



California Independent
System Operator Corporation

Competitive Path Assessment for Spring 2011

Department of Market Monitoring

April 2011

TABLE OF CONTENTS

1 Executive summary1

2 Background1

2.1 Updated network model..... 2

2.2 System conditions..... 2

2.2.1 Demand forecast 2

2.2.2 Hydroelectric generation..... 3

2.3 Generation ownership and portfolios 4

2.4 Identification of candidate competitive paths 5

3 Competitive path assessment.....9

3.1 2011 spring season results..... 9

3.1.1 Base case results..... 9

3.1.2 CPA results..... 10

4 Concluding comments.....12

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 the 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 in effect during the 2011 spring season (approximately April, May, and June).

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production scenarios (high, medium, and low), and combinations of the ten largest suppliers' internal generation withdrawn from the model.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 but three candidate paths pass the test and will be deemed as competitive for purposes of local market power mitigation procedures. Non-candidate paths are deemed uncompetitive 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 DB51 as well as monthly release congestion revenue rights (CRR) model for April 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.
- Individual branches that comprise an aggregate constraint are evaluated collectively if the aggregate constraint is tested and deemed competitive.
- The candidate path list is updated based on 12 months of operating data from March 2010 to February 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

¹ <http://www.caiso.com/2365/23659ca314f0.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/docs/2001/12/21/2001122108490719681.html>.

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 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 studies is based on the default full network model version DB51 as well as monthly release congestion revenue rights model for April 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 studies 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

| Year | SEASON | DAILY PEAK LOAD |
|-------------|-----------|-----------------|
| 2010 | SP | 37,025 |
| 2005 | SP | 38,694 |
| 2009 | SP | 39,370 |
| 2003 | SP | 40,117 |
| 2004 | SP | 40,476 |
| 2007 | SP | 40,839 |
| 2002 | SP | 41,023 |
| 2006 | SP | 43,719 |
| 2008 | SP | 46,789 |

Table 2. Selection of typical day for seasonal load scenario

| Load Scenario | Spring |
|---------------|-----------|
| High | 5/16/2008 |
| Medium | 6/12/2008 |
| Low | 4/29/2008 |

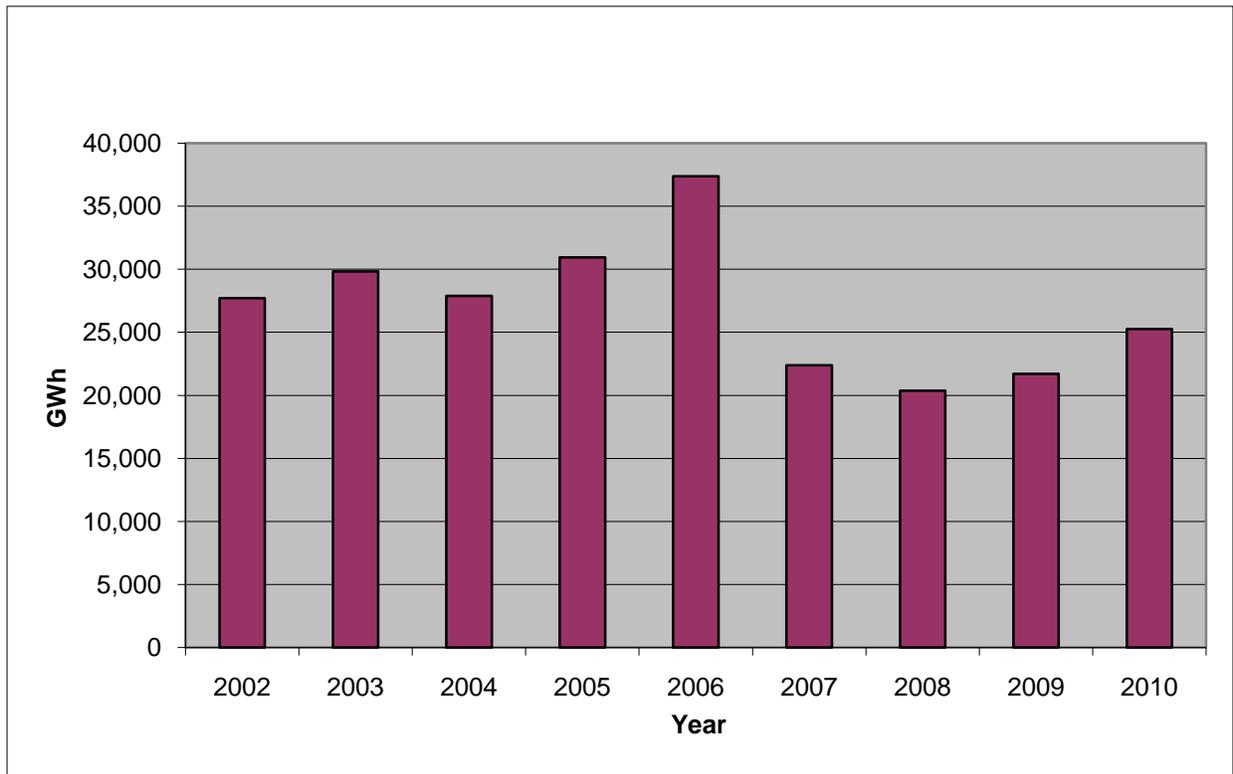
Table 3. System daily peak load for three load scenarios (megawatts)

| Load Scenario | Spring |
|---------------|--------|
| High | 41,540 |
| Medium | 36,069 |
| Low | 31,831 |

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 2009. 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 | Spring |
|----------------|-----------|
| High | 5/19/2006 |
| Medium | 5/25/2005 |
| Low | 6/20/2008 |

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 spring 2011 designations, candidate paths were identified based on data for the 12 month period from March 2010 through February 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 | 1999 |
| HUMBOLDT_BG | 1387 |
| 31010_LOWGAP1_115_31015_BRDGVILLE_115_BR_1_1 | 1241 |
| 31450_WILDWOOD_115_31464_COTWDPGE_115_BR_1_1 | 1240 |
| 31011_FRSTGLEN_115_31010_LOWGAP1_115_BR_1_1 | 1240 |
| 31450_WILDWOOD_115_31011_FRSTGLEN_115_BR_1_1 | 1240 |
| 31000_HUMBOLDT_115_31001_HMBLTTM_1.0_XF_1 | 1186 |
| 31452_TRINITY_115_31461_JESSTAP_115_BR_1_1 | 1185 |
| 31566_KESWICK_60.0_31582_STLLWATR_60.0_BR_1_1 | 1185 |
| 31580_CASCADE_60.0_31582_STLLWATR_60.0_BR_1_1 | 1185 |
| 31461_JESSTAP_115_31464_COTWDPGE_115_BR_1_1 | 1185 |
| 31000_HUMBOLDT_115_31452_TRINITY_115_BR_1_1 | 1166 |
| 31093_HYMPOMJT_60.0_31553_BIGBAR_60.0_BR_1_1 | 1163 |
| 31555_MSSTAP2_60.0_31553_BIGBAR_60.0_BR_1_1 | 1163 |
| 31556_TRINITY_60.0_31555_MSSTAP2_60.0_BR_1_1 | 1163 |
| 31080_HUMBOLDT_60.0_31000_HUMBOLDT_115_XF_2 | 1163 |
| 31092_MPLECRK_60.0_31093_HYMPOMJT_60.0_BR_1_1 | 1163 |
| 31555_MSSTAP2_60.0_31557_MILSTSTA_60.0_BR_1_1 | 1163 |
| 31110_BRDGVILLE_60.0_31112_FRUITLND_60.0_BR_1_1 | 1152 |
| 31080_HUMBOLDT_60.0_31092_MPLECRK_60.0_BR_1_1 | 1152 |
| 31080_HUMBOLDT_60.0_31001_HMBLTTM_1.0_XF_1 | 1152 |
| 31114_FRTSWRD_60.0_31116_GRBRVLE_60.0_BR_1_1 | 1151 |
| 31306_WILLITS_60.0_31308_LYTNVLE_60.0_BR_1_1 | 1151 |
| 31112_FRUITLND_60.0_31114_FRTSWRD_60.0_BR_1_1 | 1151 |
| 31116_GRBRVLE_60.0_31118_KEKAWAKA_60.0_BR_1_1 | 1151 |
| 31118_KEKAWAKA_60.0_31308_LYTNVLE_60.0_BR_1_1 | 1151 |
| 31000_HUMBOLDT_115_31015_BRDGVILLE_115_BR_1_1 | 1151 |
| 30300_TABLMTN_230_30325_PALERMO_230_BR_1_1 | 978 |
| 32308_COLGATE_60.0_30327_COLGATE_230_XF_3 | 959 |
| 31656_PALERMO_60.0_31658_BANGOR_60.0_BR_1_1 | 959 |
| 31658_BANGOR_60.0_32308_COLGATE_60.0_BR_1_1 | 959 |
| 30325_PALERMO_230_30327_COLGATE_230_BR_1_1 | 820 |
| 30325_PALERMO_230_30327_COLGATE_230_BR_1A_1 | 820 |
| 31080_HUMBOLDT_60.0_31090_HMBLTBY_60.0_BR_2_1 | 814 |
| 31086_EUREKA_60.0_31090_HMBLTBY_60.0_BR_1_1 | 814 |
| 31088_HMBLTJT_60.0_31084_HARRISST_60.0_BR_1_1 | 798 |
| 31080_HUMBOLDT_60.0_31088_HMBLTJT_60.0_BR_1_1 | 798 |
| 31088_HMBLTJT_60.0_31090_HMBLTBY_60.0_BR_1_1 | 798 |
| 33200_LARKIN_115_33204_POTRERO_115_BR_2_1 | 705 |
| 32314_SMRTSVLE_60.0_32316_YUBAGOLD_60.0_BR_1_1 | 643 |

| CONSTRAINT NAME | HOUR |
|---|------|
| 32212_E.NICOLS_115_32214_RIOOSO_115_BR_1_1 | 643 |
| 32316_YUBAGOLD_60.0_32318_BRWNSVY_60.0_BR_1_1 | 640 |
| 30015_TABLEMT_500_30040_TESLA_500_BR_1_3 | 640 |
| 32318_BRWNSVY_60.0_32320_MRYSVLLE_60.0_BR_1_1 | 640 |
| 30300_TABLMTN_230_30066_TBMT1M_1.0_XF_1 | 640 |
| 33203_MISSON_115_33204_POTRERO_115_BR_1_1 | 596 |
| 99102_PIT-TES1_230_30567_TESJCT_230_BR_1_2 | 594 |
| 30567_TESJCT_230_30700_SANMATEO_230_BR_1_1 | 594 |
| SDGEIMP_BG | 545 |
| 33205_HNTRSPT_115_33208_MARTINC_115_BR_1_1 | 543 |
| 33207_BAYSHOR2_115_33208_MARTINC_115_BR_2_1 | 538 |
| 33205_HNTRSPT_115_33208_MARTINC_115_BR_3_1 | 538 |
| 33204_POTRERO_115_33207_BAYSHOR2_115_BR_2_1 | 536 |
| 33310_SANMATEO_115_33315_RAVENSWD_115_BR_1_1 | 521 |
| 33208_MARTINC_115_30695_MARTINC_230_XF_7 | 515 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_7_S | 513 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_7_P | 513 |
| 33206_BAYSHOR1_115_33208_MARTINC_115_BR_1_1 | 511 |
| 33200_LARKIN_115_33203_MISSON_115_BR_1_1 | 511 |
| 33200_LARKIN_115_33208_MARTINC_115_BR_1_1 | 508 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_5_T | 508 |
| 30685_EMBRCDR_230_99160_MAR-EMBE_230_BR_1_1 | 508 |
| 33310_SANMATEO_115_33308_SFIA-MA_115_BR_2_1 | 508 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_6_S | 508 |
| 30710_SLACTAP1_230_30715_JEFFERSN_230_BR_1_1 | 508 |
| 30703_RAVENSWD_230_30700_SANMATEO_230_BR_2_1 | 508 |
| 30712_SLACTAP2_230_30715_JEFFERSN_230_BR_2_1 | 508 |
| 30560_E.SHORE_230_30700_SANMATEO_230_BR_1_1 | 508 |
| 33310_SANMATEO_115_33305_SHAWROAD_115_BR_6_1 | 508 |
| 33310_SANMATEO_115_33312_BELMONT_115_BR_1_1 | 508 |
| 30717_TRAN230B_230_99170_MAR-JEF1_230_BR_1_1 | 508 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_6_T | 508 |
| 33203_MISSON_115_33205_HNTRSPT_115_BR_1_1 | 508 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_7_T | 508 |
| 33208_MARTINC_115_33303_ESTGRND_115_BR_2_1 | 508 |
| 30705_MONTAVIS_230_30712_SLACTAP2_230_BR_2_1 | 508 |
| 33306_SFIA_115_33310_SANMATEO_115_BR_5_1 | 508 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_6_P | 508 |

| CONSTRAINT NAME | HOUR |
|--|------|
| 99106_SAN-MAR1_230_99104_MAR-SAN1_230_BR_1_3 | 508 |
| 33308_SFIA-MA_115_33303_ESTGRND_115_BR_2_1 | 508 |
| 33204_POTRERO_115_33206_BAYSHOR1_115_BR_1_1 | 508 |
| 33200_LARKIN_115_33204_POTRERO_115_BR_1_1 | 508 |
| 30685_EMBRCDR_230_99158_MAR-EMBD_230_BR_2_1 | 508 |
| 30705_MONTAVIS_230_30710_SLACTAP1_230_BR_1_1 | 508 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_5_S | 508 |
| 33322_UALTAP_115_33306_SFIA_115_BR_5_1 | 508 |
| 30703_RAVENSWD_230_30700_SANMATEO_230_BR_1_1 | 508 |
| 33203_MISSON_115_33205_HNTRSPT_115_BR_2_1 | 508 |
| 33356_BURLNGME_115_33310_SANMATEO_115_BR_4_1 | 508 |
| 33305_SHAWROAD_115_33208_MARTINC_115_BR_6_1 | 508 |
| 33310_SANMATEO_115_30700_SANMATEO_230_XF_5_P | 508 |
| 33307_MILLBRAE_115_33310_SANMATEO_115_BR_1_1 | 508 |
| 33208_MARTINC_115_33307_MILLBRAE_115_BR_1_1 | 508 |
| 33204_POTRERO_115_33205_HNTRSPT_115_BR_1_1 | 508 |
| 33208_MARTINC_115_33310_SANMATEO_115_BR_3_1 | 508 |
| 33208_MARTINC_115_33356_BURLNGME_115_BR_4_1 | 508 |
| 33208_MARTINC_115_30695_MARTINC_230_XF_8 | 508 |
| 33208_MARTINC_115_33322_UALTAP_115_BR_5_1 | 508 |

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 spring season 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 but three candidate paths pass under the study conditions, and are therefore deemed competitive for the 2011 spring season⁴.

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 | 11,630 | 12,630 | 10,517 | 7,589 | 2,671 | 3,278 | -1,036 | 1,237 |
| 2 | 11,202 | 12,074 | 9,710 | 7,527 | 2,710 | 3,124 | -1,395 | 897 |
| 3 | 10,876 | 11,776 | 9,702 | 7,252 | 2,755 | 2,740 | -1,066 | 1,258 |
| 4 | 10,825 | 11,722 | 9,587 | 7,254 | 2,757 | 2,747 | -1,136 | 1,195 |
| 5 | 11,169 | 12,239 | 9,935 | 7,767 | 2,803 | 2,702 | -1,052 | 1,245 |
| 6 | 11,491 | 12,768 | 10,234 | 7,686 | 2,912 | 3,227 | -954 | 1,329 |
| 7 | 12,576 | 13,960 | 12,033 | 8,268 | 2,843 | 3,316 | -363 | 1,841 |
| 8 | 13,413 | 14,969 | 13,497 | 8,897 | 2,665 | 3,416 | -56 | 2,329 |
| 9 | 13,883 | 15,891 | 13,884 | 9,305 | 2,758 | 3,919 | -70 | 2,328 |
| 10 | 14,521 | 16,808 | 14,864 | 9,914 | 2,787 | 3,922 | -332 | 2,722 |
| 11 | 15,125 | 17,548 | 15,324 | 10,786 | 3,014 | 3,853 | -333 | 2,815 |
| 12 | 15,524 | 17,977 | 15,642 | 11,476 | 2,996 | 3,839 | -519 | 2,587 |
| 13 | 15,865 | 18,394 | 16,126 | 11,784 | 2,961 | 3,941 | -598 | 2,469 |
| 14 | 16,418 | 18,854 | 16,938 | 11,976 | 2,703 | 4,208 | -484 | 2,515 |
| 15 | 16,917 | 19,109 | 17,408 | 12,159 | 2,773 | 4,312 | -332 | 2,562 |
| 16 | 17,169 | 18,900 | 17,646 | 12,130 | 2,928 | 4,128 | -343 | 2,517 |
| 17 | 17,309 | 18,694 | 17,727 | 12,141 | 2,662 | 4,272 | -692 | 2,157 |
| 18 | 17,174 | 18,006 | 17,146 | 11,632 | 2,787 | 4,457 | -1,086 | 1,842 |
| 19 | 16,786 | 17,365 | 16,618 | 11,301 | 2,794 | 4,236 | -1,191 | 1,750 |
| 20 | 16,070 | 17,207 | 15,983 | 10,947 | 2,795 | 4,305 | -939 | 1,861 |
| 21 | 15,929 | 17,620 | 15,772 | 11,208 | 2,679 | 4,332 | -868 | 1,940 |
| 22 | 15,067 | 16,401 | 14,812 | 10,087 | 2,627 | 4,358 | -1,063 | 1,828 |
| 23 | 13,576 | 15,020 | 13,289 | 9,611 | 2,615 | 3,457 | -1,072 | 1,783 |
| 24 | 12,262 | 13,736 | 12,017 | 8,806 | 2,617 | 2,968 | -426 | 1,837 |

Table 8. Failed candidate path list

| CONSTRAINT NAME |
|--|
| 33200_LARKIN_115_33204_POTRERO_115_BR_2_1 |
| 33203_MISSON_115_33204_POTRERO_115_BR_1_1 |
| 33308_SFIA-MA_115_33303_ESTGRND_115_BR_2_1 |

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 |
|--|---|
| 30015_TABLEMT_500_30040_TESLA_500_BR_1_3 | 32316_YUBAGOLD_60.0_32318_BRWNSVY_60.0_BR_1_1 |
| 30300_TABLMTN_230_30066_TBMT1M_1.0_XF_1 | 32318_BRWNSVY_60.0_32320_MRYSVLLE_60.0_BR_1_1 |
| 30300_TABLMTN_230_30325_PALERMO_230_BR_1_1 | 33200_LARKIN_115_33203_MISSON_115_BR_1_1 |
| 30325_PALERMO_230_30327_COLGATE_230_BR_1A_1 | 33200_LARKIN_115_33204_POTRERO_115_BR_1_1 |
| 30325_PALERMO_230_30327_COLGATE_230_BR_1_1 | 33200_LARKIN_115_33208_MARTINC_115_BR_1_1 |
| 30560_E.SHORE_230_30700_SANMATEO_230_BR_1_1 | 33203_MISSON_115_33205_HNTRSPT_115_BR_1_1 |
| 30567_TESJCT_230_30700_SANMATEO_230_BR_1_1 | 33203_MISSON_115_33205_HNTRSPT_115_BR_2_1 |
| 30685_EMBRCDR_230_99158_MAR-EMBD_230_BR_2_1 | 33204_POTRERO_115_33205_HNTRSPT_115_BR_1_1 |
| 30685_EMBRCDR_230_99160_MAR-EMBE_230_BR_1_1 | 33204_POTRERO_115_33206_BAYSHOR1_115_BR_1_1 |
| 30703_RAVENSWD_230_30700_SANMATEO_230_BR_1_1 | 33204_POTRERO_115_33207_BAYSHOR2_115_BR_2_1 |
| 30703_RAVENSWD_230_30700_SANMATEO_230_BR_2_1 | 33205_HNTRSPT_115_33208_MARTINC_115_BR_1_1 |
| 30705_MONTAVIS_230_30710_SLACTAP1_230_BR_1_1 | 33205_HNTRSPT_115_33208_MARTINC_115_BR_3_1 |
| 30705_MONTAVIS_230_30712_SLACTAP2_230_BR_2_1 | 33206_BAYSHOR1_115_33208_MARTINC_115_BR_1_1 |
| 30710_SLACTAP1_230_30715_JEFFERSN_230_BR_1_1 | 33207_BAYSHOR2_115_33208_MARTINC_115_BR_2_1 |
| 30712_SLACTAP2_230_30715_JEFFERSN_230_BR_2_1 | 33208_MARTINC_115_30695_MARTINC_230_XF_7 |
| 30717_TRAN230B_230_99170_MAR-JEF1_230_BR_1_1 | 33208_MARTINC_115_30695_MARTINC_230_XF_8 |
| 31000_HUMBOLDT_115_31001_HMBLTTM_1.0_XF_1 | 33208_MARTINC_115_33303_ESTGRND_115_BR_2_1 |
| 31000_HUMBOLDT_115_31015_BRDGVLLE_115_BR_1_1 | 33208_MARTINC_115_33307_MILLBRAE_115_BR_1_1 |
| 31000_HUMBOLDT_115_31452_TRINITY_115_BR_1_1 | 33208_MARTINC_115_33310_SANMATEO_115_BR_3_1 |
| 31010_LOWGAP1_115_31015_BRDGVLLE_115_BR_1_1 | 33208_MARTINC_115_33322_UALTAP_115_BR_5_1 |
| 31011_FRSTGLEN_115_31010_LOWGAP1_115_BR_1_1 | 33208_MARTINC_115_33356_BURLNGME_115_BR_4_1 |
| 31080_HUMBOLDT_230_31000_HUMBOLDT_115_XF_2 | 33305_SHAWROAD_115_33208_MARTINC_115_BR_6_1 |
| 31080_HUMBOLDT_60.0_31001_HMBLTTM_1.0_XF_1 | 33306_SFIA_115_33310_SANMATEO_115_BR_5_1 |
| 31080_HUMBOLDT_60.0_31088_HMBLTJT_60.0_BR_1_1 | 33307_MILLBRAE_115_33310_SANMATEO_115_BR_1_1 |
| 31080_HUMBOLDT_60.0_31090_HMBLTBY_60.0_BR_2_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_5_P |
| 31080_HUMBOLDT_60.0_31092_MPLECRK_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_5_S |
| 31086_EUREKA_60.0_31090_HMBLTBY_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_5_T |
| 31088_HMBLTJT_60.0_31084_HARRISST_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_6_P |
| 31088_HMBLTJT_60.0_31090_HMBLTBY_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_6_S |
| 31092_MPLECRK_60.0_31093_HYMPOMJT_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_6_T |
| 31093_HYMPOMJT_60.0_31553_BIGBAR_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_7_P |
| 31110_BRDGVLLE_60.0_31112_FRUITLND_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_7_S |
| 31112_FRUITLND_60.0_31114_FRTSWRD_60.0_BR_1_1 | 33310_SANMATEO_115_30700_SANMATEO_230_XF_7_T |
| 31114_FRTSWRD_60.0_31116_GRBRVLE_60.0_BR_1_1 | 33310_SANMATEO_115_33305_SHAWROAD_115_BR_6_1 |
| 31116_GRBRVLE_60.0_31118_KEKAWAKA_60.0_BR_1_1 | 33310_SANMATEO_115_33308_SFIA-MA_115_BR_2_1 |
| 31118_KEKAWAKA_60.0_31308_LYTNVLE_60.0_BR_1_1 | 33310_SANMATEO_115_33312_BELMONT_115_BR_1_1 |
| 31306_WILLITS_60.0_31308_LYTNVLE_60.0_BR_1_1 | 33310_SANMATEO_115_33315_RAVENSWD_115_BR_1_1 |
| 31450_WILDWOOD_115_31011_FRSTGLEN_115_BR_1_1 | 33322_UALTAP_115_33306_SFIA_115_BR_5_1 |
| 31450_WILDWOOD_115_31464_COTWDPGE_115_BR_1_1 | 33356_BURLNGME_115_33310_SANMATEO_115_BR_4_1 |
| 31452_TRINITY_115_31461_JESSTAP_115_BR_1_1 | 33912_SPRNGGJ_115_33914_MI-WUK_115_BR_1_1 |
| 31461_JESSTAP_115_31464_COTWDPGE_115_BR_1_1 | 99102_PIT-TES1_230_30567_TESJCT_230_BR_1_2 |
| 31555_MSSTAP2_60.0_31553_BIGBAR_60.0_BR_1_1 | 99106_SAN-MAR1_230_99104_MAR-SAN1_230_BR_1_3 |
| 31555_MSSTAP2_60.0_31557_MILSTSTA_60.0_BR_1_1 | HUMBOLDT_BG |
| 31556_TRINITY_60.0_31555_MSSTAP2_60.0_BR_1_1 | SDGEIMP_BG |
| 31566_KESWICK_60.0_31582_STLLWATR_60.0_BR_1_1 | 22360_IMPRLVLY_500_22468_MIGUEL_500_BR_1_2 |
| 31580_CASCADE_60.0_31582_STLLWATR_60.0_BR_1_1 | 22609_OTAYMESA_230_20149_TJI-230_230_BR_1_1 |
| 31656_PALERMO_60.0_31658_BANGOR_60.0_BR_1_1 | 22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_1_1 |
| 31658_BANGOR_60.0_32308_COLGATE_60.0_BR_1_1 | 22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_2_1 |
| 32212_E.NICOLS_115_32214_RIOOSO_115_BR_1_1 | 22716_SANLUSRY_230_24131_S.ONOFRE_230_BR_3_1 |
| 32308_COLGATE_60.0_30327_COLGATE_230_XF_3 | 22844_TALEGA_230_24131_S.ONOFRE_230_BR_1_1 |
| 32314_SMRTSVLE_60.0_32316_YUBAGOLD_60.0_BR_1_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 but three candidate paths passed the competitiveness test. Note that there are a total of roughly 4,800 individual line segments in the FNM 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.