California Independent
System Operator Corporation

Competitive Path Assessment for 2011 Release 4

Department of Market Monitoring

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1 Executive summary

The competitive path designations resulting from the competitive path assessment (CPA) are used to establish the set of transmission paths applied in the two market passes where local market power mitigation (LMPM) is applied. A description of the complete CPA procedure is provided in a previous white paper for initial competitive path designations.[1] Starting in April 2010, path designations are applied seasonally, at least four times per year.

This white paper provides updated information on the CPA procedure, and the set of competitive path designations that will be the release 4 for 2011. The effective date will be released in a market notice.

This current release of CPA results evaluates path competitiveness across three load scenarios (high, medium, and low), three hydroelectric production scenarios (high, medium, and low), and combinations of the ten largest suppliers' internal generation withdrawn from the model. The general methodology remains the same, with updates on transmission network model, candidate path list, and input data.

Results show that all candidate paths pass the test and will be deemed competitive for purposes of local market power mitigation procedures. Non-candidate paths are deemed non-competitive by default except for "grandfathered" paths (existing branch groups).

Changes in the simulation condition relative to the prior study include:

- The full network model is based on the default full network model version DB55 as well as monthly release congestion revenue rights (CRR) model for October 2011.
- Pivotal suppliers' capacities are adjusted based on the latest tolling agreement survey (October/November 2010) covering January to December 2011 from major generation companies and load serving entities.
- The candidate path list is updated based on 12 months of operating data from September 2010 to August 2011.

2 Background

Local Market Power Mitigation and Reliability Requirement Determination (LMPM-RRD) under the new market requires prior designation of network constraints (or paths)[2] into two classes, "competitive" and "non-competitive." Under the LMPM-RRD procedures, generation bids that are dispatched up to relieve congestion on transmission paths pre-designated as "non-competitive" are subject to bid mitigation.[3] LMPM-RRD is applied in a two-step process to identify specific circumstances where local market power exists. This process occurs just prior to running the market (day-ahead or real-time) and applies

[1] http://www.caiso.com/Documents/WhitePaper-CompetitivePathAssessment.pdf

[2] The term path is used synonymously with transmission constraints in this context, and includes all transmission constraints that are enforced in Pass 1 and Pass 2 of Pre-IFM. A path is by definition directional.

[3] A detailed description of the LMPM-RRD procedures can be found in the tariff and Business Practice Manuals on the ISO web site at http://www.caiso.com/rules/Pages/default.aspx.

mitigation to resources that have been identified as having local market power. All transmission facilities that are modeled in the full network model have a designation of "competitive" or "non-competitive." The first step of this process clears supply against forecast demand, with thermal limits enforced only on the set of competitive constraints (the Competitive Constraint Run or CCR). This provides a benchmark dispatch that reflects competition among suppliers since only those transmission constraints deemed competitive are applied in the network model.

The second step applies all constraints, competitive and non-competitive, and re-dispatches all resources to meet forecast load. In this second step, the All Constraint Run (ACR), some resources will be dispatched further up (compared to the CCR) to relieve congestion on the non-competitive constraints now that they have been applied in the market solution. Those resources that have been dispatched up in the ACR, relative to the competitive benchmark dispatch from the CCR, are deemed to have local market power since they were needed to relieve congestion on a non-competitive constraint. These resources will have their bid curve mitigated to their Default Energy Bid from the CCR dispatch point to the full bid-in output for that resource.

2.1 Updated network model

The network model used for the competitive path assessment study is based on the default full network model version DB55 as well as monthly release congestion revenue rights model for October 2011. The current study uses the default full network model for transmission topology and individual equipment (e.g., line and transformer) rating in PSS/E format, while using information from CRR model for aggregated constraints such as branch group rating.

The network model used in the current CPA is a bus-branch oriented network model which is derived directly from the full network model software using the exporting interface. This base PTI format bus-branch model was then imported into the simulation software for the competitive path assessment studies.

2.2 System conditions

2.2.1 Demand forecast

The purpose of the study is to assess the competitiveness of the candidate paths using a wide range of system supply and demand conditions. To do this, we construct three demand forecast scenarios as follows. First, actual historical load for Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric transmission areas have been obtained from telemetry data. From this data, a seasonal ISO system-wide daily peak load duration curve is created to represent the peak load condition in that season. Four pairs of seasons/years are then selected based on seasonal peak load. Three load scenarios are then chosen for each season by selecting individual days within a season that corresponds to specific points on the daily peak hour load duration curve for that season. Currently, the high, medium, and low load scenarios are chosen based on the 95th percentile, 80th percentile, and 65th percentile, respectively, for the daily peak hour load duration curve for each season.

Table 1 shows the historical peak load for the study season since 2002. Based on the daily peak load, the season/year is selected as the representing season in the studies. Table 2 shows the three specific days selected for the high load, medium load, and low load scenarios. Table 3 shows the assumed ISO system daily peak load for various load scenarios.

Table 1. Historical seasonal peak load

OPR_YR	SEASON	DAILY_PEAK_LOAD
2009	FALL	33,541
2007	FALL	34,067
2006	FALL	34,218
2004	FALL	34,320
2002	FALL	35,168
2005	FALL	35,184
2010	FALL	36,167
2003	FALL	36,480
2008	**FALL**	**41,597**

Table 2. Selection of typical day for seasonal load scenario

Load Scenario	Fall
High	12/17/2008
Medium	10/29/2008
Low	11/13/2008

Table 3. System daily peak load for three load scenarios (megawatts)

Load Scenario	Fall
High	34,191
Medium	32,449
Low	31,535

2.2.2 Hydroelectric generation

For purposes of determining bids for hydro units used in the analysis, three hydro scenarios (wet, medium, and dry) were simulated based on California's historical hydroelectric production data. Figure 1 shows the production level of hydroelectric resources within the ISO control area from 2002 through 2010. As shown, 2008 is a low hydroelectric production year, 2005 is a medium production year, and 2006 is a high production year.

After the low, medium and high hydro years are identified, a hydro daily production duration curve was constructed for each season and each year. The 95th percentile date was then determined in each season as the hydro scenario date for the actual 24-hour simulation. Table 4 summarizes the days identified for various load scenarios in each season.

Figure 1. Annual total ISO hydroelectric production

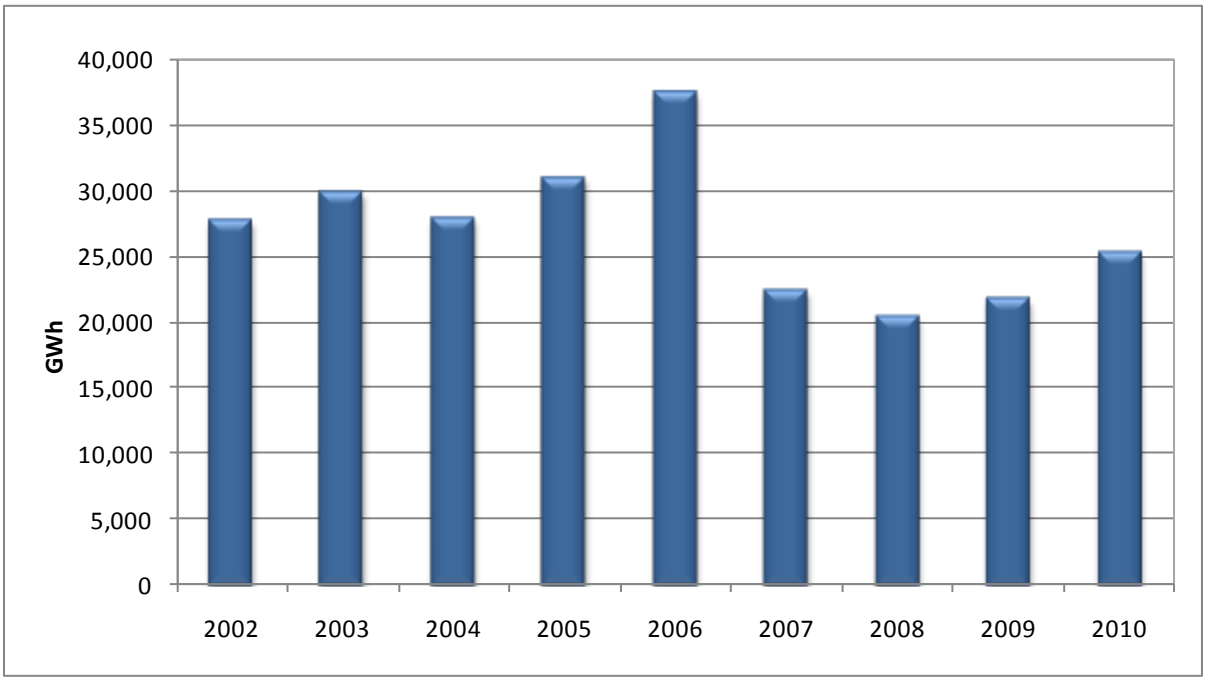

Table 4. Selection of typical day for seasonal hydro scenario

Hydro Scenario	Fall
High	11/30/2006
Medium	12/26/2005
Low	10/8/2008

2.3 Generation ownership and portfolios

Generation resources with a tolling agreement are excluded from the owners' portfolio. A new round of tolling agreement surveys has been done in October/November 2010 for large generation companies and load serving entities, for the survey period between January and December 2011.

This study focuses specifically on the impact of generation capacity by the ten largest owners in the ISO control area who are net sellers and have an installed generator capacity over 500 MW after consideration of tolling agreement adjustments. The CPA considers only net sellers in the selection of potentially pivotal suppliers since net buyers are less likely to benefit from increasing prices through withholding supply.

Table 5. Suppliers considered and their generation capacity concentration, adjusted for tolling agreements

Supplier	Capacity
S1	3,527
S2	2,582
S3	1,944
S4	1,691
S5	1,496
S6	1,036
S7	859
S8	743
S9	625
S10	552

2.4 Identification of candidate competitive paths

In evaluating whether or not paths are competitive, the CPA focuses on the subset of all transmission paths for which this designation is most likely to impact market outcomes. The criteria for identifying candidate competitive paths (those that will be tested in this assessment), is based on the frequency of operational mitigation that has occurred in the most recent 12 months of operation.

For the coming designations, candidate paths were identified based on data for the 12 month period from September 2010 through August 2011. This represents the most recent 12 month period for which data were available at the time this study needed to be initiated.

Hours of congestion management were based on hours when congestion occurred in the day-ahead or real-time market, as well as when congestion may have been managed in real time through reliability must-run (RMR) dispatches or exceptional dispatches.

- To identify hours when congestion occurred in the ISO's markets, every hour where a constraint's market flow equaled or exceeded its limit was counted as an hour of managed congestion for the constraint. A constraint was counted as being congested if it was binding during any part of an hour in the day-ahead LMPM run, day-ahead market run, real-time LMPM run, or the real-time market run.

- To identify hours when congestion on a constraint may have been managed in real-time using RMR resources, data were collected reflecting resources that received real-time RMR dispatch instructions. For any hour where an RMR dispatch was made to a specific resource, that hour was counted toward all lines that are mitigated using that RMR resource as identified in the ISO Operating Procedures. The line/resource relationships identified in the ISO Operating Procedures were used to create the specific mapping to count each hour of real-time RMR dispatch of a specific resource as an hour of operational mitigation for a specific line or path.

- To identify hours when congestion on a constraint may have been managed in real-time using exceptional dispatches, operator log entries were used to identify the reason for individual exceptional dispatches for real-time energy. In cases where the reason did not include a specific line

or lines, but cited a specific transmission operating procedures, these transmission operating procedures were used to map the resource to a specific set of transmission facilities. As with the real-time RMR dispatches, any hour where a resource was exceptionally dispatched for real-time energy was counted as an hour of operational mitigation for all lines for which that resource was identified as providing operational mitigation unless a specific subset of those lines was identified in the operator log for that particular exceptional dispatch.

Each hour during which this analysis indicated congestion occurred either (a) in the market or that may have been managed in real-time via (b) an RMR dispatch or (c) exceptional dispatch (or any combination of the three categories) was counted as one hour of congestion for the constraint.

Table 6 shows intra-zonal interfaces and individual transmission lines that had greater than 500 hours of congestion and consequently have been identified as candidate paths.

Table 6. Candidate path list

CONSTRAINT_NAME	HOUR
33912_SPRNGGJ_115_33914_MI-WUK_115_BR_1_1	3129
34112_EXCHEQUR_115_34116_LEGRAND_115_BR_1_1	2152
31450_WILDWOOD_115_31464_COTWDPGE_115_BR_1_1	1581
31010_LOWGAP1_115_31015_BRDGVLLE_115_BR_1_1	1578
31011_FRSTGLEN_115_31010_LOWGAP1_115_BR_1_1	1577
31450_WILDWOOD_115_31011_FRSTGLEN_115_BR_1_1	1577
31000_HUMBOLDT_115_31452_TRINITY_115_BR_1_1	1376
31555_MSSTAP2_60.0_31553_BIGBAR_60.0_BR_1_1	1362
31093_HYMPOMJT_60.0_31553_BIGBAR_60.0_BR_1_1	1360
31118_KEKAWAKA_60.0_31308_LYTNVLLE_60.0_BR_1_1	1360
31555_MSSTAP2_60.0_31557_MILSTSTA_60.0_BR_1_1	1360
31116_GRBRVLLE_60.0_31118_KEKAWAKA_60.0_BR_1_1	1360
31556_TRINITY_60.0_31555_MSSTAP2_60.0_BR_1_1	1360
31092_MPLECRK_60.0_31093_HYMPOMJT_60.0_BR_1_1	1360
POTRERO_MSL	1343
HUMBOLDT_BG	1290
31306_WILLITS_60.0_31308_LYTNVLLE_60.0_BR_1_1	1111
31566_KESWICK_60.0_31582_STLLWATR_60.0_BR_1_1	1073
31580_CASCADE_60.0_31582_STLLWATR_60.0_BR_1_1	1052
33950_RVRBKTP_115_33934_TULLOCH_115_BR_1_1	961
33950_RVRBKTP_115_33944_RVRBANK_115_BR_1_1	958
33932_MELONES_115_33934_TULLOCH_115_BR_1_1	958
33562_BELLOTA_115_33950_RVRBKTP_115_BR_1_1	958
33948_RVRBKJ2_115_33953_VLYHMTP2_115_BR_1_1	952
33511_AVENATP2_115_33514_MANTECA_115_BR_1_1	951
33506_STANISLS_115_33948_RVRBKJ2_115_BR_1_1	950
33953_VLYHMTP2_115_33511_AVENATP2_115_BR_1_1	950
33953_VLYHMTP2_115_33952_VALLYHM_115_BR_1_1	950
33511_AVENATP2_115_33510_AVENA_115_BR_1_1	950
33200_LARKIN_115_33204_POTRERO_115_BR_2_1	931
31461_JESSTAP_115_31464_COTWDPGE_115_BR_1_1	926
31452_TRINITY_115_31461_JESSTAP_115_BR_1_1	926
31000_HUMBOLDT_115_31001_HMBLTTM_1.0_XF_1	923
31086_EUREKA_60.0_31090_HMBLTBY_60.0_BR_1_1	905
31080_HUMBOLDT_60.0_31000_HUMBOLDT_115_XF_2	898
31080_HUMBOLDT_60.0_31088_HMBLTJT_60.0_BR_1_1	890
31080_HUMBOLDT_60.0_31092_MPLECRK_60.0_BR_1_1	890
31110_BRDGVLLE_60.0_31112_FRUITLND_60.0_BR_1_1	889
31080_HUMBOLDT_60.0_31001_HMBLTTM_1.0_XF_1	889
31080_HUMBOLDT_60.0_31090_HMBLTBY_60.0_BR_2_1	888

CONSTRAINT_NAME	HOUR
31088_HMBLTJT_60.0_31084_HARRISST_60.0_BR_1_1	888
31088_HMBLTJT_60.0_31090_HMBLTBY_60.0_BR_1_1	888
31112_FRUITLND_60.0_31114_FRTSWRD_60.0_BR_1_1	888
31114_FRTSWRD_60.0_31116_GRBRVLLE_60.0_BR_1_1	888
31000_HUMBOLDT_115_31015_BRDGVLLE_115_BR_1_1	888
30515_WARNERVL_230_30800_WILSON_230_BR_1_1	862
30900_GATES_230_30970_MIDWAY_230_BR_1_1	855
34157_PANOCHET_115_34156_MENDOTA_115_BR_1_1	837
34101_CERTANJ2_115_34116_LEGRAND_115_BR_1_1	834
30875_MCCALL_230_30880_HENTAP2_230_BR_1_1	833
30873_HELM_230_30875_MCCALL_230_BR_1_1	832
34159_PANOCHEJ_115_34160_HAMMONDS_115_BR_1_1	832
30790_PANOCHE_230_30873_HELM_230_BR_1_1	832
30881_HENRIETA_230_34430_HENRETTA_115_XF_3	832
30879_HENTAP1_230_30900_GATES_230_BR_1_1	832
30880_HENTAP2_230_30900_GATES_230_BR_2_1	832
34161_DFSTP_115_34162_OROLOMA_115_BR_1_1	832
34116_LEGRAND_115_34154_DAIRYLND_115_BR_1A_1	832
30875_MCCALL_230_34370_MCCALL_115_XF_1_P	832
30810_GREGG_230_30879_HENTAP1_230_BR_1_1	832
34105_CERTANJ1_115_34121_SHARONT_115_BR_1_1	832
34160_HAMMONDS_115_34161_DFSTP_115_BR_1_1	832
30875_MCCALL_230_34370_MCCALL_115_XF_3_P	832
34116_LEGRAND_115_34154_DAIRYLND_115_BR_1_1	832
30835_HERNDON_230_34412_HERNDON_115_XF_2_S	831
34418_KINGSBRG_115_34420_CORCORAN_115_BR_2_1	831
30879_HENTAP1_230_30881_HENRIETA_230_BR_1_1	831
34462_GUR3TPT_70.0_34554_AMSTGSW_70.0_BR_1_1	831
34159_PANOCHEJ_115_34158_PANOCHE_115_BR_1_1	831
34128_OAKH_JCT_115_34123_KERCH1TP_115_BR_2_1	831
30835_HERNDON_230_34412_HERNDON_115_XF_1_T	831
34363_CLOVISJ1_115_34360_WWARDJT_115_BR_1_1	831
34358_KERCKHF2_115_34123_KERCH1TP_115_BR_2_1	831
30875_MCCALL_230_34370_MCCALL_115_XF_1_S	831
30790_PANOCHE_230_30825_MCMULLN1_230_BR_1_1	831
34363_CLOVISJ1_115_34366_SANGER_115_BR_1_1	831
34105_CERTANJ1_115_34100_CHWCHLLA_115_BR_1_1	831
34362_CLOVIS_115_34363_CLOVISJ1_115_BR_1_1	831
34460_GUERNSEY_70.0_34462_GUR3TPT_70.0_BR_1_1	831
30835_HERNDON_230_34412_HERNDON_115_XF_1_S	831

CONSTRAINT_NAME	HOUR
34100_CHWCHLLA_115_34101_CERTANJ2_115_BR_1_1	831
34540_HENRITTA_70.0_34542_JCBSCRNR_70.0_BR_1_1	831
34358_KERCKHF2_115_34360_WWARDJT_115_BR_1_1	831
30825_MCMULLN1_230_30830_KEARNEY_230_BR_1_1	831
30875_MCCALL_230_34370_MCCALL_115_XF_3_T	831
34462_GUR3TPT_70.0_34542_JCBSCRNR_70.0_BR_1_1	831
34158_PANOCHE_115_30790_PANOCHE_230_XF_1	831
34418_KINGSBRG_115_34420_CORCORAN_115_BR_1_1	831
30875_MCCALL_230_34370_MCCALL_115_XF_3_S	831
30835_HERNDON_230_34412_HERNDON_115_XF_1_P	831
30830_KEARNEY_230_30835_HERNDON_230_BR_1_1	831
30875_MCCALL_230_34370_MCCALL_115_XF_2	831
34356_KERCKHF1_115_34123_KERCH1TP_115_BR_1_1	831
30880_HENTAP2_230_30881_HENRIETA_230_BR_2_1	831
34157_PANOCHET_115_34158_PANOCHE_115_BR_1_1	831
34116_LEGRAND_115_34134_WILSONAB_115_BR_1_1	831
30875_MCCALL_230_34370_MCCALL_115_XF_1_T	831
34360_WWARDJT_115_34414_WOODWARD_115_BR_1_1	831
30835_HERNDON_230_34412_HERNDON_115_XF_2_P	831
30835_HERNDON_230_34412_HERNDON_115_XF_2_T	831
30805_BORDEN_230_30810_GREGG_230_BR_1_1	817
30796_STOREY1_230_30810_GREGG_230_BR_1_1	816
30796_STOREY1_230_30800_WILSON_230_BR_1_1	816
SDGE_PCT_UF_IMP_BG	691
SCE_PCT_IMP_BG	592
32218_DRUM_115_32244_BRNSWKT2_115_BR_2_1	582

3 Competitive path assessment

As described above, the CPA is based on typical days in the season being examined. For each typical day, various potentially pivotal supplier combinations are evaluated for each of the nine load and hydro scenarios. The following section presents the hourly system conditions for the base case, medium load, and medium hydro scenario in the study season without any suppliers' capacity removed.

3.1 2011 release 4 results

3.1.1 Base case results

The base case results are presented in Table 7 below for medium load, medium hydro, and no supplier capacity withdrawn. General simulation characteristics are presented, including load, total generation

internal to the ISO, net import values, and internal path flows (Path 15 and Path 26) for each of the 24 hours of the medium load medium hydro base case.

3.1.2 CPA results

All candidate paths pass under the study conditions, and are therefore deemed competitive for the study season.[4]

Table 7. Base case: Model output, medium hydro, medium load, and no supply withdrawn

Hour	Load (MWh)		Generation (MWh)		Net Import (MWh)		Internal Path Flow (N->S)	
	NP26	SP26	NP26	SP26	NP26	SP26	Path 15	Path 26
1	9,515	12,089	10,344	7,176	885	3,773	-1,386	497
2	9,522	11,552	10,485	7,432	181	3,527	-2,219	-75
3	9,379	11,279	10,672	7,031	184	3,677	-2,000	263
4	9,430	11,243	10,685	7,099	89	3,348	-2,127	128
5	9,711	11,647	11,146	7,394	39	3,339	-1,983	245
6	10,621	12,666	11,968	8,463	-192	3,624	-2,246	-75
7	11,797	14,062	13,336	9,157	49	3,828	-2,101	469
8	12,202	14,336	13,773	8,867	917	3,498	-1,316	1,382
9	12,414	15,292	13,735	8,933	1,520	3,907	-801	1,915
10	12,596	16,252	14,052	8,987	1,637	4,512	-730	2,236
11	12,758	17,146	14,656	8,928	1,926	4,815	-111	2,902
12	12,784	17,749	15,162	9,020	1,751	4,994	203	3,228
13	12,853	18,320	15,457	9,127	1,874	5,093	555	3,594
14	12,970	18,907	15,645	9,797	1,744	5,196	374	3,407
15	13,008	19,201	15,685	10,055	1,566	5,354	229	3,285
16	12,962	19,198	15,676	10,255	1,627	5,050	306	3,387
17	12,899	18,608	15,188	10,105	1,925	4,651	271	3,366
18	13,028	18,002	15,159	9,684	2,357	4,614	561	3,628
19	13,870	18,579	15,624	9,964	2,568	5,065	491	3,462
20	13,629	17,838	15,559	9,508	2,544	4,626	645	3,632
21	13,011	16,859	15,076	9,276	1,411	4,873	-378	2,635
22	11,960	15,351	13,762	8,494	1,075	4,342	-847	1,939
23	10,915	13,823	12,144	7,711	1,050	4,372	-1,154	1,202
24	10,023	12,760	11,251	6,967	945	4,152	-1,256	1,103

Table 8. Failed candidate path list

CONSTRAINT NAME
- None -

[4] For active branch group, individual branch is deemed as competitive as well if the branch group is in the candidate path list and passes the test and the sum of individual branch limits is greater than the branch group limit.

Table 9. Competitive path list

CONSTRAINT_NAME	CONSTRAINT_NAME
33912_SPRNGGJ_115_33914_MI-WUK_115_BR_1_1	30875_MCCALL_230_34370_MCCALL_115_XF_1_S
34112_EXCHEQUR_115_34116_LEGRAND_115_BR_1_1	30790_PANOCHE_230_30825_MCMULLN1_230_BR_1_1
31450_WILDWOOD_115_31464_COTWDPGE_115_BR_1_1	34363_CLOVISJ1_115_34366_SANGER_115_BR_1_1
31010_LOWGAP1_115_31015_BRDGVLLE_115_BR_1_1	34105_CERTANJ1_115_34100_CHWCHLLA_115_BR_1_1
31011_FRSTGLEN_115_31010_LOWGAP1_115_BR_1_1	34362_CLOVIS_115_34363_CLOVISJ1_115_BR_1_1
31450_WILDWOOD_115_31011_FRSTGLEN_115_BR_1_1	34460_GUERNSEY_70.0_34462_GUR3TPT_70.0_BR_1_1
31000_HUMBOLDT_115_31452_TRINITY_115_BR_1_1	30835_HERNDON_230_34412_HERNDON_115_XF_1_S
31555_MSSTAP2_60.0_31553_BIGBAR_60.0_BR_1_1	34100_CHWCHLLA_115_34101_CERTANJ2_115_BR_1_1
31093_HYMPOMJT_60.0_31553_BIGBAR_60.0_BR_1_1	34540_HENRITTA_70.0_34542_JCBSCRNR_70.0_BR_1_1
31118_KEKAWAKA_60.0_31308_LYTNVLLE_60.0_BR_1_1	34358_KERCKHF2_115_34360_WWARDJT_115_BR_1_1
31555_MSSTAP2_60.0_31557_MILSTSTA_60.0_BR_1_1	30825_MCMULLN1_230_30830_KEARNEY_230_BR_1_1
31116_GRBRVLLE_60.0_31118_KEKAWAKA_60.0_BR_1_1	30875_MCCALL_230_34370_MCCALL_115_XF_3_T
31556_TRINITY_60.0_31555_MSSTAP2_60.0_BR_1_1	34462_GUR3TPT_70.0_34542_JCBSCRNR_70.0_BR_1_1
31092_MPLECRK_60.0_31093_HYMPOMJT_60.0_BR_1_1	34158_PANOCHE_115_30790_PANOCHE_230_XF_1
POTRERO_MSL	34418_KINGSBRG_115_34420_CORCORAN_115_BR_1_1
HUMBOLDT_BG	30875_MCCALL_230_34370_MCCALL_115_XF_3_S
31306_WILLITS_60.0_31308_LYTNVLLE_60.0_BR_1_1	30835_HERNDON_230_34412_HERNDON_115_XF_1_P
31566_KESWICK_60.0_31582_STLLWATR_60.0_BR_1_1	30830_KEARNEY_230_30835_HERNDON_230_BR_1_1
31580_CASCADE_60.0_31582_STLLWATR_60.0_BR_1_1	30875_MCCALL_230_34370_MCCALL_115_XF_2
33950_RVRBKTP_115_33934_TULLOCH_115_BR_1_1	34356_KERCKHF1_115_34123_KERCH1TP_115_BR_1_1
33950_RVRBKTP_115_33944_RVRBANK_115_BR_1_1	30880_HENTAP2_230_30881_HENRIETA_230_BR_2_1
33932_MELONES_115_33934_TULLOCH_115_BR_1_1	34157_PANOCHET_115_34158_PANOCHE_115_BR_1_1
33562_BELLOTA_115_33950_RVRBKTP_115_BR_1_1	34116_LEGRAND_115_34134_WILSONAB_115_BR_1_1
33948_RVRBKJ2_115_33953_VLYHMTP2_115_BR_1_1	30875_MCCALL_230_34370_MCCALL_115_XF_1_T
33511_AVENATP2_115_33514_MANTECA_115_BR_1_1	34360_WWARDJT_115_34414_WOODWARD_115_BR_1_1
33506_STANISLS_115_33948_RVRBKJ2_115_BR_1_1	30835_HERNDON_230_34412_HERNDON_115_XF_2_P
33953_VLYHMTP2_115_33511_AVENATP2_115_BR_1_1	30835_HERNDON_230_34412_HERNDON_115_XF_2_T
33953_VLYHMTP2_115_33952_VALLYHM_115_BR_1_1	30805_BORDEN_230_30810_GREGG_230_BR_1_1
33511_AVENATP2_115_33510_AVENA_115_BR_1_1	30796_STOREY1_230_30810_GREGG_230_BR_1_1
33200_LARKIN_115_33204_POTRERO_115_BR_2_1	30796_STOREY1_230_30800_WILSON_230_BR_1_1
31461_JESSTAP_115_31464_COTWDPGE_115_BR_1_1	SDGE_PCT_UF_IMP_BG
31452_TRINITY_115_31461_JESSTAP_115_BR_1_1	SCE_PCT_IMP_BG
31000_HUMBOLDT_115_31001_HMBLTTM_1.0_XF_1	32218_DRUM_115_32244_BRNSWKT2_115_BR_2_1
31086_EUREKA_60.0_31090_HMBLTBY_60.0_BR_1_1	14002_MOENKOPI_500_99002_MOE-ELD _500_BR_1 _7
31080_HUMBOLDT_60.0_31000_HUMBOLDT_115_XF_2	18229_SO POINT_69.0_25909_MOHVAUX2_69.0_BR_1 _1
31080_HUMBOLDT_60.0_31088_HMBLTJT_60.0_BR_1_1	18620_MERCHANT_230_24041_ELDORDO _230_BR_1 _1
31080_HUMBOLDT_60.0_31092_MPLECRK_60.0_BR_1_1	19012_MEAD S _230_24041_ELDORDO _230_BR_1 _1
31110_BRDGVLLE_60.0_31112_FRUITLND_60.0_BR_1_1	19012_MEAD S _230_24041_ELDORDO _230_BR_2 _1
31080_HUMBOLDT_60.0_31001_HMBLTTM_1.0_XF_1	19020_BLYTHE _161_24017_BLYTHESC_161_BR_1 _1
31080_HUMBOLDT_60.0_31090_HMBLTBY_60.0_BR_2_1	19042_PARKER _230_25402_GENE _230_BR_1 _1
31088_HMBLTJT_60.0_31084_HARRISST_60.0_BR_1_1	21007_COACHELV_230_24804_DEVERS _230_BR_1 _1
31088_HMBLTJT_60.0_31090_HMBLTBY_60.0_BR_1_1	21076_RAMON _230_24806_MIRAGE _230_BR_1 _1
31112_FRUITLND_60.0_31114_FRTSWRD_60.0_BR_1_1	22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_1 _1
31114_FRTSWRD_60.0_31116_GRBRVLLE_60.0_BR_1_1	22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_2 _1
31000_HUMBOLDT_115_31015_BRDGVLLE_115_BR_1_1	22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_3 _1
30515_WARNERVL_230_30800_WILSON_230_BR_1_1	22844_TALEGA _230_24131_S.ONOFRE_230_BR_1 _1
30900_GATES_230_30970_MIDWAY_230_BR_1_1	22844_TALEGA _230_24131_S.ONOFRE_230_BR_2 _1
34157_PANOCHET_115_34156_MENDOTA_115_BR_1_1	24019_CAMINO _230_19012_MEAD S _230_BR_E _1
34101_CERTANJ2_115_34116_LEGRAND_115_BR_1_1	24019_CAMINO _230_19012_MEAD S _230_BR_W _1
30875_MCCALL_230_30880_HENTAP2_230_BR_1_1	24036_EAGLROCK_230_24147_SYLMAR S_230_BR_1 _1
30873_HELM_230_30875_MCCALL_230_BR_1_1	24042_ELDORDO _500_26048_MCCULLGH_500_BR_1 _1
34159_PANOCHEJ_115_34160_HAMMONDS_115_BR_1_1	24086_LUGO _500_26105_VICTORVL_500_BR_1 _1
30790_PANOCHE_230_30873_HELM_230_BR_1_1	24114_PARDEE _230_24147_SYLMAR S_230_BR_1 _1
30881_HENRIETA_230_34430_HENRETTA_115_XF_3	24114_PARDEE _230_24147_SYLMAR S_230_BR_2 _1
30879_HENTAP1_230_30900_GATES_230_BR_1_1	24147_SYLMAR S_230_24059_GOULD _230_BR_1 _1
30880_HENTAP2_230_30900_GATES_230_BR_2_1	24729_INYO _230_24998_INYO SCE_230_BR_1 _1
34161_DFSTP_115_34162_OROLOMA_115_BR_1_1	25903_MOH-LGHN_500_24097_MOHAVE _500_BR_1 _1
34116_LEGRAND_115_34154_DAIRYLND_115_BR_1A_1	30060_MIDWAY _500_24156_VINCENT _500_BR_1 _2
30875_MCCALL_230_34370_MCCALL_115_XF_1_P	30060_MIDWAY _500_24156_VINCENT _500_BR_2 _2
30810_GREGG_230_30879_HENTAP1_230_BR_1_1	30060_MIDWAY _500_24156_VINCENT _500_BR_3 _2
34105_CERTANJ1_115_34121_SHARONT_115_BR_1_1	64096_SLVR PS2_55.0_24722_CONTROL _55.0_BR_1 _1
34160_HAMMONDS_115_34161_DFSTP_115_BR_1_1	64096_SLVR PS2_55.0_24722_CONTROL _55.0_BR_2 _1
30875_MCCALL_230_34370_MCCALL_115_XF_3_P	99010_VELAS-LB_230_24076_LAGUBELL_230_BR_1 _1
34116_LEGRAND_115_34154_DAIRYLND_115_BR_1_1	99013_CAL CAPS_500_24801_DEVERS _500_BR_1 _1
30835_HERNDON_230_34412_HERNDON_115_XF_2_S	22356_IMPRLVLY_230_20118_ROA-230 _230_BR_1 _1
34418_KINGSBRG_115_34420_CORCORAN_115_BR_2_1	22356_IMPRLVLY_230_21025_ELCENTRO_230_BR_1 _1
30879_HENTAP1_230_30881_HENRIETA_230_BR_1_1	22536_N.GILA _500_22360_IMPRLVLY_500_BR_1 _1
34462_GUR3TPT_70.0_34554_AMSTGSW_70.0_BR_1_1	22609_OTAYMESA_230_20149_TJI-230 _230_BR_1 _1
34159_PANOCHEJ_115_34158_PANOCHE_115_BR_1_1	22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_1 _1
34128_OAKH_JCT_115_34123_KERCH1TP_115_BR_2_1	22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_2 _1
30835_HERNDON_230_34412_HERNDON_115_XF_1_T	22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_3 _1
34363_CLOVISJ1_115_34360_WWARDJT_115_BR_1_1	22844_TALEGA _230_24131_S.ONOFRE_230_BR_1 _1
34358_KERCKHF2_115_34123_KERCH1TP_115_BR_2_1	22844_TALEGA _230_24131_S.ONOFRE_230_BR_2 _1

4 Concluding comments

The simulation results and competitive test outcomes presented in this paper represent the competitive path designations that will be incorporated in the market software for the upcoming season. These designations reflect updates introduced in the last version of the CPA, updated input data and network model, as well as adjustments to supplier portfolios to account for transfer of operational and bidding control of generation resources within the ISO control area.

Incorporating results from the season studied, all candidate paths passed the competitiveness test. Note that there are a total of roughly 4,800 individual line segments in the Full Network Model and several aggregated constraints, and a subset of these constraints were included in the testing as candidate paths.

There are still factors that may require periodic review and update of the CPA. Such factors include:

- **Update of full network model.** The FNM is updated periodically to reflect new transmission facilities, adjustments of major transmission limits, seasonal switching, and other factors. Temporary network changes such as outages may have a significant impact on market congestion.
- **Market clearing model and optimization**. Currently the CPA is done by a simulation tool different from the market software. To further align the simulations used for path designations with the actual market model and software, developing the CPA within a simulation tool that more closely reflects the market software will be reviewed.
- **Impact of relatively small generation owners.** The 3-pivotal supplier tests are computationally intensive, and there are an extremely large number of potential combinations of suppliers that could withdraw. It is impractical to simulate all potential combinations for all suppliers. The reason for the threshold of 500 MW is to identify larger suppliers that can more easily influence market prices. However, there may be cases where, in a relatively small congested area, a small generation owner whose generation capacity is less than the selection threshold may be pivotal to relieve the constraint. While this analysis does not consider such cases, the Department of Market Monitoring has developed tools to analyze the effectiveness of LMPM in local areas and will monitor market outcomes for the purpose of detecting potentially uncompetitive circumstances in local areas. In cases where uncompetitive outcomes are observed and the competitive path designations for that area do not appear to be consistent with the market outcomes, DMM will evaluate both the path designations as well as the application of LMPM in that area.