THE Brattle GROUP

MEMORANDUM

TO: PJM

FROM: Johannes Pfeifenberger and Bin Zhou, The Brattle Group

SUBJ: ATWACC Update for PJM CONE Analysis

DATE: August 21, 2018

One of the inputs to Brattle's analysis of PJM's Cost of New Entry (CONE), for an online date of June 1, 2022, is the after-tax weighted average cost of capital (ATWACC). It is used as the discount rate to annualize new entry investment costs.[1] Following the same analytical approach that has been used since 2011 for PJM's CONE analysis and endorsed by FERC,[2] we conducted an ATWACC analysis (undertaken between December 2017 and January 2018) and recommended an ATWACC of 7.5%. This recommendation incorporated the impact of the reduction in the U.S. federal corporate income tax rate from 35% to 21%.[3]

Financial forecasts for future periods are inevitably limited to the information available at the time of forecasts and expert judgement about future trends. Our original ATWACC analysis had allowed for a higher risk-free rate in our cost of equity analysis by looking at long-term forecast

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1 Note that this cost of capital estimate is used only to determine the annualized value of CONE, not the financial return that investors will actually earn on their investment in the PJM wholesale electricity markets. That actual return will be determined by the capacity market clearing price, which depends on the actual offers that suppliers make into the capacity market auction, in conjunction with margins earned in the E&AS markets. Suppliers will offer into the capacity market based on their actual costs, which can include financing costs that are higher or lower than our estimated cost of capital. If a supplier's bid is competitive, the market will clear at a price equal to or higher than that bid, and the supplier's investors will earn the return that is associated with that market price.

2 FERC Order Conditionally Accepting Tariff Revisions Subject to Compliance Filing, issued on November 28, 2014, 149 FERC ¶ 61,183.

3 Together with the state income taxes, the combined income tax rate is 27.7% (8.5% + 21% × (1 - 8.5%) = 27.715%). Brattle's April 2018 CONE Report incorrectly assumed that, under the new tax law, state income taxes are not deductible for federal income tax purposes at the corporate level.

as a sensitivity analysis. However, as shown by Energyzt[4], the risk-free rate and cost of debt of below-investment grades have increased further since we undertook our ATWACC analysis.

Taking into account the larger-than-expected recent changes in interest rates as well as additional market evidence on U.S. merchant generation business (i.e., the Dynegy acquisition by Vistra), we increase our recommended ATWACC from 7.5% to 8.0%. Our recommended financing components, reflecting this 8.0% ATWACC, are: debt ratio 55%, equity ratio 45%, cost of debt 5.5%, and cost of equity 13.0%:

- We updated the debt and equity ratios from 65%/35% to 55%/45% in response to financial analyst assumptions presented in the Energyzt August 2, 2018 presentation.[5]
- Our initial analysis recommended a 6.5% cost of debt based on a combination of B-rated and BB-rated debt, consistent with the higher 65% debt ratio. At the lower 55% debt ratio, the debt will be less risky and cost of debt will be lower.[6] We believe that the lower 55% debt ratio makes BB the more likely rating associated with the lower leverage.
- The yield of BB-rated bonds has increased to 5.1% (by about 100 basis points) since we undertook our original ATWACC analysis. We therefore lowered our cost of debt recommendation from 6.5% to 5.5%. This 5.5% cost of debt reflects the higher interest rates environment, the reduced risk of debt at the lower debt ratio, and allows for an additional 40 basis points future increase in the bond yield.
- Consistent with the above recommended capital structure ratios, cost of debt, and an 8.0% ATWACC, the cost of equity is estimated to be 13.0%: $13.0\% \times 45\% + 5.5\% \times 55\% \times (1 - 27.7\%) = 8.0\%$.

The rest of this memo explains our additional analysis and rationale for the updates, and responds to some of the points raised by Energyzt.

Figure 1 (update of Figure 6 in the report) presents our 2018 update of the ATWACC (on the very right) and implied ATWACC premiums above the risk-free rate together with our recommendations from previous CONE studies, including the original 2017-based recommendation in our current CONE analysis (the 2011, 2014 and 2017 data are from the original Figure 6). Corresponding to our updated 2018 ATWACC recommendation, the "risk premium" of the ATWACC recommendation over the risk-free rate (20-year Treasury bond

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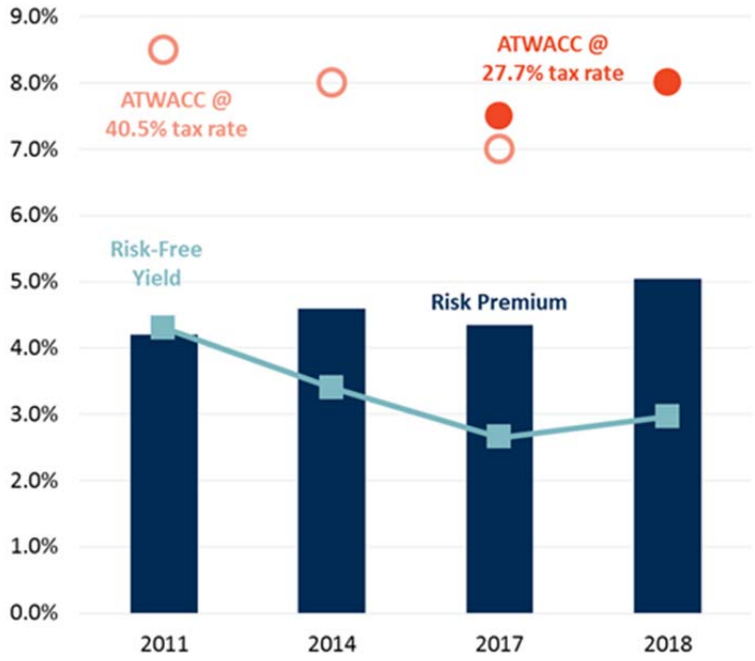
[4] Energyzt, PJM Quadrennial Review: Discount Rate, July 27, 2018, available at: https://pjm.com/-/media/committees-groups/committees/mic/20180727-special/20180727-item-02-quadrennial-review-p3-presentation.ashx.

[5] Confidential survey results presented by Energyzt to PJM.

[6] However, as acknowledged by Energyzt, the change in capital structure will not affect ATWACC.

rates) is now about 5.0%, which is higher than the approximately 4.5% risk premiums of the ATWACCs used in our prior recommendations.[7]

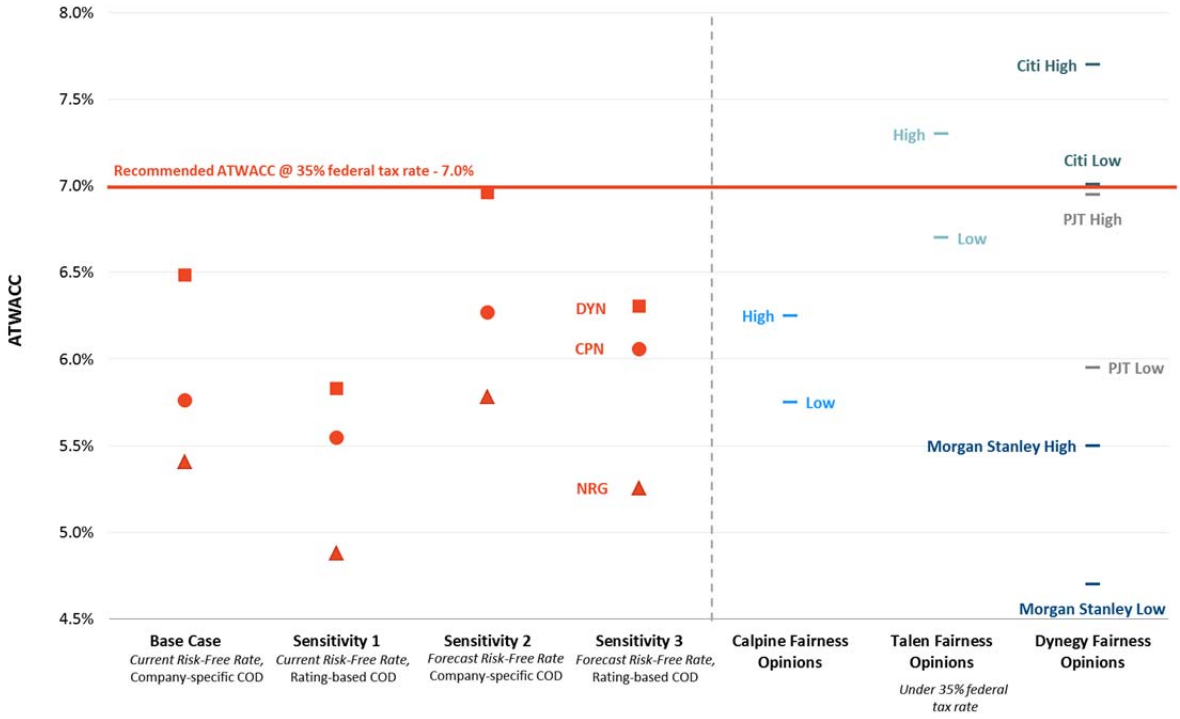
Figure 1. Comparison of Brattle ATWACC Recommendations (2018 Column Represents the Current Update)



When we compare the ATWACC premiums over time, we are implicitly assessing the reasonableness of our recommendation from a historical perspective. We should note that this historical comparison is not the basis or the starting point of our analysis; rather, this comparison against prior recommendations is a benchmarking check of the results from our analysis of market conditions and business risks. Our ATWACC analysis in Figure 2 (based on Figure 7 in the report) incorporates additional market evidence regarding ATWACC from U.S. merchant generation transactions mentioned above, as of November 2017—confirming the original 7.0% ATWACC estimate for the prior 35% corporate tax rate.

[7] Note that the risk premium shown in Figure 1 is defined as ATWACC minus the risk-free rate. This is different from the 6.9% market risk premium ("MRP") that is used in the capital asset pricing model (CAPM) to calculate cost of equity: CoE = risk-free rate + beta × MRP. MRP measures the excess return on a stock market portfolio such as NYSE stock index or S&P 500 over the risk-free rate.

Figure 2. ATWACC of U.S. IPPs and Discount Rates from Fairness Opinions as of Nov 2017 (35% Federal Tax Rate)



The starting point of our ATWACC analysis is the quantification of business risks in the U.S. merchant generation business from the market evidence. In our original analysis, consistent with our analyses in previous PJM CONE reports, we examined (1) a sample of U.S. independent power producers (IPPs); and (2) ATWACC-based discount rates used by financial analysts in evaluating recent merchant generation M&A transactions. We also considered a sample of Canadian IPPs in our current PJM CONE report, since two of the U.S. IPPs were acquired. In recognition of higher merchant generation risks compared to the average risk of (partly contracted) IPP portfolios, we recommended an ATWACC at the very high end of the ranges associated with these merchant generation company reference points. In January 2018, this yielded an ATWACC of 7.0% under the 35% federal corporate income tax rate (consistent with Figure 2 above) and 7.5% as a result of the lower tax rates.

In this updated analysis, we added the discount rates used in the fairness opinions of Dynegy's acquisition by Vistra. The Dynegy transaction was announced on October 29, 2017, and the fairness opinions from the financial advisors (Citi for Vistra, Morgan Stanley and PJT for Dynegy) were made public in February 2018, after the conclusion of our initial ATWACC analysis. Each of the three financial advisors involved in that transaction used a distinct range of (ATWACC-based) discount rates for evaluating the Dynegy acquisition: 4.7% to 5.5% as used by Morgan Stanley, 5.95% to 6.95% as used by PJT, and 7.0% to 7.7% as used by Citi. This rather wide range of discount rates (4.7% to 7.7%) reflects the uncertainty in cost of capital estimates for the U.S. merchant generation industry. These estimates, as of October 29, 2017, likely do not

yet reflect the impact of the new tax law. Even when including these new data, we believe the original 7.0% applicable under the 35% tax law as shown in Figure 2 is still the most reasonable estimate, as of November 2017. (Our view of ATWACC recommendations obtained from potential lenders as presented to PJM by Energyzt is discussed below.)

There are two necessary adjustments to the 7.0% ATWACC estimate in Figure 2. First, we increased the ATWACC from 7.0% to 7.5% to incorporate the changes in the new tax law. This adjustment was already included in our original recommendation. Second, we now also incorporate new data showing that the risk-free rate and cost of debt have increased since our original work:

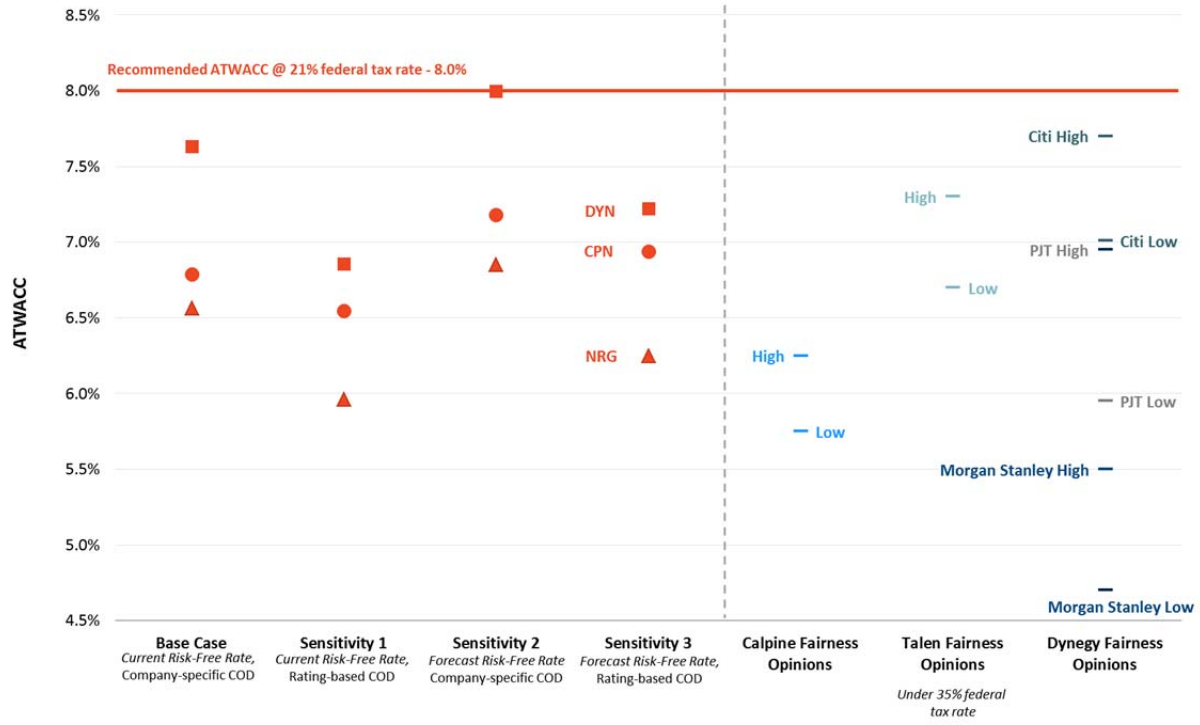
(a) Risk-free Rate: In our analysis we used both a current risk-free rate as measured by the 20-year Treasury bond rate and a forecasted risk-free rate as approximated by the consensus forecasts from BlueChip. The 20-year T-Bond rate increased about 0.3 percent (from 2.65% to 2.96%) since our original analysis. However, the long-term forecast remains at 3.5%;[8]

(b) Cost of Debt: In our analysis we used both rating-based index interest rates (the BB- and B-rate bond yields) as well as company-specific bond yields. The ratings-based bond yield increased by approximately 100 basis points since our original analysis. As for the company-specific yields, because two of the U.S. IPPs are now part of larger corporate parents, their current costs of debt have decreased and will no longer reflect the higher costs of debt for U.S. IPPs. We ignore this decrease and, instead, assume that the IPPs' company-specific borrowing costs (consistent with the sample-companies' debt ratings) have increased by 100 basis points since our initial analysis.

The resulting updated ATWACC estimates for the U.S. IPPs, including the discount rates disclosed in the most recent fairness opinions (which do not reflect the lower federal corporate income tax rate), are shown in Figure 3. Our Base Case and three Sensitivity Cases reflect different combinations of risk-free rates (current v. forecast) and costs of debt (ratings-based v. company-specific) as described in the full report. Based on these updated reference points, we recommend 8.0% as our updated ATWACC.

[8] As of March 2018, BlueChip's forecast for a 10 year Treasury Bond for 2020 remains at 3.5%. The five year average for 2020-2024 is 3.7%.

Figure 3. ATWACC under Current Interest Rates (21% Federal Corporate Income Tax Rate)



Beyond the higher interest rates incorporated in the updated ATWACC recommendation, we also respond to four other points that Energyzt raised in regard to our original ATWACC recommendation.

1. Implied Un-Levered Beta

Energyzt bases its 9.7% or higher ATWACC primarily on a historical comparison with the PJM 2014 decision of an 8.0% ATWACC.[9] There are several problems with this analysis.

First, the fundamental premise of this approach is that the implied un-levered beta and risk in PJM, estimated in 2014, should be the same as that estimated in 2018. This premise is not supportable, given evidence presented in our original report showing that ATWACC estimates for U.S. IPPs and discount rates used in merchant generation transactions were lower in 2018 than in 2014.[10] For example, discount rates used in the Calpine fairness opinion (as of August 17,

[9] We have not investigated the reference to ISO-NE 2017, but we want to note that the mechanics for estimating ATWACC is different from our approach.

[10] PJM CONE Study 2014, Table 25.

2017), ranged from 5.75% to 6.25%. The discount rates for the NRG-GenOn merger in 2012 ranged from 7.7 to 9.2% for NRG and from 9.2–10.2% for GenOn.

Second, if one were to conduct a historical benchmarking analysis, a more straightforward way is to compute the ATWACC premium over the risk-free rate (as we have done in Figure 1 above). At Energyzt's recommended ATWACC of 9.7%, the resulting ATWACC premium above the risk free rate would be 6.7%, well above the premium that existed in the 2014 recommendation.

Third, Energyzt's comparison of the un-levered betas between our 2014 and 2018 recommendations is based on an incorrect application of the un-levering formula:

$$\text{Un-Levered Beta} = \text{Levered Beta} / (1 + (1 - \text{Tax Rate}) \times \text{Debt} / \text{Equity}).$$

This formula is based on the corporate finance theory that financial leverage does not affect the asset risk of a company or project,[11] and is used to estimate un-levered betas from levered betas and the observed capital structure.[12] Columns [1] and [4] of Table 1 replicate Energyzt's results: Energyzt pointed to the drop in their calculated un-levered betas from 0.85 to 0.58 as evidence that our current analysis under-estimates risk and ATWACC.[13] However, Energyzt's conclusion is based on an erroneous use of the un-levering formula, which is derived under a constant tax rate, in situations when tax rates change. To see this error, compare columns [3] and [4], where all the cost of capital components are the same, but the tax rates are different: (1) under the higher old tax rate (column [3]), a 7.0% ATWACC corresponds to an un-levered beta of 0.64; whereas (2) under the lower new tax rate, the ATWACC is 7.5% and corresponds to an un-levered beta of 0.58 (as shown in column [4]). Put differently, under Energyzt's method, a lower ATWACC, due entirely to a higher tax rate, would imply higher un-levered business risk! This unreasonable result is artificial solely because the un-levered beta formula is misused. Consequently, any inferences drawing from this comparison of un-levered betas are incorrect.

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[11] The theory-based un-levered beta formula does not lead to exactly constant ATWACCs. The concept behind the un-levered formula however, is consistent with our empirics-based ATWACC approach.

[12] Reversely, a re-levering formula, Levered Beta = Un-Levered Beta × (1 + (1 − Tax Rate) × Debt / Equity), can be used to re-lever un-levered betas to any hypothetical capital structure.

[13] Energyzt July 27 presentation, at p. 7.

Table 1. ATWACC, Equity Betas, and Un-Levered Betas

	2014		2018	
	40.50%	29.50%	40.50%	29.50%
	[1]	[2]	[3]	[4]
Assumptions:				
Risk-free Rate	3.40%	3.40%	3.50%	3.50%
Market Risk Premium	6.50%	6.50%	6.90%	6.90%
CoE	13.80%	13.80%	12.80%	12.80%
CoD	7%	7%	6.50%	6.50%
E/V	40%	40%	35%	35%
D/V	60%	60%	65%	65%
Tax Rate	40.50%	29.50%	40.50%	29.50%
ATWACC	8.0%	8.5%	7.0%	7.5%
Implied Betas:				
Levered Beta	1.60	1.60	1.35	1.35
Un-Levered Beta	0.85	0.78	0.64	0.58

Notes:

Levered Beta = (CoE – Risk-Free Rate) / Market Risk Premium;

Un-Levered Beta = Levered Beta / (1 + (1 – Tax Rate) × D/V / E/V).

2. ATWACC Estimates from Lenders

Energyzt presents ATWACC recommendations from several lenders as of November 2017.[14] They range from 7.5% to 12% based on the 35% federal income tax rate. Through our prior experience with interviewing developers and lenders in analyzing the financing cost of merchant generation companies, we believe relying on such a survey would introduce subjective and upwardly-biased results, because (1) developers and lenders tend to, consciously or not, provide cost of capital estimates consistent with the high returns they would like to earn rather than a competitive level of financing costs; (2) these survey results are not binding, and it is not clear that any actual bids or investments have been made with the expectation to earn these rates; and (3) it is unclear whether projects bid into PJM's capacity market at some of the high recommended financing cost assumptions would be sufficiently competitive to clear in the auction.

To avoid the resulting potential upward bias of lender surveys, we prefer to rely on market data for publicly-traded sample companies (with appropriate adjustment for, and consideration of, differences in business risk for PJM merchant generation investments), supplemented by the benchmark ATWACC-based discount rates employed by investment analysts preparing fairness

[14] Energyzt August 2, 2018 confidential presentation to PJM, at pp. 16 – 19.

opinions for merchant generation companies as an additional reference point. The selected fairness opinions have been used by investors in both the target companies and acquiring companies to value actual merchant generation merger and acquisition transactions for which there are corroborative market prices. Hence, the data from fairness opinions have the advantage of being an unbiased reference point. Compared to the potential bias introduced through lender surveys, we believe our approach yields an unbiased and market-based estimate of the cost of capital for merchant generation investments in PJM.

3. Reliance on TransAlta

Energyzt mischaracterized our reliance on Transalta. The company is included in our Canadian IPP sample. Our main conclusion is based primarily on evidence from the U.S. reference points presented in Figures 6 and 7 of our April 2018 report. The fact that our ATWACC recommendation is closer to Transalta's ATWACC is just a coincidence.

4. Comparison to Utility Costs of Equity

Energyzt suggested that our originally proposed 12.8% cost of equity is consistent with their estimated cost of equity for regulated utilities at 65% debt ratio,[15] and therefore must under-estimate the cost of equity for merchant generation. However, Energyzt's attempt to re-lever allowed cost of equity from a different book-value capital structure to our recommended capital structure is based on stale costs of equity data: the regulatory costs of equity used in their regression analysis are not all of 2017 or 2018 vintages. Our recommended overall rate of return for merchant generation companies in PJM is well above that of regulated utilities.

[15] Energyzt July 27, 2018 presentation, at p. 33.