CAISO PLANNING PROCEDURE P-101

System Impact and Facility Study Procedures

Consistent with the obligations outlined in the ISO Tariff, the Participating TO Tariff and the Transmission Control Agreement (TCA), if a new or, if applicable, existing Generating Unit requests interconnection to the ISO Controlled Grid, the applicable Participating TO will perform the necessary Interconnection, System Impact and Facilities Studies to determine potential reliability impacts and Congestion impacts. The applicable Participating TO will perform such studies pursuant to the timeline specified in the applicable Participating TO's Tariff.

The applicable Participating TO will perform a study, under ISO review, as follows:

1. Create a power flow model for the new or repowered Generating Unit's initial year of operation, with generation and load designed to stress transmission facilities in the area of the new Generating Unit.

    1.1. The generation and load patterns should represent adverse conditions, and be consistent with the Participating TO's annual planning assessment. For example, if wet hydro generation dispatch results in higher system stress in a local area than average hydro dispatch, then the wet hydro dispatch should be used for the generator interconnection study.

    1.2. In the case of repowered units, to the extent that the total capability of the new unit(s) exceed that of the unit(s) being replaced, the Congestion mitigation requirements of this Procedure will apply to the increased amount of total capability. In addition, if a repowered power plant (which may consist of more than one unit) is comprised of units that have different capabilities than the original units (even if the total capability of the plant remains unchanged), then any new Congestion impacts that may result from resizing the individual units will be determined in accordance with this procedure.

    1.3. The study should model conditions that are anticipated to exist during the first year of operation of the Generating Unit. The applicable Participating TO may also study the impact of the Generating Unit's interconnection in future years using different assumptions, as conditions may warrant. However, the Generating Unit is not responsible for impacts beyond the first year of interconnection (except as described in CAISO Planning Procedure P-102: Assessment of System Benefits Associated with a Generator's System Reinforcement Beyond the First Point of Interconnection). An example of a situation requiring study of

system impacts beyond the first year of interconnection is provided below.

If the initial studies determine that a reinforcement is required to interconnect a Generating Unit and that a similar reinforcement is needed to serve future load growth (as indicated by the applicable Participating TO's annual planning assessment), the Participating TO will ensure that the planned reinforcement is adequately sized to accommodate both the Generator Unit and load growth. However, as noted above, the Generating Unit will not be responsible for any additional costs due to load growth. To the extent that the applicable Participating TO determines that a reinforcement is needed to both interconnect a new or repowered Generating Unit and to serve future load growth, the cost of any System Impact or Facilities Studies will be borne proportionately between the Participating TO and the new or repowered Generating Unit based upon their incremental impact on the proposed facility.

1.4. Existing Generating Units (other than hydroelectric facilities) should be represented at no more than the maximum demonstrated capability of the Generating Units, as determined by the Generating Unit's maximum hourly output over the two-year period prior to the start of the interconnection study. All generation capabilities modeled (including hydro capability) should be representative of the seasonal conditions modeled. Where common facilities (for example, steam field limits, cooling water discharge temperature limits, or penstock head losses) limit the combined output of any plant, the maximum generation represented in the study should reflect these limitations.

Exceptions to the above rule will be considered on a case by case basis. The Participating TO or the new or repowered Generating Unit must demonstrate, to the ISO's satisfaction, that the exception is warranted. Proposed Generating Units with a queue position ahead of that of the new or repowered Generating Unit (in the same zone) will be represented at their maximum proposed output (as indicated in their interconnection application to the ISO). If appropriate, the proposed new or repowered Generating Units may be represented at less than full output. If any of the proposed Generating Units are modeled at less than full output, reasonable dispatch assumptions for these generators should be used. Any Generating Unit requesting interconnection may request that the System Impact Study be conducted by modeling the proposed Generating Units at various output levels.

1.5. Subject to any appropriate modifications, the applicable Participating TO should make every effort to use the same base case used in preparing its most recent annual planning assessment. Under any circumstance, the degree of stress should be the same as that applied in the annual planning assessment.

1.6. If the applicable Participating TO determines that there are unacceptable conditions (e.g., overloads or low voltages) in the base-case studies even without the new or repowered Generating Unit, the Participating TO shall, if possible, adjust the base-case to eliminate the unacceptable conditions. Adjustments can include reasonable redispatch /commitment of generation or adding transmission reinforcements, remedial action schemes, or other operating procedures that are planned to be operational on or before the time the new or repowered Generating Unit goes into service.

1.7. The Participating TO will document any remaining unacceptable conditions. The Generating Unit requesting interconnection will not be held responsible for mitigating these unacceptable conditions

2. The Participating TO shall add the new or repowered Generating Unit to the power flow model and balance loads and resources by reducing existing generation located in a zone (Displacement Zone) different than the zone in which the new or repowered Generating Unit is located. The Displacement Zone should be selected to result in the least amount of Intra-Zonal Congestion.

   Section 2, above, outlines the methodology to be used for determining the impact on Intra-Zonal Congestion from interconnecting the new or repowered Generating Unit. This procedure is not intended to preclude the use of additional base cases and studies, if required, to assess the impact on reliability from the addition of the new or repowered Generating Unit. Any additional cases, however, should be consistent with the cases developed by the applicable Participating TO for use in its annual transmission assessment.

3. The Participating TO shall identify all Applicable Reliability Criteria violations that result from the addition of the new or repowered Generating Unit. The Participating TO should, to the extent possible, mitigate the problems by curtailing existing Reliability Must-Run (RMR) Generating Units that recover all of their fixed costs from RMR contracts.[1] The Participating TO shall document any such curtailments assumed in the study.

[1] The ISO has defined an uncompetitive generator as a generator that is dependent on an RMR Contract for recovery of all its fixed costs. It is not the intent of this method to reserve transmission capacity for generators that are uncompetitive in the market. A competitive new generation project should be able to displace an uncompetitive generator as long as the new

4. The Participating TO will assess each overload or other unacceptable condition to determine whether it can be mitigated using Adjustment Bids. The Participating TO will also determine, using the following criteria, whether there is a competitive market for Adjustment Bids:

   a) The expected overload can be alleviated by reasonable redispatch /commitment (i.e., no more MW than necessary assuming that all generators' Adjustment Bids are the same).[2] This reasonable dispatch will consider the effectiveness of each unit in mitigating the expected overload.

   b) No single entity's (including its affiliates) Generating Units provide more than 20% of the total incremental or decremental Adjustment Bids.

      4.1 If a) and b) above are both satisfied, then there is a competitive market for Adjustment Bids, and existing Inter-Zonal and Intra-Zonal Congestion management procedures should be used to mitigate the problem. The new or repowered Generating Unit is not responsible for mitigating any Intra-Zonal Congestion.

      4.2 If either a) or b) above is not satisfied, there is not a competitive market for Adjustment Bids. The new or repowered Generating Unit is then responsible for mitigating any incremental Intra-Zonal Congestion:

         4.2.1 If the increase in the flow on the overloaded element resulting from the interconnection of the Generating Unit is more than 5% of the element rating, the new or repowered Generating Unit must mitigate the Intra-Zonal Congestion.

         4.2.2 If the addition of the new or repowered Generating Unit (at its maximum output) causes a voltage violation (either steady-state level or deviation) and the change in the voltage (between the before and after cases) is greater than 1% of the rated bus voltage, then the impact is significant and the new or repowered Generating Unit must mitigate the impact.

         4.2.3 If the addition of the new or repowered Generating Unit (at its maximum output) causes a reactive margin criteria violation (either MVAR or voltage) and the change in the

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generator would satisfy all of the reliability requirements of the uncompetitive generator without an RMR Contract for recovery of all its fixed costs.

[2] This assumption needs to be made because some generators may be much more effective, per MW, at mitigating an overload than others, which could give them market power.

margin (between the before and after cases) is greater than 5% of the required margin or if the change in voltages at the critical bus is greater than 1% of that bus's rated voltage, then the impact is significant and the new or repowered Generating Unit must mitigate the impact.

5. The Participating TO will develop mitigation plans for each unacceptable condition. Mitigation plans may include system reinforcements (e.g., facility additions), Remedial Action Schemes, or operating procedures (e.g., curtailments).

   If unacceptable conditions existed prior to the addition of a new or repowered Generating Unit, the new or repowered Generating Unit is only responsible for the incremental cost of the system reinforcements necessary to bring the system into compliance with Applicable Reliability Criteria that are due to the addition of the new or repowered generator. If conditions are worse after the Generating Unit (to the extent these conditions exceed the levels of significance described in section 4, above), then the Generating Unit will only pay the portion of the reinforcement costs attributable to the presence of the new or repowered Generating Unit. If the conditions are better after the Generating Unit interconnects (but still in violation of the Applicable Reliability Criteria and in excess of the levels of significance described in section 4, above), the Generating Unit is eligible to receive recognition of System Benefits.

   The following examples clarify the application of Principle 5.

   - A line has an existing overload in the base case before the new Generating Unit, and reconductoring the line will mitigate this overload. After the new Generating Unit is added, the reconductoring work has to be expanded to include replacement of some towers and insulator strings. In this example, the Generating Unit is responsible for the cost of replacing the towers and insulator strings, but not for the cost of the reconductoring project that would have been required even without the new Generating Unit.

   - A line has an existing overload in the basecase before the new Generating Unit and reconductoring the line will mitigate this overload. After the new Generating Unit's transmission facilities are added, the reconductoring work does not require as large a conductor to be installed as would be required without the new Generating Unit's transmission facilities. In this example, the Generating Unit is eligible for a System Benefits credit for cost savings resulting from the use of the smaller conductor.

6. If a new or repowered Generating Unit sites in an area that impacts another Generating Unit that had previously opted to pay Intra-Zonal Congestion costs rather than mitigate the increase in Intra-Zonal Congestion resulting from its interconnection, the following principles will apply.

    6.1. If the new or repowered Generating Unit also chooses to pay Congestion costs, the new or repowered Generating Unit will be responsible for all incremental costs incurred. This principle effectively results in a "last on, first off" policy. The first Generating Unit will only be responsible for Intra-Zonal Congestion costs that occur when the first Generating Unit is generating. The second Generating Unit is responsible for all additional Intra-Zonal Congestion costs.

    6.2. If the new or repowered Generating Unit chooses to construct the transmission facilities necessary to eliminate the incremental Intra-Zonal Congestion and the facilities constructed mitigate all Intra-Zonal Congestion, the first Generating Unit may either: 1) continue to pay the historical average Congestion costs, with payments made to the new or repowered Generating Unit (since the ISO is no longer incurring any Intra-Zonal Congestion costs); or 2) contribute its proportionate share of the reinforcement costs (using the methodology described in this document). If the first Generating Unit opts to contribute to the system reinforcement, it will no longer be responsible for any Intra-Zonal Congestion costs due to its interconnection to the ISO Controlled Grid.

7. If more than one Generating Unit chooses to site in an area subject to Intra-Zonal Congestion and they have the same queue position, the responsibility to mitigate the incremental Intra-Zonal Congestion will be allocated to each Generating Unit based on the relative impact of each Generating Unit.

8. If more than one Generating Unit chooses to site in an area subject to Intra-Zonal Congestion, the Generating Units have different queue positions, and the transmission reinforcements required to mitigate all of the incremental Intra-Zonal Congestion resulting from the Generating Units' interconnection are known, the following principle will apply:

    8.1. The first Generating Unit will pay the cost of the reinforcement needed to mitigate the incremental Intra-Zonal Congestion resulting from such Generating Unit's interconnection. The second Generating Unit is responsible for the difference between the first Generating Unit's share and the total cost of the reinforcement that is built to eliminate the incremental Intra-Zonal Congestion caused by both Generating Units. Any additional Generating Units are responsible for the difference between the previous Generating Unit's reinforcement costs and their own reinforcement costs. Let:

    PV_1 = Present value of the reinforcement required to mitigate Congestion after the addition of the first new generator (G_1).
    PV_2 = Present value of the reinforcement required to mitigate Congestion after the addition of the second new generator (G_2).
    PV_3 = Present value of the reinforcement required to mitigate Congestion after the addition of the third new generator (G_3).
    PV_n = Present value of the reinforcement required to mitigate Congestion after the addition of the n^{th} new generator (G_n).
    PV_U = Present value of the reinforcement required to mitigate Congestion after the addition of all new generators ($G_{1+2+3...+n}$).
    S_1 = The share of the reinforcement costs borne by the first generator (G_1).
    S_2 = The share of the reinforcement costs borne by the second generator (G_2).
    S_3 = The share of the reinforcement costs borne by the third generator (G_3)
    S_{n-1} = The share of the reinforcement costs borne by the next to the last generator (G_{n-1})
    S_n = The share of the reinforcement costs borne by the last generator (G_n)

    Then,

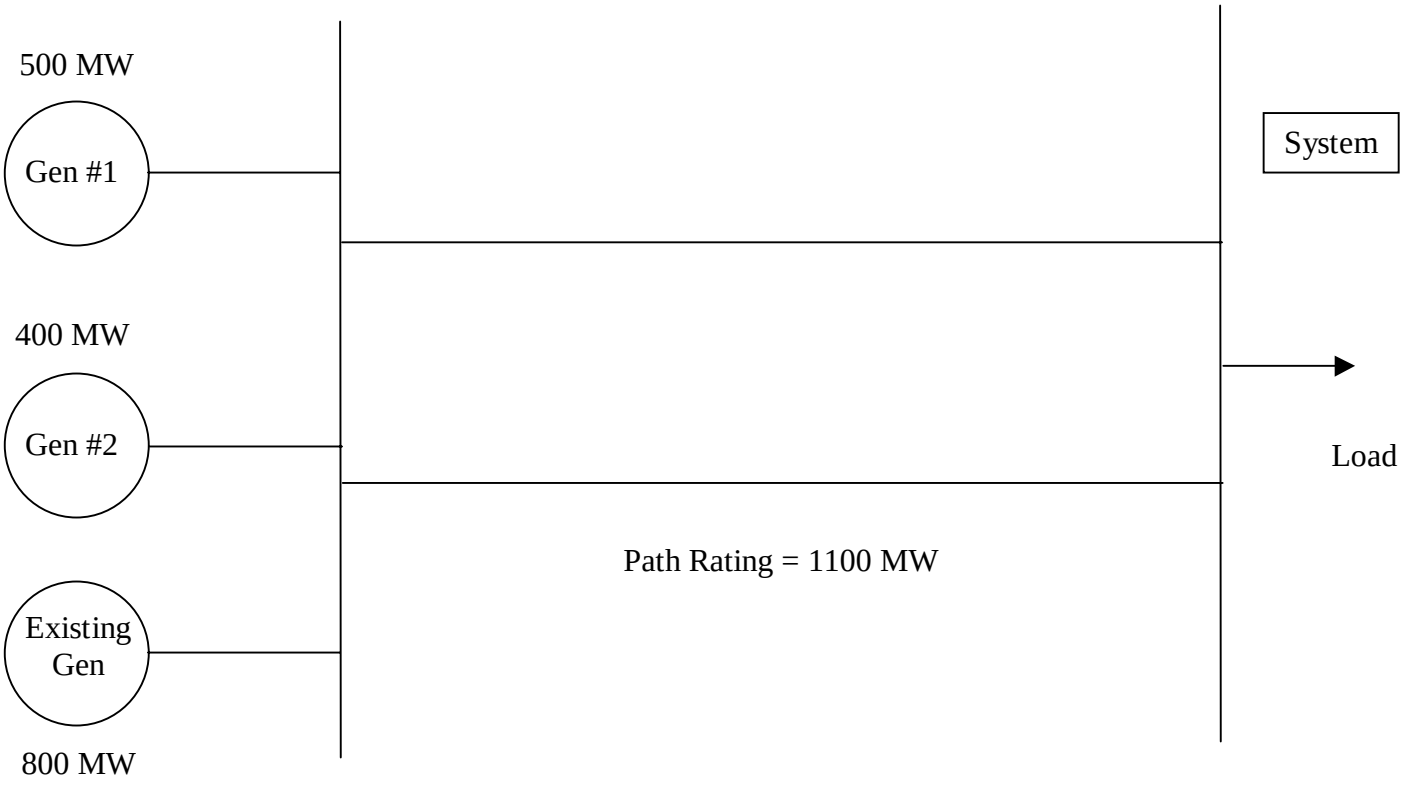
$$PV_3 = PV_U,$$
$$S_1 = PV_1,$$
$$S_2 = PV_2 - S_1,$$
$$S_3 = PV_3 - S_2 - S_1.$$
$$\vdots$$
$$S_n = PV_n - S_{n-1} \cdots - S_1.$$

9. If the Participating TO determines that a Generating Unit is responsible to mitigate any incremental Intra-Zonal Congestion and that Generating Unit opts to construct a transmission reinforcement, the Participating TO will determine the System Benefits, if any, associated with such transmission facilities. If more than one Generating Unit pays for a transmission reinforcement, the System Benefits associated with that transmission facility shall be assigned pro-rata, based on cost-responsibility, to each Generating Unit that pays for such transmission facility. The calculation of System Benefits is described in CAISO Planning Procedure P-102, Assessment of System Benefits Associated with a Generator's System Reinforcement Beyond the First Point of Interconnection.

10. The ISO and other interested participants will review the Interconnection, System Impact, and Facilities Studies in accordance with the ISO Tariff and applicable state licensing authority AFC proceedings.

APPENDIX A:
COST ALLOCATION EXAMPLES

System for Examples #1, #2, and #3



In both examples #1 and #2, Generator #1 is ahead of Generator #2 in the interconnection queue.

EXAMPLE #1

Only one feasible alternative exists to increase the transfer capability of the constrained path. See Table 1 below.

TABLE 1

No.	Alternative	Incremental Rating Increase	Cost
1	Reconductor Existing Lines (with the next incremental conductor)	600 MW	$10 M

Then by Section 8.1, the cost allocation for each generator would be:

$$PV_1 = \$10\ M$$

$$PV_2 = PV_U = \$10\ M$$

$$S_1 = PV_1 = \$10\ M$$

$$S_2 = PV_U - S_1 = \$10\ M - \$10\ M = \$0\ M$$

EXAMPLE #2

Two feasible alternatives exist to increase the transfer capability of the constrained path. See Table 2 below.

TABLE 2

No.	Alternative	Incremental Rating Increase	Cost
1	Reconductor Existing Lines (with the next incremental conductor)	300 MW	$8 M
2	Construct a New Transmission Line	700 MW	$20 M

Then by Section 8.1, the cost allocations for each generator would be:

$$PV_1 = \$8\ M$$

$$PV_2 = PV_U = \$20\ M$$

$$S_1 = PV_1 = \$8\ M$$

$$S_2 = PV_U - S_1 = \$20\ M - \$8 M = \$12\ M$$

EXAMPLE #3

Two feasible alternatives exist to increase the transfer capability of the constrained path. See Table 3 below. In this example Generator #1 and Generator #2 are in the same queue position.

TABLE 3

No.	Alternative	Incremental Rating Increase	Cost
1	Reconductor Existing Lines (with the next incremental conductor)	300 MW	$8 M
2	Construct a New Transmission Line	700 MW	$20 M

Then by Section 7, the cost allocations for each generator would be:

Available Capacity = 1100 MW - 800 MW = 300 MW
Capacity Needed = 500 MW + 400 MW = 900 MW
New Capacity Needed = 900 MW - 300 MW = 600 MW

Gen #1 Share = 600*500/900 = 333 MW
Gen #2 Share = 600*400/900 = 267 MW

Gen #1 Cost = $20M*333/600 = $11.11M
Gen #2 Cost = $20M*267/600 = $8.89M