October 16, 2014

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Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, D.C. 20426

Re: *PJM Interconnection, LLC,* Docket No. ER14-2940-000

Dear Ms. Bose:

Ryan Hardy and Mark Repsher of PA Consulting Group, Inc. ("PA"), on behalf of PJM Power Providers ("P3")[1], respectfully submit comments on the PJM Interconnection, LLC's ("PJM") proposed updates to the PJM Open Access Transmission Tariff (the "Tariff"), in which PJM seeks to revise elements of the Reliability Pricing Model ("RPM"). The purpose of this affidavit is to analyze PJM's proposed cost of funds used to support the after-tax weighted average cost of capital ("ATWACC"), which is a component of the Net Cost of New Entry ("Net CONE").

In addition to the direct analysis in this affidavit, our view is informed by market intelligence, both public and proprietary, that has been acquired through substantial work in the PJM market, with developers, private equity investors, distribution utilities, and electric cooperatives. In the last 24 months alone, as part of PA's energy team, we have provided advisory support and market analysis to over 10 GW of new build generation development capacity. Based on this work, as well as over 25 years of combined experience in the U.S. electricity markets, we believe that PJM's proposed Tariff revisions appear to underestimate the reasonable zone of ATWACC by 1 to 5.5 percentage points when adjusting the debt-to-equity ratio ("D/E Ratio"), cost of debt ("COD"), and cost of equity ("COE") parameters to reflect more appropriate and realistic values.

PJM's application of appropriate and realistic values to the ATWACC parameters within the RPM capacity market construct is extremely important to the reliability of the PJM electric grid. As noted by the Brattle Group, Inc.'s ("Brattle") triennial review of the PJM Variable Resource Requirement ("VRR") curve (the

[1] P3 is a non-profit organization dedicated to advancing federal, state and regional policies that promote properly designed and well-functioning electricity markets in the PJM region. P3 membership is comprised of energy providers that are members of PJM, conduct business in the PJM balancing authority area, and are signatories to various PJM agreements. Combined, P3 members own over 87,000 megawatts of generation assets and over 51,000 miles of transmission lines in the PJM region, serve nearly 12.2 million customers and employ over 55,000 people in the PJM region, representing 13 states and the District of Columbia. These comments are those of Mr. Hardy and Mr. Repsher and do not necessarily reflect the specific views of any particular member of P3 with respect to any issue.

"2014 Brattle Study"[2]), under-procurement in sub-locational deliverability areas ("sub-LDAs") due to the underestimation of Net CONE likely "has disproportionately high reliability consequences". The same argument can be made for the PJM market as a whole. Stated simply, if PJM's Net CONE is set lower than the true requirement for new build, grid reliability will be put at risk, as the resulting market compensation—including RPM capacity prices—will be insufficient to incite new market entry. Ultimately, the ATWACC has a significant impact on the resulting Net CONE.[3]

Details of our qualifications are set forth in our curriculum vitae, attached to our affidavit.

[2] Brattle, Cost of New Entry Estimates for Combustion Turbine and Combined Cycle Plants in PJM with June 1, 2018 Online Date, published May 15, 2014, see page vii.

[3] From PJM's Capacity Senior Task Force Final Report on August 21, 2014, PJM's recommended ATWACC of 8% results in a Gross Cost of New Entry ("Gross CONE") of $150/kW-yr for Area 1, while an increase of ATWACC to 13.5% results in a Gross CONE of $224.20/kW-yr for Area 1.

continued

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. ER14-2940-000

AFFIDAVIT OF RYAN HARDY & MARK REPSHER
IN SUPPORT OF COMMENTS AND LIMITED PROTEST OF PJM POWER PROVIDERS

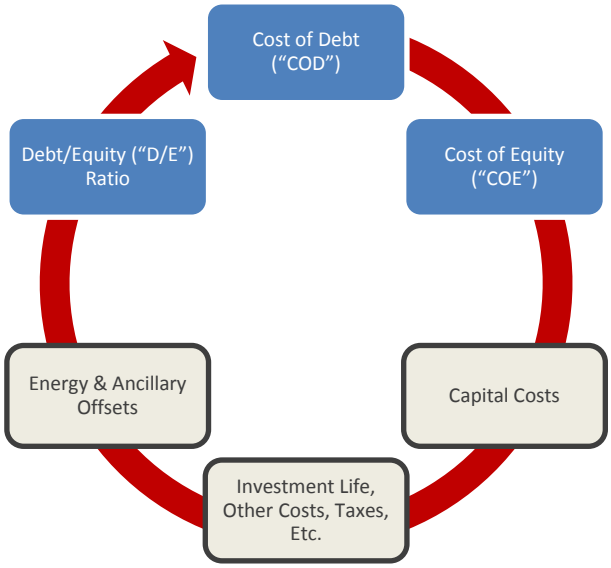
continued

I. Introduction

1. On September 25, 2014, PJM submitted proposed Tariff revisions to the Federal Energy Regulatory Commission ("FERC"), including updates to the Net CONE calculation utilized within the RPM capacity market construct. In calculating the Net CONE, PJM primarily relied upon Brattle's triennial review of the PJM VRR curve (i.e., the 2014 Brattle Study) as justification for the proposed Tariff revision.

2. Our expert opinion in this affidavit is based on the review of three components of the Net CONE calculation proposed by PJM, which are the D/E Ratio, COD, and COE parameters. These parameters are proposed to be used for a three year period, starting with the RPM's 2018/2019 Base Residual Auction ("BRA"). As previously mentioned, the purpose of this affidavit is to determine if these three proposed parameters fall within a range of reasonableness for inclusion in the calculation of the proposed ATWACC, and whether the resulting ATWACC proposed in the 2014 Brattle Study is reasonable. As discussed within this affidavit, we conclude that the ATWACC used for the combustion turbine ("CT") reference technology is below the "zone of reasonableness". This affidavit does not comment on other parameters proposed by Brattle, including the appropriate reference technology, capital costs, investment life, and energy & ancillary ("E&A") offsets.[4] Figure 1 overviews the components addressed in this analysis (top three boxes; marked in blue).

Figure 1: Overview of Areas Addressed in this Affidavit (Blue Boxes)



[4] Our lack of commentary on the other three (3) components does not constitute endorsement of these assumptions. Rather, we did not analyze these additional areas as part of the scope for this affidavit.

continued

3. PJM's proposed revisions rely on several key assumptions from the 2014 Brattle Study, which result in (or from[5]) the proposed ATWACC of 8.0%. The key ATWACC assumptions that we analyzed for reasonableness include:

a. **D/E Ratio**: PJM's proposal to utilize the 2014 Brattle Study recommendation of a 60/40 D/E Ratio (i.e., 60% Debt and 40% Equity);

b. **COD:** PJM's proposal to utilize the 2014 Brattle Study recommendation of a pre-tax rate of 7.0%; and

c. **COE**: PJM's proposal to utilize the 2014 Brattle Study recommendation of a rate of 13.8%.

4. It is important to note that the 2014 Brattle Study proposed using the above financial parameters for both combined cycle ("CC") and CT technologies, while PJM has put forth these financial assumptions utilizing a CT as the reference technology to calculate Net CONE. As we describe below, this tends to understate the cost of funds associated with the development of a CT, which has inherently greater market risk.

5. The remainder of our analysis in this affidavit demonstrates how Brattle's Balance Sheet Financing Methodology[6] skews PJM's proposed ATWACC away from a zone of reasonableness. In particular, the majority of recent and current financings in the PJM market for single asset investment/development have been completed on a project-level basis, which affects achievable D/E Ratios, CODs and COEs:

a. The **D/E Ratios** proposed by PJM indicate a higher leverage than is actually achievable in the PJM market for single asset investment/development; a reasonable range for CC and CT debt leverage is 45-55% with CT technology, *which is the reference technology put forth by PJM*, likely falling at the lower end of the range.

b. Recent project-level financings in PJM have exhibited pre-tax **CODs** higher than those proposed by PJM and indicated in the 2014 Brattle Study; a reasonable range for CC and CT project-level debt financing is 7-9%, with the range depending on specific project risk and debt leverage levels.

c. PJM's proposed **COE** also falls below the low end of the reasonable range; a reasonable range for new CC and CT COE is 15-20% when accounting for the risk profile of the investment (e.g., merchant cash flows, construction risk) as well as the investor profile (e.g., private equity and power generation development shops) with pure-play developers near the top of this range.

[5] As noted in the following section, the 2014 Brattle Study methodology is somewhat opaque, with parts of the report reading as if certain "components" of the final ATWACC have been derived (or "backed into") from the final ATWACC versus a fundamental "building up" of the individual D/E Ratio, COD and COE components (and an appropriate tax rate) to arrive at the final ATWACC value.

[6] This term is further defined in Section II of this affidavit, but is generally defined by the fact that the financial data points utilized in the 2014 Brattle Study are all underpinned by the utilization of corporate-level publicly-traded Independent Power Producer financial metrics.

continued

II. The 2014 Brattle Study ATWACC methodology

6. The methodology employed in the 2014 Brattle Study to develop PJM's proposed ATWACC of 8% is opaque and relies upon a mix of inappropriate corporate financial metrics and circular logic to arrive at the component pieces that build up to its 8.0% ATWACC recommendation. Moreover, even if one could argue that the appropriate methodology and metrics were utilized to underpin PJM's recommendation, the resulting ATWACC is at the midpoint (i.e., median) of the range of ATWACC's presented in the 2014 Brattle Study. FERC has previously relied upon setting just and reasonable return metrics that are "halfway between the midpoint of the zone of reasonableness and the top of that zone."[7]

a. The 2014 Brattle Study relies on an array of sources to develop the recommended ATWACC, including (1) the Capital Asset Pricing Model ("CAPM") approach for publicly-traded Independent Power Producers ("IPP")[8]; (2) previous triennial review process estimates (updated for changes in the risk-free rate); and (3) fairness and other analyst estimates (again, updated for changes in the risk-free rate). The common thread among each of these data points utilized in the 2014 Brattle Study is that they are all underpinned by the utilization of corporate-level publicly-traded IPP financial metrics (together, what we term the "Balance Sheet Financing Methodology").[9]

   The analysis contained in this affidavit will show, however, that developing financial parameters based on a Balance Sheet Financing Methodology ignores the reality of recent and current new build generation development in PJM. In particular, the vast majority of recent and current new build generation development in PJM (and across the United States) is being driven by private equity and power generation development shops[10], which finance investments at the project level ("Project Level Financing"). Our analysis will show that the risk profiles of publicly-traded IPPs are incompatible with recent and current new build generation development in PJM, thus making the methodology underpinning PJM's ATWACC recommendation largely irrelevant and the resulting ATWACC recommendation too low.

[7] FERC Order 531, page 7 and page 68.

[8] The 2014 Brattle Study relies on three publicly-traded IPPs for estimating capital requirements: NRG, Calpine, and Dynegy. See page 35 of the 2014 Brattle Study.

[9] For a more fulsome discussion on Brattle's approach, see 2014 Brattle Study, pages 34-37.

[10] Examples of private equity and power generation development shops with recent or current project developments in PJM include Panda Power Funds, Competitive Power Venture Holdings, Invenergy, Corona Power, Moxie Energy, and Genesis Power.

continued

b. PJM's recommended ATWACC (which, as mentioned previously, follows the 2014 Brattle Study recommendation) does not appear to rely on a fundamental build-up of the core ATWACC components (i.e., D/E Ratio, COD, and COE). In short, instead of conducting a transparent build-up of the core ATWACC components, the 2014 Brattle Study appears to (1) deliver a subjective (versus a fact-based) recommendation; and (2), of potentially more concern, "backs-in" to the underlying components that comprise the proposed ATWACC of 8%.[11] As indicated by Brattle:

"Based on this set of reference points and our assumption of merchant entry risk that exceeds the average risk of the publicly-traded generation companies, we ***believe*** *an 8.0% ATWACC is the most reasonable estimate for the purpose of estimating CONE…We [Brattle] assumed a capital structure of 60/40 debt-[to]-equity ratio to reflect typical projects' capital structures and their associated ROE [i.e., COE] and COD. For a representative COD of 7% and a 60/40 debt-to-equity capital structure, the ATWACC of 8.0%* ***translates to*** *an ROE of 13.8%..."* ***[emphasis added]***[12]

c. Additionally, PJM's (and the 2014 Brattle Study's) proposed methodology, potentially by coincidence, results in an ATWACC that is simply at the midpoint (i.e., median) of the range of ATWACC's produced by the Balance Sheet Financing Methodology (see Figure 2, and acknowledged in the 2014 Brattle Study on page 37[13]), despite the 2014 Brattle Study acknowledging that a PJM merchant project has a higher risk profile. As stated by Brattle:

"As a merchant project, the risks would be larger than for the average portfolio of independent power producers that have some long-term contracts and other hedges in place."[14]

As highlighted in FERC Order 531, to ensure that reliability is preserved, FERC exercises caution in the setting of returns that are too low and which may not be "..sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital"[15]. Based on this, FERC has previously relied upon setting just and reasonable return metrics that are "halfway between the midpoint of the zone of reasonableness and the top of that zone."[16]

[11] While the 2014 Brattle Study's (and, subsequently, PJM's) proposed D/E Ratio is consistent with the average D/E Ratio calculated by Brattle among the three analyzed publicly-traded IPPs (i.e., Calpine, NRG and Dynegy), the proposed COD and COE figures do not appear to be based off of the analyzed dataset. For example, the proposed pre-tax COD of 7% is approximately 1.5 percentage points less than the pre-tax COD indicated by the 2014 Brattle Study's CAPM analysis (see 2014 Brattle Study, page 37, Table 25). In addition, as noted directly hereafter, the 2014 Brattle Study does not provide any justification for the assumed COE, instead seeming to "back into" the COE figure *after the fact*.

[12] 2014 Brattle Study, page 37.

[13] "…we believe an 8.0% ATWACC is the most reasonable estimate for the purpose of estimating CONE. That value is above the cost of capital of Calpine and NRG, both of which have some long-term contracts and hedges in place, and it is near the mid-point of the range of the additional reference points."

[14] 2014 Brattle Study, page 34.

[15] FERC Order 531, page 68; Hope, 320 U.S. at 603

[16] FERC Order 531, page 7 and page 68.

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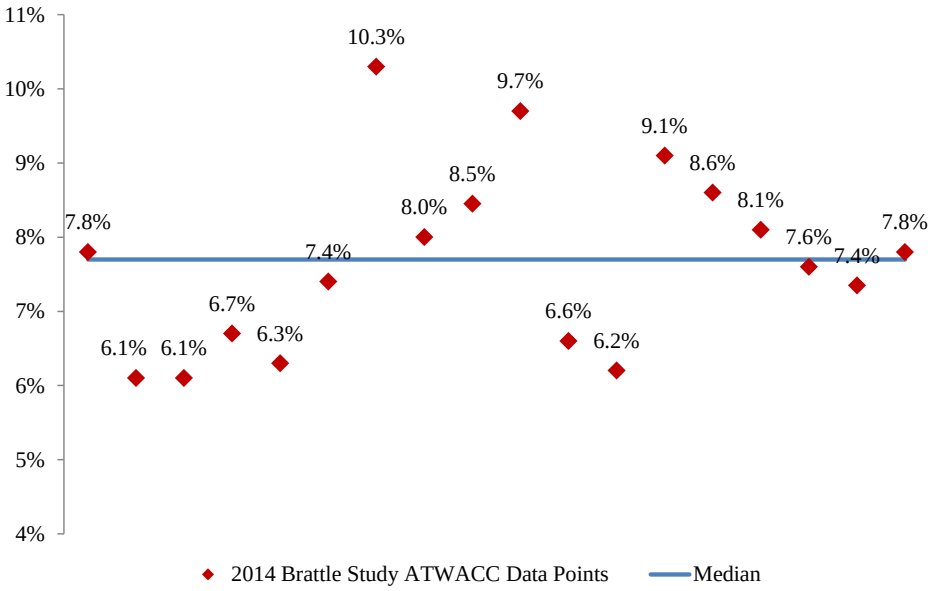
Figure 2: 2014 Brattle Study ATWACC Range[17]



III. Establishing a reasonable baseline

7. To determine the appropriate investment return metrics for the Net CONE calculation, we analyzed natural gas-fired thermal projects with projected commercial online dates of 2015 or after (i.e., the period covered by the last triennial CONE review process), and with a high likelihood of moving forward (i.e., capacity that is under construction and/or has cleared a formalized capacity market and/or has achieved financing). We found that:

a. **More than 70%** of the natural gas-fired projects (by capacity) currently under development in the PJM market are being developed by private equity or power generation development shops; other wholesale power markets have seen similar or greater development levels by these types of entities; and

b. **Less than 10%** of thermal capacity currently under development in PJM is being pursued by publicly-traded IPPs.

[17] Underlying data points from 2014 Brattle Study, page 37.

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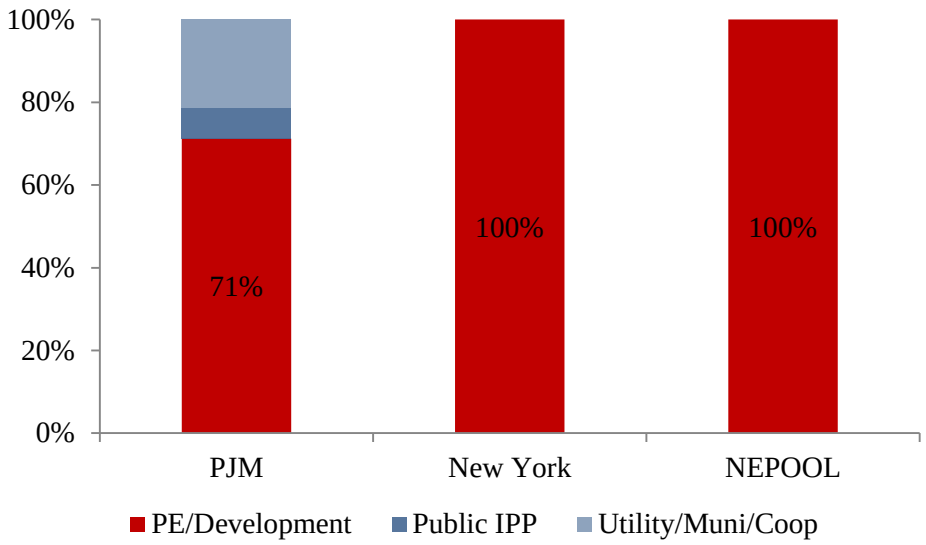
Figure 3: MW Distribution of Natural Gas-Fired Development Projects (Est. Online Year >=2015)[18]



8. We compared this baseline observation—that a significant portion of new thermal development projects in PJM, and other wholesale power markets with formalized capacity market constructs (i.e., New York and New England), are being built by private equity and power generation development shops—with the 2014 Brattle Study's approach that PJM has adopted in its filing. As discussed in Section II, Brattle's Balance Sheet Financing Methodology *may* reflect the risks and capital structures associated with publicly-traded IPPs, but it makes no attempt to take account of private equity and power generation development shops that currently establish the foundation of new build generation investors that will help PJM achieve reliability in the future.

9. In general, publicly-traded IPPs have fundamentally different capital and investment structures than private equity and power generation development shops. Publicly-traded IPPs tend to be regionally, technologically and fuel-diverse portfolios, with relatively stable earnings due to (1) the aforementioned diversification; (2) long-term asset contracts; and (3) corporate-level hedges on portfolio earnings. In contrast, private equity and power generation development shops (1) do not tend to be as well-diversified (geographically or technologically) as publicly-traded IPPs; and (2) typically pursue financing on a project-level basis, further altering the investment environment from that which a CAPM-type (i.e., Balance Sheet Financing Methodology) approach would imply. Because of these differences, the recent and current new build power generation development environment should be expected to have a different capital structure than one implied by a CAPM (i.e., Balance Sheet Financing Methodology) approach, which impacts the underlying COD, COE, and D/E Ratio.

[18] SNL Financial and PA Consulting Group.

continued

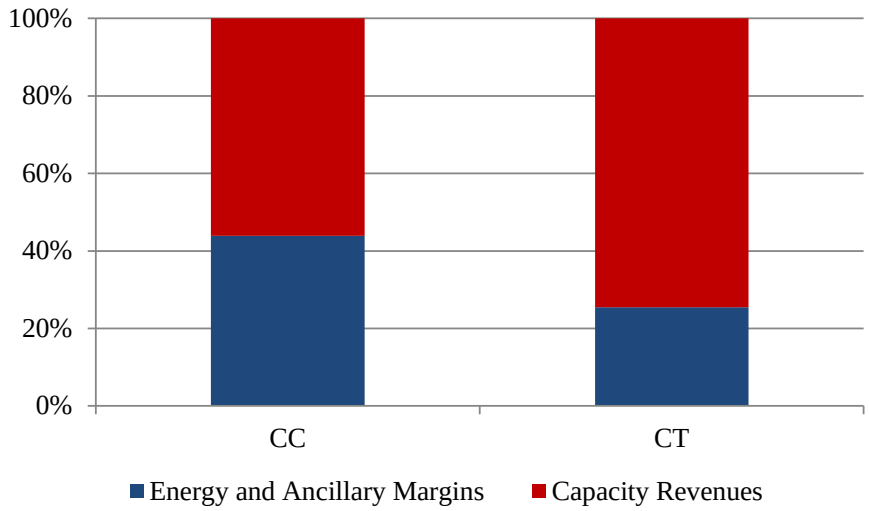
IV. Appropriate D/E Ratio

10. PJM proposes to utilize an ATWACC that is underpinned by a D/E Ratio of 60% debt and 40% equity. The apparent justification for this D/E Ratio is the 2014 Brattle Study, which appears to propose these parameters based off the average D/E Ratio of Calpine, Dynegy and NRG.[19]

11. This debt leverage is overstated for several reasons:

a. The 2014 Brattle Study proposes to use an average of CC and CT reference technology, with identical financial metrics underpinning the Net CONE calculation for both. However, PJM, in its proposed Tariff revisions, has proposed to keep the CT as the reference technology with no adjustment to these financial parameters. This proposed D/E Ratio is identical to the D/E Ratio proposed by ISO-NE (and approved by FERC), which was also based on a Brattle study. However, and importantly, the reference technology approved in ISO-NE is a CC versus the CT reference technology put forth by PJM in its proposed Tariff revisions. Exhibited in Figure 4, the gross margin profile of a CT is inherently more risky than that of a CC (i.e., a CT is less diversified as a significantly higher proportion of projected gross margins for a CT are derived from the capacity market construct than from other revenue sources, such as energy and ancillary markets), and we would expect PJM's debt leverage analysis to yield a lower percentage for CTs (and, thus, a lower D/E Ratio).

Figure 4: 2013 Percentage of Margin by Revenue Source and Resource Type[20]



[19] We say "appears to" because the 2014 Brattle Study does not ever directly acknowledge that its proposed 8% ATWACC is based on this D/E Ratio split; moreover, as stated previously, it is unclear if the 2014 Brattle Study arrived at the proposed 8% ATWACC based on a fundamental "build-up", or instead "backed into" the D/E Ratio after recommending the 8% ATWACC figure.

[20] Monitoring Analytics, LLC, State of the Market Report for PJM: 2013, March 13, 2014, see page 231.

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b. As previously mentioned, Brattle's apparent use of a Balance Sheet Financing Methodology to calculate leverage is incongruent with the structure of actual development projects in PJM, which have averaged a 56/44 D/E Ratio.[21]

It is important to note that the development projects which have occurred in the PJM market over the past three years (i.e., since the last triennial review process) have been almost exclusively CC development projects. This is a significant observation because, as illustrated elsewhere in this affidavit, the cash flow security of a CC facility is relatively more secure than a CT facility, the latter which relies almost exclusively on capacity revenues for its projected (and realized) cash flow. Given the more risky cash flow profile of a CT development project (i.e., the technology that PJM has proposed in its Tariff revisions as the reference technology), we would expect the observed D/E Ratio of 56/44 to set the *ceiling* in terms of achievable debt leverage for this type of technology. In other words, we would expect ~55% debt leverage to be at the extreme upper end of any zone of reasonableness for achievable merchant CT debt leverage.

c. In comparison to other FERC proceedings, there is precedent for utilizing a lower D/E Ratio for the reference CT technology. Namely, the 2011 Brattle Study[22] for PJM and the 2013 NERA Study for New York[23] both recommended a 50/50 D/E Ratio utilizing a CT for the reference technology. Ultimately, FERC accepted the 50/50 D/E Ratio recommendation in both proceedings.[24,25]

In addition, the 2013 NERA Study for New York analyzed a merchant project financing "MPF" case, which is generally equivalent to the project development and investment environment that PJM currently finds within its own market. The sensitivity case found that debt leverage of approximately 33% was achievable under a MPF scenario.[26] As stated in the 2013 NERA Study for New York:

"…generators have raised the issue that merchant project financing (MPF) would be a more appropriate financing assumption. We have developed a case with 1/3 debt at a cost of 9% and 2/3 equity at a cost of 15%. While the parameters of MPF are speculative, we believe that these are reasonable."[27]

[21] We conducted an analysis of the combined cycles that have achieved financing since 2012. To do this, we reviewed publically available financing data for current and recently announced new build generators.

[22] The Brattle Group, Cost of New Entry Estimates for Combustion Turbine and Combined-Cycle Plants in PJM, August 24, 2011, see page 40.

[23] NERA, Independent Study to Establish Parameters of the ICAP Demand Curve for the New York Independent System Operator, August 2, 2013, see page 56.

[24] FERC Docket ER12-513-000 and -003.

[25] FERC Docket ER14-500-000.

[26] For the avoidance of doubt, it is outside the context of this affidavit for us to offer any opinions related to the study's use of CAPM analysis in the New York capacity parameter reset proceedings and rationale for using corporate-level vs. project-level financial metrics. We utilize these data points to simply compare and contrast filings and findings made within other ISO markets, in order to offer FERC context related to the PJM proposed Tariff revisions.

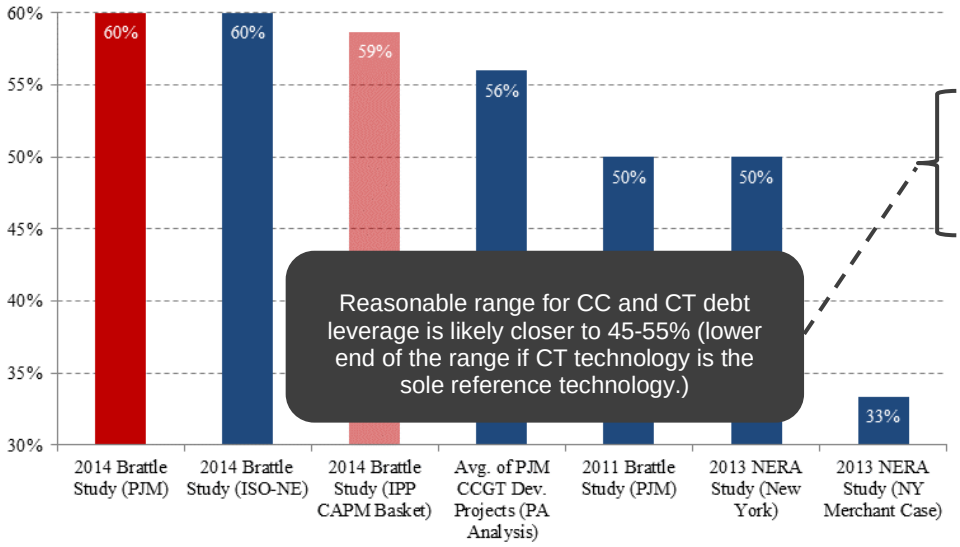
[27] 2013 NERA Study for New York, page 100.

continued

d. Moreover, in comparison to the ISO-NE market, the approved D/E Ratio of 60/40 for a CC in ISO-NE is set within an environment that allows new build generation to secure capacity payments for up to seven (7) years.[28] This creates a more stable and secure revenue stream for financing, as compared to PJM's capacity market structure where RPM revenues can be secured for only one year. All else equal, we would expect a PJM new build financing to have lower leverage given the higher risk profile from a relatively unsecured revenue stream (i.e., capacity revenues for a new development project are only visible for one year, three years in the future). This notion is further supported by the MPF case from the 2013 NERA Study for New York, which, as noted previously, is generally reflective of the project development and investment environment that PJM currently finds within its own market, and which recommends a 33/67 D/E Ratio under such a scenario.

12. Based on the logic of the aforementioned points, the D/E Ratios proposed by PJM indicate higher leverage than appear to be actually achievable in the PJM market for single asset investment/development. A more reasonable D/E Ratio is likely in the 45/55 to 55/45 range for CT and CC technology; moreover, if FERC accepts PJM's recommendation of CT technology as the sole reference technology, we would expect achievable debt leverage to be nearer the lower half of this range (i.e., 45-50% debt). See Figure 5.

Figure 5: Summary of Debt Leverage Parameters[29]



[28] See page 660 of ISO-NE proposed Tariff revision on April 1, 2014 in FERC Docket ER14-1639-000, which were accepted by FERC on May 30, 2014 in the same docket (see page 14 of the Order).

[29] 2014 Brattle Study, see page 37; FERC Docket ER14-1639-000, see page 661; PA Consulting Group; The Brattle Group, Cost of New Entry Estimates for Combustion Turbine and Combined-Cycle Plants in PJM, August 24, 2011, see page 41; NERA, Independent Study to Establish Parameters of the ICAP Demand Curve for the New York Independent System Operator, August 2, 2013, see pages 56 and 100.

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V. Appropriate COD

13. In analyzing COD for new build generation (both CC and CT technologies), it is important to understand the current state of the debt markets for new build generation. While a typical Net CONE calculation is based on the premise of a 20-year fixed interest rate loan, the actual financing structure employed in the markets is much different. The majority of new build financings have much shorter tenors, often closer to 7 years, with floating interest rates tied to LIBOR. The overall cost of debt includes a basis spread driven by the specific investment characteristics, often reflective of a Term B loan structure, as well as higher cost mezzanine debt that is subordinate to the Term B debt. It is critical to consider all of these elements in determining the appropriate COD for new build investment.

14. PJM proposes using a pre-tax COD of 7% for the reference CT technology based on the 2014 Brattle Study, which recommended a 7% COD for both CCs and CTs. Based on recent market activity and other studies, a 7% COD is likely at the lower end of a range of reasonableness, with higher COD driven by the following in many cases:

a. Brattle's pre-tax COD of 7.0% is approximately 1.5 percentage points lower than the COD implied by Brattle's IPP CAPM analysis (i.e., Balance Sheet Financing Methodology) and 1 percentage point lower than CODs observed in recent financings of new build CC development projects in PJM.[30]

b. Based on our experience working with new build generation developers and discussions with industry contacts, CODs of 7% may be achievable in some cases, but not with CTs in PJM at D/E Ratios of 60/40 as proposed in the 2014 Brattle Study; in other words, 7% COD-levels *may* be achievable at a D/E Ratio of 50/50 or lower.

c. Based on these same discussions, higher debt leverage ratios (i.e., >=60%) carry higher interest rates (either in the Term B market or through the need to access higher cost mezzanine level debt). Recent project-level financing for CCs in the PJM market, which have averaged a ~55/45 D/E Ratio, have seen debt rates average ~8%.[31] With the proposed reference technology of a CT, we would expect higher COD and/or lower D/E Ratios based on the higher risk profile of a CT investment, as mentioned earlier.

d. In comparison with other studies, Brattle's pre-tax COD is low. For example, the 2013 NERA Study for New York (MPF case) recommended a pre-tax 9% COD, which reflected a two percentage point premium to the baseline 2013 NERA Study for New York COD, based on market observations.[32] Since new build development in PJM is largely contemplated on a merchant basis, notwithstanding

[30] Based on an analysis of the combined cycles that have achieved financing since 2012, and with publicly-available COD information.

[31] Based on an analysis of the combined cycles that have achieved financing since 2012, and with publicly-available COD information.

[32] "NERA reviewed the financing costs for stand-alone merchant projects, as reported in Project Finance magazine, and observed very high financing cost (premiums of 700 to 900 basis points above LIBOR), low $/kW loan levels and tenors of less than ten years." (2013 NERA Study for New York, page 87)

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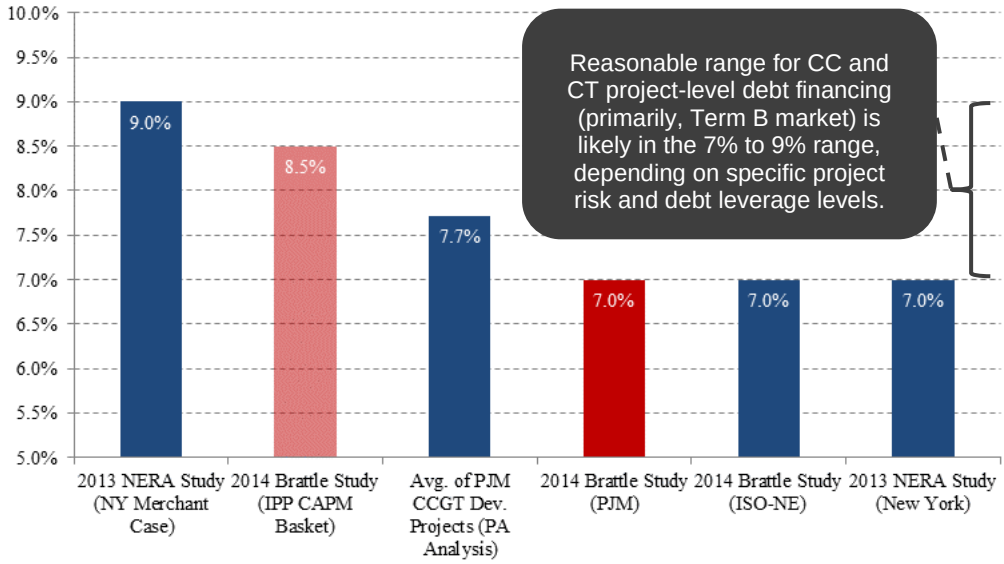
the potential costs of adding financial hedges, this merchant premium is applicable to PJM new build investment.[33]

15. Overall, the majority of recent and current financings in the PJM market are for single asset investment/development, have been completed on a project-level basis, and have exhibited pre-tax CODs higher than those indicated in the 2014 Brattle Study. See Figure 6.

Figure 6: Summary of Pre-Tax COD Parameters[34]



16. Based on these comparisons, we believe that a reasonable range for CC and CT project-level debt financing is 7-9%, with the range depending on specific project risk and debt leverage levels. However, we do not believe that the 7% COD assumed by Brattle would be reasonably achievable under Brattle's proposed 60/40 D/E Ratio for a new build CT in PJM.

VI. Appropriate COE

17. Similar to the D/E Ratio and COD parameters, establishing a reasonable zone for the COE parameter is paramount to the continued successful, and reliable, operation of the PJM grid. In particular, the COE must be set at a level that matches the inherent risk of the investment as well as the risk profile of the active investors in the market. Incorrectly setting the COE parameter (and other parameters, as discussed elsewhere

[33] In recent history, the majority of new build projects in New York have been backstopped by long-term power contracts – an environment that is not found in the PJM market. While not stated explicitly in the 2013 NERA Study for New York, this may be one reason that NY-ISO stakeholders were comfortable moving away from the pure MPF case presented within the 2013 NERA Study for New York.

[34] NERA, Independent Study to Establish Parameters of the ICAP Demand Curve for the New York Independent System Operator, August 2, 2013, see pages 56 and 100; 2014 Brattle Study, see page 37; PA Consulting Group; FERC Docket ER14-1639-000, see page 661.

continued

in this affidavit) based on a Balance Sheet Financing Methodology ignores the fact that publicly-traded IPPs have a lower risk profile than merchant new build power generation investors, which include private equity and power generation development shops. The publicly-traded IPPs have not, and are not likely to, engage in the majority of new build generation development activity required to ensure reliability in PJM unless the risk profile of the market substantially changes—say, for example, by introducing mechanisms for long-term cash flow security.

18. As noted in Section II of this affidavit, PJM has proposed to revise its COE parameter to 13.8%, which mirrors the COE parameter put forth by Brattle in the 2014 Brattle Study. Additionally, as noted previously, the means by which the 2014 Brattle Study calculates this metric is unclear, at best, and is a figure that is merely "backed-into", at worst.

19. The COE parameter proposed by the 2014 Brattle Study is close to, but still below, the low end of a reasonable zone for actual (active) project developers and investors in the PJM market. Brattle's COE does not account for the full universe of builders actually developing projects in the PJM market, which includes private equity and power generation development shops.

20. Unlike IPPs that may[35] employ a Balance Sheet Financing Methodology (as observed in a CAPM analysis) when developing new build generation projects, actual observed developers within the PJM market are investing in (and financing based on) standalone entities, with limited downward support (financial or otherwise) from the corporate-level. While applicable to the pursuit of both equity and debt investments, this environment is most publicly evident in the market through the means by which these entities acquire financing commitments (i.e., at the project level versus at the corporate level). As noted previously, private equity and power generation development shops, even at a corporate level, are in general not as geographically, technologically, and/or contractually diverse as their IPP counterparts, thus adding incremental risk associated with discrete project development.

a. Taking into account the factors that surround the actual project development environment in PJM and corresponding risk profile, it becomes evident that the proposed 13.8% COE parameter is likely below the floor. The inclusion of construction development and merchant operating risk creates incremental risk premiums that push the zone of reasonableness for COE above this floor, and which must be included in a reasonable COE range for project developers in PJM.

b. Furthermore, and as noted previously, the proposed ATWACC parameters put forth by PJM mirror (1) the parameters put forth in the 2014 Brattle Study; and, more importantly, (2) mirror the parameters put forth by ISO-NE in its 2014 capacity parameter reset (and which, like PJM, also mirrors a study developed by Brattle for ISO-NE). As previously noted in Section V, there is a fundamental disconnect between the ISO-NE and PJM capacity markets in that new developers within ISO-NE have the ability to lock-in capacity revenues for a seven (7) year timespan vs. the single year price visibility offered within the PJM RPM construct. All else equal, one would expect

[35] We say "may" because it is unclear if IPPs actually develop projects based on these corporate-level metrics vs. creating separate investment vehicles to warehouse the risks associated with project development. Based on our work and conversations with IPPs, it is more likely than not that any project development work pursued by these firms is based on this "warehousing" methodology. For example, while not directly applicable, see NRG's pursuit of development projects within the broader NRG before "dropping down" those same operating (and, in some cases, contracted) assets as more relatively cash flow secure vehicles within NRG Yield.

continued

the risk profile (and associated risk metrics) of an unhedged development project in PJM with only one year of cash flow visibility three years in advance to present a riskier investment vehicle to potential investors than a similar project in the ISO-NE market that can lock in capacity revenues for a seven (7) year timespan. As such, it is reasonable to expect that the risk profile (and resulting COE parameters) will generally be driven higher in a market with less cash flow visibility (i.e., PJM).

c. Moreover, the 2014 Brattle Study (and PJM recommendation) is based on a technologically-agnostic COE parameter of 13.8%, which is a fundamental misunderstanding of the differing risk metrics associated with CC and CT development projects in ISO-controlled markets. All else equal, a CT's greater reliance on capacity revenues (exhibited in Figure 4, above) presents a riskier investment vehicle than does a CC project that relies on a more balanced mix of revenues from the capacity, energy and ancillary markets. This is important because the reference technology that ISO-NE proposed and FERC accepted is a CC configuration, which operates (and accrues cash flow) in a fundamentally different way than a CT (the reference technology proposed by PJM to be used in the Tariff revisions). However, the ISO-NE approved COE parameter is identical to that proposed by PJM in the proposed Tariff revisions (as mentioned previously, both ISO-NE and PJM relied upon Brattle to derive ATWACC assumptions, and underlying supporting components), *even though the reference technology employed in each are fundamentally different*.

d. As it relates to other markets and FERC proceedings, the 2013 NERA Study for New York came to similar conclusions as us if one were to analyze the MPF case included within that study. The sensitivity case in the 2013 NERA Study for New York found that a 2.5 percentage point adder (i.e., total COE of 15%) was applicable for scenarios equivalent to the project development and investment environment that PJM currently finds within its own market.[36] As explained in the 2013 NERA Study for New York:

   "…generators have raised the issue that merchant project financing (MPF) would be a more appropriate financing assumption. We have developed a case with 1/3 debt at a cost of 9% and 2/3 equity at a cost of 15%. While the parameters of MPF are speculative, we believe that these are reasonable."[37]

e. The 15% is likely near the floor of the zone of reasonableness for the COE parameter, based on our (1) understanding of power market economic, publicly-traded IPP, and merchant generation risk; (2) conversations with industry contacts; and (3) actual work on development projects in the PJM market. With the current development environment in PJM dominated by projects owned by private equity and development shops, these market participants have a wide range of COE targets—with ranges from 15% to 25% and higher in some cases. However, these same market participants are also facing a competitive merchant investment environment with investors hungry for yield. These higher COEs may only be achievable, on a competitive basis, at a lower D/E Ratio than that implied by the sample of development assets that we analyzed in this affidavit (and/or by utilizing higher cost mezzanine debt). As such, a reasonable *ceiling* on the COE parameter is around 20%.

[36] For the avoidance of doubt, it is outside the context of this affidavit for us to offer any opinions related to the study's use of CAPM analysis in the New York capacity parameter reset proceedings and rationale for using corporate-level vs. project-level financial metrics. We utilize these data points to simply compare and contrast filings and findings made within other ISO markets, in order to offer FERC context related to the PJM proposed Tariff revisions.

[37] 2013 NERA Study for New York, page 100.

continued

21. Based on the aforementioned observations, we find that 15% is at the low end of the zone of reasonableness for the COE parameter, and that 20% is at the high end of the zone of reasonableness for the COE parameter.

VII. Conclusion

22. PJM's proposed Tariff, based on the 2014 Brattle Study, underestimates the proposed ATWACC by 1 to 5.5 percentage points, after adjusting the D/E Ratio, COD, and COE parameters to reflect more appropriate and realistic values.

23. Based on the observations and parameter ranges outlined in the previous sections, we recalculated the ATWACC, assuming a 40% corporate tax rate in all cases. The lower end of our range results in an ATWACC of approximately 9% (~1 percentage point higher than the 2014 Brattle Study); the higher end of our range results in an ATWACC of approximately 13.5% (~5.5 percentage points higher than the 2014 Brattle Study). We suggest that the ATWACC range of 9% to 13.5% presents a more appropriate and realistic zone of reasonableness than PJM's proposed 8% ATWACC parameter. See Table 1.

Table 1: Summary of Assumptions and ATWACC

	Brattle	PA (Lower)	PA (Higher)
D/E Ratio	60% / 40%	55% / 45%	45% / 55%
Pre-Tax COD	7.0%	7.0%	9.0%
COE	13.8%	15.0%	20.0%
After-Tax WACC	**8%**	**9%**	**13.5%**

24. In summary, relying on corporate-level (i.e., Balance Sheet Financing Methodology) financial metrics to derive ATWACC parameters is inappropriate as it ignores the reality of current and on-going thermal new build generation development in PJM. The vast majority of new build generation development projects in PJM are being pursued by private equity and power generation development shops, and the developers of these projects rely almost exclusively on project-level finance. The underlying risk profile facing these investors, including construction risk and unsecure merchant cash flows, results in higher COE expectations as compared to other markets, such as ISO-NE, that offer the ability to lock in capacity revenues for seven (7) years.

25. In the most recent PJM RPM auctions (2016/17 and 2017/18 Base Residual Auctions), the market has seen over 10 GW of new generation capacity enter the market. However, a majority of these projects are seeking both debt and equity commitments based on a view that RPM pricing, and overall market compensation, will increase over the study period, so decreases in ATWACC (or having an ATWACC that is below market), could put these projects in jeopardy as well as prohibit further new build investment.

26. Our opinion based on the analysis outlined herein is that:

continued

a. The methodology put forth by PJM to determine ATWACC is not just and reasonable as it fails to capture the current risk profile of new build investment as well as the universe of potential investors.

b. By understating the reasonable range for the cost of funds that support the calculation of ATWACC, PJM is at risk of failing to provide the proper price signals to encourage new build investment and maintain electric reliability.

c. A reasonable range for CC and CT debt leverage is 45-55%, with CT technology likely coming at the lower end of the range.

d. A reasonable range for new CC and CT COE is 15-20%, with pure-play developers near the top of this range (or higher).

e. A reasonable range for CC and CT project-level pre-tax debt financing is 7-9%, with the range depending on specific project risk and debt leverage levels; moreover, the 7% debt financing rate is not reasonable under Brattle's proposed 60/40 D/E Ratio and utilizing the CT reference technology proposed by PJM.

f. A "zone of reasonableness" for ATWACC is 9% to 13.5% versus the 8% proposed by PJM in the Tariff.

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	)	Docket No. ER14-2940-000

AFFIDAVIT OF RYAN HARDY & MARK REPSHER

I, Ryan Hardy, being duly sworn, depose and say that the statements contained in the attached Affidavit of Ryan Hardy & Mark Repsher on behalf of PJM Power Providers are true and correct to the best of my knowledge, information and belief, and I hereby adopt said testimony as if given by me in formal hearing, under oath

Signed this 15th day of October 2014

Ryan Hardy

I, Mark Repsher, being duly sworn, depose and say that the statements contained in the attached Affidavit of Ryan Hardy & Mark Repsher on behalf of PJM Power Providers are true and correct to the best of my knowledge, information and belief, and I hereby adopt said testimony as if given by me in formal hearing, under oath

Signed this 15th day of October 2014

Mark Repsher

Subscribed and sworn to be before
This 15th day of October, 2014

Notary Public

My Commission Expires:

KAREN M. YENOVKIAN
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
November 25, 2016

continued

Ryan Hardy

Member of PA's Management Group

Ryan has over 14 years of experience in energy market advisory services to support strategic planning, generation asset financings, power company restructurings and reorganizations, and power and fuel contract litigation and negotiation support. Ryan has managed the valuation process for numerous asset transactions, including thermal (natural gas, coal), renewable (wind, solar, landfill gas, and biomass) capacity and utility scale battery storage. He has been a strategic advisor to both private equity and utility clients on acquisition strategies, and he is an expert on power market structures including capacity market constructs and their impact on asset values.

Primary expertise

- Power market advisory services
- Asset valuation
- Financial restructuring and due diligence
- Litigation support

Related experience

- Battery storage valuation
- Landfill gas valuation
- Formalized capacity market analysis

Qualifications

- MBA with concentration in finance
- Member of American Society of Appraisers
- Certified Appraiser, Machinery and Technical Specialty (2014 candidate)

Types of Clients

- Private Equity
- Generation Developers
- Independent Power Producers
- Foreign Investor Owned Utilities
- Investment Banks
- Investor Owned Utilities

Primary expertise

Power Market Advisory Services – Ryan possesses extensive experience in wholesale energy markets as it relates to market price forecasting, portfolio valuation, due diligence, and contract analysis.

Asset Valuation – Ryan has amassed extensive valuation experience with thermal and renewable asset types including coal, natural gas, hydro, geothermal, wind, solar, biomass, landfill gas, and battery storage.

Financial Restructuring and Due Diligence – Ryan has led fundamental analysis and forecasting efforts for two of the largest restructuring efforts in the energy industry including valuation, budgeting, and power and fuel contract renegotiations.

Litigation Support – Ryan has supported power and fuel contract dispute resolution through providing analysis and strategic guidance to regulatory bodies supporting stakeholders with capacity market development.

Key client achievements

Confidential Hedge Fund – served as project manager and trusted advisor to $3B hedge fund providing quarterly power market updates and serving as the analytic arm to this active participant in power market investments. Provided numerous case studies examining complex scenarios around transmission development, demand growth, renewable investment, and environmental legislation.

Investor Owned Utility – Retained by a major Southeast U.S. utility to provide market insights and articulate the investment climate of power markets outside of its native service territory as part of a corporate initiative to explore strategic asset acquisition opportunities. Analyzed power markets, including an analysis of major market players, typical contract structures, market operations, and environmental regulations. In addition, evaluated the potential acquisition of a major wind developer and our presentation provided supporting materials for the company's board of directors to approve the acquisition of a 100 MW biomass power generating facility.

Confidential – Served as the strategic advisor to a client seeking to develop over $2B in new power generation projects in New Jersey, Maryland, New York, and California, among others. Worked closely with members of management to provide analysis and strategic support for both equity and debt-raising efforts, and presented market and asset analysis to potential investors, investment banks, and rating agencies resulting in the successful development of natural gas-fired combined cycle projects.

Independent Power Producer – Retained to provide negotiation support for long term power contracts, asset analytics and strategic support for power plant acquisitions and financings. Key strategic support included detailed analysis of potential contract counterparties and in-depth analysis of cogeneration power facilities including

optimization analysis around the provision of power (energy and capacity), steam, and ancillary services.

Independent Power Producer – Retained as a strategic advisor by the management group of this IPP to help develop its growth strategy. In particular, developed a process to evaluate diversification options to the IPP's current power generating portfolio, as a means to reduce overall portfolio risk. As part of this process, conducted an independent review of the IPP's current power generating portfolio, performed an in-depth analysis of all U.S. power markets, identified areas for strategic growth, and ultimately highlighted specific generation technologies, markets, and specific assets that would complement the client's current portfolio, and presented multiple executive-level presentations for the client to formulate its growth platform.

Grid Storage Developer – Served as project manager for PA's engagement with a start-up firm to provide independent market analysis and insight in support of the client's development of utility scale battery storage technology. Provided a detailed description of U.S. power markets and analyzed the potential for the technology to earn energy, capacity, and ancillary services margins as both a standalone project and in conjunction with wind generation. Utilized a proprietary storage dispatch model to evaluate the technology and forecast returns and net present value under various market scenarios. Worked with the client to develop a presentation for use in discussions with potential partners such as utilities and wind developers.

Additional experience

Coalition for the Green Bank - From 2009-2010, Mr. Hardy assisted with the development of a coalition to develop a green bank at the federal level to fund renewables, transmission and distribution. The Coalition was formed in order to advocate and support an entity funded by the government that would provide financing opportunities for clean energy technologies. Ryan's work with the Coalition involved driving initiatives such as analysis and presentations used in discussions with members of Congress and other stakeholders, hosting and speaking at stakeholder conferences and meeting with Congressmen about the Green Bank and its goals. Through its work, the Coalition facilitated the inclusion of the Clean Energy Deployment Administration (CEDA)/Green Bank in the Waxman Markey bill that passed in the House of Representatives, which encompassed many of the goals of the Coalition.

Private Equity – In 2008, Ryan supported a private equity firm in performing a valuation on a portfolio of landfill gas generating assets in the state of New York. The valuation of the portfolio was conducted in support of a potential acquisition and included analysis related to energy, capacity, and renewable energy credit (REC) markets. Conducted an analysis of the contracts in the landfill gas portfolio, which included landfill gas procurement, REC contracts, and forward capacity contracts. In addition to providing a forecast of plant cash flows, submitted a market expert report to the client outlining the Northeast power markets and the portfolio's ability to sell into both the New York and New England markets. The explanation of risk factors and projected cash flows for the portfolio allowed the client to determine a suitable price under which they would complete the transaction.

Private Equity – In 2007, Ryan managed the auction process for the sale of the client's 50 MW peaking facility in ERCOT. Drafted information memorandum and acted as lead arranger in the two-stage auction resulting in the successful sale of the power plant.

Independent Power Producer – Over several years, Ryan led the fundamental valuation effort for an IPP's U.S. generating portfolio consisting of natural gas combined cycles, combustion turbines, cogen facilities, and geothermal plants. Conducted claims analysis for power and steam contracts for various facilities, and contributed to company's plan for reorganization.

Independent Power Producer – Litigation analysis involving the violation of EPA regulations. Project work included interpreting results of the client's independent production cost modeling and recreating forecasts using PA's applications. Results of this analysis were incorporated into expert testimony. Due diligence was performed on all company documentation and depositions regarding the violations. Additional analysis was done to prepare rebuttal of opposing side's testimony.

Mark Repsher — Managing Consultant

Mr. Repsher is an energy advisor with over 13 years of experience guiding clients through initiatives spanning strategic resource and environmental compliance planning (for utilities, cooperatives, and municipalities), divestitures of non-core assets to enhance shareholder return, mergers and acquisitions, restructurings and other litigation, off-take contract structuring and valuation, asset financing, identification of concrete value 'off-ramps' to realize investment returns for specific power assets, and best practice analyses. He has worked with and presented before various Boards, CEOs, CFOs, and executive management teams when delivering on the aforementioned initiatives. During his career, Mr. Repsher has extensively analyzed North American wholesale energy markets, with a focus on coal and environmental regulatory issues. He has performed extensive work with PA's proprietary multi-pollutant optimization model, analyzing market performance under varying environmental regimes (including SO_2, NOx, mercury, and greenhouse gas programs), optimizing plant retrofit timetables, developing allowance price forecasts, analyzing market entry/exit decisions and assessing market positioning.

Primary expertise

- Strategic resource and environmental compliance planning
- Asset and contract valuation/due diligence
- Mergers, acquisitions and divestitures
- Asset valuation
- Litigation support

Related experience

- Cooperative portfolio supply planning optimization
- Utility non-core asset divestiture
- Utility and cooperative environmental compliance planning
- Private equity acquisition support
- Independent power producer restructuring support

Qualifications

- B.A. in Economics

Types of Clients

- Electric Cooperatives
- Investor Owned Utilities
- Generation Developers
- Private Equity
- Investment Banks
- Environmental Protection Agency

Primary expertise

Asset and contract valuation/due diligence – Mark forecasts plant operating and gross margin performance, values power, fuel, transportation and storage contracts, validates company financial projections, and prepares forecasts for annual budgets.

Environmental modeling – Mark analyzes environmental portfolio impacts, develops allowance price forecasts, and calculates environmental exposure risk.

Coal asset modeling – Mark provides strategic planning guidance by analyzing plant performance under varying environmental regimes, optimizing plant retrofit timetables as well as market entry/exit decisions, assessing coal flows, and forecasting transportation costs.

Litigation support – Mark has supported numerous litigation assignments, including restructuring support, force majeure analysis and other contract disputes for energy, coal, natural gas and transportation agreements, including developing models and price indices to support these initiatives.

Key client achievements

Investment Bank – Retained by a group of clients considering refinancing a natural gas combined cycle asset, and sought an independent energy market expert to provide a market assessment and asset valuation. Evaluated the power market in which the asset is based, provided a baseline valuation of the asset, and prepared an independent energy market expert report for distribution to lenders and rating agencies. The client was able to successfully refinance the project.

Independent Power Producer/Developer – Retained by a client in the process of raising debt for repowering a natural gas facility and was in need of expert assistance in obtaining financing. Evaluated the power market in which

the asset operates, evaluated the asset using different economic scenarios, and prepared an independent energy market expert report. The client was able to successfully achieve financing for the project after previous unsuccessful attempts while working with different partners.

Developer – Retained by a North American developer to evaluate the cost-benefit to local ratepayers of a proposed natural gas-fired combined cycle facility that the company was developing in the Mid-Atlantic United States versus legacy coal-fired assets that the incumbent utility proposed to transfer into local rate base. Evaluated the relative economics of each of the assets (proposed combined cycle and legacy coal-fired assets) as well as the long-term risks and benefits (e.g., fuel risk, supply diversification, etc.) that each technology posed. Based on cost-benefit analysis and strategic guidance, the client was able to successfully file briefs before the state regulatory authority in support of the proposed project and to counter claims made by the incumbent utility.

Investor Owned Utility – Retained by a large investor owned utility that was seeking to reduce its merchant power generation exposure through the asset sale of two large coal facilities and a natural gas peaking generator located in New England and PJM. Supported the client by evaluating the current and projected state of the power markets in which the assets were located, providing market overview material for the sales memorandum, projecting operations and margins for both merchant and contracted capacity, and supporting the client and their financial advisors throughout the transaction process. The work allowed the client to successfully sell the assets in a timely fashion and at a favorable price, despite difficult market conditions for coal plant transactions.

Developer – Retained by a developer to support the development of an approximately 550 MW combined cycle power plant located in PJM. Analyzed the facility's access to natural gas and surrounding transmission infrastructure, projected the operations and gross margins of the facility, as well as prepared an independent market expert report. Support allowed the client to communicate the project's investment risks and benefits to potential equity and debt investors.

Developer – Retained by an developer to support the development of an approximately 1,200 MW combined cycle power plant located in the MAAC region of PJM. As part of work, analyzed the facility's access to natural gas and surrounding transmission infrastructure. In addition, projected the operations and gross margins of the facility, as well as prepared an independent market expert report. Through support the client was able to communicate the project's investment risks and benefits to potential equity and debt investors.

Developer – Developed rebuttal testimony and supported expert witness appearance before the Minnesota Public Utilities Commission, on behalf of thermal developer, regarding Xcel Energy's petition for Approval of Competitive Resource Acquisition Proposal and Certificate of Need. In addition to preparing rebuttal testimony, assisted the client and counsel with strategic analyses and demonstratives in support of direct testimony and cross examination of witnesses.

Private Equity/Hedge Fund – Engaged to provide buy-side support for a confidential private equity client that was considering the acquisition of a contracted natural gas-fired co-generation power plant interconnected with New York Zone J. Reviewed and critiqued sell-side models and reports, conducted an analysis of the Zone J electricity region, projected asset margins both during the multiple contracts and following expiration of the contracts, provided an estimate of asset value, and prepared an independent market expert report. Work helped the client understand and get comfortable with the risks and opportunities associated with the asset and ultimately led to successful acquisition and financing of the asset.

Investor Owned Utility – Retained by a Southwestern U.S. Investor Owned Utility to develop the fair market value related to the acquisition of a peaking facility under long-term contract. In addition to developing project fair market value, required to defend valuation in front of the contract counterparty as well as a third party arbitrator, including defending approach to the utilization of an alternative CAPM approach within a single asset transaction context.

Infrastructure Fund –Retained by an international institutional investor to support the sales process related to the divestment of natural gas- and coal-fired power assets located in FRCC, WECC, and PJM. As part of the sales process, evaluated the current and projected state of the power markets in which the assets were located, developed independent financial projections for the portfolio, which included merchant and contracted capacity, assisted in the development of a confidential information memorandum, produced an independent market expert report for distribution to bidders, and supported ad hoc requests by the management team to support the broader sales process.

Global Corporation –Retained by a global corporation to provide sell-side support for a portfolio of merchant natural gas and coal-fired power assets located in PJM. As part of the sales process, evaluated the current and projected state of the power markets in which the assets were located, developed independent financial projections for the merchant portfolio, produced an independent market expert report, and supported ad hoc requests from the management team.

Investor Owned Utility – Retained by an international investor owned utility to support the sales process related to the divestment of non-core coal-fired and natural gas-fired power assets located in the Mid-Atlantic and Midwest United States. As part of the sales process, analyzed coal supply and retrofit options for the coal-fired assets, developed independent financial projections for the portfolio, assisted in the development of a confidential information memorandum, produced an independent market expert report for distribution to bidders, and supported ad hoc requests by the management team to support the broader team throughout the sales process. In addition, led team analyzing and projecting future gross margins and asset performance for portfolio; assisted financial advisors in preparation of marketing material and participated in management presentations to prospective investors in the portfolio.

Private Equity – Retained by a global investment bank and a global private equity investor to provide strategic guidance and economic analysis related to a potential natural gas power generating asset investment opportunity in the U.S. As part of this effort, conducted energy market and physical/ financial asset analytics to project the earnings of the enterprise within the power markets; advised the investment banking and private equity teams on the economic risks inherent in the energy markets and specific to the assets; advised the investment bank's commodity team and private equity's contract team on structuring and pricing the financial hedges necessary to raise debt; advised the investment bank's lending team on the inherent risks and selling points regarding the energy markets and power generating asset investment; put forth the initial logic from which the private equity team could develop future investment enhancement and exit strategies within the dynamic energy markets; assisted the private equity team in communicating the market/asset analytic approach and investment risks to potential outside equity investors. The private equity firm ultimately won the bid to purchase the power generating assets, and I continued to support them in their process of raising debt, rating the bonds, structuring hedges, identifying an energy manager, etc. in the successful effort to close the sale.

International Investor – Mark assisted in the provision of strategic market insight and analysis in support of an investor’s consideration of the acquisition of a large wind portfolio including existing and development projects located across the U.S. as well as in Spain and the Netherlands. Mark assisted in the delivery of a presentation that included a market overview of the various regions and focused on the primary risk factors to consider when assessing the future earnings of wind power generating assets. As part of the analysis, Mark helped to analyze the opportunities and potential risks in contracting with local utilities in the regions for the output including the potential willingness to procure wind power under a PPA, projected renewable demand, projected opportunity cost, and exposure to additional renewable/environmental legislation, extreme commodity price movements, and other factors. Findings were presented to the client and included as part of their overall review of the investment opportunity.

Global Conglomerate – Mark assisted a Chinese energy conglomerate to develop its investment thesis surrounding the potential acquisition of a set of hydroelectric facilities located in the Southeastern United States. The analysis spanned multiple facets, including analyzing historical facility performance and other company provided documents, producing going forward production and financial projections, analyzing local and regional transmission constraints (including any value associated with the portfolio's own transmission system), and studying potential off-take opportunities with regional load serving entities. The client was able to utilize the analysis to develop its overall investment thesis, and ultimately a bid for the portfolio.

Infrastructure Fund – Mark assisted a global conglomerate analyze and develop an investment thesis for fifteen wind power generation assets in the U.S. Mark helped to advise the firm on political and regulatory, electricity market structure, and energy fundamental opportunities and risks. The firm was able to successfully close on the investment in the wind power generation assets.

Wind Developer – Mark assisted a wind developer looking to site a merchant wind facility in the SPP market that was in the process of evolving into a Day 2 market. Mark assisted the developer in better understanding congestion and curtailment risk, forecasting cash flow projections, and communicating with various potential co-investors.

Battery Storage Developer – Mark assisted in an analysis that summarized evolving market rules as they relate to battery storage technology, projected the energy and ancillary service market prices of several markets, and used PA’s suite of proprietary dispatch optimization models to project the margins and operations of the client’s battery storage technology. Initial analysis focused on the ERCOT and PJM regions, and also supported executive management in development and execution of a go-to market strategy for the technology.

Confidential – Mark assisted in litigation support for a case involving a coal commodity contract dispute. He helped in developing a new price index for determining contract prices, conducting a market review of contracts, performing data analysis and undertaking a market analysis for the client.

Confidential – Mark assisted in litigation support developing models to estimate commodity price indices and the cost to the producer of obtaining a new agreement in the wake of a supplier’s bankruptcy. Results were used to

estimate total damages incurred by the client.

Confidential – Mark forecasted Eastern and Midwestern coal movements under varying pricing and environmental scenarios for a Midwestern mining company. The results of these analyses were used to obtain new financing for the company.

Energy Information Administration – Mark conducted an extensive review of the U.S. Energy Information Administration's long-term market forecast for Powder River Basin coal. He analyzed future coal production and reserves, future coal transportation rates, the potential for siting new coal-fired plants near the PRB supply region, the ability of PRB coal to penetrate into new markets in the eastern United States, and SO_2 emissions and allowance prices.

Environmental Protection Agency – Mark developed optimal coal transportation routing and rates for use in the Environmental Protection Agency's (EPA) national multi-pollutant modeling system, forecasting long-term rail, barge and truck routing for all U.S. coal-fired generators, competitive status of these moves, and probability of new routes being utilized as generators shift coal use patterns. These inputs are used by the EPA when modeling the economic impacts of legislative proposals.

Confidential – Mark analyzed the economics of utilizing various coal supply sources for a coal-fired power plant, the likely commodity and transportation costs of this coal supply, as well as the economics of building a new rail spur to the plant in order to facilitate new coal supply sources. He developed a report and presentation, which was utilized by the client when approaching the state's regulatory board to approve construction of the new rail spur.

Confidential – Mark provided a coal market analysis for a client looking to invest in a Central Appalachian coal producer. As part of the analysis, he analyzed both short- and long-term trends in coal commodity markets, including production, demand, regulatory and import/export trends. In addition, he analyzed the effect of environmental concerns and power market dynamics as it related to likely demand for the target coal producer's product. The client utilized analysis to evaluate the economics of this potential investment, including the future demand for coal produced by the target company.

Confidential – Mark assisted a multinational mining company in its evaluation of the Southwest U.S. power and fuel markets, including regulatory structure and key market drivers. In particular, the analysis outlined the regulatory and market structure for various Southwest U.S. power markets, the relative competitiveness (current and future) of several target coal-fired facilities in the region, the timeline needed for new power generating facility permitting and construction in these markets, the environment for regulated owners to pass through cost of service changes, and, given these factors, the likely maximum coal commodity price that the client could charge the owners of these facilities. The analysis was utilized by the client to evaluate its equity stake in coal mining projects serving both existing and planned coal-fired projects.

Confidential – Mark assisted a Southwestern U.S. investor owned utility in the evaluation of its coal procurement activities. Mark reviewed corporate principles, procurement and logistics, analysis and reporting, contract administration, market optimization, and personnel organization, utilizing on- and off-site interviews, site visits and key company documents to facilitate the analysis. He compared these findings to industry best/leading practices, and delivered a presentation and detailed report outlining findings and areas for the company to implement improvements, including "quick win" changes.

Confidential – Mark assisted a client in developing going forward strategic options for two coal-fired facilities. The client was the target of potential New Source Review ("NSR") violations, and wanted to analyze how to optimize the value of the assets before signing a Consent Decree with the Environmental Protection Agency (EPA). Using market modeling software and market expertise, worked with the client to develop a series of market cases to stress test asset valuations, looking not only at possible Consent Decree options (including 'bubble' limits), but also how the viability of these options and asset values would be impacted by new EPA regulation of SO_2, NOx, hazardous air pollutants (including mercury), combustion ash disposal, and cooling water. Delivered detailed pro formas to the client, as well as a report and board presentation outlining the implications of the findings.

Confidential – Mark provided litigation support for a power company being sued by the EPA for potential NSR emissions violations, which, if successfully argued, would have forced the company to spend significant capital on environmental retrofits. Mark worked with the client's legal team to develop statistical analyses and expert witness testimony, which the client used to counter the government agency's claims.

Confidential – Mark analyzed an Independent Power Producer's extensive coal portfolio under varying environmental scenarios, optimizing long-term plant retrofits and coal burn, valuing coal supply and transportation contracts, and validating company financial projections. The analysis was used as part of the company's successful restructuring effort to emerge from bankruptcy.