California Transmission Planning Group (CTPG)
Technical Study Team's Response to
the Comments of the Bay Area Municipal Utilities Group (BAMx) on the Results of CTPG's 2011 Phase 2 Studies for the Kramer and Ivanpah Areas

Comment:

Kramer Area:

For the Kramer area, new transmission facilities were added to the base cases to interconnect the renewable resources. The added transmission facilities are:

- Loop the Lugo-Vincent 500 kV into the proposed Llano Substation
- Install 500 kV line from Kramer to Llano
- Install 500/230 kV transformer at Kramer

The power flow cases indicate that the renewable resources are connected to the Kramer 500 kV bus.

First of all, the CAISO has determined that Kramer to Llano 500kV line is not needed to interconnect the new generation in the area.[1] Why did CTPG decide to add these facilities in all nine cases?

CTPG Technical Study Team Response:

The four renewable resource development portfolios evaluated in the California ISO's 2010-2011 Transmission Planning Process (TPP) reflected between 188 MW and 330 MW of installed renewable generating capacity in the Kramer CREZ. The renewable resource development portfolio evaluated in the CTPG's Public Policy scenario contains 250 MW of installed renewable generating capacity in the Kramer CREZ. The other eight renewable resource development scenarios evaluated in the CTPG's 2011 study work contain between 593 MW and 2381 MW of installed generating capacity in the Kramer CREZ. The CTPG suggests that BAMx contact the California ISO to determine why the California ISO's 2010-2011 transmission plan determined that the "Llano-Kramer 500 kV line, Kramer-Inyokern 230 kV, Bishop-Inyokern 230 kV lines were not needed in any of the four portfolios."

For the eight renewable resource development portfolios mentioned above, the CTPG modeled the 500-kV facilities referenced in BAMx's comment in order to mitigate N-0 overloads (reliability standard violations) that appear with the addition of the indicated amount of renewable resources in the Kramer CREZ.

[1] Section 4.5.2, *Modeling Renewable Portfolios* in the CAISO's 2010-2011 transmission plan states the following: "Llano-Kramer 500-kV line, Kramer-Inyokern 230-kV, Bishop-Inyokern 230-kV lines were not needed in any of the four portfolios, and therefore were not modeled."

For the CTPG's Public Policy scenario, after review of the CTPG's study work, it has been determined that without the 500-kV upgrades, the post-renewable power flow case 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[2] 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 under the assumptions of the 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.

Comment:

Secondly, a brief review indicated that some network additions could be the cause of the reliability problems themselves causing thermal overload of the Kramer-Lugo 230 kV and/or the Kramer-Llano 500 kV lines. For example, in the absence of the 500/230 kV transformer at Kramer (i.e., no connection to the Kramer 230 kV system), there may be not be any overloads on these two lines.

CTPG Technical Study Team Response:

If Kramer substation were not upgraded with 500/230-kV transformation capability, if a 500-kV Llano substation looping in the 500 kV Lugo-Vincent line were not built, and if a 500-kV Kramer-Llano line were not built, the connection of new renewable generation to the existing Kramer 230-kV bus would—absent some form of mitigation—result in reliability standard violations when renewable resources are added in the Kramer CREZ.[3] The CTPG chose to mitigate these reliability standard violations by assuming the referenced 500-kV upgrades would be built.

As the CTPG has indicated many times, the CTPG, to date, has not attempted to identify and evaluate a wide range of alternatives for mitigating reliability standard violations. Accordingly, there may be other alternatives that would mitigate the reliability standard violations identified by the CTPG in all nine scenarios evaluated in the CTPG's 2011 study work. Indeed, as discussed above, the CTPG has determined that non-500-kV mitigation solutions for overloads appearing in the CTPG's Public Policy scenario are feasible. Applicable Balancing Authorities and jurisdictional regulatory entities would be expected to consider a range of feasible

[2] 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.

[3] As noted above, the CTPG has determined that under the conditions of the CTPG's Public Policy scenario, N-0 reliability standard violations could be avoided with generation redispatch, and N-1 reliability standard violations would be avoided with the addition of the California ISO-approved 230-kV Coolwater-Lugo line and use of the existing Kramer area RAS.

alternatives when deciding which mitigation solution best supports achievement of California's 33-percent Renewable Portfolio Standard (RPS) requirements and other policy goals.

Comment:

Ivanpah Area:

Similarly, for the Ivanpah area, the network additions (as compared to the WECC 2012 operating cases) consist of a new Ivanpah-El Dorado 230 kV line, two 230/115 kV transformers at Ivanpah and Ivanpah-Mountain Pass 115 kV line. The renewable resources were connected to the Ivanpah 230 kV bus. For this network configuration, the loss of the Ivanpah-El Dorado 230 kV line, all the generation connected to the Ivanpah 230 kV bus would be forced to flow on the Ivanpah-Mountain Pass 115 kV line. Such a large generation overwhelms the 115 kV line causing severe overload and voltage collapse. If there were no connections to the 115 kV system (i.e., no 230 kV transformers and the 115 kV line), there would be no reliability problem for the loss of El Dorado- Ivanpah 230 kV line. In other words, a SPS/RAS comprising generation trip should be a cost-effective alternative to the potential mitigation of adding another Ivanpah-Eldorado 230-kV #2 line.

CTPG Technical Study Team Response:

The CTPG's modeling included the 230/115-kV transformer banks, and the connection at the planned Ivanpah substation to the existing 115-kV Coolwater-Dunn Siding-Baker-Mountain Pass line, because this plan of service was included in the California ISO Balancing Authority-approved 230-kV Eldorado-Ivanpah #1 transmission project. A Special Protection Scheme (SPS) is part of this plan of service and would mitigate the reliability standard violations identified by the CTPG for N-1 contingency events and N-2 if the 230-kV Eldorado-Ivanpah #2 line is built. The CTPG acknowledged the effectiveness of this SPS mitigation for N-2 contingencies in the draft 2011 Phase 2 Study Report. (See, for example, Table 42)

For purposes of the CTPG's 2011 study work, the CTPG did not include the planned SPS in its studies and identified a transmission infrastructure solution for N-1 reliability standard violations, *i.e.*, the 230-kV Eldorado-Ivanpah #2 transmission line. The CTPG did not include the planned SPS because it is specific to projects moving forward in the interconnection process; and these projects are not reflected in the renewable resources assumed by the CTPG for the Mountain Pass CREZ.

As noted above, the CTPG, to date, has not attempted to identify and evaluate a wide range of alternatives for mitigating reliability standard violations. The alternative suggested to operate the existing 115-kV Coolwater-Dunn Siding-Baker-Mountain Pass line as a radial connection to Coolwater has not been studied by the CTPG. As pointed out above, the 230-kV Eldorado-Primm-Ivanpah #1 transmission project, which includes the 115-kV connection to the existing 115-kV Coolwater-Dunn Siding-Baker-Mountain Pass line, has already been approved by the California ISO. Given this approval, it is unclear how useful consideration of other alternatives would be.

Comment:

One of the stated objectives of the CTPG Phase 2 study is to "use power flow, voltage stability and transient stability analysis to identify potential violations of NERC and WECC reliability standards and criteria." Based on our cursory review, we would like to know if the study power flow cases represent the network additions as intended and whether there are any other reasons for these additions.

CTPG Technical Study Team Response:

The network additions included in the CTPG's power flow cases are represented in the cases as intended by the CTPG. The CTPG included network upgrades that have been approved by Balancing Authorities. Other network upgrades may be included in the post-renewable power flow cases as mitigation solutions for identified reliability standard violations.

Comment:

The other objective of the CTPG Phase 1 study is to "test the effectiveness of transmission infrastructure additions in mitigating those violations." This is a major task and we applaud CTPG's effort on proposing mitigations. Since the study evaluates reliability problems caused by the addition of new generation, one of the effective mitigations, even without testing, is to trip the concerned generation. Thus we would like to CTPG suggest that one of the cost-effective mitigation measures is RAS for tripping the problematic generation. All other mitigation alternatives should be compared to the RAS alternative. Although the CTPG identifies RAS comprising tripping of relevant generation as one of the mitigation measures in the Appendix to the report, it is not emphasized. For example, it was not identified in the summary table of "Potential Mitigation by Scenario," as presented on slide 78 of the CTPG presentation on the November 4th Stakeholder meeting.

CTPG Technical Study Team Response:

The CTPG Technical Study Team agrees that Remedial Action Schemes (RAS) that trip generation for specific contingencies can be an alternative for mitigating reliability standard violations that would otherwise occur. However, SPS/RAS is not appropriate in all situations. The presence of SPS/RAS can complicate operations, especially during maintenance outages. And there is always the possibility that a SPS/RAS will fail to operate or misoperate. The California ISO, for example, has established limits on the number of monitoring points that can be included in a RAS. The CTPG has not attempted to establish the parameters under which potential SPS/RAS solutions would or would not be considered acceptable.

In its 2011 study work the CTPG has considered the use of SPS/RAS to resolve some reliability standard violations. The CTPG's November 4, 2011, presentation provides two slides that summarize the CTPG's 2011 study work. As BAMx indicates, Slide 78 tabulates the "Potential

Mitigation by Scenario." Additionally slide 79 contains a table, "Description of Potential Mitigation," describing the various mitigation measures, including SPS/RAS that were employed.

In addition, as stated in the draft CTPG Phase 2 Study Report, the CTPG has not identified or evaluated all feasible alternatives for mitigating identified reliability standard violations. The CTPG defers to project sponsors, balancing authorities and regulatory entities with responsibility for authorizing the construction of, and cost recovery for, such facilities to evaluate a reasonable range of feasible alternatives in reaching decisions as to how grid requirements are best met.