Developing a Comprehensive Methodology for Valuating Transmission Impacts for New Generation Developments

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Presentation Outline

- ❑ Introduction & Overview
- ❑ Power Procurement
- ❑ Transmission Valuation
- ❑ Valuation Methodology Implementation
- ❑ Conclusion

Introduction

❑ This paper describes a methodology which can be suitably employed by any load serving entity (LSE) in NERC region for including transmission costs in the Request For Offer (RFO) overall evaluation process for the procurement of new generation resources.

❑ The merits of the methodology described in this paper solely reflect the views of the authors only and do not establish SCE position for RFO valuation purposes.

❑ The Federal Energy Regulatory Commission (FERC) has established a standardized process for interconnecting new generation that should be applied by responsible planning coordinators (ISO/RTO/TO).

❑ The process used by California Independent System Operator (CAISO) was filed with FERC in a document called the Large Generator Interconnection Procedure (LGIP).

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LGIP Process in California

❑ The LGIP was established to ensure non-discriminatory access to the transmission system by providing interconnection on a first-come, first-served basis.

❑ As part of the current LGIP, a generation developer must establish a position on the interconnection queue of the CAISO to which their project will connect.

❑ The developer will be required to fund any identified upgrades, but will be reimbursed by the Participating Transmission Owner (PTO) over five years.

❑ The LGIP does not consider the economic value of new generation when determining the upgrades. The location of the uneconomic plant could increase the total transmission cost for the system.

❑ There is no strong incentive for generators to select cost effective locations.

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Power Procurement

❑ The public utilities in general, and California IOUs in particular have established a fair RFO valuation process that treats all offers on the same and consistent way and takes into account all cost that will be borne on their customers.

❑ The transmission network upgrade costs for the new generators must be incorporated to ensure that an offer's valuation reflects the relevant total wholesale cost of power to the consumer.

❑ The cost estimates for transmission Network Upgrades can vary dramatically during the study process due to development schedule changes in the proposed generation projects.

Transmission Valuation

❑ To help mitigate the cost uncertainty, adders are developed for various scenarios to better characterize the amount of uncertainty involved with the transmission interconnection costs.

❑ Transmission adders can be developed using information from System Impact Studies (SIS) and Facility Studies (FAS) for various RFO projects as requested by the counterparties (CP) under LGIP process.

❑ The transmission upgrade costs can be classified into:

➢*Interconnection Facility costs*
➢*Network Upgrade costs*

Transmission Valuation Methodology

- A simplistic approach that can be used by IOUs to incorporate transmission Network Upgrade costs into the overall valuation process can be based on cost MW-based sharing mechanism.
- Certain transmission costs estimates will be subject to revisions if there is a change in the queued generation projects that were included in the study.
- This simplistic protocol can assess this uncertainty by considering several scenarios when developing adders to allocate the transmission network upgrade costs.
- If the valuation order of the offers in a given cluster matches the queue order of the offers, then there should be no conflict between FERC's interconnection process and least-cost, best-fit planning.

Transmission Valuation Methodology (cont'd)

- Transmission network upgrade costs can be shared on:

1. *MW loading factor basis for upgraded transmission lines and interconnection transformers (ratio between multiple of generation capacity and power transfer distribution factor (PTDF) and sum of multiple of generation capacity and PTDF for all new generation projects that have countable influence on line/transformer MW flow loading), and*
2. *Projects impact factors on short-circuit duty basis for each breaker's upgrade cost (calculated by project contribution to the three-phase short-circuit current).*

- The transmission upgrade costs calculated this way would reflect the physical impact of new generation projects to the MW loading of upgraded network elements and short-circuit duties.

PTDF Methodology Implementation

❑ PTDFs for new generation projects are needed for all upgraded lines and interconnection transformers and impact factors on short circuit duties for each upgraded circuit breaker.

❑ A minimum value of PTDFs and short-circuit duties may be used to determine the level at which a specific offer would no longer participate in the allocation of costs for a specific transmission upgrade.

❑ PTDFs and impact factors on short-circuit duties should be determined using base-case network snapshot that includes

➢ *all planned transmission projects approved by CAISO's Board*

➢ *all new interconnecting generation projects and related upgrades from CAISO's queue for the year of commercial operation date (COD) of the last RFO project in queue.*

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PTDF Methodology Implementation (cont'd)

❑ Only one power flow base case is needed with correct topology and injections (load and generation) planned for the year of COD of the last RFO project. PTDFs depend only on network topology.

❑ Impact on short circuit duties may be provided by CAISO and/or Transmission employees, or may be calculated by Merchant employees from the composed base case upon acquiring the needed software tool.

❑ The following approach can be applied for an assessment of transmission upgrade cost adders in least-cost best-fit RFO valuation process:

❖ Using SIS and/or FAS study reports prepare quantities of all three types of transmission upgrade costs:

➢ *Interconnection Facility Costs (project specific costs)*
➢ *Network Upgrade Costs*
➢ *Costs of replacement of each circuit breaker*

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PTDF Methodology Implementation (cont'd)

- Determine MW loading factors for each upgraded transmission facility (for new generation projects with countable influence on flow) and calculate cost share for each new generation project
- Determine impact factors on short-circuit duties for each new generation project and calculate generation project's cost share due to replacement of circuit breakers
- Run overall valuation and selection process with transmission costs adders determined in the three steps listed above.
- Repeat steps 1-4 (if necessary) to perform sensitivity analysis of possible influence of different development scenarios of project that participate in RFO.

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PTDF Methodology Implementation (cont'd)

- Conduct some sensitivity analysis based on set of independent (or guided) permutation of possible influences of different development scenarios and queuing positions of non-RFO projects.
- These different development scenarios that will be considered in Step 5 will include First Estimate, Best Case for Low Value and Final Estimate.
  - **First Estimate:** For each shared Network upgrade, a set of adders will be developed based on the assumption that all offers will receive a cost allocation according to their PTDF. A PTDF will only be calculated for a given offer and a specific facility, if that offer's SIS report indicates that the offer may be responsible for that upgrade.
  - **Best Case for Low Value Scenario:** This scenario will determine which offers are most likely to be unattractive under any circumstances and if there is any offer that may have significant fluctuation in its overall valuation, including generation and transmission costs, as a result of uncertainty regarding its Network Upgrade costs.

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PTDF Methodology Implementation (cont'd)

- **Best Estimate:** This scenario uses the adders from the First Estimate scenario as a starting point. If any of the optimistic or pessimistic assumptions are deemed to be probable or have a large impact, those assumptions may be included in this scenario to derive final cost adders for valuation.

- **Treatment of Non-RFO Generation Projects**

- Non-RFO projects will generally not need to be included in developing the adders for the offers with the following exceptions:

1. *If a planned non-RFO project is utilizing spare transmission capacity for a specific transmission facility and has a superior queue position with regard to a specific offer, this information could be used to develop an optimistic adder for an offer with low valuation in the Best Case for Low Value scenario.*

2. *If a planned non-RFO project has been requested to fund an upgrade that would also provide capacity for a specific offer, this information could be used to develop a pessimistic adder for an offer with high valuation in the Best Case for Low Value scenario.*

PTDF Methodology Implementation (cont'd)

- The main advantages of the proposed methodology can be summarized as shown below:

- *Determination of cost sharing of any upgraded element that reflects physical impact of new generating projects on MW loading of upgraded line/transformer or short-circuit duty of upgraded breaker.*

- *Requires only one power flow base-case that may be built by Merchant employees if they fail to obtain a suitable database from CAISO.*

- *Easy calculation of cost sharing with limited need for power-flow analysis.*

- *Methodology is expected to simplify the analysis of different scenarios that result from queue changes by using PTDFs and finding the most equitable allocation of costs for RFO participants.*

Sample Calculation of line/transformer upgrade cost distribution by MW loading factors and PTDF

Total Network Upgrade Cost	$1000000

New Generation Project	PTDF Factor	New Generation Capacity MW	MW Flow Contribution MW	MW Loading Factor	Upgrade Cost
A	0.200	100	20.0	0.250	$250,000
B	0.250	50	12.5	0.156	$156,250
C	0.035	500	17.5	0.219	$218,750
D	0.150	200	30.0	0.375	$375,000
Total	-	-	80.0	1.000	$1,000,000

Sample Calculation of short-circuit duties impact factors and sharing of breaker's upgrade costs

Total Breaker Replacement Cost	$1000000

New Generation Project	Three-phase SC current Contribution [A]	Short-Circuit Duty Impact Factor	Cost per project
A	2000	0.20	$200000
B	3500	0.35	$350000
C	4500	0.45	$450000
Total	10000	1.00	$1000000

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Inputs & Outputs

- For each Offer Variation, the input will be:
  - Size of the Offer Variation
  - Offer Valuation
  - SIS/FAS costs and study results
- Information from the CAISO's deliverability studies may be used
- The output will be:
  - A set of impacted transmission facilities for each offer
  - A monthly value in dollars per month for transmission upgrade costs for each scenario
  - A report that provides a summary for each Offer Variation and explains the uncertainty associated with the Transmission Adders

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Data Requirements for Long-Term RFO Valuation

1. Interconnection Study Correspondence
2. Queue Information
3. Overload Information
4. FERC 2004 waivers
5. Study Conditions
6. Generation Redispatch
7. Geographical Maps showing project locations
8. Protection Upgrades
9. Fault Study Results
10. Network Upgrades
11. Cost Information
12. Tentative Construction Schedule
13. Supporting Documentation

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Conclusion

❑ Development of a suitable methodology is highly beneficial for including transmission costs in the RFO valuation process for the procurement of new resources.

❑ The transmission network upgrade costs for the new generators must be incorporated to ensure that an offer's valuation reflects the relevant total wholesale cost of power to the consumer including any impacts on the transmission system.

❑ The main intent of developing a Transmission Protocol is to ensure that a consistent valuation methodology has been applied by IOU for all the Offers from generation developers to comply with the least-cost, best-fit criteria advocated by CPUC.

❑ The cost estimates for transmission network upgrades can vary dramatically due to development and schedule changes in the proposed generation projects.

❑ To help mitigate this uncertainty, adders need to be developed by IOU for various scenarios to better characterize the amount of uncertainty involved with the transmission interconnection costs for new generation developments.

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