California ISO

LOCAL CAPACITY TECHNICAL ANALYSIS

OVERVIEW OF STUDY REPORT AND PRELIMINARY RESULTS

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Local Capacity Technical Analysis Overview and Study Results

I. Executive Summary

As part of the Phase 2 workshops on the implementation of Resource Adequacy Requirements ("RAR"), the California Public Utilities Commission ("CPUC") asked the California Independent System Operator Corporation ("CAISO") to perform a technical analysis on the amount of generation capacity that is necessary within transmission constrained areas of the grid. This overview summarizes how the CAISO analysis was conducted and the preliminary results of this analysis.

Generally, the results of this study produced MW requirements within Local Capacity Areas that are significantly higher than the amount of Reliability Must Run ("RMR") contracts that have been signed utilizing the CAISO's Local Area Reliability Service ("LARS") technical analysis. In addition, this technical study identified two additional Local Capacity Areas beyond those already established by the LARS technical studies as transmission constrained local areas in which generation capacity is needed to ensure reliable operation of the CAISO Controlled Grid.

The difference in MW requirements between this Local Capacity Area technical study and LARS arises from the goal of local RAR to permit the CAISO to meet its operational and planning requirements within areas with severely limited transmission capability. The scope of LARS is more limited. The current RMR Criteria is basically a subset of the Grid Planning Standards that includes only single contingencies (NERC Category B). The criteria for this study expands the subset of contingencies to include simultaneous and overlapping double contingencies (NERC Category C). In addition, the current RMR criteria requires an assessment of the system with 1 in 5 summer peak load level, while this study assumes a 1 in 10 summer peak load level.

As an example, under this Local Capacity Area analysis the CAISO must operate the grid with an ability to recover from overlapping contingencies in which a major facility is lost from service, the system is then readjusted, and then another major facility (N-1 or common mode N-2) is lost from service. The modification of assumptions to more closely reflect the CAISO's operational requirements results in higher MW needs within the affected Local Capacity Areas compared to previous LARS studies. These are the actual conditions under which the CAISO must plan and operate the CAISO Controlled grid. Therefore, the CAISO believes this study reflects the necessary and appropriate levels of resources for an effective local capacity obligation.

II. Introduction

This overview report summarizes the CAISO study methodology, criteria and preliminary results for the "CAISO Controlled Grid Local Capacity Technical Study." This study is intended to provide the technical basis for local capacity requirements that must be met for an effective Resource Adequacy program.

The parameters of the study were initially presented and discussed with stakeholders at a CPUC workshop conducted at the CAISO on January 25, 2005. The proposed methodology and criteria for this Local Capacity Area technical study were published as part of a "Straw Proposal" document that was distributed to the CPUC service list of workshop participants. This document has since been posted on the CAISO website at:

http://www.caiso.com/docs/2005/06/22/2005062214371421107.pdf

This overview includes the preliminary results of the study, expressed in MWs that are meant to define the minimum amount of capacity that is needed in each Local Capacity Area for reliable operation of the CAISO Controlled Grid.

This overview also identifies the transmission lines into these Local Capacity Areas and the substation facilities[1] that encircle or are included within each Local Capacity Area. The CAISO believes this information can be used to geographically define each Local Capacity Area and to assign specific local capacity obligations to the load serving entities ("LSEs") that serve load within these geographic boundaries. The CAISO anticipates that the CPUC will establish such an allocation mechanism through the CPUC's upcoming orders on Resource Adequacy.

III. Background and Description of Local Area Requirements under Resource Adequacy

The regulatory framework adopted by the CPUC in the October 28th 2004 decision on resource adequacy includes three distinct categories by which generators would be assessed for their ability to deliver the output of electricity, and thereby count toward meeting an LSE's resource adequacy obligation.

The deliverability of generation to the aggregate of load measures the ability of generators to provide energy to the CAISO transmission system at peak load and not be limited by the transmission system or dispatch of other resources in the vicinity. The CAISO conducted a baseline study assessing the deliverability of

[1] The CAISO is confirming the names of some of these substations and expects to present this information in other documents soon to be posted.

existing generators and presented the preliminary results to stakeholders on May 9, 2005. An additional phase of this baseline study will be conducted soon to account for new generation projects with approved interconnection studies. Thereafter the deliverability of new resources will be assessed incrementally as part of the CAISO's technical studies to ensure the safe and reliable interconnection of new generators.

The deliverability of imports identifies the MW amounts that should be considered deliverable from outside the CAISO Controlled Grid through import paths. For this initial assessment, the CAISO analyzed data that reflected the historical use of intertie points between the CAISO's Controlled Grid and neighboring systems. The preliminary results for the deliverability of imports category also were presented to stakeholders on May 9, 2005.

The third leg of deliverability is the focus of this study and overview report. The deliverability to load within transmission constrained areas identifies the MW amounts of generating capacity that must be procured within load pockets to reliably serve the load located within these areas of the CAISO Controlled Grid.

All three categories of deliverability are assumed to be part of the resource adequacy rules that will be implemented in June, 2006. It is expected the CPUC will require that specific resources must be deliverable to the aggregate of load in order to count as qualified capacity meeting an LSE's overall resource adequacy obligation. Generating units within load pockets that qualify as deliverable to load within a transmission constrained Local Area could count both toward the Local Capacity Area obligation and the overall RA obligation for an LSE.

As part of this final report the CAISO intends to identify the generating resources that are eligible for meeting the MW amount that must be procured within each transmission constrained area. These Local Capacity Areas very closely resemble the areas in which the CAISO designate RMR Units for the 2005 Contract Year. This occurs because local generation must be used to serve load due to the limited ability of transmission lines to deliver output from resources located outside the transmission constrained area.

The CAISO intends to phase out RMR. In an accompanying White Paper that will be discussed at the June 29, 2005 stakeholder meeting, the CAISO begins to describe the necessary operational requirements for LSE procured resources. In addition, the CAISO proposes a process for transitioning to the LSE's procuring Local Capacity resources under new rules established in the CPUC's RA proceeding.

It is possible that the flexibility in LSE procurement may result in a set of resources that meets the MW obligation, but does not fully ensure the CAISO's ability to respond to all contingencies. Therefore, the CAISO expects to develop a Local Area Reliability Contract ("LARC") where the CAISO may enter into a

contract in a limited or "backstop" role to ensure the reliable operation of the CAISO Controlled Grid within the redesigned market and Resource Adequacy paradigm.[2]

Finally, the CAISO intends to perform this Local Capacity Area technical analysis annually. However, the transmission constraints that give rise to the Local Capacity requirement may be relieved with the introduction of additional transmission infrastructure. While this is certainly feasible, the CAISO anticipates that the boundaries of Local Capacity Areas will be fairly static over a 3-5 year time horizon and the minimum amount of capacity procured within each Local Capacity Area should remain reasonably stable. In short, the Local Capacity requirement for each Local Capacity Area may decline as transmission improvements relieve constraints, or increase proportionally as load grows; however, LSEs should be able to anticipate these changes over the long-term in order to strategically plan how to reach their procurement targets.

IV. The Study

A. Objectives

The purpose of this annual study is to determine which specific areas within the CAISO Controlled Grid exhibit local reliability problems and what MW amount should be targeted to provide the capacity needed to mitigate these potential local reliability problems. The results of this overview will show:

A. The total generation capacity (in MWs) that must be available within each Local Area.

B. A list of the transmission lines and substations that encircle each Local Area, from which a geographical description can be drawn to identify which load is encompassed within each pocket.

In addition, the final study report will include a list of generating units that are located within each Local Capacity Area and therefore eligible to count toward meeting the local requirement. Generator deficiencies in Local Areas also will be described to highlight areas where some generating units exist, yet the reliability criteria are not met due to the insufficiency of these resources**.**

B. Key Study Assumptions

The CAISO utilized the "2006 CAISO Controlled Grid – Summer Peak" as the base case. This base case was adjusted to reflect a one-in-ten-year peak load forecast that was provided by the Participating Transmission Owners ("PTOs").

[2] LARC may also serve as a backstop mechanism to address the exercise of market power for local capacity.

The CAISO also utilized electronic contingency files provided by the PTOs. This information includes remedial action and special protection schemes that are expected to be in operation prior to 2006.

The assumptions related to generation adopted for this study are similar to the assumptions made for RMR studies, including the availability of "Must Take" resources at their contract ratings, the dispatch of hydro generation and the explicit representation of municipal, state, federal and QF generating units in the power flow base cases. However, the Local Capacity studies include the MWs value of these units where the RMR studies did not.

C. Methodology and Summary of Criteria

This study applies the established planning and operating standards of the CAISO to determine the necessary reliability standards within Local Capacity Areas. These planning and operating criteria are consistent with the NERC/WECC standards that address system performance levels A, B and C.

Performance Level A is a normal operating condition with no overloads and all voltages within their normal operating limits.

Performance Level B incorporates N-1 contingencies that could include the loss of a single generator, a single transmission line or a single transformer bank. This standard requires enough generation so that the system avoids voltage collapse or transient instability as a result of these potential N-1 scenarios. The transmission system also should remain within emergency thermal limits and acceptable voltage limits. Following this N-1 contingency the generation must be sufficient to allow for operators to bring the system back to within acceptable (normal) operating range (voltage and loading) and/or appropriate OTC.

Performance Level C requires sufficient generation for the system to absorb the loss of a generating unit or transmission facility, readjust to a normal operating state, and then suffer the loss of another transmission facility. This standard requires a MW amount within that Local Capacity Area sufficient to keep the system within emergency thermal limits and acceptable voltage limits, as well as avoiding voltage collapse and transient instability.

Performance Level C also incorporates N-2 contingencies that could include the simultaneous loss of two transmission lines or two generating units. This standard requires enough generation so that the system avoids voltage collapse or transient instability as a result of these potential N-2 scenarios. The transmission system also should remain within emergency thermal limits and acceptable voltage limits.

Finally, for the large local areas (e.g. over 2000 MW of load) this study incorporates operating requirements for "N-1, followed by N-2" contingencies that go beyond NERC Performance Level C standards. This would include contingencies where the system suffers the loss of a single generating unit or transmission line, the system is readjusted and then the simultaneous loss (common mode failure)[3] of two transmission lines occurs. Under these contingencies the CAISO would be allowed to shed load,[4] and the criteria requires only enough generation available to prevent voltage collapse or transient instability.

Hundreds of thousands of simulations were run to determine the largest potentially operating contingencies within each Local Capacity Area. These contingencies were measured against these standards described above to determine the minimal amount of capacity need in the Local Capacity Area.

The CAISO conducted this Study using the GE PSLF power flow/stability program.

V. Summary of Preliminary Study Results

A. Humboldt Area

The most critical contingencies for the Humboldt area involve 1) the loss of the Bridgeville-Cottonwood 115 kV line along with one Humboldt Bay Power Plant and 2) the loss of the Humboldt-Trinity 115 kV line along with one Humboldt Bay Power Plant. These multiple contingencies establish the target of 162 MW as the minimum capacity necessary for the Humboldt area.

The transmission tie lines into the area include:

Humboldt-Bridgeville 115 kV line #1
Humboldt-Trinity 115 kV line#1
Willits-Garberville 60 line kV #1
Trinity-Maple Creek 60 kV

The substations that delineate the Humboldt Area are:

- Low Gap 115 kV
- Humboldt 115 kV

[3] These failures include a double circuit tower and the loss of two 500kv lines that are located in the same corridor.

[4] While the CAISO criteria generally allows for load shedding for the N-1, N-2 contingencies, the CAISO also maintains the level of reliability that existed prior to its formation. As such, to the extent a PTO's pre-CAISO standards did not allow for load shedding, the CAISO will also not allow load shedding in that area or corridor.

- Kekawaka 60 kV
- Ridge Cabin 60 kV

B. North Coast / North Bay Area

Eagle Rock pocket

The most critical contingency for the Eagle Rock-Fulton sub-area is described by the loss of the Fulton-Ignacio 230 kV line #1 and the Fulton-Lakeville 230 kV line #1. This limiting contingency requires a minimum capacity of 319 MW within this pocket.

The key transmission facilities coming into this sub-area are:

Fulton-Lakeville 230 kV line #1
Fulton-Ignacio 230kV line #1
Cortina 230/115 kV Transformer #1
Lakeville-Sonoma 115 kV line #1
Corona-Lakeville 115 kV line #1
Willits-Garberville 60 kV line #1

The substations that delineate the Eagle Rock-Fulton sub-area are:

- Fulton 230 kV
- Corona 115 kV
- Sonoma 115 kV
- Cortina 115 kV
- Laytonville 60 kV

Lakeville pocket

The most critical contingency for the Lakeville sub-area would be outages on Vaca-Dixon-Lakeville 230 kV line #1 and the Crockett-Sobrante 230 kV line #1. This limiting contingency requires a minimum capacity of 658 MW within this pocket. The transmission tie lines into this sub-area are:

Vaca Dixon-Lakeville 230 kV line #1
Tulucay-Vaca Dixon 230 kV line #1
Lakeville-Sobrante 230 kV line #1
Ignacio-Sobrante 230 kV line #1
Lakeville-Fulton 230 kV line #1
Lakeville-Corona 115 kV line #1

The substations that delineate the Lakeville sub-area are:

- Lakeville 230 kV
- Ignacio 230 kV
- Tulucay 230 kV
- Lakeville 115 kV

C. Greater Bay Area

The most limiting contingencies within the Greater Bay Area are an over-lapping outage of the Tesla-Metcalf 500 kV line with the Tesla-Newark #1 230 kV line. The amount of generation required within the Greater Bay area is predicated on staying within the emergency rating of the Tesla-Newark #2 230 kV line and specifically that portion of the line consisting of bundled 1113 AL conductor emanating from Newark Substation. This requires 5,435 MWs[5] of generation resources within the Greater Bay area.

Under the CAISO Revised Action Plan for San Francisco, all Potrero generation will continue to be required through 2006.

The substations that delineate the Greater Bay Area are:

- Sobrante 230 kV
- Moraga 230 kV
- Contra Costa Sub 230 kV
- Contra Costa P.P. 230 kV
- Pittsburg 230 kV
- Tesla 230 kV
- Metcalf 500 kV
- Moss Landing 500 kV
- Morgan Hill 115 kV
- Newark 115 kV

D. Sierra Area

The most critical contingencies in the Sierra area are 1) the loss of the Poe-Rio Oso 230 kV line #1 and the Colgate – Rio Oso 230 kV line #1, and 2) the loss of the Cresta-Rio Oso 230 kV line #1 and the Colgate – Rio Oso 230 kV line #1. The minimum capacity needed for the Sierra area is 1730 MW.

[5] This MW amount includes Market and Qualifying Facility generation only at this time. This total does not include the amount of municipal generation that was modeled on-line in the analysis and as such, the total amount of generation required in the Greater Bay Area is 5,435 MW plus the amount of muni generation that was modeled on-line. A tabulation of muni generation was not available for inclusion in this initial overview report.

The transmission tie lines into the Sierra area are:

Table Mt-Rio Oso 230 kV line #1
Rio Oso-Poe 230 kV line #1
Rio Oso-Cresta 230 kV line #1
Gold Hill-Ralston 230 kV line #1
Colgate 230/60 kV Transformer #1
Atlantic 230/60 kV Transformer #1
Gold Hill 230/115 kV Transformer #1
Gold Hill 230/115 kV Transformer #2
Palermo 230/115/60 kV Transformer #1
Caribou-Palermo 115 kV line #1
Bogue-Rio Oso 115 kV line #1
Rio Oso-Nicolaus 115 kV line #1
Pease-Rio Oso 115 kV line #1
Drum-Rio Oso 115 kV line #1
Drum-Rio Oso 115 kV line #2
Drum-Summit 115 kV line #1
Drum-Summit 115 kV line #2
Spaulding-Summit 60 kv line #1
Table Mt-Pease 60 kV line #2

The substations that delineate the Sierra Area are:

- Palermo 230 kV
- Rio Oso 230 kV
- Colgate 230 kV
- Atlantic 230 kV
- Gold Hill 230 kV
- Drum 115 kV
- Caribou 115 kV
- Table Mountain 60 kV
- Tamarack 60 kV

E. Sacramento Area

The critical contingency for the Cortina sub-area is the loss of Wadham Generator #1. This contingency necessitates a minimum capacity of 25 MWs within this pocket. The tie line into this pocket is the Cortina 230/60 kV transformer #1.

The critical contingency for the Davis-West Sacramento sub-area involves the Rio Oso-Woodland 115 kV line #2 and the Davis-Brighton 115kV line #1. This

contingency necessitates a minimum capacity of 65 MWs within this pocket. The tie lines coming into this pocket are:

Rio Oso-Woodland 115 kV #1
Rio Oso-Woodland 115 kV #2
Davis-West Sacramento 115 kV #1
Davis-Brighton 115 kV #1

The substations that delineate the Davis-Sacramento sub-area are:

- Woodland 115 kV
- Davis 115 KV

F. Stockton Area

The critical contingency for the Tesla-Bellota sub-area is the loss of Tesla-Tracy 115 kV #1 and Tesla-Safeway 115 kV #1. The capacity needed for the Stockton area is 449 MWs. The transmission facilities that establish the boundary of the Stockton area are:

Bellota 230/115 kV Transformer #1
Bellota 230/115 kV Transformer #2
Tesla 230/115 kV Transformer #1
Tesla 230/115 kV Transformer #3

The substations that delineate the Tesla-Bellota sub-area are:

- Tesla 115 kV
- Bellota 115 kV

G. Greater Fresno Area

The most limiting contingency within the Wilson sub-area is the loss of the Wilson - Melones 230 kV line, which requires 1,560 MWs as a minimum generating capacity within the Wilson pocket to avoid criteria violations. At least 120 MWs of this amount must come from the Helms generating units.

The most limiting contingency within the Herndon sub-area is the loss of the Herndon 230/115 kV bank 1, which requires a minimum of 1,207 MWs generating capacity within the Herndon sub-area to avoid criteria violations.

The most limiting contingency within the McCall sub-area is the loss of Kings River – Sanger – Reedley 115 kV line, which requires a minimum of 1,345 MWs generating capacity within the McCall sub-area to avoid criteria violations.

Within the Henrietta sub-area a minimum 40 MW generating capacity is needed to mitigate the Henrietta 230/70 kV bank overload.

The most limiting contingencies within the Merced sub-area is the double line outage of the Wilson – Atwater 115 kV #1 and #2 lines, the Wilson – Merced 115 kV #1 and #2 lines, which requires a minimum of 172 MWs generating capacity within the Merced sub-area to avoid criteria violations.

The total aggregated generation needed for the Greater Fresno is 2,814 MWs, which comprises a combination of MW requirements from each sub-area.

The transmission facilities coming into the Greater Fresno area are:

Gates-Henrietta Tap 1 230 kV
Gates-Henrietta Tap 2 230 kV
Gates #1 230/115 kV Transformer Bank
Los Banos #3 230/70 Transformer Bank
Los Banos #4 230/70 Transformer Bank
Panoche-Gates #1 230 kV
Panoche-Gates #2 230 kV
Panoche-Coburn 230 kV
Panoche-Moss Landing 230 kV
Panoche-Los Banos #1 230 kV
Panoche-Los Banos #2 230 kV
Panoche-Dos Amigos 230 kV
Warnerville-Wilson 230 kV
Wilson-Melones 230 kV
Corcoran – Alpaugh - Smyrna 115 kV
Coalinga #1-San Miguel 70 kV

The substations that delineate the Greater Fresno area are:

- Los Banos 230 kV
- Gates 230 kV
- Panoche 230 kV
- Wilson 230 kV
- Alpaugh 115 kV
- Coalinga 70 kV

H. Kern Area

For the Kern PP sub-area, the critical contingencies would be outages on the Kern PP 230/115 kV transformer Bank 5 and the Kern PP – Kern Front 115 kV line, which requires a minimum capacity of 771 MW within this load pocket.

For the Weedpatch sub-area, the critical contingencies would be the loss of the Wheeler Ridge – San Bernard 70 kV line and the Wheeler Ridge – Tejon 70 kV line, which requires a minimum capacity of 26 MWs within this load pocket.

The total generation needed for the Kern area is 797 MW.

The transmission facilities coming into the Kern area are:

- Gates – Midway 230 kV line
- Morro Bay – Midway 230 kV lines #1 and #2
- Midway 230/115 kV transformer banks
- Gates – Arco 230 kV line
- Arco 230/70 kV transformer bank
- Smyrna - Semitropic – Midway 115 kV line
- Temblor – San Luis Obispo 115 kV line
- Arco – Cholame 70 kV line

The substations that delineate the Kern Area are:

- Midway 230 kV
- Arco 230 kV
- Smyrna 115 kV
- Temblor 70 kV

I. LA Basin Area

The total market generation requirement for the LA Basin is 5,300 MW.[6]
This total is defined by what is required within the Western sub-area and what is required within the Eastern sub-area.

The most limiting contingency in the Western sub-area is the loss of Vincent - Riohondo 230 kV line #2, followed by loss of Mesa - Vincent 230 kV line which

[6] This MW amount includes Market generation only at this time. This total does not include the amount of Qualifying Facility and municipal generation that was modeled on-line in the analysis and as such, the total amount of generation required for the LA Basin is 5,300 MW plus the amount of muni generation and Qualified Facilities that was modeled on-line.

requires a minimum of 4,450 MWs generating capacity within the Western pocket to resolve criteria violations.

The most critical contingencies in the Eastern sub-area is the loss of Devers – Valley 500 kV line, followed by the loss of two Lugo – Miraloma 230 kV lines #2 and #3. These contingencies would require 850 MWs as the minimum amount of generating capacity needed within the Eastern pocket to resolve criteria violations.

The substation facilities that form the boundaries of the LA Basin are:

- Eldorado
- Devers
- Mirage
- Vincent
- San Onofre
- Sylmar
- Lugo
- Inyo

J. *San Diego Area*

The most limiting contingency in the San Diego area is described by the outage of 500 kV Southwest Power Link (SWPL) between Imperial Valley and Miguel Substations over-lapping with an outage of the new Palomar Combined-Cycle Power plant (542 MW) while staying within the South of San Onofre (WECC Path 44) non-simultaneous import capability rating of 2,500 MWs. Therefore the 2,620 MWs of capacity required within this area is predicated on having sufficient generation in the San Diego Area to reduce Path 44 to its non-simultaneous rating within 30 minutes.

The transmission tie-lines forming a boundary around San Diego include:

San Onofre - San Luis Rey #1, #2, & #3 230 kV Lines (Path 44 lines)
San Onofre – Talega #1 & #2 230 kV Lines (Path 44 lines)
Imperial Valley – Miguel 500 kV line
Imperial Valley – La Rosita 230 kV line
Imperial Valley – El Centro 230 kV line

The San Diego Area boundary substations impacting the area can be defined by the following sub-stations:

- San Onofre

- San Luis Rey
- Talega
- Imperial Valley
- Miguel

VI. Next Steps

The CAISO encourages stakeholder input and written comments on these preliminary results and the methodology utilized. It would be particularly helpful to receive stakeholder views soon so that stakeholder input and any consensus can be incorporated within the CAISO's comments to CPUC workshop report.

The preliminary results in this study may be refined as the CAISO continues to review its analysis. The CAISO intends to finalize these results through a Final RAR technical study report, currently scheduled for release by July 29, 2005.

If necessary, the CAISO may conduct a possible 2nd deliverability stakeholder meeting on July 20, 2005, to review this study, finalize the results and consider other deliverability issues.