

TO: PJM Stakeholders
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SUBJ: Brattle Response to IMM CONE Study
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The Brattle Group has reviewed the Independent Market Monitor's (IMM's) CONE calculations and provided comments on the most significant differences. We believe the following items have the greatest impact on the variation in the net CONE: configuration of the CT, the inclusion of inlet air chilling, gas interconnection costs, and financial assumptions. The market monitor highlighted other differences in assumptions between the two studies, which include ambient conditions, whether major maintenance is included in the fixed O&M or variable O&M, and the IMM's assumption of an SCR and CO catalyst in the Rest of RTO. However, these have less impact on the final value.

1. Brattle assumed a **1×0 configuration of the CT**, while the IMM assumed 2×0.
 - a. The difference in this assumption has the largest impact on the overall CONE, due to economies of scale with the larger plant. Sargent & Lundy estimates very roughly (not with the rigor that went into our bottom-up estimates of the 1×0) that doubling the capacity of the plant might increase the cost by \$115 million.
 - b. Either assumption may be reasonable. Our estimate is based on the observation that 1×0 is the only configuration we have seen for the very few H-class simple cycle plants being proposed and developed. For example, we have seen a 1×0 configuration for H-class CTs in both the Canal 3 plant in ISO-NE, which is under construction, and the Puente Power Station, which had been proposed in CAISO. None of the proposed H-class CTs that we have seen have a 2×0 configuration. Additionally, the 1×0 is closer to the capacity of the 2×0 of the old model specified in the tariff.
2. The IMM included **air inlet chilling** in their CT design, but Brattle did not.
 - a. Inlet air chilling would add around 50 MW to each turbine.
 - b. The market monitor estimated the total cost of inlet air chilling as \$20 million for a two-turbine plant. However, Sargent & Lundy estimates this cost as \$50–60 million.
 - c. In S&L's experience with many projects, most plants use evaporative cooling instead of inlet chilling. Although some developers do evaluate inlet chilling in the planning stage, most usually do not find inlet chilling to be a sensible

economic decision, particularly for plants that operate under PJM's ambient conditions.

- d. Brattle has similarly assumed evaporative cooling instead of inlet chilling in the 2011 and 2014 CONE studies. In the 2011 study, we noted, "we selected inlet evaporative cooling for power augmentation for both plant types because it increases their output substantially for only a small increase in cost. The slightly higher output that inlet chilling could provide does not appear cost-effective for the incremental cost."¹
 - e. We therefore disagree with including inlet chilling in the reference resource.
 - f. If inlet chilling is included, the cost implications would have to be examined more closely.
3. The IMM's estimates of **gas interconnection costs** are much lower than Brattle's.
 - a. Both parties sampled gas lateral costs from EIA data to calculate a cost estimate per mile of gas lateral, and assumed a five-mile interconnection. Brattle also estimated a cost for the substation required for each project.
 - b. Using the sample, Brattle calculated a cost of \$4.6 million per mile plus a cost of \$3.4 million for the substation. The IMM estimated only \$2.5 million per mile. We noticed that some of the more recent projects included in our sample were more expensive than the older projects, so this may explain the differences. We will be able to better understand why the estimates are so different once the IMM's sample becomes available.
 4. Brattle and IMM recommend different **after-tax weighted-average cost of capital** (ATWACC): 7.5% by Brattle v. 8.5% by IMM, as summarized in the table below. Our recommendation is based on our independent estimation from publicly-traded merchant generation companies and market evidence from recent merger and acquisition transactions. We also make changes due to a lower corporate tax rate. The components are developed to be consistent with the 7.5% ATWACC, as explained in Brattle's CONE Report, Section VI.A. In contrast, IMM's approach appears to be based on separate and outdated estimates of each component, without regard for whether the weighted-average cost of capital is consistent with project risk and current capital market conditions. Brattle's approach has been endorsed in FERC's 2014 order.

¹ The Brattle Group. Cost of New Entry Estimates for Combustion-Turbine and Combined-Cycle Plants in PJM. August 24, 2011. Page 12. (http://files.brattle.com/files/7932_cost_of_new_entry_estimates_for_combustion-turbine_and_combined-cycle_plants_in_pjm_spees_et_al_aug_24_11.pdf)

Assumption	Market Monitor	Brattle
Cost of Equity	12%	12.8%
Equity Ratio	50%	35.0%
Debt Interest Rate	7.0%	6.5%
Debt	50%	65%
Effective Tax Rate	28.11%	30.0%
ATWACC	8.5%	7.5%

5. The IMM calculates **a higher CONE for a “stand alone entity”** than for an entity within a parent company, primarily because it assumes that tax deductions from bonus depreciation and interest expenses would be limited. We believe the IMM is making a false distinction because even the “stand alone” projects that are project-financed and not directly owned by a larger company are typically structured so that equity investors (whether corporations or investment funds) can take advantage of the tax benefits. The question is about the tax appetite of the owners, which is a matter separate from organization form and financing of the project-level entity.