLLNGEA 60 kV	Base Case	P0	Normal	1.02	<1.05	<1.05	1.06	<1.05	1.02	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-9	COLGATE 60 kV	Base Case	P0	Normal	1.03	<1.05	<1.05	1.06	<1.05	1.03	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-10	CORDELIA 115 kV	Base Case	P0	Normal	1.02	0.99	1.01	1.06	1.05	1.02	1.00	1.00	1.01	1.01	Cortina area voltage support
CVLY-V-11	CORT_D 115 kV	Base Case	P0	Normal	1.06	1.05	1.06	1.07	1.06	1.06	1.07	1.05	1.05	1.05	Cortina area voltage support
CVLY-V-12	CORTINA 115 kV	Base Case	P0	Normal	1.06	1.05	1.06	1.07	1.06	1.06	1.07	1.05	1.05	1.05	Cortina area voltage support
CVLY-V-13	CPM 115 kV	Base Case	P0	Normal	1.02	<1.05	<1.05	1.06	<1.05	1.02	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-14	DIMOND_1 115 kV	Base Case	P0	Normal	1.02	<1.05	<1.05	1.06	<1.05	1.02	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-15	DOBBINS 60 kV	Base Case	P0	Normal	1.02	1.03	1.03	1.06	1.06	1.02	1.03	1.03	1.04	1.04	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-16	DONNELLS 115 kV	Base Case	P0	Normal	1.05	1.06	1.05	1.06	1.02	1.05	1.05	1.05	1.05	1.05	Check generator voltage setting
CVLY-V-17	DRUM 115 kV	Base Case	P0	Normal	1.04	1.05	1.05	1.07	1.06	1.04	1.05	1.05	1.05	1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-18	DTCH FL1 115 kV	Base Case	P0	Normal	1.04	0.00	0.00	1.07	0.00	1.03	0.00	0.00	0.00	0.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-19	DTCH FL2 115 kV	Base Case	P0	Normal	1.04	1.05	1.05	1.07	1.06	1.04	1.05	1.05	1.05	1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-20	GOLDHILL 115 kV	Base Case	P0	Normal	1.03	1.04	1.04	1.06	1.08	1.02	1.05	1.04	1.05	1.04	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-21	HERDLYN 60 kV	Base Case	P0	Normal	1.04	<1.05	<1.05	1.06	<1.05	1.04	<1.05	<1.05	<1.05	<1.05	Check voltage settings in the area
CVLY-V-22	HORSHE2 115 kV	Base Case	P0	Normal	1.02	<1.05	<1.05	1.06	0.00	1.01	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-23	MADISON 115 kV	Base Case	P0	Normal	1.02	0.99	1.01	1.06	1.05	1.02	1.01	1.00	1.01	1.01	Cortina area voltage support
CVLY-V-24	MAINE-PR 60 kV	Base Case	P0	Normal	1.03	<1.05	<1.05	1.06	<1.05	1.02	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-25	MIZOU_T1 115 kV	Base Case	P0	Normal	1.02	<1.05	<1.05	1.06	<1.05	1.01	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-26	PUTH CRK 115 kV	Base Case	P0	Normal	1.04	1.00	1.03	1.06	1.05	1.04	1.02	1.01	1.02	1.02	Cortina area voltage support
CVLY-V-27	SOUTH BY 60 kV	Base Case	P0	Normal	1.04	<1.05	<1.05	1.06	<1.05	1.04	<1.05	<1.05	<1.05	<1.05	Check voltage settings in the area
CVLY-V-28	TOSCO-PP 60 kV	Base Case	P0	Normal	1.04	<1.05	<1.05	1.06	<1.05	1.04	<1.05	<1.05	<1.05	<1.05	Check voltage settings in the area
CVLY-V-29	VACA-CB 115 kV	Base Case	P0	Normal	1.06	<1.05	<1.05	1.08	<1.05	1.06	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-30	VACA-DXN 60 kV	Base Case	P0	Normal	1.04	<1.05	<1.05	1.06	<1.05	1.03	<1.05	<1.05	<1.05	<1.05	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-31	VACAVLL1 115 kV	Base Case	P0	Normal	1.04	1.00	1.03	1.06	1.05	1.04	1.02	1.01	1.02	1.02	Cortina area voltage support
CVLY-V-32	VACAVLL2 115 kV	Base Case	P0	Normal	1.03	1.00	1.02	1.06	1.05	1.03	1.02	1.01	1.02	1.02	Cortina area voltage support
CVLY-V-33	WEST SDE 60 kV	Base Case	P0	Normal	1.04	<1.05	<1.05	1.06	<1.05	1.04	<1.05	<1.05	<1.05	<1.05	Check voltage settings in the area
CVLY-V-34	CLSA CRS 60 kV	Base Case	P0	Normal	0.92	0.93	0.94	0.99	1.00	0.91	0.94	0.93	0.92	0.93	Cortina area voltage support
CVLY-V-35	COLUSA 60 kV	Base Case	P0	Normal	0.92	0.92	0.93	0.99	1.00	0.91	0.93	0.93	0.91	0.93	Cortina area voltage support
CVLY-V-36	CRTNA M 230 kV	Base Case	P0	Normal	0.96	0.94	0.96	0.98	0.97	0.96	0.96	0.94	0.95	0.95	Cortina area voltage support
CVLY-V-37	DELEVAN 60 kV	Base Case	P0	Normal	0.94	0.94	0.95	1.00	1.01	0.93	0.95	0.94	0.93	0.95	Cortina area voltage support
CVLY-V-38	DUNNIGAN 60 kV	Base Case	P0	Normal	0.94	0.94	0.95	0.99	1.00	0.93	0.95	0.94	0.94	0.95	Cortina area voltage support
CVLY-V-39	MAXTAP 60 kV	Base Case	P0	Normal	0.94	0.94	0.95	1.00	1.01	0.93	0.95	0.94	0.93	0.95	Cortina area voltage support
CVLY-V-40	MAXWELL 60 kV	Base Case	P0	Normal	0.94	0.94	0.95	1.00	1.01	0.93	0.95	0.94	0.93	0.95	Cortina area voltage support
CVLY-V-41	PEAS RG 60 kV	Base Case	P0	Normal	0.95	0.96	0.97	0.99	1.01	0.94	0.97	0.96	0.97	0.97	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-42	PLAINFLD 60 kV	Base Case	P0	Normal	0.89	>0.95	>0.95	1.01	>0.95	0.88	>0.95	>0.95	>0.95	>0.95	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-43	WILSONAV 60 kV	Base Case	P0	Normal	0.92	0.92	0.93	0.99	1.00	0.91	0.93	0.93	0.91	0.93	Cortina area voltage support
CVLY-V-44	COLUSA 60 kV	CORTINA 115/60kV TB 5	P1	N-1	0.95	0.92	0.95	1.01	1.03	0.94	0.95	0.89	0.93	0.89	Cortina area voltage support
CVLY-V-45	DIST2047 60 kV	CORTINA #1 60kV	P1	N-1	0.89	0.90	0.91	0.98	1.00	0.88	0.91	0.90	0.89	0.90	Cortina area voltage support
CVLY-V-46	LODI 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	0.90	1.00	1.01	1.01	1.01	0.89	1.01	1.01	1.02	1.02	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-47	MONDAVI 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	0.90	1.00	1.01	1.01	1.01	0.89	1.01	1.01	1.02	1.02	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-48	NEW HOPE 60 kV	LOCKEFORD-BELLOTA 230kV	P1	N-1	0.89	0.99	1.00	1.01	1.01	0.88	1.00	1.00	1.01	1.01	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-49	PLAINFLD 60 kV	VACA-DIX 115/60kV TB 9	P1	N-1	0.87	>0.90	>0.90	1.00	>0.90	0.86	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-50	WILKINS 60 kV	CORTINA #1 60kV	P1	N-1	0.89	0.90	0.91	0.98	1.00	0.88	0.91	0.90	0.89	0.90	Cortina area voltage support
CVLY-V-51	APPLE HL 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.93	1.02	1.01	1.05	1.08	0.90	1.02	1.02	1.01	1.01	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-52	CLRKSVLE 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.92	1.02	1.01	1.05	1.08	0.89	1.01	1.02	1.01	1.01	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-53	CNTRY CB 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.90	1.04	1.04	1.04	1.05	0.86	1.04	1.04	1.04	1.04	Operating action plan
CVLY-V-54	COLONY 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	0.83	1.00	0.98	1.02	1.02	0.81	0.91	1.01	0.97	0.98	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-55	COLUSA 60 kV	CORTINA 60kV Section MD	P2	Bus	0.93	0.92	0.92	0.97	0.98	0.91	0.92	0.89	0.92	0.88	Cortina area voltage support
CVLY-V-56	CORT_D 115 kV	CORTINA 230kV - Ring R2 & R3	P2	Non-bus-tie breaker	0.94	0.94	0.93	1.02	0.99	0.94	0.94	0.90	0.93	0.89	Cortina area voltage support
CVLY-V-57	DAVIS 115 kV	BRIGHTN - ME 115kV & BRIGHTN-DAVIS-BRKR SLG line	P2	Non-bus-tie breaker	0.91	0.99	1.01	1.02	1.04	0.89	1.00	0.99	1.00	1.00	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-58	DEL MAR 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.89	1.00	0.99	1.04	1.09	0.86	0.99	0.99	0.99	0.99	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-59	DIST2047 60 kV	CORTINA - MA 60kV & CORTINA #1 line	P2	Non-bus-tie breaker	0.89	0.91	0.91	0.98	1.00	0.89	0.92	0.91	0.89	0.91	Cortina area voltage support
CVLY-V-60	DMND SPR 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.91	1.01	1.00	1.04	1.08	0.88	1.01	1.01	1.00	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-61	DUNNIGAN 60 kV	CORTINA 230kV - Ring R2 & R3	P2	Non-bus-tie breaker	0.95	0.94	0.94	0.97	0.98	0.94	0.94	0.92	0.94	0.90	Cortina area voltage support
CVLY-V-62	EIGHT MI 230 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.83	0.97	0.95	0.99	1.03	0.80	0.94	0.94	0.97	0.97	Operating action plan
CVLY-V-63	ELDORAD 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.93	1.02	1.01	1.05	1.08	0.90	1.02	1.02	1.01	1.01	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-64	ENCINAL 60 kV	PEASE - MA 60kV & PEASE-HARTER line	P2	Non-bus-tie breaker	0.91	0.89	0.91	0.99	0.99	0.90	0.91	0.91	0.91	0.91	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-65	FLINT 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.92	1.01	1.00	1.05	1.07	0.90	1.01	1.01	1.01	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-66	HAMMER 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.89	1.03	1.03	1.04	1.05	0.85	1.04	1.04	1.03	1.03	Operating action plan
CVLY-V-67	LIVE OAK 60 kV	PEASE - MA 60kV & PEASE-HARTER line	P2	Non-bus-tie breaker	0.91	0.89	0.91	0.99	0.99	0.90	0.91	0.91	0.91	0.91	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-68	LODI 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	0.82	0.99	0.90	1.01	1.01	0.79	0.90	1.00	0.90	0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-69	MAXWELL 60 kV	CORTINA 230kV - Ring R2 & R3	P2	Non-bus-tie breaker	0.95	0.94	0.94	0.97	0.99	0.93	0.94	0.92	0.94	0.90	Cortina area voltage support
CVLY-V-70	METTLER 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.88	1.02	1.02	1.03	1.05	0.83	1.02	1.03	1.02	1.02	Operating action plan
CVLY-V-71	MONDAVI 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	0.82	0.99	0.90	1.01	1.01	0.79	0.90	1.00	0.90	0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-72	MSHR 60V 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.86	1.02	1.00	1.02	1.05	0.81	1.02	1.02	1.00	1.00	Operating action plan
CVLY-V-73	NEW HOPE 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	0.80	0.97	0.92	1.01	1.01	0.77	0.89	0.98	0.91	0.92	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-74	PLAINFLD 60 kV	VACA-DIX 230kV - Section 1E & 1F	P2	Bus-tie breaker	0.86	>0.90	>0.90	1.00	>0.90	0.85	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-75	PLCRVLB2 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.92	1.01	1.00	1.04	1.08	0.88	1.01	1.01	1.00	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-76	PLCRVLB3 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.91	1.01	1.00	1.04	1.08	0.88	1.01	1.01	1.00	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-77	PLSNT GR 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.92	1.01	1.00	1.03	1.05	0.89	1.01	1.00	1.01	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-78	ROCKLIN 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.91	1.01	1.00	1.04	1.09	0.88	1.01	1.01	1.00	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-79	SEBASTIA 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.88	1.01	1.02	1.02	1.03	0.84	1.02	1.02	1.02	1.02	Operating action plan
CVLY-V-80	SHPRING 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.92	1.01	1.00	1.04	1.08	0.89	1.01	1.01	1.01	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-81	SIERRAPI 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.89	1.00	0.99	1.04	1.09	0.86	0.99	0.99	0.99	0.99	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-82	SPICAMIN 115 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.93	1.02	1.01	1.05	1.08	0.90	1.02	1.02	1.01	1.01	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-83	STAGG 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.91	1.04	1.04	1.04	1.05	0.87	1.04	1.05	1.04	1.04	Operating action plan
CVLY-V-84	TAYLOR 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.91	1.01	1.00	1.04	1.09	0.88	1.01	1.01	1.01	1.00	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-85	TERMNOUS 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.88	1.02	1.02	1.02	1.04	0.84	1.02	1.03	1.02	1.02	Operating action plan
CVLY-V-86	UOP 60 kV	TESLA E 230kV - Section 2E & 1E	P2	Bus-tie breaker	0.90	1.04	1.04	1.04	1.05	0.86	1.04	1.04	1.04	1.04	Operating action plan
CVLY-V-87	VICTOR 60 kV	LOCKFORD 230kV - Ring R3 & R2	P2	Non-bus-tie breaker	0.84	1.00	1.03	1.03	1.02	0.81	0.92	1.01	1.03	1.03	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-88	WILKINS 60 kV	CORTINA - MA 60kV & CORTINA #1 line	P2	Non-bus-tie breaker	0.89	0.91	0.91	0.98	1.00	0.89	0.92	0.91	0.89	0.91	Cortina area voltage support

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-89	APPLE HL 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	0.87	0.95	0.93	1.04	1.07	0.78	0.95	0.95	0.88	0.93	Transfer trip to open other end
CVLY-V-90	DMND SPR 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	0.78	0.89	0.85	1.02	1.06	0.66	0.88	0.88	0.78	0.86	Transfer trip to open other end
CVLY-V-91	ELDORAD 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	0.85	0.94	0.91	1.04	1.07	0.75	0.93	0.93	0.86	0.91	Transfer trip to open other end
CVLY-V-92	PLCRVLB2 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	0.79	0.90	0.86	1.02	1.06	0.67	0.88	0.89	0.79	0.86	Transfer trip to open other end
CVLY-V-93	PLCRVLB3 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	0.78	0.89	0.86	1.02	1.06	0.67	0.88	0.89	0.79	0.86	Transfer trip to open other end
CVLY-V-94	SHPRING 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	0.77	0.88	0.84	1.02	1.06	0.65	0.87	0.87	0.77	0.85	Transfer trip to open other end
CVLY-V-95	SPICAMIN 115 kV	MISSOURI FLAT-GOLD HILL #2 115kV [2670] (GOLDHILL-SHPRING2)	P2-1	Line section w/o fault	0.87	0.95	0.93	1.04	1.07	0.78	0.95	0.95	0.88	0.93	Transfer trip to open other end
CVLY-V-96	ARBUCKLE 60 kV	WADHAM 9kV Gen Unit 1 & CORTINA 115/60kV TB 5	P3	G-1/N-1	>0.90	0.89	>0.90	>0.90	>0.90	0.90	>0.90	>0.90	>0.90	>0.90	Cortina area voltage support
CVLY-V-97	DRAKE 60 kV	WADHAM 9kV Gen Unit 1 & CORTINA 115/60kV TB 5	P3	G-1/N-1	>0.90	0.88	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	Cortina area voltage support
CVLY-V-98	DUNNIGAN 60 kV	WADHAM 9kV Gen Unit 1 & CORTINA 115/60kV TB 5	P3	G-1/N-1	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	0.90	>0.90	>0.90	>0.90	Cortina area voltage support
CVLY-V-99	ENCINAL 60 kV	GRNLEAF2 14kV Gen Unit 1 & PEAS RG 60/60kV TB 1	P3	G-1/N-1	>0.90	>0.90	>0.90	0.84	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Pease 115/60 kV Transformer Addition and Bus Upgrade project.
CVLY-V-100	GRSS VLY 60 kV	ROLLINSF 7kV Gen Unit 1 & COLGATE-GRASS VALLEY 60kV [6490]	P3	G-1/N-1	0.91	0.93	0.92	0.98	1.00	0.90	0.92	0.93	0.91	0.92	Short Term : Action Plan; Long Term : Pease 115/60 kV Transformer Addition and Bus Upgrade project.
CVLY-V-101	HARINTON 60 kV	WADHAM 9kV Gen Unit 1 & CORTINA 115/60kV TB 5	P3	G-1/N-1	>0.90	0.89	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	Cortina area voltage support

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-102	HARTER 60 kV	GRNLEAF2 14kV Gen Unit 1 & PEAS RG 60/60kV TB 1	P3	G-1/N-1	>0.90	>0.90	>0.90	0.82	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Pease 115/60 kV Transformer Addition and Bus Upgrade project.
CVLY-V-103	LIVE OAK 60 kV	GRNLEAF2 14kV Gen Unit 1 & PEAS RG 60/60kV TB 1	P3	G-1/N-1	>0.90	>0.90	>0.90	0.85	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Pease 115/60 kV Transformer Addition and Bus Upgrade project.
CVLY-V-104	MAXWELL 60 kV	WADHAM 9kV Gen Unit 1 & CORTINA 115/60kV TB 5	P3	G-1/N-1	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	0.90	>0.90	Cortina area voltage support
CVLY-V-105	MERIDIAN 60 kV	WADHAM 9kV Gen Unit 1 & CORTINA 115/60kV TB 5	P3	G-1/N-1	>0.90	0.88	>0.90	>0.90	>0.90	0.90	>0.90	>0.90	>0.90	>0.90	Cortina area voltage support
CVLY-V-106	MRYSVLLE 60 kV	GRNLEAF2 14kV Gen Unit 1 & PEAS RG 60/60kV TB 1	P3	G-1/N-1	>0.90	>0.90	>0.90	0.82	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Pease 115/60 kV Transformer Addition and Bus Upgrade project.
CVLY-V-107	DEL MAR 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	0.84	1.05	1.03	1.04	1.07	0.81	1.04	1.03	1.03	1.03	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-108	PLSNT GR 115 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	0.89	1.03	1.03	1.03	1.03	0.86	1.03	1.02	1.03	1.03	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-109	ROCKLIN 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	0.86	1.06	1.04	1.04	1.06	0.82	1.05	1.04	1.04	1.04	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-110	SIERRAPI 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	0.84	1.05	1.03	1.04	1.07	0.81	1.04	1.03	1.03	1.03	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-111	TAYLOR 60 kV	Atlantic 230 kV BAAH Bus #1 (failure of non-redundent relay)	P5-5	Non-redndant relay (bus)	0.86	1.06	1.04	1.04	1.06	0.82	1.05	1.04	1.04	1.04	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-112	BELL PGE 115 kV	PLACER-GOLD HILL #1 115kV [3340] & DRUM-HIGGINS 115kV [4393]	P6	N-1/N-1	0.89	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-113	BRUNSWCK 115 kV	BRIGHTON 230/115kV TB 9 & BRIGHTON 230/115kV TB 10	P6	N-1/N-1	>0.90	>0.90	>0.90	>0.90	>0.90	0.86	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-114	COLONY 60 kV	LOCKFORD 230/60kV TB 3 & LOCKEFORD-BELLOTA 230kV [4990]	P6	N-1/N-1	0.83	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-115	DEL MAR 60 kV	RIO OSO-ATLANTIC 230kV [5590] & ATLANTIC-GOLD HILL 230kV [4330]	P6	N-1/N-1	0.85	>0.90	>0.90	>0.90	>0.90	0.82	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-116	DIST2047 60 kV	CORTINA #1 60kV [0] & CORTINA-VACA 230kV [4540]	P6	N-1/N-1	0.88	0.89	0.89	>0.90	>0.90	0.87	0.89	0.87	0.88	0.87	Cortina area voltage support
CVLY-V-117	E.MRYSVE 115 kV	BRIGHTON 230/115kV TB 9 & BRIGHTON 230/115kV TB 10	P6	N-1/N-1	>0.90	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-118	EIGHT MI 230 kV	STAGG-TESLA 230kV [5680] & EIGHT MILE ROAD-TESLA 230kV [4660]	P6	N-1/N-1	0.85	>0.90	>0.90	>0.90	>0.90	0.84	>0.90	>0.90	>0.90	>0.90	Operating action plan
CVLY-V-119	FLINT 115 kV	PLACER-GOLD HILL #1 115kV [3340] & DRUM-HIGGINS 115kV [4393]	P6	N-1/N-1	0.90	>0.90	>0.90	>0.90	>0.90	0.88	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-120	HIGGINS 115 kV	PLACER-GOLD HILL #1 115kV [3340] & DRUM-HIGGINS 115kV [4393]	P6	N-1/N-1	0.88	>0.90	>0.90	>0.90	>0.90	0.86	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-121	LINCLN 115 kV	BRIGHTON 230/115kV TB 9 & BRIGHTON 230/115kV TB 10	P6	N-1/N-1	>0.90	>0.90	>0.90	>0.90	>0.90	0.83	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-122	LODI 60 kV	LOCKFORD 230/60kV TB 3 & LOCKEFORD-BELLOTA 230kV [4990]	P6	N-1/N-1	0.82	>0.90	>0.90	>0.90	>0.90	0.85	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-123	MERIDIAN 60 kV	WADHAM 9kV Gen Unit 1 & CORTINA 115/60kV TB 5	P6	N-1/N-1	>0.90	0.88	>0.90	>0.90	>0.90	0.90	>0.90	0.88	0.90	0.88	Cortina area voltage support
CVLY-V-124	METTLER 60 kV	STAGG-TESLA 230kV [5680] & EIGHT MILE ROAD-TESLA 230kV [4660]	P6	N-1/N-1	>0.90	>0.90	>0.90	>0.90	>0.90	0.88	>0.90	>0.90	>0.90	>0.90	Operating action plan
CVLY-V-125	MONDAVI 60 kV	LOCKFORD 230/60kV TB 2 & LOCKEFORD-BELLOTA 230kV [4990]	P6	N-1/N-1	0.82	>0.90	>0.90	>0.90	>0.90	0.85	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-126	MSHR 60V 60 kV	STAGG-TESLA 230kV [5680] & EIGHT MILE ROAD-TESLA 230kV [4660]	P6	N-1/N-1	0.89	>0.90	>0.90	>0.90	>0.90	0.86	>0.90	>0.90	>0.90	>0.90	Operating action plan
CVLY-V-127	NEW HOPE 60 kV	LOCKFORD 230/60kV TB 3 & LOCKEFORD-BELLOTA 230kV [4990]	P6	N-1/N-1	0.80	>0.90	>0.90	>0.90	>0.90	0.84	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-128	OLIVHRST 115 kV	BRIGHTON 230/115kV TB 9 & BRIGHTON 230/115kV TB 10	P6	N-1/N-1	>0.90	>0.90	>0.90	>0.90	>0.90	0.83	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-129	PEASE 115 kV	PALERMO-PEASE 115kV [3220] & PEASE-RIO OSO 115kV [3270]	P6	N-1/N-1	>0.90	>0.90	>0.90	>0.90	>0.90	0.88	>0.90	>0.90	>0.90	0.86	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-130	PLACER 115 kV	PLACER-GOLD HILL #1 115kV [3340] & DRUM-HIGGINS 115kV [4393]	P6	N-1/N-1	0.89	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-131	PLAINFLD 60 kV	VACA-DIX 230/115kV TB 3 & VACA-DIX 115/60kV TB 9	P6	N-1/N-1	0.85	>0.90	>0.90	>0.90	>0.90	0.84	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-132	PLSNT GR 115 kV	RIO OSO-ATLANTIC 230kV [5590] & ATLANTIC-GOLD HILL 230kV [4330]	P6	N-1/N-1	0.89	>0.90	>0.90	>0.90	>0.90	0.86	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-133	PLUMAS 60 kV	BRIGHTON 230/115kV TB 9 & BRIGHTON 230/115kV TB 10	P6	N-1/N-1	>0.90	>0.90	>0.90	>0.90	>0.90	0.88	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-134	ROCKLIN 60 kV	RIO OSO-ATLANTIC 230kV [5590] & ATLANTIC-GOLD HILL 230kV [4330]	P6	N-1/N-1	0.87	>0.90	>0.90	>0.90	>0.90	0.83	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-135	SIERRAPI 60 kV	ATLANTIC-GOLD HILL 230kV [4330] & RIO OSO-ATLANTIC 230kV [5590]	P6	N-1/N-1	0.85	>0.90	>0.90	>0.90	>0.90	0.82	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-136	TAYLOR 60 kV	RIO OSO-ATLANTIC 230kV [5590] & ATLANTIC-GOLD HILL 230kV [4330]	P6	N-1/N-1	0.87	>0.90	>0.90	>0.90	>0.90	0.83	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-137	VICTOR 60 kV	LOCKFORD 230/60kV TB 3 & LOCKEFORD-BELLOTA 230kV [4990]	P6	N-1/N-1	0.84	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-138	COLONY 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	0.89	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-139	EIGHT MI 230 kV	EIGHT MILE ROAD-TESLA 230kV [4660] & STAGG-TESLA 230kV [5680]	P7	DCTL	0.85	>0.90	>0.90	>0.90	>0.90	0.83	>0.90	>0.90	>0.90	>0.90	Operating action plan
CVLY-V-140	LODI 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	0.87	>0.90	>0.90	>0.90	>0.90	0.85	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-141	MONDAVI 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	0.87	>0.90	>0.90	>0.90	>0.90	0.85	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-142	NEW HOPE 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	0.86	>0.90	>0.90	>0.90	>0.90	0.84	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.

Study Area: PG&E Central Valley

High/Low Voltage

California ISO

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)										Potential Mitigation Solutions
					2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	2018 SP No BTM-PV	2021 SP No AAEE	2021 SP Heavy Renewable & Min Gas Gen	2026 SP No BTM-PV	2026 Retirement of QF Generations	
CVLY-V-143	PEASE 115 kV	Palermo-Pease 115 kV Line amd Pease-Rio Oso 115 kV Line	P7	DCTL	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	>0.90	0.86	Short Term : Action Plan; Long Term : Rio Oso Area 230 kV Voltage Support Project
CVLY-V-144	PLAINFLD 60 kV	Vaca-Peabody 230 kV Line & Vaca-Lambie Sw Sta 230 kV Line	P7	DCTL	0.88	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Vaca – Davis Voltage Conversion Project
CVLY-V-145	VICTOR 60 kV	BRIGHTON-BELLOTA 230kV [4420] & LOCKEFORD-BELLOTA 230kV [4990]	P7	DCTL	0.89	>0.90	>0.90	>0.90	>0.90	0.87	>0.90	>0.90	>0.90	>0.90	Short Term : Action Plan; Long Term : Lockeford-Lodi Area 230 kV Development project.
CVLY-V-146	Diverge	BELLOTA 230kV - Section 1E & 2E	P2	Bus-tie breaker	diverge	diverge	diverge	-	-	diverge	diverge	diverge	diverge	diverge	Bellota 230 kV bus upgrade
CVLY-V-147	Diverge	STAGG-D Section 1D & STAGG-E Section 1E 230kV	P2	Bus-tie breaker	-	diverge	-	-	-	-	diverge	diverge	-	-	Short Term : Action Plan; Long Term : Preferred resource.
CVLY-V-148	Diverge	GOLDHILL 230kV - Section 2D & 1D	P2	Bus-tie breaker	diverge	diverge	-	-	-	diverge	diverge	diverge	diverge	-	Short Term : Action Plan; Long Term : Atlantic-Placer 115 kV line project.

Study Area: PG&E Central Valley

Transient Stability

California ISO

ID	Contingency	Category	Category Description	Transient Stability Performance (Number of voltage and frequency violations)										Potential Mitigation Solutions
				2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	Select..	Select..	Select..	Select..	Select..	
CVLY-SP-TS-1	GWF Tracy 3Ø fault with normal clearing.	P1-1	G-1	1	1	1	1	1						Under review with PTO .
CVLY-SP-TS-2	Rio Oso-Atlantic 230 kV line 3Ø fault with normal clearing.	P1-2	L-1	0	0	0	0	0						No violation
CVLY-SP-TS-3	Vaca Dixon 500/230 kV bank 3Ø fault with normal clearing.	P1-3	T-1	4	2	3	12	4						Under review with PTO .
CVLY-SP-TS-4	Vaca Dixon 230 kV SVD 3Ø fault with normal clearing.	P1-4	SVD-1	3	5	4	17	2						Under review with PTO .
CVLY-SP-TS-5	Rio Oso 230 kV SLG fault with normal clearing.	P2-2	Bus	1	1	1	1	1						Under review with PTO .
CVLY-SP-TS-6	Brighton 115 kV breaker SLG fault with normal clearing.	P2-3	Non-bus-tie breaker	0	0	0	0	0						No violation
CVLY-SP-TS-7	Monta Vista 230 kV breaker SLG fault with normal clearing.	P2-4	Bus-tie breaker	13	5	25	25	6						Under review with PTO .
CVLY-SP-TS-8	Ralston 3Ø fault with normal clearing with GWF Tracy offline in the base case.	P3-1	G-1/G-1	9	3	23	21	2						Under review with PTO .
CVLY-SP-TS-9	Rio Oso-Atlantic 230 kV 3Ø fault with normal clearing with GWF Tracy offline in the base case.	P3-2	G-1/L-1	11	9	9	11	11						Under review with PTO .
CVLY-SP-TS-10	Vaca Dixon 500/230 kV bank 3Ø fault with normal clearing with GWF Tracy offline in the base case.	P3-3	G-1/T-1	25	15	15	15	13						Under review with PTO .
CVLY-SP-TS-11	Vaca Dixon 230 kV SVD 3Ø fault with normal clearing with GWF Tracy offline in the base case.	P3-4	G-1/SVD-1	163	143	157	124	79						Under review with PTO .
CVLY-SP-TS-12	GWF Tracy SLG fault expanded to elements lost due to stuck breaker and clear fault from remote breakers with normal clearing time.	P4-1	Stuck Breaker (Gen)	38	30	29	1	2						Under review with PTO .
CVLY-SP-TS-13	Rio Oso-Atlantic 230 kV line SLG fault expanded to elements lost due to stuck breaker and clear fault from remote breakers with normal clearing time.	P4-2	Stuck Breaker (Line)	11	9	9	11	11						Under review with PTO .
CVLY-SP-TS-14	Vaca Dixon 500/230 kV SLG fault expanded to elements lost due to stuck breaker and clear fault from remote breakers with normal clearing time.	P4-3	Stuck Breaker (Tran)	50	26	30	11	15						Under review with PTO .

Study Area: PG&E Central Valley

Transient Stability

California ISO

ID	Contingency	Category	Category Description	Transient Stability Performance (Number of voltage and frequency violations)										Potential Mitigation Solutions
				2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	Select..	Select..	Select..	Select..	Select..	
CVLY-SP-TS-15	Vaca Dixon SVD SLG fault expanded to elements lost due to stuck breaker and clear fault from remote breakers with normal clearing time.	P4-4	Stuck Breaker (SVD)	2	4	3	5	2						Under review with PTO .
CVLY-SP-TS-16	Brighton 115 kV breaker SLG fault expanded to elements lost due to stuck breaker and clear fault from remote breakers with normal clearing time.	P4-5	Stuck Breaker (Bus)	25	15	15	15	13						Under review with PTO .
CVLY-SP-TS-17	Gold Hill 230 kV breaker SLG fault expanded to elements lost due to stuck breaker and clear fault from remote breakers with normal clearing time.	P4-6	Stuck Breaker (Bus-tie)	163	143	157	124	79						Under review with PTO .
CVLY-SP-TS-18	GWF Tracy SLG fault with delayed clearing.	P5-1	Non-redndant relay (Gen)	1	1	1	1	1						Under review with PTO .
CVLY-SP-TS-19	GWFTracy-Schulte 115 kV Line SLG fault with delayed clearing.	P5-2	Non-redndant relay (Line)	4	4	4	4	5						Under review with PTO .
CVLY-SP-TS-20	Rio Oso 230/115 kV transformer SLG fault with delayed clearing.	P5-3	Non-redndant relay (Tran)	211		447	11	203						Under review with PTO .
CVLY-SP-TS-21	Metcalf SVD SLG fault with delayed clearing.	P5-4	Non-redndant relay (SVD)	18	6	3	3	0						Under review with PTO .
CVLY-SP-TS-22	Schulte 115 kV bus #1 SLG fault with delayed clearing.	P5-5	Non-redndant relay (Bus)	9	9	9	9	9						Under review with PTO .
CVLY-SP-TS-23	Drum-Higgins 115 kV Line 3Ø fault with normal clearing with the Drum-Rio Oso kV #2 115 kVLine out in base case.	P6-1	L-1/N-1	7	5	5	7	7						Under review with PTO .
CVLY-SP-TS-24	Brighton 230/115kV Transformer #9 3Ø fault with normal clearing with the Brighton 230/115kV Transformer #10 out in base case.	P6-2	T-1/N-1	1	1	1	0	1						Under review with PTO .
CVLY-SP-TS-25	W.Sac-Brighton 115kV Line 3Ø fault with normal clearing with the W. Sac SVD out in base case.	P6-3	SVD-1/N-1	3	1	1	3	3						Under review with PTO .

Study Area: PG&E Central Valley

Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance (Number of voltage and frequency violations)										Potential Mitigation Solutions
				2018 Summer Peak	2021 Summer Peak	2026 Summer Peak	2018 Spring Off-Peak	2021 Summer Light Load	Select..	Select..	Select..	Select..	Select..	
CVLY-SP-TS-26	Monta Vista-Jefferson Nos. 1 & 2 230 kV lines SLG fault with normal clearing.	P7-1	DCTL	0	0	0	0	0						No violation

Study Area: PG&E Central Valley

Single Contingency Load Drop

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

No single contingency resulted in total load drop of more than 250 MW.

Study Area: PG&E Central Valley

Single Source Substation with more than 100 MW Load

ID	Substation	Load Served (MW)										Potential Mitigation Solutions
		Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	

No single source substation with more than 100 MW Load