California Transmission Planning Group (CTPG)
Technical Study Team Response to the
November 14, 2011, Comments of the
Bay Area Municipal Transmission Group (BAMx) on
CTPG's October 26, 2011, Draft Phase 2 Study Report

Comment:

CTPG again has spent substantial resources into developing a number of scenarios to essentially stress the transmission system. In some ways BAMx sees much of the study work as just confirming what one would expect - you can develop a generation pattern that builds a lot of generation in Area A and reduces a corresponding amount of generation in Area B so that under certain contingencies the existing transmission system between A and B becomes inadequate.

Once you confirm that the existing transmission system is inadequate, you can propose mitigation solutions. But CTPG cautions stakeholders that those mitigations are only exemplary because it is up to the balancing area to determine if there is a violation and to approve any plan of mitigation. Furthermore, CTPG does not even provide very rough cost estimates of the example mitigations.

CTPG Technical Study Team Response:

BAMx is correct that several of the scenarios studied by CTPG in 2011 intentionally "stressed" specific paths prior to the addition of renewable resources. These are Scenario Number 1, a Pacific Northwest spring scenario in which north-to-south flows on the California-Oregon AC Intertie (COI) were stressed prior to the addition of renewable resources; and Scenario Number 3, a northwest Nevada summer scenario in which north-to-south flows on the California-Oregon AC Intertie (COI) were stressed prior to the addition of renewable resources. However, the other seven scenarios evaluated by CTPG during its 2011 study work did not intentionally stress any particular transmission paths prior to the addition of renewable resources; *i.e.*, CTPG used whatever path flows resulted from the WECC generation dispatch pattern present in the applicable power flow seed case obtained from the WECC.

BAMx is also correct that, other than identifying at least one mitigation solution, CTPG determined its 2011 study work would not include a broad assessment of potential alternatives (wires or non-wires) for mitigating observed reliability criteria violations. Since CTPG is not undertaking a comparative assessment of mitigation alternatives, there is limited value in estimating the costs of the mitigation solutions identified by CTPG.

Comment:

BAMx endorses the method of re-dispatching thermal generation across the WECC wide grid. But CTPG should include re-dispatch of generation as a mitigation alternative when it expects it could solve a given reliability criteria violation. This suboptimal generation pattern, where

possible, will likely be the most economical mitigation measure for those areas where a transmission solution is very expensive and not so where an inexpensive transmission solution is available.

BAMx would encourage this type of qualitative discussion be included in this year's report and that CTPG consider how it can best use its resources to provide such useful information in future studies.

CTPG Technical Study Team Response:

As noted above, CTPG determined its 2011 study work would not include a broad assessment of potential alternatives, such as the pre-contingency out-of-economic-merit-order redispatch of generation, for mitigating observed reliability criteria violations. Whether the costs of such out-of-economic-merit-order redispatch would be less than the life-cycle costs of building new transmission that does not require such redispatch, requires the use of hourly economic grid simulation modeling as well as other complementary analysis to capture the full range of life-cycle economic benefits provided by new transmission. To date, CTPG has not undertaken this type of economic analysis.

CTPG understands that an assessment of feasible alternatives is needed in order to demonstrate that any particular solution is superior and, on this basis, should be pursued. In connection with the development of CTPG's 2012 work plan, the CTPG Technical Study Team will consider BAMx's suggestion "to provide such useful information in future studies." CTPG will also consider whether to augment its draft 2011 Phase 2 study report with a discussion that specifically acknowledges the potential that out-of-economic-merit-order redispatch of generation could be a cost-effective alternative to constructing new transmission.

Comment:

BAMx appreciates CTPG efforts in developing and performing many studies on nine (9) different scenarios, and BAMx recognizes CTPG's substantial efforts to report its results to a large group of Stakeholder's in a transparent manner. However, BAMx finds the lack of Base Case availability to be a major obstacle to effective participation in the process.

In particular, BAMx found the need for the Ivanpah mitigation[1] and Kramer mitigation[2] in all scenarios to be quite surprising. Both of these mitigations are identified for not only for foundation and "stress" scenarios that have higher renewable generation in certain areas, but also in the CPUC Public Policy scenario, which has a minimal amount of renewable resources modeled in the corresponding Mountain Pass and Kramer CREZs, respectively. The CTPG Phase II study report has identified that these mitigations were a result of diverged power flow

[1] Add a second Ivanpah-Eldorado 230kV line in addition to the CAISO approved and the CPUC permitted Ivanpah-Eldorado line.

[2] Coolwater-Lugo 230-kV line plus potentially one of the following: a) Revise existing Kramer RAS to trip more generation, b) Second Kramer-Llano 500-kV line, or c) A second 500-kV line between Kramer & Windhub or Midway or Pisgah.

solutions indicating post- transient voltage collapse and transient instability in the Ivanpah - Eldorado area and Kramer areas under *N-1* and *N-2* conditions, respectively. If BAMx had the base cases, it might be able to better understand the reasons for the otherwise surprising results. BAMx might also be able to suggest alternative mitigations.

In order to provide any meaningful comments on the potential mitigation measures prescribed by CTPG, BAMx needs to perform independent assessment of some if not all scenarios modeled by CTPG. Once BAMX has access to the underlying power flow cases, it should be able to do so. BAMx requests CTPG allow supplemental Stakeholder comments up to two-weeks beyond the date when the base cases are made available.

CTPG Technical Study Team Response:

The CTPG Technical Study Team has committed to provide stakeholders with the appropriate non-disclosure agreements, access to the power flow cases used in CTPG's technical analysis. BAMx's request for power flow cases is currently being processed.

With respect to system performance in the Ivanpah and Kramer areas (which are, in large measure, determined by generation additions within the Mountain Pass CREZ and the Kramer CREZ respectively), the CTPG Technical Study Team has reviewed its study results and believes certain clarifications are in order.

The primary driver for system performance in these areas is the amount of renewable resources modeled in these CREZs.

		CREZ:	**Mountain Pass**		**Kramer**	
Scenario Number	**Scenario**	**Season/Time**	**Installed Capacity (MW)**	**Dispatched Capacity (MW)**	**Installed Capacity (MW)**	**Dispatched Capacity (MW)**
1	PNW Import – stress COI	Early June/ @ 5 PM PST	410	235	1313	587
2	PNW Import – foundation		410	235	1313	587
3	Northwest Nevada Import –stress COI	Summer Peak/ July @ 4 PM PST	410	270	1747	1120
4	Northwest Nevada – foundation		410	270	1747	1120
5	South to North Flow – foundation	Fall/ late Sept. @ 9 AM PST	410	353	2381	1841
6	CPUC Public Policy – foundation	Summer Peak/ July @ 4 PM PST	490	284	250	186
7	Central California – foundation	Summer Peak/ July @ 4 PM PST	410	270	1226	795
8	West of River 50% Eldorado injection – foundation w/ east-to-west emphasis	Fall/ late Sept. @ 9 AM PST	410	353	593	485
9	West of River 50% Palo Verde injection – foundation w/ east-to-west emphasis		410	353	593	485

<u>Ivanpah Area</u>
The CTPG study cases for all scenarios assume that:

- A new Ivanpah 230/115-kV substation is built within the Mountain Pass CREZ. The existing 115-kV Coolwater-Dunn Siding-Baker-Eldorado line would be looped into the new Ivanpah substation.
- The portion of the existing 115-kV Coolwater-Dunn Siding-Baker-Eldorado line between Ivanpah and Eldorado substations would be replaced with a new 230-kV Ivanpah-Eldorado line.
- Generation in the Mountain Pass CREZ (shown on the above table) is assumed to be connected to the new Ivanpah substation.

With this configuration, an outage of the 230-kV Ivanpah-Eldorado line results in all of the generation connected to Ivanpah substation to flow over the existing 115-kV line between Ivanpah and Coolwater substations. Due to the existing line's limited capacity and the considerable distance between Ivanpah and Coolwater substations, reactive power requirements are high and available sources are incapable of supplying the necessary reactive power. Voltage collapse results. Voltage collapse was found to occur in all scenarios, including the CPUC Public Policy scenario.

Mitigation of these impacts could be accomplished by building a 230-kV Ivanpah-Eldorado #2 line, or by dropping generation interconnected at Ivanpah via a Special Protection Scheme in the event the 230-kV Ivanpah-Eldorado line was forced out of service. Such mitigation could be feasible under the CAISO's planning standards as long as the amount of generation dropped did not exceed 1,150 MW.

Kramer Area

The CTPG Technical Study Team had initially assumed that a new Llano 500 kV substation, a new 500 kV Kramer-Llano line, and a new Kramer 500/230 kV transformer would allow the post-renewable power flow cases in all scenarios to be solved under N-0 conditions with no reliability criteria violations in the Kramer area. While this remains correct, the CTPG Technical Study Team has now determined that without the 500 kV upgrades, the post-renewable power flow case for CTPG's Public Policy scenario can be solved under N-0 conditions with no reliability standard violations in the Kramer area assuming that either the new renewable generation is dispatched to a maximum of 177 megawatts[3] or an out-of-economic-merit-order dispatch is used.

Without the 500 kV upgrades, the N-1 outage of one of the existing 230 kV Kramer-Lugo lines will overload the other in CTPG's Public Policy scenario. However, this overload can be mitigated by increasing the amount of generation that is automatically tripped under an existing Remedial Action Scheme (RAS) for the 230 kV contingency event. Also, as confirmed by power flow analysis, the addition of the 230 kV Coolwater-Lugo line—which has been approved by the California ISO—will reduce flows on the 230-kV Kramer-Lugo lines and thereby eliminate the need to add generation to the existing RAS.

CTPG will update the final 2011 Phase 2 Study report to reflect this information.

[3] For the summer peak condition used in the Public Policy Scenario, the 250 MW of installed renewable generation in the Kramer CREZ was dispatched at 186 MW.

Compared to the Public Policy Scenario, the other eight scenarios model significantly greater renewable resources in the Kramer CREZ. As such, the Llano 500-kV substation, the 500-kV Kramer-Llano line, and a Kramer 500/230-kV transformer are effective in mitigating N-0 overloads that would otherwise be present in the post-renewable power flow cases. As indicated in the Draft 2011 Phase 2 Study Report, there are other impacts requiring mitigation. Potential mitigation measures for these other impacts are described in the report.