

Economic Planning Study
Congestion Identification in the CAISO-Controlled Grid
Simulation Results

Database version ID: 110217

Overview of Study Cases:

Case	RPS Portfolio	RPS Portfolio acronym	Base Cases
Base case	P4: Hybrid	P4 - Hybrid	CAISO-B2015_110217 and CAISO-B2020_110217
Sensitivity case 1	P1: High in-state transmission utilization	P1 - High UTL	CAISO-B2015_110217_P1 and CAISO-B2020_110217_P1
Sensitivity case 2	P2: High Out-of-State	P2 - High OOS	CAISO-B2015_110217_P2 and CAISO-B2020_110217_P2
Sensitivity case 3	P3: High Distributed Generation	P3 - High DG	CAISO-B2015_110217_P3 and CAISO-B2020_110217_P3

Simulation tool:

ABB GridView Version 7.0 (released on 8-Jun-2010) with service pack of 15-Feb-2011

Database:

Database reference: WECC TEPPC datasets - "2017 PC4A" (released on 11-Nov-2008)

Database updates: Updates from TEPPC datasets 2020 PC0 (released on 21-Jan-2011) and CAISO modeling

Database established: CAISO production simulation platform "DB110217"

Congestion Identification in the CAISO-Controlled Grid

Simulation Results

The base case: RPS portfolio #4 - Hybrid case (Hybrid)

Study cases: CAISO-B2015_110217 and CAISO-B2020_110217

Congestion is ranked by weighted-average of congestion costs in the right-most column

#	Utilities	Area	Congested Transmission Facilities	Rating (MVA)	2015		2020		2015		2020		Average Congestion Costs (M\$)
					Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	
1	PG&E	North Valley Area (NVA)	Delevan - Cortina 230 kV line	331	0.511	29	1.661	67	0.511	29	1.662	68	1.086
			Table Mountain - Vaca Dixon 500 kV line	2146			0.001	1					
2	PG&E - SCE	Path 26 (Northern-Southern California)	Midway - Vincent 500 kV line #1, subject to loss of Midway - Vincent #2	2468	0.334	100	0.549	117	0.495	171	0.712	151	0.604
			Midway - Vincent 500 kV line #1, subject to loss of Midway - Whirlwind 500 kV line	2468	0.070	33	0.041	11					
			Midway - Vincent 500 kV line #2, subject to loss of Midway - Whirlwind 500 kV line	2567	0.065	20	0.004	5					
			Path 26 (Northern - Southern California) - path ratings	4000 3000	0.025	14	0.097	13					
			Path 26 (Northern - Southern California) - operating transfer limits	dynamic	0.001	4	0.020	5					
3	PG&E - TID	Los Banos North (LBN)	Los Banos - Westley 230 kV line	591			0.012	3	0.000	0	1.112	50	0.556
			Los Banos - Westley 230 kV line, subject to loss of Los Banos - Tesla 500 kV line	677			1.099	47					
4	SDG&E - CFE	Path 45 (SDG&E - CFE)	Path 45 (SDG&E - CFE) - path rating	408	0.302	8	0.167	9	0.302	8	0.167	9	0.234
5	PG&E	Greater Fresno Area (GFA)	Cottle B - Warnerville 230 kV line	269	0.000	1	0.028	6	0.126	54	0.263	77	0.194
			Bellota - Cottle B 230 kV line	269	0.029	6	0.024	6					
			Bellota - Cottle B 230 kV line, subject to loss of Bellota - Cottle A 230 kV line	316	0.001	1	0.040	6					
			Warnerville - Wilson 230 kV line	269	0.093	44	0.154	55					
			Warnerville - Wilson 230 kV line, subject to loss of Melones - Wilson 230 kV line	316			0.013	3					
			Kearney - Herndon 230 kV line	329	0.001	1	0.003	1					
			Borden - Gregg 230 kV line	269 → 329	0.002	1							
6	SCE	Big Creek Area	Magunden - Vestal 230 kV line #2, subject to loss of line #1	373	0.105	1	0.243	10	0.108	4	0.243	10	0.175
			Magunden-Antelope 230 kV line	357									
			Magunden - Pastoria 230 kV #2, subject to loss of Magunden - Pastoria 230 kV #1	329	0.002	3							
7	SCE	Vincent	Vincent 500/230 kV transformer #1	1000			0.320	21	0.000	0	0.320	21	0.160
8	PacifiCorp - PG&E	Path 66 (COI)	Path 66 (COI)	4800			0.129	12	0.016	17	0.137	29	0.077
			Path 25 (PacifiCorp/PG&E 115 kV Interconnection)	100	0.016	17	0.008	17					
9	LADWP - SCE	Path 60 (Inyo-Control 115 kV tie)	Inyo 115 kV phase shifter	56	0.008	11	0.027	36	0.008	11	0.027	36	0.018
10	LADWP - SCE	Path 61 (Victorville-Lugo 500 kV line)	Lugo - Victorville 500 kV line, subject to loss of Eldorado - Pisgah 500 kV line	2598			0.014	2	0.000	0	0.014	2	0.007
11	PG&E - SPP	Path 24 (PG&E - Sierra)	Path 24 (PG&E - Sierra)	160 150	0.003	1			0.003	1	0.000	0	0.001
12	PG&E & WAPA	Path 15 (Midway - Los Banos)	Path 15 (Midway - Los Banos) - operating transfer limits	dynamic			0.000	3	0.000	0	0.000	3	0.000
Total:						1.569	295	4.655	456				3.112

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Simulation Results

Sensitivity case: RPS portfolio #1 - High in-state transmission utilization (High UTL)

Study cases: CAISO-B2015_110217_P1 and CAISO-B2020_110217_P1

Congestion is ranked by weighted-average of congestion costs in the right-most column

#	Area	Area	Congested Transmission Facilities	Rating (MVA)	2015		2020		2015		2020		Average Congestion Costs (M\$)
					Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	
1	PG&E - TID	Los Banos North (LBN)	Los Banos - Westley 230 kV line	591			0.058	11	0.000	0	3.421	130	1.711
			Los Banos - Westley 230 kV line, subject to loss of Los Banos - Tesla 500 kV line	677			3.363	119					
2	PG&E	North Valley Area (NVA)	Delevan - Cortina 230 kV line	331	0.513	33	1.724	65	0.513	33	1.724	65	1.118
3	SCE	Vincent	Vincent 500/230 kV transformer #1	1000	0.002	1	1.242	57	0.002	1	1.242	57	0.622
4	PG&E - SCE	Path 26 (Northern-Southern California)	Midway - Vincent 500 kV line #1, subject to loss of Midway - Vincent #2	2468	0.236	89	0.510	91	0.357	141	0.624	124	0.491
			Midway - Vincent 500 kV line #1, subject to loss of Midway - Whirlwind 500 kV line	2468	0.066	26	0.054	14					
			Midway - Vincent 500 kV line #2, subject to loss of Midway - Whirlwind 500 kV line	2567	0.036	13							
			Path 26 (Northern - Southern California) - path ratings	4000 3000	0.013	9	0.061	19					
			Path 26 (Northern - Southern California) - operating transfer limits	dynamic	0.007	4							
5	SDG&E - CFE	Path 45 (SDG&E - CFE)	Path 45 (SDG&E - CFE) - path rating	408	0.304	8	0.320	9	0.304	8	0.320	9	0.312
6	SCE	Big Creek Area	Magunden - Vestal 230 kV line #2, subject to loss of line #1	373	0.119	3	0.439	10	0.122	5	0.445	11	0.283
			Magunden - Pastoria 230 kV #2, subject to loss of Magunden - Pastoria 230 kV #1	329	0.003	2	0.006	1					
7	PG&E	Greater Fresno Area (GFA)	Cottle B-Warnerville 230 kV #1	269			0.032	3	0.097	39	0.301	79	0.199
			Bellota - Cottle B 230 kV line	269	0.035	7	0.011	4					
			Bellota - Cottle B 230 kV line, subject to loss of Bellota - Cottle A 230 kV line	316	0.005	1	0.048	6					
			Warnerville - Wilson 230 kV line	269	0.052	27	0.182	57					
			Warnerville - Wilson 230 kV line, subject to loss of Melones - Wilson 230 kV line	316			0.027	6					
			Kearney - Herndon 230 kV line	329	0.002	1	0.002	3					
			Borden - Gregg 230 kV line	269 → 329	0.003	3							
8	PacifiCorp - PG&E	Path 66 (COI)	Path 66 (COI)	4800			0.090	8	0.019	20	0.109	28	0.064
			Path 25 (PacifiCorp/PG&E 115 kV Interconnection)	100	0.019	20	0.019	20					
9	LADWP - SCE	Path 60 (Inyo-Control 115 kV tie)	Inyo 115 kV phase shifter	56	0.014	21	0.045	67	0.014	21	0.045	67	0.030
10	SCE	LA Basin metro area	Lewis - Villa Park 230 kV line, subject to loss of Serrano - Lewis 230 kV line	1023			0.021	2	0.000	0	0.021	2	0.010
11	PG&E - SPP	Path 24 (PG&E - Sierra)	Path 24 (PG&E - Sierra)	160 150	0.004	2			0.004	2	0.000	0	0.002
Total:					1.433	270	8.251	572					4.842

Congestion Identification in the CAISO-Controlled Grid

Simulation Results

Sensitivity case: RPS portfolio #2 - High Out-of-State (High OOS)

Study cases: CAISO-B2015_110217_P2 and CAISO-B2020_110217_P2

Congestion is ranked by weighted-average of congestion costs in the right-most column

#	Utilities	Area	Congested Transmission Facilities	Rating (MVA)	2015		2020		2015		2020		Average Congestion Costs (M\$)
					Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	
1	PG&E - SCE	Path 26 (Northern-Southern California)	Midway - Vincent 500 kV line #1		0.000		1		1.081		239		1.391
			Midway - Vincent 500 kV line #1, subject to loss of Midway - Vincent #2	2468	0.861	169	1.503	235					
			Midway - Vincent 500 kV line #1, subject to loss of Midway - Whirlwind 500 kV line	2468	0.106	33	0.084	21					
			Midway - Vincent 500 kV line #2, subject to loss of Midway - Whirlwind 500 kV line	2567	0.088	23	0.018	10					
			Path 26 (Northern - Southern California) - path ratings	4000 3000	0.020	11	0.076	21					
			Path 26 (Northern - Southern California) - operating transfer limits	dynamic	0.005	2	0.020	7					
2	SCE	Vincent	Vincent 500/230 kV transformer #1	1000	0.002	1	0.869	41	0.002	1	0.869	41	0.436
3	SDG&E - CFE	Path 45 (SDG&E - CFE)	Path 45 (SDG&E - CFE) - path rating	408	0.302	8	0.332	9	0.302	8	0.332	9	0.317
4	SCE	Big Creek Area	Magunden - Vestal 230 kV line #2, subject to loss of line #1	373	0.104	1	0.416	10	0.104	1	0.416	10	0.260
5	PG&E	Greater Fresno Area (GFA)	Bellota - Cottle B 230 kV line	269	0.029	7	0.041	6	0.118	52	0.339	87	0.229
			Bellota - Cottle B 230 kV line, subject to loss of Bellota - Cottle A 230 kV line	316	0.002	2	0.001	2					
			Warnerville - Wilson 230 kV line	269	0.079	38	0.191	69					
			Warnerville - Wilson 230 kV line, subject to loss of Melones - Wilson 230 kV line	316	0.008	4	0.104	9					
			Kearney - Herndon 230 kV line	329			0.001	1					
			Borden - Gregg 230 kV line	269 → 329	0.000	1							
6	PG&E - TID	Los Banos North (LBN)	Los Banos - Westley 230 kV line, subject to loss of Los Banos - Tesla 500 kV line	677			0.081	11	0.000	0	0.081	11	0.040
7	PG&E	Greater Bay Area (GBA)	Collinsville 500/230 kV transformer	1122			0.051	16	0.001	2	0.084	40	0.043
			Pittsburg D - E 230 kV tie	1195	0.001	2	0.034	24					
8	PG&E	North Valley Area (NVA)	Delevan - Cortina 230 kV line	331	0.065	4			0.065	4	0.000	0	0.033
9	LADWP - SCE	Path 61 (Victorville-Lugo 500 kV line)	Lugo - Victorville 500 kV line, subject to loss of Eldorado - Pisgah 500 kV line	2598	0.017	1	0.034	24	0.017	1	0.034	24	0.025
10	PacifiCorp - PG&E	Path 66 (COI)	Path 66 (COI)	6800			0.020	2	0.015	18	0.034	19	0.025
			Path 25 (PacifiCorp/PG&E 115 kV Interconnection)	100	0.015	18	0.014	17					
11	LADWP - SCE	Path 60 (Inyo-Control 115 kV tie)	Inyo 115 kV phase shifter	56	0.012	15	0.013	20	0.012	15	0.013	20	0.012
Total:					1.717	341	3.903	555					2.810

Congestion Identification in the CAISO-Controlled Grid

Simulation Results

Sensitivity case: RPS portfolio #3 - High Distributed Generation (High DG)

Study cases: CAISO-B2015_110217_P3 and CAISO-B2020_110217_P3

Congestion is ranked by weighted-average of congestion costs in the right-most column

#	Utilities	Area	Congested Transmission Facilities	Rating (MVA)	2015		2020		2015		2020		Average Congestion Costs (M\$)
					Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	Cost (M\$)	Hours (Hrs)	
1	PG&E - SCE	Path 26 (Northern-Southern California)	Midway - Vincent 500 kV line #1, subject to loss of Midway - Vincent #2	2468	0.484	125	1.208	179	0.633	188	1.375	225	1.004
			Midway - Vincent 500 kV line #1, subject to loss of Midway - Whirlwind 500 kV line	2468	0.047	23	0.064	16					
			Midway - Vincent 500 kV line #2, subject to loss of Midway - Whirlwind 500 kV line	2567	0.059	18	0.016	7					
			Path 26 (Northern - Southern California) - path ratings	4000 3000	0.029	14	0.033	9					
			Path 26 (Northern - Southern California) - operating transfer limits	dynamic	0.013	8	0.054	14					
2	PG&E	North Valley Area (NVA)	Delevan - Cortina 230 kV #1	331	0.320	20	0.928	39	0.320	20	0.928	39	0.624
3	PG&E - TID	Los Banos North (LBN)	Los Banos - Westley 230 kV line, subject to loss of Los Banos - Tesla 500 kV line	677			0.769	23	0.000	0	0.769	23	0.385
4	SDG&E - CFE	Path 45 (SDG&E - CFE)	Path 45 (SDG&E - CFE) - path rating	408	0.303	8	0.295	8	0.303	8	0.295	8	0.299
5	PG&E	Greater Fresno Area (GFA)	Cottle B - Warnerville 230 kV line	269			0.000	1	0.088	33	0.316	81	0.202
			Bellota - Cottle B 230 kV line	269	0.023	5	0.009	3					
			Bellota - Cottle B 230 kV line, subject to loss of Bellota - Cottle A 230 kV line	316			0.101	12					
			Warnerville - Wilson 230 kV line	269	0.065	28	0.134	54					
			Warnerville - Wilson 230 kV line, subject to loss of Melones - Wilson 230 kV line	316			0.070	10					
			Kearney - Herndon 230 kV line	329			0.000	1					
6	SCE	Vincent	Vincent 500/230 kV transformer #1	1000	0.004	1	0.396	17	0.004	1	0.396	17	0.200
7	SCE	Big Creek Area	Magunden - Vestal 230 kV line #2, subject to loss of line #1	373	0.001	1	0.224	5	0.001	1	0.227	6	0.114
			Magunden-Antelope 230 kV line	357			0.003	1					
8	PacifiCorp - PG&E	Path 66 (COI)	Path 66 (COI)	4800			0.042	4	0.021	21	0.065	28	0.043
			Path 25 (PacifiCorp/PG&E 115 kV Interconnection)	100	0.021	21	0.023	24					
9	LADWP - SCE	Path 60 (Inyo-Control 115 kV tie)	Inyo 115 kV phase shifter	56	0.016	26	0.019	31	0.016	26	0.019	31	0.017
10	LADWP - SCE	Path 61 (Victorville-Lugo 500 kV line)	Lugo - Victorville 500 kV line, subject to loss of Eldorado - Pisgah 500 kV line	2598	0.033	3			0.033	3	0.000	0	0.016
11	PG&E - SPP	Path 24 (PG&E - Sierra)	Path 24 (PG&E - Sierra)	160 150	0.005	2			0.005	2	0.000	0	0.003
12	PG&E & WAPA	Path 15 (Midway - Los Banos)	Path 15 (Midway - Los Banos) - operating transfer limits	dynamic			0.000	1	0.000	0	0.000	1	0.000
Total:					1.423	303	4.389	459					2.906