DOCKETED

Docket Number:	15-AFC-01
Project Title:	Puente Power Project
TN #:	215433-5
Document Title:	Exhibit - Appendix D on Behalf of Intervenors SC, ECVC, and EDC
Description:	Exhibit
Filer:	Matthew A. Smith
Organization:	Environmental Defense Center
Submitter Role:	Intervenor
Submission Date:	1/18/2017 3:16:38 PM
Docketed Date:	1/18/2017

Exhibit 4010

APPENDIX D: 2025 Local Capacity Technical Analysis for the Los Angeles Basin (LA Basin), Big Creek/Ventura and San Diego Local Capacity Requirement Areas

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California Independent System Operator

2025
LOCAL CAPACITY TECHNICAL ANALYSIS

DRAFT REPORT AND STUDY RESULTS

March 28, 2016

Local Capacity Technical Analysis
Overview and Study Results

I. Executive Summary

This Report documents the results and recommendations of the 2025 Long-Term Local Capacity Technical (LCT) Study. The LCT Study objectives, inputs, methodologies and assumptions are the same as those discussed in the 2015 LCT Study to be adopted by the CAISO and CPUC in their 2015 Local Resource Adequacy needs.

Overall, the 2025 LCR need for the overall LA Basin remains fairly constant compared to the 2024 LCR need (8,319 MW vs. 8,350 MW). However, the Eastern LA Basin sub-area LCR need, due to the same critical contingency, in the sub-area reduces by about 650 MW due to lower net peak demand in the LA Basin (320 MW). For the Western LA Basin sub-area, however, the LCR need increases by about 620 MW, which can be met by either additional local capacity procurement (up to maximum authorized amount of 2,500 MW), or by implementing one of the potential transmission solutions as evaluated further in the Western LA Basin sub-area. The reason for the increase in the Western LA Basin sub-area LCR need for the 2025 time frame is due to updated level that reflects higher dispatch of renewable resources that are based on the CPUC-provided technology factors (for Net Qualifying Capacity), for modeled renewable generation north and east of the LA Basin LCR area. This higher level of renewable generation dispatch (about 2,000 MW higher) reflects updated modeling for generation NQC outputs for centralized photovoltaic solar farms located outside north and east of the LA Basin LCR area. In addition, the updated models also include NQC level of generation dispatch for wind generation resources located north of the LA Basin LCR area. The increase in renewable generation dispatch level to reflect NQC-level outputs contributes to further thermal loading concerns for the 230kV lines south of newly upgraded Mesa Substation under contingency conditions. This reflects the ability of the upgraded Mesa Substation to facilitate delivering more renewable generation into the LA Basin load centers when it's upgraded to 500kV voltage level and having additional 230kV lines in

the Western LA Basin looped into it. In the Western LA Basin Sub-area LCR need discussion section, the ISO evaluated thirteen different options, which include either additional resource procurement and/or small-scale transmission upgrades[1], for mitigating the identified overloading concerns.

The overall San Diego-Imperial Valley LCR need increases by about 720 MW, mainly due to the need to dispatch resources to mitigate thermal loading concerns on the 230kV lines south of new upgraded Mesa Substation as discussed above. Although it is more effective to have additional resources in the Western LA Basin to mitigate this thermal loading concern, existing resources in the San Diego-Imperial Valley LCR area were dispatched after additional resource additions reach maximum procurement authorized for the Western LA Basin (i.e., 2500 MW).

Alternatively to the above, the following are several potential small-scale transmission upgrades studied for the Western LA Basin sub-area. These could effectively address this loading concern while maintaining the long-term power procurement at the current level that was approved by the CPUC for SCE's Western LA Basin and incremental procurement[2] of preferred resources and energy storage for the San Diego sub-area.

- opening Mesa 500/230kV Bank #2 under contingency conditions;
- re-arranging Mesa-Laguna Bell 230kV Lines and Opening Laguna Bell – La Fresa 230kV line under contingency; and
- Installing 10-Ohm series reactors[3] on the Mesa-Laguna Bell #1 230kV Line and potentially the Mesa-Redondo 230kV line in the future (beyond ten-year horizon for this line)

[1] Small-scale transmission upgrades include upgrades that are anticipated to be confined within the substation boundaries and do not require new Rights-of-Way for implementation.
[2] Incremental procurement of preferred resources and energy storage in San Diego area amounts to 250 MW, which is less than the 300 MW ceiling for preferred resources and energy storage authorized by the CPUC.
[3] Variation of this option includes thyristor-controlled series reactor to be inserted upon occurrence of the second N-1 contingency under peak load conditions. This option would have higher cost than the permanently installed series reactor, but its advantage is to preserve the original line impedance for lower losses in the pre-contingency condition.

Of the above three options, installing 10-Ohm series reactors[4] on the Mesa-Laguna Bell #1 230kV Line and potentially the Mesa-Redondo 230kV line in the future (i.e., the third option listed above) appears to have the least impact to the system under contingency condition and potentially have the lowest cost. This transmission upgrade option also would appear to be less costly and more effective in mitigating the potential loading concern than the option that calls for additional local capacity preferred resource procurement in the western LA Basin.

The following table summarizes the range of alternatives that were studied to address the 2025 LCR need under various resource procurement scenarios, including the above options and other alternatives that were found not to be sufficient and would leave a resource deficiency in the area.

Table D1: Summary of Alternatives for Meeting Long-Term (2025) LCR Needs for the LA Basin / San Diego Areas

No	Scenarios	Results
Alternatives that do meet the identified need		
1	• This is the same as option 1 described above • Fully procure LTPP Tracks 1 and 4 resources up to maximum authorizations for SCE (i.e., 2500 MW) and SDG&E (i.e., 1100 MW); and • Repurpose a total of 476 MW of existing demand response (i.e., this amount is approximately 286 MW beyond the baseline assumption of 189 MW in the LTPP Track 4 scoping ruling) with adequate operational characteristics[5], ***OR***	Then there is no resource deficiency

[4] Variation of this option includes thyristor-controlled series reactor to be inserted upon occurrence of the second N-1 contingency under peak load conditions. This option would have higher cost than the permanently installed series reactor, but its advantage is to preserve the original line impedance for lower losses in the pre-contingency condition.
[5] Implementable within 20 minutes time frame

No	Scenarios	Results
2	Alternatively to the above additional resource procurement scenario, • implement the CPUC recent decisions for SCE's procurement (i.e., 1813 MW) for the western LA Basin sub-area, and • procure additional 250 MW[6] of preferred resources for local capacity in the San Diego sub-area (part of the CPUC maximum authorizations of 300 MW of preferred resources for San Diego), and • implement small transmission upgrades[7] in the western LA Basin	Then there is no resource deficiency; system is more robust than Scenario #1
Alternatives that do NOT meet the identified need		
3A	• LTPP Tracks 1 and 4 are not fully procured up to maximum authorizations (i.e., 687 MW less than maximum authorized amount of 2500 MW) for the western LA Basin; • however, fully procure 300 MW preferred resources in San Diego to complete the San Diego local capacity procurement; • utilize LTPP Track 4 baseline assumptions for existing demand response (i.e., 190 MW for both western LA Basin and San Diego sub-areas) • but there are no further transmission upgrades in the western LA Basin, ***OR***	Then there would be resource deficiency
3B	Alternately • same Scenario as #2 but AAEE does not materialize as forecast (i.e., 962 MW in the western LA Basin and 401 MW in San Diego sub-area) , ***OR***	Then there would be resource deficiency

[6] Potential preferred resources for procurement under consideration by SDG&E

[7] For further information on potential small-scale transmission upgrades in the western LA Basin, please see discussion and summary table under the "Western LA Basin Sub-area" in this report.

No	Scenarios	Results
3C	• same as Option 3A, but the existing demand response is fully repurposed and used (i.e., 894 MW in the western LA Basin and 17 MW in the San Diego sub-area)	Then there would still be resource deficiency

For the Big Creek/Ventura LCR area, the demand forecast decreased by 285 MW and the Big Creek/Ventura overall LCR need has decreased by 94 MW. The AAEE remains critical for the Santa Clara and Moorpark sub-areas. The Moorpark sub-area LCR need is determined to be 516 MW, which exceeds its available local resources by 234 MW after Ormond Beach and Mandalay retirement by the end of 2020. The Moorpark sub-area is projected to be resource deficient by 234 MW if there is no approval decision from the CPUC for local capacity procurement to replace Ormond Beach and Mandalay generation after their retirement by the end of 2020 to comply with the SWRCB's Policy on OTC generating facilities. However, with the CPUC approval for long-term local capacity procurement selection in the Moorpark sub-area, it is expected that there is no resource deficiency.

The load forecast used in this study is based on the final adopted California Energy Demand 2015 - 2025 final forecast developed and adopted by the CEC, namely the mid-demand baseline with low-mid additional achievable energy efficiency (AAEE), which is posted at: http://www.energy.ca.gov/2014_energypolicy/documents/index.html#adoptedforecast.

The following table provides a summary of the local capacity requirements for the Big Creek/Ventura, LA Basin and San Diego/Imperial Valley LCR areas for the 2025 study year.

2025 Local Capacity Needs

Table D2: Summary of Long-Term LCR Needs (2025) for Local Reliability Areas in Southern California

	Qualifying Capacity (MW)			2025 LCR Need Based on Single-Element Contingency (MW)			2025 LCR Need Based on Multiple-Element Contingency (MW)		
Local Area Name	**Existing Resources**	**CPUC-approved procurement contracts**	**Total**	**Available Capacity Needed**	**Deficiency**	**Total**	**Available Capacity Needed**	**Deficiency**	**Total**
Western LA Basin	2,728	1,813	4,541	4,541	(695)	5,236	4,541	(973)[8]	5,514
Eastern LA Basin	3,531	N/A	3,531	2,132	0	2,132	2,805	0	2,805
Big Creek/Ventura	3,667	Pending review and decision from the CPUC for the Moorpark sub-area procurement selection	3,667	2,111	0	2,111	2,455	234	2,689
San Diego/ Imperial Valley	4,618	800	4,618[9]	3,151	0	3,151	4,618	(250)[10]	4,868

The following are write-ups for each Local Capacity Area, which lists relevant new projects that were approved by the ISO Board, and which were modeled in the study cases, as well as reasons for changes between the 2024 Long-Term LCR study and the 2025 Long-Term LCR study results.

[8] This can be met with: (a) 687 MW of potential further procurement; and (c) 286 MW of additional repurposing for existing demand response (beyond the baseline 173 MW assumptions for the Western LA Basin sub-area and 17 MW for San Diego sub-area), or by minor transmission upgrades in the area.

[9] This also includes 133 MW of wind resources, 67 MW (NQC value) of new RPS distributed generation (PV), 17 MW of existing demand response and 800 MW of conventional resources that were approved by the CPUC as part of the long-term procurement plan for Tracks 1 and 4.

[10] This can be met with additional procurement (250 MW) of preferred resources and energy storage as previously authorized by the CPUC for long-term procurement plan (Tracks 1 and 4) for San Diego area.

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II. Overview of the Study: Inputs, Outputs and Options

A. Objectives

As was the objective of all previous LCT Studies, the intent of the 2025 Long-Term LCT Study is to identify specific local areas within the CAISO Balancing Authority Area (BAA)'s southern California that have limited import capability and determine the minimum resource capacity (MW) necessary to mitigate the local reliability problems in those areas.

B. Key Study Assumptions

Inputs and Methodology

The ISO used the same Inputs and Methodology as agreed upon by interested parties previously incorporated into the 2025 LCR Study, as well as ISO Final Study Plan for the 2015 – 2016 Transmission Planning Process and the "CPUC Assigned Commissioner's Ruling on Updates to the Planning Assumptions and Scenarios for Use in the 2014 Long Term Procurement Plan and the California Independent System Operator's 2015-16 Transmission Planning Process" (the CPUC ACR Planning Study Assumptions). The following table sets forth a summary of the approved inputs and methodology that have been used in the previous 2024 LCR Study and this 2025 LCR Study:

Table D3: Summary of Inputs and Methodology Used in this LCR Study:

Issue:	**HOW INCORPORATED INTO THIS LCR STUDY:**
Input Assumptions:	
• Transmission System Configuration	The existing transmission system has been modeled, including all projects operational on or before June 1, of the study year and all other feasible operational solutions brought forth by the PTOs and as agreed to by the CAISO.
• Generation Modeled	The existing generation resources has been modeled and also includes all projects that will be on-line and commercial on or before June 1, of the study year
• Load Forecast	Uses a 1-in-10 year summer peak load forecast

Methodology:	
• **Maximize Import Capability**	Import capability into the load pocket has been maximized, thus minimizing the generation required in the load pocket to meet applicable reliability requirements.
• **QF/Nuclear/State/Federal Units**	Regulatory Must-take and similarly situated units like QF/Nuclear/State/Federal resources have been modeled on-line at qualifying capacity output values for purposes of this LCR Study.
• **Maintaining Path Flows**	Path flows have been maintained below all established path ratings into the load pockets, including the 500 kV. For clarification, given the existing transmission system configuration, the only 500 kV path that flows directly into a load pocket and will, therefore, be considered in this LCR Study is the South of Lugo transfer path flowing into the LA Basin.
Performance Criteria:	
• **Performance Level B & C[11], including incorporation of PTO operational solutions**	This LCR Study is being published based on Performance Level B and Performance Level C criterion, yielding the low and high range LCR scenarios. In addition, the CAISO will incorporate all new projects and other feasible and CAISO-approved operational solutions brought forth by the PTOs that can be operational on or before June 1, of the study year. Any such solutions that can reduce the need for procurement to meet the Performance Level C criteria will be incorporated into the LCR Study.
Load Pocket:	
• **Fixed Boundary, including limited reference to published effectiveness factors**	This LCR Study has been produced based on load pockets defined by a fixed boundary. The CAISO only publishes effectiveness factors where they are useful in facilitating procurement where excess capacity exists within a load pocket.

Further details regarding the previous 2024 as well as 2025 LCR Study methodology and assumptions are provided in Section III, below.

C. Grid Reliability

Service reliability builds from grid reliability because grid reliability is reflected in the planning standards of the Western Electricity Coordinating Council ("WECC") that incorporate standards set by the North American Electric Reliability Council ("NERC") (collectively "NERC Planning Standards"). The NERC Planning Standards apply to the

[11] TPL 002 Category B is generally equivalent to TPL 001-4 Category P1. TPL 003 Category C is generally equivalent to TPL 001-4 P2 through P7.

C. Power Flow Program Used in the LCR analysis

The technical studies were conducted using General Electric's Power System Load Flow (GE PSLF) program version 18.1. This GE PSLF program is available directly from GE or through the Western System Electricity Council (WECC) to any member.

To evaluate Local Capacity Areas, the starting base case was adjusted to reflect the latest generation and transmission projects as well as the one-in-ten-year peak load forecast for each Local Capacity Area as provided to the CAISO by the PTOs.

Electronic contingency files provided by the PTOs were utilized to perform the numerous contingencies required to identify the LCR. These contingency files include remedial action and special protection schemes that are expected to be in operation during the year of study. An CAISO created EPCL (a GE programming language contained within the GE PSLF package) routine was used to run the combination of contingencies; however, other routines are available from WECC with the GE PSFL package or can be developed by third parties to identify the most limiting combination of contingencies requiring the highest amount of generation within the local area to maintain power flows within applicable ratings.

IV. Locational Capacity Requirement Study Results

A. Summary of Study Results

LCR is defined as the amount of resource capacity that is needed within a Local Capacity Area to reliably serve the load located within this area. The results of the CAISO's analysis are summarized in the Executive Summary Tables.

Table D5: 2025 Local Capacity Needs vs. Peak Load and Local Area Resources

	2025 Total LCR (MW)	Peak Load (1 in10) (MW)	2025 LCR as % of Peak Load	Total Available Local Area Resources to Meet LCR Needs (MW)	2025 LCR as % of Total Area Resources
LA Basin	8,319	22,376	37%	7,346	113%** $
Big Creek/Ventura	2,689	4,794	56%	3,667	73%**
San Diego/Imperial Valley	4,868	5,394	90%	4,618	105% $

* Value shown only illustrative, since each local area peaks at a different time.

** Resource deficient LCA (or with sub-area that are deficient) – deficiency included in LCR. Resource deficient area implies that in order to comply with the criteria, at summer peak, load must be shed immediately after the first contingency, or further local capacity resource procurement is needed.

$ These are calculated with existing resources and future resources that already have approved PPTAs.

Table 3 shows how much of the Local Capacity Area load is dependent on local resources and how much local resources must be available in order to serve the load in those Local Capacity Areas in a manner consistent with the Reliability Criteria.

The term “Qualifying Capacity” used in this report is the “Net Qualifying Capacity” (“NQC”) posted on the CAISO web site at:

http://www.caiso.com/planning/Pages/ReliabilityRequirements/Default.aspx

The NQC list includes the area (if applicable) where each resource is located for units already operational. Neither the NQC list nor this report incorporates Demand Side Management programs and their related NQC. Units scheduled to become operational before June 1 of 2025 have been included in this 2025 Long-Term LCR Report and added to the total NQC values for those respective areas (see detail write-up for each area).

Regarding the main tables up front (page 5), the column, “YEAR LCR Requirement Based on Category B” identifies the local capacity requirements, and deficiencies that must be addressed, in order to achieve a service reliability level based on Performance Criteria- Category B or single-element contingencies. The column, “YEAR LCR

Requirement Based on Category C with Operating Procedure", sets forth the local capacity requirements, and deficiencies that must be addressed, necessary to attain a service reliability level based on Performance Criteria-Category C, with operational solutions as applicable, for multiple element contingencies (two or more elements, for more details, please see Table 1).

B. Summary of Results by Local Area

Each Local Capacity Area's overall requirement is determined by also achieving each sub-area requirement. Because these areas are a part of the interconnected electric system, the total for each Local Capacity Area is not simply a summation of the sub-area needs. For example, some sub-areas may overlap and therefore the same units may count for meeting the needs in both sub-areas.

3. LA Basin Area

Area Definition

The transmission tie lines into the LA Basin Area are:

1) San Onofre - San Luis Rey #1, #2, and #3 230 kV Lines
2) San Onofre - Talega #2 230 kV Lines
3) San Onofre - Capistrano #1 230 kV Lines
4) Lugo - Mira Loma #2 & #3 500 kV Lines
5) Lugo - Rancho Vista #1 500 kV Line
6) Sylmar - Eagle Rock 230 kV Line
7) Sylmar - Gould 230 kV Line
8) Vincent – Mesa Cal #1 500 kV Line
9) Vincent - Mesa Cal #1& #2 230 kV Line
10) Vincent - Rio Hondo #1 & #2 230 kV Lines
11) Devers - Red Bluff 500 kV #1 and #2 Lines
12) Mirage - Coachelv # 1 230 kV Line
13) Mirage - Ramon # 1 230 kV Line
14) Mirage - Julian Hinds 230 kV Line

The substations that delineate the LA Basin Area are:

1) San Onofre is in San Luis Rey is out
2) San Onofre is in Talega is out