

Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Kern-Pk T-01	Kern-Kern Oil-Famoso 70kV	Semitropic-Wasco 70kV	B	L-1	78%	78%	102%	Reconductor Kern-Kern Oil-Famoso 70kV or install second 115/70kV at Semitropic
Kern-Pk T-02	Kern-Magunden-Witco 115kV	West Park-Magunden 115kV	B	L-1	98%	103%	114%	Reconductor Kern-Magunden-Witco 115kV
Kern-Pk T-03	Kern-Kern Oil-Famoso 70kV	Semitropic-Wasco 70kV	B	L-1	78%	78%	102%	Reconductor Kern-Kern Oil-Famoso 70kV or install second 115/70kV at Semitropic
Kern-Pk T-04	Midway-La Paloma #1 230kV	Midway 1D 230kV bus fault	C1	Bus	N/A	109%	109%	Trip La Paloma unit
Kern-Pk T-05	Midway-La Paloma #2 230kV	Midway 2E 230kV bus fault	C1	Bus	110%	109%	109%	Trip La Paloma unit
Kern-Pk T-06	Midway-Semitropic 115kV	Midway 2E 115kV bus fault	C1	Bus	100%	N/A	N/A	Reconductor Midway-Semitropic 115kV line
Kern-Pk T-07	Tejon-San Bernard 70kV	Wheeler Ridge D 70kV bus fault	C1	Bus	102%	102%	103%	Upgrade Wheeler Ridge 70kV system from 1/0 Cu to larger conductor
Kern-Pk T-08	Kern-Kern Oil-Famoso 70kV	Semitropic D 70kV bus fault	C1	Bus	77%	78%	102%	Reconductor Kern-Kern Oil-Famoso 70kV
Kern-Pk T-09	Midway-Wheeler Ridge #1 230kV	Midway 2D 230kV bus fault	C1	Bus	N/A	143%	144%	Trip CDWR pump load on Midway-Wheeler Ridge 230kV path
Kern-Pk T-10	Midway-Shafter 115kV	Midway 115kV CB301 failure	C2	Breaker	161%	165%	176%	Reconductor Midway-Shafter 115kV, Shafter-Rio Bravo 115kV and Midway-Rio Bravo-Renfro 115kV lines

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Study Area: **PG&E San Joaquin Valley Kern - Summer Peak**



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					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Kern-Pk T-11	Midway-Wheeler Ridge #1 230kV	Midway 230kV CB642 failure	C2	Breaker	N/A	146%	148%	Trip CDWR pump load on Midway-Wheeler Ridge 230kV path
Kern-Pk T-12	Midway-Wheeler Ridge #1 230kV	Midway 230kV CB632 failure	C2	Breaker	N/A	145%	146%	Trip CDWR pump load on Midway-Wheeler Ridge 230kV path
Kern-Pk T-13	Kern-Lerdo-Kern Oil 115kV	Midway 115kV CB392 failure	C2	Breaker	89%	89%	112%	Reconductor Kern-Lerdo-Kern Oil 115kV
Kern-Pk T-14	Midway-La Paloma #2 230kV	Midway 230kV CB662 failure	C2	Breaker	110%	109%	110%	Trip La Paloma unit
Kern-Pk T-15	Lerdo-Famoso 115kV	Semitropic 115kV CB152 failure	C2	Breaker	78%	79%	105%	Reconductor Lerdo-Famoso 115kV
Kern-Pk T-16	Midway #1 230/115kV	Midway 230kV CB182 failure	C2	Breaker	90%	96%	103%	Upgrade Midway #1 230/115kV
Kern-Pk T-17	Kern-Lerdo-Kern Oil 115kV	Kern PP 115kV CB262 failure	C2	Breaker	91%	95%	102%	Reconductor Kern-Lerdo-Kern Oil 115kV
Kern-Pk T-18	Midway #1 230/115kV	Midway #2 & #3 230/115kV	C3	T-1-1	109%	115%	115%	Upgrade Midway #1 230/115kV transformer
Kern-Pk T-19	Kern PP #4 230/115kV	Kern PP #3 & #5 230/115kV	C3	T-1-1	128%	N/A	104%	Rerate Kern PP #4 230/115kV
Kern-Pk T-20	Midway -Kern #1 230kV	Midway -Kern #4 & #4 230kV	C3/C5	L-1-1	97%	101%	114%	Reconductor Midway-Kern #1 230kV
Kern-Pk T-21	Kern Oil-Witco 115kV	Kern PP-Westpark #1 & #2 115kV	C5	L-2	80%	78%	112%	Reconductor Kern Oil-Witco 115kV

Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Off-Peak	2017 Partial Peak	
Kern-OfPk T-01	Midsun-Midway 115kV	Copus-Old River 70 kV Line	B	L-1	N/A	N/A	114%	Reconductor Midway-Midsun-Taft 115kV path
Kern-OfPk T-02	Midway-Wheeler Ridge #1 230kV	Midway 1D 230kV bus fault	C1	Bus	119%	N/A	114%	Trip CDWR pump load on Midway-Wheeler Ridge 230kV path
Kern-OfPk T-03	Midway-Wheeler Ridge #1 230kV	Midway 2D 230kV bus fault	C1	Bus	119%	70%	111%	Trip CDWR pump load on Midway-Wheeler Ridge 230kV path
Kern-OfPk T-04	Midway-Shafter 115kV	Midway 115kV CB302 failure	C2	Breaker	80%	99%	149%	Reconductor Midway-Shafter 115kV
Kern-OfPk T-05	Midway #2 230/115kV	Midway 230kV CB632 failure	C2	Breaker	N/A	N/A	136%	Upgrade Midway #2 230/115kV
Kern-OfPk T-06	Lerdo-Famoso 115kV	Midway 115kV CB392 failure	C2	Breaker	N/A	N/A	136%	Reconductor Lerdo-Famoso 115kV
Kern-OfPk T-07	Midway-Wheeler Ridge #1 230kV	Midway 230kV CB642 failure	C2	Breaker	121%	71%	114%	Trip CDWR pump load on Midway-Wheeler Ridge 230kV path
Kern-OfPk T-08	Midway #1 230/115kV	Midway 115kV CB182 failure	C2	Breaker	N/A	N/A	109%	Upgrade Midway #1 230/115kV xfmr
Kern-OfPk T-09	Kern PP #4 230/11kV	Kern PP #3 & #5 230/115kV	C3	T-1-1	105%	N/A	120%	Upgrade Kern PP #4 230/115kV or parallel another transformer
Kern-OfPk T-10	Live Oak-Kern Oil 115kV	Semitropic-Famoso & Kern Oil-Witco 115kV	C3	L-1-1	N/A	N/A	122%	Reconductor Live Oak-Kern Oil 115kV
Kern-OfPk T-11	Midway-Kern #1 230kV	Midway-Kern #3 & #4 230kV	C3/C5	L-1-1	N/A	N/A	116%	Reconductor Midway-Kern #1 230kV
Kern-OfPk T-12	Kern Oil-Witco 115kV	Kern PP-Westpark #1 & #2 115kV lines	C5	L-2	79%	78%	112%	Reconductor Kern Oil-Witco 115kV

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %			Potential Mitigation Solutions
					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Kern-Pk D-01	Carrizo 115kV	Midway-Temblor 115kV	B	L-1	-0.104	-0.108	-0.111	Reconductor Midway-Temblor-San Luis Obispo 115kV path
Kern-Pk D-02	Wasco 70kV	Semitropic 115/70kV	B	T-1	-0.076	-0.081	-0.108	Add reactive support at Semitropic or parallel transformer
Kern-Pk D-03	Wasco 70kV	Semitropic-Wasco 70kV	B	L-1	-0.076	-0.081	-0.108	Add reactive support at Wasco or parallel line from Semitropic
Kern-Pk D-04	Temblor 115kV	Midway-Temblor 115kV	B	L-1	-0.143	-0.147	-0.154	Add reactive support at Temblor
Kern-Pk D-05	Magunden Junction 70kV	Semitropic 115/70kV & Kern Canyon Unit 1	B	L-1/G-1	-0.056	0.048	-0.051	Add reactive support at Kern PP
Kern-Pk D-06	Kern Ridge 115kV	Midway-Temblor 115kV	B	L-1	-0.14	-0.143	-0.15	Add reactive support at Temblor
Kern-Pk D-07	Tupman 115kV	Midway 115kV CB302 failure	C2	Breaker	-0.128	-0.132	-0.142	Trip Tupman load
Kern-Pk D-08	Wasco 70kV	Semitropic 115kV CB152	C2	Breaker	-0.075	-0.08	-0.107	Add reactive support at Wasco 70kV

Voltage Deviations

ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %			Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Off-Peak	2017 Partial Peak	
Kern-OfPk D-01	Tembler 115kV	Midway-Tembler 115kV	B	L-1	-0.1043	-0.1295	-0.2009	Reconductor Midway-Tembler-San Luis Obispo 115kV path
Kern-OfPk D-02	Taft 70kV	Copus-Old River 70kV	B	L-1	-0.0013	-0.0006	0.217	Add reactive support at Taft 115kV
Kern-OfPk D-03	Wasco 70kV	Semitropic D 115kV	C1	Bus	-0.075	-0.08	-0.107	Add reactive support at Wasco 70kV
Kern-OfPk D-04	Tupman 115kV	Midway 115kV CB302 failure	C2	Breaker	-0.05	-0.057	-0.0132	Trip Tupman load
Kern-OfPk D-05	Ganso 115kV	Midway 115kV CB392 failure	C2	Breaker	-0.068	-0.023	-0.184	Add reactive support at Ganso 115kV or Smyrna 115kV
Kern-OfPk D-06	Tembler 115kV	Midsun-Midway 115kV & Midway-Tembler 115kV lines	C5	L-2	-0.1039	-0.1292	-0.1449	Reconductor Midway-Tembler-San Luis Obispo 115kV path

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High/Low Voltage

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)			Potential Mitigation Solutions
					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Kern-Pk V-01	Cuyama	Base Case	A	N-0	0.919	0.935	0.932	Install reactive support on Taft 70kV subsystem
Kern-Pk V-02	Wellfield	Base Case	A	N-0	0.924	0.991	0.987	Short term plan
Kern-Pk V-03	Kern Ridge	Midway-Temblor 115kV	B	L-1	0.876	0.876	0.866	Add reactive support at Temblor
Kern-Pk V-04	Wasco 70kV	Semitropic 115/70kV	B	T-1	0.917	0.923	0.884	Install reactive support on Semitropic-Kern 70kV subsystem
Kern-Pk V-05	Temblor	Midway-Temblor 115kV & Texaco Lost Hills Unit 1	B	L-1/G-1	1.022	0.805	1.023	Add reactive support at Temblor
Kern-Pk V-06	Ogle Tap	Lerdo-Kern Oil-7th Standard 115kV	B	L-1	1.054	1.058	1.055	Under review for possible exemptions
Kern-Pk V-07	Wasco 70kV	Semitropic D 115kV bus fault	C1	Bus	0.918	0.923	0.885	Add reactive support at Wasco 70kV
Kern-Pk V-08	Tupman 115kV	Midway 115kV CB302 failure	C2	Breaker	0.898	0.9008	0.885	Trip Tupman load
Kern-Pk V-09	Wasco 70kV	Semitropic 115kV CB152 failure	C2	Breaker	0.918	0.924	0.885	Add reactive support at Wasco 70kV

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Transient Stability



ID	Contingency	Category	Category Description	Transient Stability Performance			Potential Mitigation Solutions
				2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Kern-Pk TS-01	SLG on Midway 1D 230kV bus and Midway CB632 fails to operate	C9	SLG with stuck breaker	unstable	unstable	unstable	Further study needed.

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Study Area: **PG&E San Joaquin Valley Kern - Summer Light Load, Summer Off-Peak & Summer Partial Peak**



Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance			Potential Mitigation Solutions
				2014 Summer Light Load	2017 Summer Off-Peak	2017 Partial Peak	
Kern-OfPk TS-01	SLG on Kern PP #5 230/115kV and Kern PP CB572 fails to operate	C7	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Kern-OfPk TS-02	SLG on Midway #1 500/230kV and Midway CB732 fails to operate	C7	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Kern-OfPk TS-03	SLG on Midway 1D 230kV bus and Midway CB632 fails to operate	C9	SLG with stuck breaker	unstable	unstable	stable	Further study needed.

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Study Area: **PG&E San Joaquin Valley Kern - Summer Light Load, Summer Off-Peak & Summer Partial Peak**



High/Low Voltage

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)			Potential Mitigation Solutions
					2014 Summer Light Load	2017 Summer Off-Peak	2017 Partial Peak	
Kern-OfPk V-01	Cuyama 70kV	Base Case	A	N-0	0.987	0.973	0.944	Base Case
Kern-OfPk V-02	Temblor 115kV	Midway-Temblor 115kV	B	L-1	0.9225	0.8824	0.8027	Reconductor Midway-Temblor-San Luis Obispo 115kV path
Kern-OfPk V-03	Wasco 70kV	Semitropic 115/70kV	B	T-1	0.9229	0.9283	0.8921	Add reactive support at Wasco 70kV
Kern-OfPk V-04	Semitropic 115kV	Midway 115kV CB392 failure	C2	Breaker	0.975	0.999	0.835	Add reactive support at Smyrna and Semitropic
Kern-OfPk V-05	Tupman 115kV	Midway 115kV CB302 failure	C2	Breaker	1.006	0.979	0.891	Trip Tupman load
Kern-OfPk V-06	Cuyama	Taft-Chalk Cliff 115kV & Taft #2 115/70kV	C3	L-1/T-1	0.9734	0.9485	0.8718	Install second transformer at Taft 115/70kV
Kern-OfPk V-07	Temblor 115kV	Midsun-Midway 115kV & Midway-Temblor 115kV lines	C5	L-2	0.927	0.886	0.809	Reconductor Midway-Temblor-San Luis Obispo 115kV path

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Single Contingency Load Drop

ID	Worst Contingency	Category	Category Description	Amount of Load Drop (MW)			Potential Mitigation Solutions
				2014	2017	2022	

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

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Single Source Substation with more than 100 MW Load

ID	Substation	Load Served (MW)			Potential Mitigation Solutions
		2014	2017	2022	

No single source substation with more than 100 MW Load