

2012/2013 ISO Reliability Assessment - Final Study Results

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



Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Fres-Pk T-01	Kearney-Caruthers 70kV line	None	A	N-0	96%	97%	108%	Reconductor Kearney-Caruthers 70kV
Fres-Pk T-02	Kearney #2 230/70kV transformer	Helm-Kerman 70kV line	B	T-1	108%	109%	114%	Add parallel 230/70kV transformer at Kearney
Fres-Pk T-03	Gregg-Herndon #2 230kV line	Bus 1 fault at Herndon 230kV	C1	Bus	96%	99%	103%	Reconductor Gregg-Herndon #2 230kV line
Fres-Pk T-04	Herndon #2 230/115kV transformer	Bus 1 fault at Herndon 230kV	C1	Bus	103%	106%	114%	Consider 4th 230/115kV transformer at Herndon or 115kV back-tie to Kerckhoff 2 PH
Fres-Pk T-05	Herndon-Bullard #1 115kV line	Bus 1 fault at Herndon 115kV	C1	Bus	115%	122%	132%	Reconductor Herndon-Bullard 115kV lines
Fres-Pk T-06	Manchester-Herndon 115kV line	McCall 230kV CB202 failure	C2	CB	138%	N/A	N/A	Consider SPS to drop load in the McCall 115kV area
Fres-Pk T-07	Panoche-Oro Loma 115kV	Dairyland-Le Grand 115kV & Panoche-Oro Loma 115kV lines	C3	L-1-1	73%	111%	119%	Reconductor Panoche-Oro Loma-Wilson 115kV path
Fres-Pk T-08	Warnerville-Wilson 230kV line	Helms-Gregg #1 & #2 lines	C3/C5	L-1-1	93%	105%	102%	Reconductor Bellota-Warnerville-Wilson 230kV path
Fres-Pk T-09	Gregg-Herndon #2 230kV line	Gregg-Herndon #1 & Gregg-Ashlan 230kV lines	C3	L-1-1	107%	110%	115%	Reconductor Gregg-Herndon #2 230kV line
Fres-Pk T-10	Gregg-Ashlan 230kV line	Gregg-Herndon #1 & #2 lines	C3/C5	L-1-1/L-2	173%	177%	84%	Reconductor Gregg-Ashlan 230kV line (Already modeled in 2022 case)
Fres-Pk T-11	Oro Loma-Canal 70kV line	Mercy Springs-Oro Loma 70kV line and Oro Loma 115/70kV transformer	C3	L-1/T-1	N/A	100%	103%	Add parallel 230/70kV transformer at Oro Loma or reconductor Oro Loma-Canal 70kV line

Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Fres-Pk T-12	McCall-Cal Ave 115kV	Cal Ave-Sanger 115kV & McCall-West Fresno 115kV	C3/C5	L-1-1	97%	105%	119%	Add second Sanger-Cal Ave 115kV or add second McCall-West Fresno 115kV
Fres-Pk T-13	West Fresno-McCall 115kV	McCall-Cal Ave 115kV & Cal Ave-Sanger 115kV	C3	L-1-1	89%	95%	106%	Add second Sanger-Cal Ave 115kV or add second McCall-West Fresno 115kV
Fres-Pk T-14	Cal Ave-Sanger 115kV	McCall-Cal Ave 115kV & McCall-West Fresno 115kV	C3	L-1-1	95%	100%	110%	Reconductor Cal Ave-Sanger 115kV
Fres-Pk T-15	Sanger-Kings River-Reedley 115kV (Reedley-Piedra)	Sanger-Reedley 115kV & McCall-Reedley 115kV	C3	L-1-1	140%	149%	163%	New project to reconductor Sanger-Kings River-Reedley and install reactive support at Reedley 115kV
Fres-Pk T-16	Wilson-LeGrand 115kV	Kerckhoff-Clovis-Sanger #1 & #2 115kV	C3/C5	L-1-1	109%	107%	113%	Kerckhoff SPS already mitigates.
Fres-Pk T-17	Reedley #2 115/70kV transformer	Reedley #4 115/70kV & Reedley-Dinuba 70kV	C3	L-1-1	94%	98%	105%	New transformer at Reedley
Fres-Pk T-18	Herndon #2 230/115kV transformer	Herndon #1 & #3 230/115kV transformers	C3	T-1-1	100%	105%	114%	Operational action plan/SPS to drop load
Fres-Pk T-19	Warnerville-Wilson 230kV	Helms-Gregg #1 & #2 230kV	C3	L-1-1	93%	105%	102%	Reconductor Bellota-Wilson 230kV Path
Fres-Pk T-20	Panoche-Oro Loma 115kV	Panoche-Mendota 115kV & Le Grand-Dairyland 115kV	C3	L-1-1	73%	111%	119%	Reconductor Panoche-Oro Loma 115kV Line
Fres-Pk T-21	Kearney-Biola 70kV & Borden #2 230/70kV transformer	Borden #1 230/70kV transformer	C3	L-1/T-1	94%	97%	101%	Upgrade Borden #1 230/70kV transformer. Note: Model rating is lower than one-line dwg rating
Fres-Pk T-22	Gregg-Herndon#2 230kV	Gregg-Herndon #1 230kV & Gregg-Ashlan 230kV	C3	L-1-1	107%	110%	115%	Trip two Helms units

Thermal Overloads

ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)			Potential Mitigation Solutions
					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Fres-Pk T-23	Los Banos-Canal 70kV	Mercy Springs #1 230/70kV and Oro Loma #2 115/70kV	C3	T-1-1	N/A	97%	105%	Possible RAS. Add another transformer at Oro Loma or Mercy Springs

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	
Fres-OfPk T-01	Warnerville-Wilson 230kV	Base Case Overload	A	L-0	50%	36%	157%	Turn on Helms if available
Fres-OfPk T-02	Midway-Gates 230kV	Gates #11 500/230kV transformer	B	T-1	N/A	107%	N/A	Add second Gates 500/230kV transformer
Fres-OfPk T-03	Merced-Merced Falls 70kV line	Exchequer-Le Grand 115kV line (Exchequer SPS not modeled)	B	L-1	N/A	104%	N/A	DEC Exchequer PH
Fres-OfPk T-04	Herndon-Bullard #1 115kV	Herndon 115kV bus 1 fault	C1	Bus	N/A	N/A	103%	Consider SPS to drop Bullard 115kV load
Fres-OfPk T-05	Merced Falls-Exchequer 70kV	Le Grand 115kV bus fault	C1	Bus	N/A	209%	159%	DEC Exchequer PH
Fres-OfPk T-06	Schindler-Coalinga 2 70kV	Gates 1D 230kV bus fault	C1	Bus	N/A	N/A	105%	Consider SPS to drop load on Gates 70kV
Fres-OfPk T-07	Kearney-Herndon 230kV	Gates 1E 230kV bus fault	C1	Bus	N/A	N/A	105%	INC Helms PGP
Fres-OfPk T-08	Exchequer-Le Grand 115kV	Merced Falls 70kV bus fault	C1	Bus	N/A	104%	82%	DEC Exchequer PH
Fres-OfPk T-09	Oro Loma-Mercy Springs 70kV	Panoche 230kV CB202 failure	C2	Breaker	N/A	76%	180%	Consider sectionalizing Panoche 230kV bus to minimize impact
Fres-OfPk T-10	Panoche-Gates #1 230kV	Gates 230kV CB202 failure	C2	Breaker	N/A	N/A	118%	Reconductor Gates-Panoche 230kV path
Fres-OfPk T-11	Gates-Gregg 230kV	McCall 230kV CB202 failure	C2	Breaker	N/A	109%	N/A	Consider BAAH upgrade at Henrietta
Fres-OfPk T-12	Panoche-Gates #1 230kV	Gates 230kV CB312 failure	C2	Breaker	N/A	114%	N/A	Reconductor Gates-Panoche 230kV path
Fres-OfPk T-13	Oro Loma-Mercy Springs 70kV	Panoche 115kV CB102 failure	C2	Breaker	N/A	80%	107%	Consider sectionalizing Panoche 115kV bus to minimize impact

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



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	
Fres-OfPk T-14	Panoche-Schindler #1 OR #2 115kV	Panoche-Schindler #2 OR #1 115kV & Gates #5 230/70kV	C3	L-1-1	N/A	N/A	131%	Add second Gates 230/70kV transformer
Fres-OfPk T-15	Exchequer-Le Grand 115kV	Merced-Merced Falls 70kV & Exchequer-Yosemite 70kV	C3	L-1-1	N/A	109%	87%	DEC Exchequer PH
Fres-OfPk T-16	Manchester-Airways-Sanger 115kV	Kerckhoff-Clovis-Sanger #1 & #2	C3	L-1-1	N/A	110%	N/A	DEC Kerckhoff PH
Fres-OfPk T-17	Kearney-Herndon 230kV	Warnerville-Wilson 230kV & Gates-Gregg 230kV	C3	L-1-1	N/A	80%	116%	INC Helms PP
Fres-OfPk T-18	Wilson-Legrand 115kV	Warnerville-Wilson 230kV & Melones-North Merced 230kV	C3	L-1-1	N/A	N/A	101%	INC Helms PP or reconductor El Nido-Wilson 115kV
Fres-OfPk T-19	Oro Loma-El Nido 115kV	Warnerville-Wilson 230kV & Melones-North Merced 230kV	C3	L-1-1	N/A	77%	128%	INC Helms PP or reconductor Oro Loma-El Nido 115kV
Fres-OfPk T-20	Panoche-Oro Loma 115kV	Warnerville-Wilson 230kV & Panoche-Mendota 115kV	C3	L-1-1	N/A	88%	123%	INC Helms PP or reconductor Panoche-Oro Loma 115kV
Fres-OfPk T-21	Panoche-Gates 230kV	Panoche-Gates #2 & Los Banos 500/230kV	C3	L-1/T-1	N/A	109%	N/A	INC Panoche EC
Fres-OfPk T-22	Wilson-Borden 230kV	Panoche-Kearney 230kV & Wilson-Gregg 230kV	C3	L-1-1	N/A	N/A	129%	INC Helms PP or reconductor Bellota_Warnerville-Gregg 230kV Path
Fres-OfPk T-23	Coalinga 1-Coalinga 2 70kV	Templeton-Gates 230kV & Gates-Coalinga 1 70kV	C3	L-1-1	N/A	71%	102%	Reconductor Coalinga 1-Coalinga 2 70kV
Fres-OfPk T-24	Gregg-Ahslan 230kV	Gregg-Herndon #1 & #2 230kV	C3	L-1-1	N/A	N/A	101%	Reconductor Gregg-Ahslan 230kV
Fres-OfPk T-25	Kerckhoff 2-Chowchilla 115kV	Kerckhoff-Clovis-Sanger #1 & #2	C3	L-1-1	164%	103%	131%	DEC Kerckhoff PH
Fres-OfPk T-26	Los Banos-Canal 70kV	Los Banos-Canal-Oro Loma 70kV & Mercy Spring #1 230/70kV	C3	L-1/T-1	N/A	N/A	105%	Reconductor Los Banos-Canal 70kV

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	
Fres-OfPk T-27	Gates-Midway 230kV	Gates-Arco 230kV & Gates #11 500/230kV	C3	L-1/T-1	N/A	115%	N/A	Redispatch generation
Fres-OfPk T-28	Barton-Airways-Sanger 115kV	Manchester-Airways-Sanger 115kV & Woodward-Shepherd 115kV	C3	L-1-1	N/A	109%	N/A	Trip a Helms pump
Fres-OfPk T-29	Los Banos-Dos Amigos 230kV	Warnerville-Wilson 230kV & Gates #11 500/230kV	C3	L-1/T-1	N/A	N/A	109%	Trip Dos Amigos PP load

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	
Fres-Pk D-01	Mariposa 70kV	Exchequer-Le Grand 115kV line (Exchequer SPS modeled)	B	L-1/G-1	-0.082	-0.086	-0.097	Update Exchequer SPS to run back instead of drop Exchequer PH for loss of Exchequer-Le Grand 115kV line
Fres-Pk D-02	Borden 230kV	Borden-Gregg 230kV	B	L-1	-0.055	-0.056	N/A	Upgrade Borden earlier
Fres-Pk D-03	Chowchilla 115kV	Le Grand-Chowchilla 115kV	B	L-1	-0.057	-0.054	-0.056	Add reactive support at Chowchilla
Fres-Pk D-04	Bonita 70kV	Merced #2 115/70kV and El Nido unit	B	L-1/G-1	-0.044	-0.049	-0.057	Add second transformer at Merced Falls 115/70kV
Fres-Pk D-05	Oakhurst 115kV	Kerckhoff-Oakhurst 115kV line & Kerckhoff #1	B	L-1/G-1	N/A	-0.056	-0.06	Install reactive support at Oakhurst
Fres-Pk D-06	Oakhurst 115kV	Bus Fault at Kerckhoff 2	C1	Bus	-0.097	-0.124	-0.135	Add reactive support at Oakhurst
Fres-Pk D-07	McCall 115kV	McCall CB202 230kV CB202 failure	C2	Breaker	-0.186	N/A	N/A	Low voltages throughout McCall area. Consider SPS to drop load in McCall 115kV area
Fres-Pk D-08	West Fresno	Cal Ave-Sanger 115kV & McCall-West Fresno 115kV	C3	L-1-1	-0.154	-0.172	-0.21	Add second Cal Ave-Sanger 115kV line or second McCall-West Fresno 115kV (Also mitigates overloads)
Fres-Pk D-09	Coalinga 1	Coalinga 1-Coalinga 2 70kV & Gates-Coalinga 1 70kV	C3	L-1-1	-0.166	-0.168	-0.192	Install reactive support at Coalinga
Fres-Pk D-10	Yosemite 70kV	Exchequer-Le Grand 115kV & Exchequer-Mariposa 70kV	C3	L-1-1	-0.135	-0.144	-0.164	Reconductor Exchequer-Merced Falls 70kV to eliminate Exchequer SPS
Fres-Pk D-11	Oro Loma 70kV	Mercy Springs-Oro Loma 70kV & Oro Loma #2 115/70kV	C3	L-1/T-1	N/A	-0.157	-0.163	Install reactive support at Oro Loma
Fres-Pk D-12	Wahtoke 115kV	Sanger-Reedley 115kV & McCall-Reedley 115kV	C3	L-1-1	-0.111	-0.123	-0.141	New project to reconductor Sanger-Kings River-Reedley 115kV and install reactive support (Also mitigates overloads)
Fres-Pk D-13	Henrietta 230kV	Gates-Gregg 230kV & Gates-McCall 230kV	C3	L-1-1	-0.112	-0.116	-0.121	Upgrade Henrietta to BAAH

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	
Fres-Pk D-14	Mendota 115kV	Panoche-Mendota 115kV and Oro Loma #2 115/70kV	C3	L-1/T-1	-0.091	-0.113	-0.103	Install reactive support at Mendota 115kV
Fres-Pk D-15	Dinosaur Point Junction 70kV tap	Los Banos #3 & #4 230/70kV transformers	C3	T-1-1	N/A	-0.083	-0.087	Install reactive support at Los Banos 70kV or third 230/70kV transformer
Fres-Pk D-16	Oro Loma 70kV	Mercy Springs 230/70kV and Oro Loma #2 115/70kV	C3	T-1-1	N/A	-0.053	0.06	Install second transformer at Mercy Springs or Oro Loma
Fres-Pk D-17	Corcoran 115kV	McCall-Kingsburg #1 115kV and Kingsburg-Corcoran #2 115kV	C3	L-1-1	-0.057	-0.058	-0.059	Install reactive support at Corcoran
Fres-Pk D-18	Borden	Warnerville-Wilson 230kV & Borden-Gregg 230kV	C3	L-1-1	-0.077	-0.086	0.016	Install reactive support at Borden earlier
Fres-Pk D-19	Oro Loma	Mercy Springs-Oro Loma 70kV & Oro Loma #2 115/70kV	C3	L-1/T-1	N/A	-0.157	-0.163	Install reactive support at Oro Loma

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	
Fres-OfPk D-01	Avenal	Gates #5 230/70kV transformer	B	T-1	0.011	0.011	-0.0875	Add second Gates 230/70kV transformer
Fres-OfPk D-02	Maripos, Yosemite, Saxon Creek	Exchequer-Le Grand 115kV and McSwain Unit 1	B	L-1/G-1	-0.018	-0.035	-0.144	Update Exchequer SPS to runback instead of drop for loss of Exchequer-LeGrand 115kV
Fres-OfPk D-03	Bonita	Le Grand 115kV bus fault	C1	Bus	0.003	-0.13	-0.09	Increase reactive support at Merced
Fres-OfPk D-04	Oakhurst	Kerckhoff 2 115kV bus fault	C1	Bus	-0.04	-0.05	-0.114	Add reactive support at Chowchilla or Le Grand
Fres-OfPk D-05	Panoche 1 115kV bus	Panoche 230kV CB202 failure	C2	Breaker	-0.036	-0.065	-0.166	Consider sectionalizing Panoche 230kV bus
Fres-OfPk D-06	Coalinga 1	Coalinga 1-Coalinga 2 70kV & Gates-Coalinga #1 70kV	C3	L-1-1	0.017	-0.038	-0.144	Add reactive support at Coalinga 1
Fres-OfPk D-07	Poso J1, Firebaugh, and Mendota	Panoche-Mendota 115kV & Oro Loma #2 115/70kV	C3	L-1/T-1	0.013	-0.076	-0.171	Add reactive support at Mendota
Fres-OfPk D-08	Dairyland, Mendota	Dairyland-Le Grand 115kV & Panoche-Mendota 115kV	C3	L-1-1	0.006	-0.067	-0.162	Add reactive support at Mendota
Fres-OfPk D-09	Oro Loma	Mercy Spring-Oro Loma 70kV & Oro Loma #2 115/70kV	C3	L-1-1	N/A	-0.049	-0.125	Add reactive support at Oro Loma or second transformer at Oro Loma 115/70kV
Fres-OfPk D-10	Avenal, Sun City, Kettleman	Panoche-Schindler #2 115kV & Gates #5 230/70kV	C3	L-1/T-1	0.005	0.01	-0.165	Add second transformer at Gates 230/70kV
Fres-OfPk D-11	Borden	Warnerville-Wilson 230kV & Borden-Gregg 230kV	C3	L-1-1	-0.54	-0.03	-0.112	Consider running a Helms unit after first contingency

High/Low Voltage

ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)			Potential Mitigation Solutions
					2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	
Fres-Pk V-01	Mariposa 70kV	Exchequer-Le Grand 115kV	B	L-1	0.903	0.898	0.885	Update Exchequer SPS to run back instead of drop for loss of Exchequer-Le Grand 115kV line
Fres-Pk V-02	Oakhurst 115kV	Kerckhoff 2 bus fault	C1	Bus	0.903	0.897	0.889	Add reactive support at Oakhurst
Fres-Pk V-03	McCall 115kV	McCall 230kV CB202 failure	C2	Breaker	0.846	N/A	N/A	Low voltages throughout McCall area. Consider SPS to drop load in McCall 115kV area
Fres-Pk V-04	West Fresno 115kV	California Ave-Sanger 115kV & McCall-West Fresno 115kV	C3	L-1-1	0.849	0.828	0.788	Add second Cal Ave-Sanger 115kV line or second McCall-West Fresno 115kV line and add reactive support at Cal Ave (Second line also mitigates overloads in the area)
Fres-Pk V-05	Coalinga 1	Coalinga 1-Coalinga 2 70kV & Gates-Coalinga 1 70kV	C3	L-1-1	0.833	0.832	0.808	Install reactive support at Coalinga
Fres-Pk V-06	Oro Loma	Mercy Springs-Oro Loma 70kV & Oro Loma #2 115/70kV	C3	L-1/T-1	N/A	0.869	0.864	Install reactive support at Oro Loma
Fres-Pk V-07	Firebaugh	Oro Loma #2 115/70kV and multiple	C3	L-1-1	0.899	N/A	N/A	Short term action plan until Oro Loma 70kV reinforcement in place

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	
Fres-OfPk V-01	Bear Valley, Exchequer, Yosemite	Exchequer-Le Grand 115kV & McSwain Unit 1	B	L-1/G-1	0.993	0.983	0.84	Update Exchequer SPS to runback instead of drop for loss of Exchequer-Le Grand 115kV
Fres-OfPk V-02	Avenal	Gates #5 230/70kV transformer	B	T-1	0.998	1.02	0.888	Add second transformer at Gates 230/70kV
Fres-OfPk V-03	Henrietta 230kV	Gates #1E 230kV bus fault	C1	Bus	1.008	0.95	0.877	Consider BAAH looping Henrietta through Gates-Gregg 230kV and Gates-McCall 230kV lines
Fres-OfPk V-04	Avenal 70kV	Gates #1D 230kV bus fault	C1	Bus	1	1.02	0.887	Consider SPS to drop load on Gates 70kV system
Fres-OfPk V-05	Oakhurst	Kerckhoff 2 115kV bus fault	C1	Bus	0.995	0.972	0.884	Add reactive support at Chowchilla or Le Grand
Fres-OfPk V-06	Bonita	Le Grand 115kV bus fault	C1	Bus	1.02	0.86	0.855	Increase reactive support at Merced
Fres-OfPk V-07	Avenal, Coalinga 1	Panoche-Schindler #1 OR #2 & Gates #5 230/70kV	C3	L-1/G-1	0.992	1.019	0.812	Add second transformer at Gates 230/70kV
Fres-OfPk V-08	Coalinga 1	Coalinga 1-Coalinga 2 70kV & Gates-Coalinga #1 70kV	C3	L-1-1	1.016	0.961	0.837	Add reactive support at Coalinga 1
Fres-OfPk V-09	Firebaugh, Mendota	Dairyland-Le Grand 115kV & Panoche-Mendota 115kV	C3	L-1-1	1.034	0.951	0.84	Add reactive support at Mendota
Fres-OfPk V-10	Firebaugh, Mendota	Panoche-Mendota 115kV & Oro Loma #2 115/70kV	C3	L-1/T-1	0.964	0.949	0.843	Add reactive support at Mendota
Fres-OfPk V-11	Oro Loma	Mercy Spring-Oro Loma 70kV & Oro Loma #2 115/70kV	C3	L-1/T-1	N/A	0.974	0.883	Add reactive support at Oro Loma
Fres-OfPk V-12	Helms PP	Warnerville-Wilson 230kV & Helms-Gregg #2 230kV	C3	L-1-1	1.032	0.878	0.974	Consider runnign Helms after first contingency
Fres-OfPk V-13	Borden	Warnerville-Wilson 230kV & Borden-Gregg 230kV	C3	L-1-1	0.96	0.951	0.871	Consider runnign Helms after first contingency
Fres-OfPk V-14	Henrietta	Gates-Gregg 230kV & Gates-McCall 230kV	C3	L-1-1	0.824	0.858	N/A	Loop Henrietta 230kV through Gates-Gregg 230kV & Gates-McCall 230kV

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	
Fres-OfPk V-15	Mendota	Wilson-Le Grand 115kV & Panoche-Mendota 115kV	C3	L-1-1	0.868	0.985	0.949	Short term plan
Fres-OfPk V-16	Los Banos	Los Banos-Canal-Oro Loma 70kV & Los Banos #4 230/70kV	C3	L-1/T-1	1.1007	1.051	1.053	Under review for possible exemptions
Fres-OfPk V-17	Herndon 115kV	Panoche-Kearney 230kV & Gates-Gregg 230kV lines	C3/C5	L-1-1	0.999	N/A	0.856	Add reactive support at Herndon and Gregg



Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance			Potential Mitigation Solutions
				2014 Summer Peak	2017 Summer Peak	2022 Summer Peak	

No transient stability issues identified.

Transient Stability

ID	Contingency	Category	Category Description	Transient Stability Performance			Potential Mitigation Solutions
				2014 Summer Light Load	2017 Summer Off-Peak	2017 Partial Peak	
Fres-OfPk TS-01	SLG on Herndon #1 230/115kV and Herndon CB272 fails to operate	C7	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Fres-OfPk TS-02	SLG on McCall #1 230/115kV and McCall CB 272 fails to operate	C7	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Fres-OfPk TS-03	SLG on Helms-Gregg #1 230kV and Gregg CB332 fails to operate	C8	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Fres-OfPk TS-04	SLG on Borden-Gregg 230kV and Gregg CB512 fails to operate	C8	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Fres-OfPk TS-05	SLG on Haas-McCall 230kV and McCall CB262 fails to operate	C8	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Fres-OfPk TS-06	SLG on Herndon #1 230kV bus and Herndon CB202 fails to operate	C9	SLG with stuck breaker	stable	unstable	stable	Further study needed.
Fres-OfPk TS-07	SLG on McCall #1 230kV bus and McCall CB202 fails to operate	C9	SLG with stuck breaker	stable	unstable	stable	Further study needed.

2012/2013 ISO Reliability Assessment - Final Study Results

Study Area: **PG&E San Joaquin Valley Greater Fresno**



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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Study Area: **PG&E San Joaquin Valley Greater Fresno**

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