BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of the Application of Union Electric Company for Authority To Continue the Transfer of Functional Control of Its Transmission System to the Midwest Independent Transmission System Operator, Inc.	))))))	Case No. EO-2011-0128

REBUTTAL TESTIMONY AND RESPONSE TO COMMISSION QUESTIONS OF

JAMES F. WILSON

ON BEHALF OF THE

MISSOURI JOINT MUNICIPAL ELECTRIC UTILITY COMMISSION

SEPTEMBER 14, 2011

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I. INTRODUCTION AND PURPOSE OF TESTIMONY

Q 1: Please state your name, position and business address.

A: My name is James F. Wilson. I am an economist and independent consultant doing business as Wilson Energy Economics. My business address is 4800 Hampden Lane Suite 200, Bethesda, MD 20814.

Q 2: Please describe your experience and qualifications.

A: I have over 25 years of consulting experience, primarily in the electric power and natural gas industries. Many of my assignments have pertained to the economic and policy issues arising from the interplay of competition and regulation in these industries, including restructuring policies, market design, market analysis and market power. Other recent engagements have involved resource adequacy and capacity markets, contract litigation and damages, forecasting and market evaluation, pipeline rate cases and evaluating allegations of market manipulation.

I have been involved in electricity restructuring and wholesale market design issues for over twenty years in PJM, New England, Ontario, California, Russia, and other regions. I have also been involved in issues of reliability planning, resource adequacy, and peak load forecasting, among many others.

With regard to the PJM system, I have been involved in a broad range of market design and resource planning issues over the past several years. Since PJM Interconnection, L.L.C. ("PJM") proposed the Reliability Pricing Model ("RPM") capacity construct in 2005 I have prepared numerous affidavits, reports, and analyses of RPM. I have also been involved in capacity market issues in New England, California, and other regions.

I have submitted affidavits and testified in Federal Energy Regulatory Commission and state regulatory proceedings. Prior to founding Wilson Energy Economics, my consulting career was with LECG, ICF Resources, Decision Focus Inc., and as an independent consultant. I have an M.S. degree in Engineering-Economic Systems from Stanford University and the A.B. degree from Oberlin College. My experience and qualifications, and a listing of past testimony, are included in my CV attached as Attachment JFW-1.

Q 3: On whose behalf are you appearing in this proceeding?

A: I am appearing on behalf of the Missouri Joint Municipal Electric Utility Commission ("MJMEUC").

Q 4: Please describe the scope and purpose of your testimony.

A: This proceeding addresses the application of Union Electric Company (d/b/a Ameren Missouri) to the Public Service Commission of the State of Missouri ("Commission") for authority to continue to transfer control of its transmission system to the Midwest Independent Transmission System Operator, Inc. ("MISO"). MISO has recently proposed an enhanced Resource Adequacy Requirement ("RAR") and new, mandatory capacity auctions ("MISO RAR Filing")[1] with similarities in purpose and structure to PJM's RPM capacity construct. I was asked by counsel for MJMEUC to discuss RPM's performance and its impact on PJM consumers; the likely performance of MISO's

[1] Midwest Independent Transmission System Operator, Inc. Filing to Enhance RAR By Incorporating Locational Capacity Market Mechanisms, FERC Docket No. ER11-4081, July 20, 2011.

construct, and whether it is likely to become more similar to RPM over time; and what this could mean for Ameren Missouri's customers if Ameren Missouri remains in MISO.

My testimony responds to Question 17 in the Commission's August 23, 2011 *Order Directing the Commission Staff to Respond to Questions from the Commission in its Prefiled Testimony*, which asked whether Ameren Missouri's continued membership in MISO could pose a detriment to any Missouri customers.

II. SUMMARY

Q 5: Please summarize your main points.

MISO's RAR and PJM's RPM pursue similar objectives, and many of the design elements are similar. There are also some significant differences that have the potential to avoid some of the adverse impact of RPM on consumers, however, these differences have not been approved by FERC and many of them may be rejected. MISO's construct is likely to turn out much more like RPM once it is approved by FERC, and also over time as stakeholders, especially generation asset owners, press for the provisions they value in RPM.

RPM has not performed as expected and intended, and it has imposed substantial cost on consumers without commensurate benefit. Under RPM, capacity auctions are held three years in advance of a delivery year, and this has been very costly to consumers while providing few identifiable benefits. RPM also sets capacity prices by zone, and this too has been very costly to consumers while failing to have the intended impact of attracting relatively more capacity to those zones where prices have been much higher. The mechanics of RPM create strong incentives for capacity sellers to economically or

physically withhold. While mitigation is imposed, there is substantial flexibility within the mitigation provisions. Due to anticipated environmental regulations that will require costly pollution control retrofits to some existing plants, the mitigation has essentially been eliminated for many coal plants, which resulted in a huge increase in the RPM price for the PJM RTO region in the most recent auction.

That RPM has not performed as expected and intended reflects a contradiction between the stated goals and expectations for the construct, and its design elements. Briefly, the vision was for a long-term market construct that would create stable price signals reflecting long-term supply and demand conditions and attract major new power plants. But the design is clearly for a capacity spot market, offering single-year commitments and setting prices that reflect supply and demand in a single year.

The view that RPM is a long-term construct persists despite auction results that consistently reflect its short-term, spot nature. The contradiction is reflected in current FERC policies for capacity markets and design elements that are in conflict with the fundamental structure of RPM, as I will further explain. The contradiction is also reflected in The Brattle Group's recent review of RPM ("Brattle 2011 RPM Review").[2] Consequently, there is little hope that RPM design and expectations will become better aligned anytime soon. RPM's complexity, many administrative parameters, and

[2] The Brattle Group, *Second Performance Assessment of PJM's Reliability Pricing Model*, August 26, 2011, available at http://www.pjm.com/~/media/committees-groups/committees/mrc/20110818/20110826-brattle-report-second-performance-assessment-of-pjm-reliability-pricing-model.ashx.

questionable results have caused it to be controversial and led to many stakeholder processes and regulatory proceedings addressing RPM issues.

MISO's description of its RAR construct reflects the same confusion between vision and design as reflected in the RPM design. The performance of the proposed construct is likely to also deviate from goals and expectations with costly impacts for consumers. In particular, the expressed hope that the proposed capacity auctions will be competitive and create meaningful price signals that will influence investment decisions is likely to be unfulfilled. Instead, similar to RPM, the construct is likely to set volatile price signals that balance short-term supply and demand while imposing unnecessary cost on consumers and largely failing to influence major capacity decisions. Thus, the Commission should be concerned about the performance of such a construct and its potential impact on consumers served by utilities participating in MISO.

Q 6: How is the remainder of your testimony organized?

A: The next section describes MISO's proposed RAR mechanism and capacity auctions, and PJM's RPM capacity construct. Section IV discusses RPM performance and the impacts it has had on capacity decisions, consumer cost, and PJM stakeholder processes. Section V discusses the prospects for MISO's capacity construct and why it is likely to become more like RPM over time. Section VI is a brief conclusion.

III. BACKGROUND: MISO'S RAR FILING AND PJM'S RPM CAPACITY CONSTRUCT

Q 7: Please describe MISO's proposed RAR and capacity auctions, as reflected in the recent FERC filing.

A: MISO proposes to establish Local Clearing Requirements (the amount of capacity located within a zone required for reliability) and hold mandatory auctions a few months before the start of each Planning Year to acquire the capacity. Market participants will be permitted to self supply resources and the auctions will clear the required residual amounts, if available. It is anticipated that seven zones will be defined. Market power mitigation will apply to capacity sellers and buyers, and MISO proposes that the auction price would be capped at the administrative, levelized Cost of New Entry ("CONE"). There is also an "opt out" provision.

Q 8: Please describe the main features of PJM's RPM capacity construct.

A: PJM's RPM construct also begins with locational capacity requirements, and also involves mandatory auctions to clear residual needs. The number of zones has changed year to year but is comparable to the number in MISO's proposal. However, PJM holds the mandatory auctions three years before each Planning Year (or Delivery Year in PJM parlance) and uses a "sloped" capacity demand curve capped at 150% of Net CONE (the cost of new entry net of an estimate of earnings from energy and ancillary services markets). The seller market power mitigation in PJM is at least nominally more stringent than MISO proposes, imposing must-offer requirements and offer caps based on net avoided cost on most existing resources. RPM also includes a Minimum Offer Price Rule designed to prevent new entry deemed uneconomic.

Q 9: Please summarize the most important differences between MISO's proposal and RPM.

A: I consider the most important differences between RPM and what MISO has proposed to be the following:

1. MISO proposes to hold the mandatory auctions a few months before the Planning Year; under RPM, the mandatory auctions are held three years ahead.
2. MISO proposes to clear supply in the auctions against a fixed Planning Reserve Margin Requirement while respecting Local Clearing Requirements and transmission constraints, with the prices in all zones capped at CONE; RPM employs sloped demand curves that can clear a larger quantity at relatively low prices or a smaller quantity if sufficient supply is only available at higher prices.
3. MISO proposes to allow load-serving entities to opt out of the auctions for one year at a time and for partial amounts of their Planning Reserve Margin Requirements; under RPM, the opt-out provision requires a five year commitment and has various other restrictive provisions (it has only been used by one market participant to date).
4. MISO's minimum offer price rule would apply only if the market monitor "concludes that the new resources is attempting to improperly depress" auction clearing prices,[3] and is otherwise more restricted in its application than PJM's analogous rule.
5. RPM appears to have tighter seller market power mitigation than MISO has proposed.

Q 10: In light of these differences, how is RPM performance relevant to the Commission's deliberations in this proceeding?

A: As noted in my summary and further discussed below, RPM's provisions have all been approved by FERC, while some of the elements proposed by MISO have never been approved by FERC. In addition, most of the elements in MISO's proposal that differ from RPM have been vigorously opposed by some market participants. Consequently,

the Commission should be concerned that MISO's construct may look more like RPM over time, and have impacts on MISO consumers similar to RPM's impacts on PJM consumers.

IV. RPM PERFORMANCE AND PROCESS

A. Performance of PJM's RPM Capacity Construct

Q 11: Please describe the role RPM was intended to play in PJM's wholesale markets and how it was expected to perform.

A: RPM was intended to be a mechanism that would, among other things, determine when and where new power plants would be built. It was expected to set stable price signals reflecting the need for new entry by location, and these price signals were expected to attract an efficient mix of existing and new resources, including demand response and transmission.

The proponents of RPM predicted that new power plants would compete with offers into RPM's auctions at prices based on their levelized cost of construction net of anticipated energy and ancillary services market earnings. This competition was expected to result in a relatively "flat" supply curve at prices close to such "Net CONE" values, leading to stable prices over time and weak incentives to withhold capacity from the auctions. It was expected that the new power plants that cleared in RPM auctions would be built while those that offered at too high a price and failed to clear would not.

[3] MISO RAR Filing proposed tariff language (Tab A), Section 65.7.2.d.

It was believed that the locational auction clearing prices would guide new entry to those zones where it was most needed, and that when the auction clearing prices rose to Net CONE there would be new entry.

Q 12: Has RPM performance been as expected and intended?

A: No. Rather than stable, RPM prices have been highly volatile. Exhibit JFW-1, from PJM's report on the most recent auction, shows the pattern of RPM prices in the PJM RTO region and zones over the eight base residual auctions held to date. Prices have varied widely, even in the large RTO zone, and in no zone has the price moved in the same direction three years in a row.

It has been seen that new power plants are generally not offered at prices based on their levelized cost ("Net CONE"),[4] in fact there is little supply offered at prices within a wide range around auction clearing prices. This helps to explain the "steep" supply curves, shown in Exhibit JFW-2 for the RTO Region (supply curves for zones are even steeper). As Exhibit JFW-2 shows, there is very little supply offered at prices above roughly $80/MW-day.

The steep supply curves result in prices being highly sensitivity to small changes in supply, demand, or the various administrative parameters used in RPM, leading to price

[4] See, for instance, Brattle 2011 RPM Review p. 149 ("In fact, the wide range of offer prices for new generation observed in RPM auctions over the last few years suggests the existence of a large range of cost structures, market outlooks, and bidding strategies."); or p. 93 ("However, natural-gas fired generation projects have similarly submitted offers at a large range of prices, both above and well below Net CONE. Some individual units have even offered sections of their capacity over a large range of prices. Although we do not know the ultimate cost- or non-cost justification behind the wide range of bids for new natural gas units, offers seem to reflect a wide range of different bidding, hedging, and market-timing strategies.")

volatility. The administrative parameters have been especially changeable and explain much of the year to year volatility of RPM prices.

While there have been large locational price differences, these have not led to relatively more incremental capacity being offered or cleared in the zones with the high prices. This is summarized in Exhibit JFW-3, which compares incremental and decremental capacity in the large, competitive, and relatively low-priced Rest of RTO region to the Mid Atlantic ("MAAC") and Eastern Mid Atlantic ("EMAAC") zones where prices have been considerably higher (as can be seen in Exhibit JFW-1). Exhibit JFW-3 shows that in Rest of RTO there has been relatively more offered demand response and energy efficiency, generation uprates, new generation units, and net imports, and relatively less retirement. There is also relatively more planned generation for future delivery years.[5]

Q 13: Can you give some sense of how RPM prices and costs are very sensitive to RPM supply, demand, and administrative parameters, resulting in price volatility?

A: Yes. PJM provides sensitivity analyses requested by stakeholders around the results of each base residual auction. The most recent available sensitivity analysis, for the 2013/2014 delivery year, shows that an additional 1,000 MW of low-cost supply (or 1,000 MW lower capacity demand) in the Mid Atlantic zone would have lowered the clearing price by over $60/MW-day, from $226.15/MW-day to $165.44/MW-day.[6]

[5] A more detailed discussion of RPM performance is included in Wilson, James F., *Comments And Responses To Questions On Behalf Of Southern Maryland Electric Cooperative*, October 1, 2010, Maryland PSC Administrative Docket No. PC22, available at http://webapp.psc.state.md.us/Intranet/AdminDocket/NewIndex3_VOpenFile.cfm?ServerFilePath=C%3A%5CAdminDocket%5CPublicConferences%5CPC22%5C36%2Epdf.

[6] PJM, *RPM Scenario Analysis Results* posted September 14, 2010, available at http://www.pjm.com/markets-and-operations/rpm/~/media/markets-ops/rpm/rpm-auction-info/scenario-analysis-results.ashx.

reducing capacity cost by over $1.5 billion. 1,000 MW is only 1.4% of the reliability requirement for this region. Put another way, a 1% change in the Mid Atlantic capacity demand or supply raises the RPM clearing price about 20%, and raises capacity cost by roughly $1 billion.

Q 14: Why has RPM performance not been as expected and intended?

A: There was never sound economic logic behind the hope that RPM, clearly designed as a capacity spot market offering one-year commitments, would drive decisions regarding power plants with useful lives of 20 years or longer. Nor was there sound economic logic behind the hope that new power plants would be offered at prices based on Net CONE.[7]

The mismatch between expectations and reality reflects the misguided hope that RPM would perform like a long-term market (as it might have if, for instance, it offered ten year or longer commitments), while its design is limited to demand, supply, price and commitments for a single year.

Q 15: What is the significance of the mismatch between the expectations for RPM and its design?

A: The contradiction between vision and design has led to design elements that raise the cost to consumers while failing to accomplish their intended purpose, or doing so very inefficiently; as a result, RPM has been unnecessarily costly to consumers. For instance, part of the hope that RPM would serve as a long-term market mechanism apparently rests on holding the auctions three years in advance of a delivery year. But this feature has

[7] For a more detailed discussion of the conceptual flaws underlying current capacity market designs see Wilson, James F., *Forward Capacity Market CONEfusion*, Electricity Journal Volume 23 Issue 9, November, 2010.

been very costly without commensurate benefit.[8] In addition, RPM has resulted in some locational prices much higher than prices in other zones, but this has not attracted relatively more capacity, as noted above. As a result, the strong "price signals" imposed high costs on consumers without much impact or benefit.

Q 16: Please explain why holding the auctions three years forward has been costly to PJM consumers.

A: There are a number of reasons why holding the auctions years before a planning year results in higher capacity prices.

1. Inaccuracy and conservatism in administrative parameters such as load forecasts, transmission capacities, and local clearing requirements contribute to higher requirements and higher auction clearing prices. In PJM, errors in the load forecasts have been the main cause of excessive prices in recent years.
2. Many resources are unable or unwilling to participate in an auction held so far in advance, reducing participation in the auction and raising prices. For an older plant that may encounter performance problems and may be retired, a three year forward auction is risky. Many of the new demand response opportunities that will become available for a delivery year have not been identified three years in advance and, accordingly, are not offered into the auction (in PJM, this is recognized to some extent by deferring some capacity purchases to later "incremental" auctions).
3. In addition, market power mitigation imposed years in advance is necessarily more flexible than it would be if imposed closer to the delivery year; for instance, sellers are allowed to assume higher outage rates, leading to a lower offer quantity. This results in broader scope for withholding in a three year forward auction.

[8] Further discussion of the impact of the three year forward aspect is included in Wilson, James F., *Comments And Responses To Questions On Behalf Of Southern Maryland Electric Cooperative*, October 1, 2010, Maryland PSC Administrative Docket No. PC22, p. 13.

Q 17: Why have higher capacity prices in some zones not resulted in relatively more incremental capacity in those zones?

A: I have identified three reasons for the seemingly paradoxical result that market participants are offering relatively more incremental (and less decremental) capacity in the Rest of RTO region where prices are relatively low than in PJM's zones where prices have been so much higher. First, market participants are apparently not finding RPM's zonal prices and price differentials to be credible and are largely ignoring them. They are set for a single year at a time and are highly changeable. Market participants know that new transmission capacity, new generation, and changes to RPM rules can reduce or eliminate locational price differentials. Second, while other market participants may be ignoring RPM's zonal price signals, the owners of portfolios of capacity located in the zones and earning the high prices know that offering incremental capacity there will depress the prices, resulting in a disincentive to provide additional capacity and an incentive to withhold capacity. Finally, it is also true that the zones tend to be relatively developed areas where it can be more difficult to locate suitable sites and gain all regulatory approvals for new capacity. In addition, the best sites may be the locations of existing power plants whose owners face disincentives to expand capacity.

Q 18: You state that RPM is essentially a capacity spot market. How has it performed in that regard?

A: Other than setting unnecessarily high prices, RPM has performed well as a capacity spot market. It has cleared sufficient resources on a year-by-year basis, including incremental resources, to satisfy reliability objectives. In light of the fact that RPM, as a capacity spot market, offers single-year commitments, it has mainly attracted various low-investment, relatively short-lead time incremental resources such as demand response, upgrades to

existing plants, deferred retirements, or incremental imports; resources whose decisions can be influenced by a one-year commitment and capacity price. Over 80% of the incremental resources cleared in RPM's eight base residual auctions held to date have been resources of this type (as summarized in Exhibit JFW-4).

Q 19: You state that RPM has not attracted major new power plants. Why not?

A: Sponsors of major new power plants require greater assurance of future revenues than RPM's one-year commitments provide.

Q 20: Can RPM be changed to play a more effective role in attracting major new power plants?

A: I do not believe it can. While there have been efforts to find a way to offer a multi-year price assurance through RPM (the New Entry Pricing Rule, or NEPA), this would be unlikely to result in a useful change to RPM, which by its fundamental design is a capacity spot market. The Brattle 2011 RPM Review also opposes such efforts, concluding that NEPA would not provide an efficient solution to the problem (p. 156).

Recently, PJM has proposed to hold voluntary auctions for longer-term capacity commitments, separate from the RPM auctions. However, market participants already have the ability to enter into bilateral capacity deals if they can find willing counterparties, so it is doubtful that voluntary centralized auctions for long-term capacity would attract much participation.

Q 21: The recent review of RPM performance by The Brattle Group states that RPM is "performing well." Do you disagree?

A: Yes. The review focused on capacity adequacy; the megawatts. There has been adequate capacity in PJM, so in that regard RPM has accomplished its role. This is the basis for

The Brattle Group's conclusion. The Brattle 2011 RPM Review did not discuss or assess whether adequacy has been accomplished in a cost-effective manner.

Indeed, the Brattle 2011 RPM Review criticized a number of the administrative parameters used in RPM that determine auction clearing prices, including load forecasts and transmission estimates, that have raised prices substantially.

Q 22: You stated that RPM prices were excessive. Did The Brattle Group claim otherwise?

A: Yes, the Brattle 2011 RPM claimed that stakeholders' concerns that RPM prices had been too high were "contradicted by evidence available to date" (p. i). The report found that RPM prices and price changes were consistent with "market fundamentals", RPM's administrative parameters, and changes in market design (p. 159). But this amounts to nothing more than the superficial observation that RPM prices were set based on the intersection of the RPM supply curves and the RPM capacity demand curves used in the auctions. Such prices are only as good as those supply and demand curves. The Brattle Group was critical of many of the administrative determinations behind the demand curve and made numerous recommendations.

The conclusion that prices were not too high ignores the errors and flaws in the administrative parameters. It also fails to evaluate whether the supply curves reflected all available supply offered at competitive prices. The Brattle 2011 RPM Review did not discuss any details of RPM's seller market power mitigation measures, despite concerns raised by stakeholders in this regard.

Q 23: You stated that RPM's three-year-forward characteristic has been very costly to consumers in PJM without commensurate benefit. Did The Brattle Group conclude otherwise?

A: No. The Brattle Group did not evaluate the three-year-forward characteristic as part of its performance evaluation.

Q 24: You stated that RPM prices were excessive due, among other causes, to very large load forecast errors. Did The Brattle Group conclude otherwise?

No; the Brattle 2011 RPM Review did not perform such evaluation. The report did not compare the auction clearing prices to the prices that would have obtained had the load forecasts (which stakeholders have criticized as too high for three years now), transmission estimates, and other parameters been more accurate. On this basis, the auction clearing prices have been quite excessive, due, among other causes, to enormous errors in the three year forward load forecasts (which were over five percent too high for the 2009, 2010 and 2011 delivery years[9]).

Q 25: You stated that RPM's locational pricing has not attracted relatively more capacity to those zones where capacity prices have rather consistently been much higher. Did The Brattle Group conclude otherwise?

A: No. While the data included in The Brattle Group's report illustrate this (for instance, the data in Table 11 on p. 445), the Brattle 2011 RPM Review did not discuss or evaluate whether higher prices in zones attracted relatively more incremental capacity than did other, lower-priced zones. The report simply observed that capacity has been adequate in all zones.

Q 26: You stated that RPM's prices are likely to remain volatile. Did The Brattle Group conclude otherwise?

[9] See PJM load forecast reports, from 2007 through 2011, Table B-1, available at http://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx.

A: No. The report discussed changes to RPM to make clearing prices less volatile, but recommended against such changes, noting (correctly, in my opinion) the importance of auction prices reflecting supply and demand conditions. The report also recommended changes to the processes for some administrative parameters that could moderate the impact of changes in such parameters on price volatility to some extent.

Q 27: You stated that RPM's prices remain volatile largely because the auction supply curves remain "steep" in the vicinity of the clearing prices (as Exhibit JFW-2 showed). Did The Brattle Group state otherwise?

A: Yes. The Brattle 2011 RPM Review claims that the supply curves have become "flatter" and more "gradual" (p. 22) over time.

Q 28: What are the facts with respect to supply curves in PJM's zones; are they getting more gradual or not?

A: The supply curves are not becoming more gradual. While some "flattening" of the supply curve for the RTO region appears in the most recent auction (as shown in Exhibit JFW-2), this resulted from sellers offering existing plants at much higher prices to reflect anticipated costs of compliance with new environmental rules.

With respect to the Mid Atlantic and other zones, The Brattle 2011 RPM Review provided no data to support a claim of more gradual supply curves over time, and the available evidence (from PJM's sensitivity analyses, for instance) suggests that the supply curves remain very steep, with little change year to year in the relevant portion of the curves (with prices in a broad range around clearing prices).

Q 29: New environmental rules will require many coal-fired power plants to install pollution control retrofits, retire or convert to another fuel. Does the RPM construct assist the owners of such plants in these difficult decisions?

A: No. It is expected that the owners of larger, newer coal plants will invest in the upgrades, while many smaller and older plants will retire. Owners of plants that fall between these extremes may face a difficult decision. The decision to invest in costly environmental upgrades must be made based on the longer-term economics of a plant, as such investments can only make sense in anticipation of many additional years of operation. Capacity constructs that award capacity commitments and payments for only one year at a time (as RPM does, and as MISO's construct is proposed to do), whether the awards are two months forward (as MISO proposes) or three years forward (as under RPM), provide input that is of very limited value in making such long-term decisions.

Q 30: You stated that the anticipated environmental rules have essentially eliminated the market power mitigation in the PJM Rest of RTO region. Please elaborate.

A: RPM allows owners of existing plants who state that they plan major investments to include an amortized amount of the investment in their mitigated RPM offer price caps, which are otherwise based on net avoided cost. These amortized amounts are often very large and result in the owners of such plants essentially being allowed to offer at any price up to a very high cap. The ownership of generation is fairly concentrated in PJM, and especially the owners of large portfolios will find it attractive to take advantage of the opportunity to economically withhold some capacity under these rules. By contrast, the owner of a single plant would never include the amortized amount of plant investment in its offer price if that would cause it to fail to clear and, as a result, receive no capacity payment or fixed cost recovery.[10]

[10] A more detailed discussion of RPM's provision for allowing sellers to include plant investment in their capacity offer prices and how this likely would be used to withhold capacity is found in Wilson, James F., *Supplemental*

Q 31: You state that RPM's one-year commitments cannot play much of a role in decisions about major environmental upgrades. Did The Brattle Group conclude otherwise?

A: The Brattle Group vaguely suggested (p. i) that RPM "facilitated decisions regarding the economic tradeoffs between investment in environmental retrofits on aging coal plants or their retirement." However, there was no discussion of the difficult decisions faced by the owners of such plants, and the fact that RPM does not provide much help with these multi-year decisions, as described above. Nor was there any discussion of the fact that RPM's rules, which allow owners facing such investments to substantially raise their RPM offer prices, essentially eliminate the market power mitigation provisions.

The lack of any discussion of this important issue was surprising, because The Brattle Group's 2008 report on RPM did include such a discussion.[11] In that earlier report, The Brattle Group acknowledged the multi-year nature of decisions regarding major plant investments. That report also recognized that once an owner has decided to make such an investment it is a sunk cost and would generally not be reflected in a competitive offer price into RPM, so it may not be appropriate to allow offer prices to be raised based on an amortized amount of the investment.

Affidavit in Support of Answer of the RPM Buyers, July 28, 2008, *Maryland Public Service Commission et al v. PJM Interconnection, L.L.C.*, FERC Docket No. EL08-67-000, p. 18.

[11] The Brattle Group, *Review of PJM's Reliability Pricing Model (RPM)*, June 30, 2008, pp. 110-115, available at http://www.pjm.com/markets-and-operations/rpm/~/media/documents/ferc/2008-filings/20080630-er05-1410-000.ashx

B. RPM Stakeholder Processes and Regulatory Proceedings

Q 32: In your Summary you mentioned that RPM has also had an impact on stakeholders through an increase in stakeholder processes and regulatory proceedings. Please elaborate.

A: There has been a large number of PJM stakeholder meetings, FERC technical conferences and regulatory proceedings (both Section 205 and 206), and state-level proceedings pertaining to RPM's performance and its many rules and administrative parameters since RPM was proposed in August 2005. Twenty meetings of the Markets and Reliability Committee focused exclusively on RPM will be held during the twenty-week period from June 28, 2011 to November 2, 2011, of which several will be all-day meetings; and RPM issues also arise in other stakeholder meetings and before higher-level committees. Stakeholders actively participate in these processes and proceedings to protect or promote their interests with respect to RPM. The meetings addressing RPM tend to be well-attended.

Q 33: Why are there so many stakeholder processes and regulatory proceedings pertaining to RPM?

A: The level of activity around RPM results from its high cost and questionable performance; the high sensitivity of its prices to nearly all of its rules and parameters; and its many controversial implementation details.

RPM is a highly complex mechanism involving many rules and parameters. Due to the "steep" supply and demand curves, small details in the rules and parameters can have a large impact on RPM clearing prices, as described earlier. Stakeholders recognize that these details can have a large impact on capacity prices, revenues and costs and,

therefore, many engage actively to attempt to influence how these parameters are set in a manner consistent with their interests.

Q 34: Is there broad and balanced representation of stakeholder interests in these stakeholder processes and regulatory proceedings?

A: In my opinion, no, the participation has been broad but not very balanced. The results of these proceedings can have a very large impact on capacity prices and revenues with little or no impact on the cost to provide capacity, so incremental RPM revenues are almost entirely profit for capacity sellers. Therefore, owners of generation assets have much at stake in these processes and apply substantial resources. By contrast, the interests of consumers (the parties who are directly affected if resource adequacy is not achieved, but who also must bear the cost of it), are typically less well represented.

Q 35: What are some of the RPM features and parameters over which stakeholders have struggled in recent years?

A: The two main parameters of RPM's capacity demand curves are the reliability requirement and Net CONE. Stakeholders have repeated addressed many details of the Net CONE calculation, including the many cost inputs to the CONE calculation and financial assumptions such as whether real or nominal levelization should be used, among many other details. Stakeholders have also repeated addressed many details of the Energy and Ancillary Services Offset and Net CONE calculation, including whether a historical or forward-looking E&AS Offset should be used, and for which locations in PJM the E&AS Offset should be calculated, among many other details. Stakeholders have also addressed the inputs and assumptions to the reliability requirements calculations, including PJM's load forecasting methodology, the applicable resource adequacy criterion, and many details of the modeling to determine reliability

requirements. Stakeholders have also addressed many details of the seller market power mitigation, including the outage rates to use, details of avoided-cost offer caps, and the flexibility to include investment costs in the offer caps, among many other details. The manner in which demand response participates in the capacity market has also been a nearly constant subject of one or more stakeholder processes, with generation owners generally hostile to this resource which has a moderating impact on capacity prices.

Q 36: RPM was implemented through a settlement. While many aspects of RPM have been the subject of stakeholder processes and disputes, are the elements of RPM that were broadly supported by stakeholders under the settlement protected from further changes?

A: Apparently not. The primary example pertains to RPM's Minimum Offer Price Rule. The details of this rule were an important part of the negotiated settlement. However, through a rather rapid FERC proceeding last spring, the existing rule was eliminated and replaced by a new rule that has a different, much broader objective and entirely different details than stakeholders had agreed under the earlier settlement.

V. PROSPECTS FOR MISO'S RAR CONSTRUCT AND CAPACITY AUCTIONS

Q 37: You explained that RPM prices have been and likely will continue to be volatile. Based on MISO's filing, do you expect capacity prices in MISO will also be volatile?

A: Yes, I would expect capacity prices in MISO to be volatile. In years when there is substantial excess capacity in some zones, sellers may have to offer at prices close to going-forward cost to clear and receive a capacity payment. Under such circumstances prices should be fairly low and reflect rather competitive circumstances.

However, shortage situations in zones may occur simply because the supply available is a few megawatts short of the Local Clearing Requirement, resulting in prices at the price

cap. Or, capacity sellers may find it profitable to attempt to physically or economically withhold some capacity from the auctions to create a shortage situation so that a seller's other capacity in the auction can earn the price cap.

I would expect prices to be volatile between these two states – going forward cost of existing capacity, or the price cap – and to rarely clear at prices between these levels, because the auction is proposed to clear a fixed quantity (no sloped demand curve), and, as in PJM, there are likely to be very few capacity offers at prices between these levels.

Q 38: What level of price cap will be applied in the auctions?

A: MISO proposes to set the auction price cap at the administrative Cost of New Entry ("CONE") value. However, I would not be surprised if FERC approves a higher price cap, consistent with policies in other markets (such as ISO New England, whose capacity construct also employs a fixed requirement or "vertical" demand curve, and where the maximum auction price has been set at twice CONE).

Q 39: What level of participation would you expect in the proposed auctions?

A: Based on MISO's filing, I would expect participation to be low, as market participants, especially load-serving entities, will prefer to arrange self-supply and bilateral deals rather than take chances on what is likely to be a volatile auction vulnerable to some exercise of market power by capacity sellers.

Q 40: If MISO zonal capacity prices are volatile, what impact might this have on entities whose loads and resources may be located in different zones?

A: Volatile zonal capacity prices would expose entities with resources and load in different zones to the risk of very high Zonal Deliverability Charges, which reflect zonal price differences, unless they are able to hedge the risk. Volatile zonal capacity prices could

create an inefficient incentive to attempt to locate resources near loads when it might otherwise be less costly to locate them elsewhere.

Q 41: Do you expect there will be incentives to physically or economically withhold from the capacity auctions proposed by MISO?

A: Yes. Because the supply curves are likely to be steep and the demand curves are proposed to be vertical, small changes in offered supply will be able to have a large impact on price. Capacity sellers will face incentives to offer less rather than more capacity, and to offer at least some of the capacity at higher prices, to attempt to raise the clearing price and maximize the chance of a shortage clearing situation.

Q 42: Do you expect that capacity sellers will have some flexibility to physically or economically withhold from the capacity auctions proposed by MISO?

A: Yes. Mitigation of physical and economic withholding is always highly imperfect, as the rules must afford asset owners reasonable flexibility to manage their assets, and the information available to the market monitor about unit capability and cost will always be incomplete and imperfect. The mitigation proposed by MISO is much looser than the mitigation under RPM, and would appear to afford owners substantial flexibility.

Q 43: Please summarize the apparent flexibility for some physical or economic withholding from the proposed MISO capacity auctions.

A: First, there is a 50 MW threshold for physical withholding, suggesting that each market participant is free to withhold this quantity at their election. The amount of capacity available from a unit depends upon its nominal rating and outage rate; the owner will have some control over these parameters and the market monitor is unlikely to be able to challenge these values. Capacity can also be withheld by exporting it, and the proposed tariff language (section 63.3.a.i) states that exporting resources “may warrant mitigation”

only if the price of such export transaction is less than 50 percent of the auction clearing price.

Q 44: You stated that RPM allows capacity sellers to substantially raise their capacity offer prices to reflect an amortized amount of the cost of potential environmental upgrades, and that this essentially eliminated the mitigation for many sellers. Do you expect that sellers of capacity into MISO's markets will also be allowed to raise their offer prices on this basis?

A: Yes, I expect that MISO and its market monitor will also have to allow this flexibility, and, as a result, there will likely not be effective market power mitigation in some zones.

Q 45: Are there other ways capacity sellers may attempt to influence MISO capacity prices, other than physical and economic withholding of their assets?

A: Yes. Capacity sellers will also have incentives to attempt to erect barriers to entry into this market. The recent MOPR proceeding in RPM is an example; the effort to impose minimum offer prices on new resources to prevent entry deemed "uneconomic" was spearheaded by the owners of existing assets. Another example is the multi-faceted opposition by generation asset owners to demand response participation in the PJM capacity market.

In addition, transmission owners that also own or are affiliated with generation in a zone will know that expanding transmission capacity into the zone would moderate capacity prices or even eliminate the zone. Therefore, such transmission owners will face a disincentive to expand transmission into any such zone.

Q 46: Would you expect the implementation of the capacity auction to have an impact on bilateral markets for capacity in MISO?

A: Yes. Market participants in PJM state that there was an active market for bilateral capacity deals in PJM prior to RPM implementation, that has all but disappeared since.[12] I would expect the implementation of the RAR and mandatory capacity auctions in MISO would have a negative impact on bilateral markets in MISO.

Q 47: In its RAR filing MISO suggests that it has proposed a "robust and effective" (p. 7) and "vibrant and competitive" market mechanism (p. 12), that will create a "liquid and robust" auction process (p. 8) and establish "competitive capacity prices" (p. 12). In an attached affidavit, MISO's witness Todd P. Hillman suggests that the proposed auctions will provide "an efficient and transparent market mechanism" that will "send more accurate and transparent market signals" (p. 14). Do you expect the auctions will have these characteristics?

A: No. As described above, I expect participation will be low, and auction prices will be volatile between the two extremes of the going forward cost of existing resources and the applicable, administrative price cap. I would not expect the auctions to be liquid, robust, or vibrant, and I would expect that the resulting prices would often not reflect competition.

Q 48: MISO suggests that its proposed mechanism will "encourage the development of Planning Resources in the locations where they are most needed" (p. 7), providing "location specific financial information for investment in new Planning Resources (p. 12) and "focused market signals on the cost of capacity" (p. 10). In an attached affidavit, MISO's witness Clair J. Moeller suggests that the auctions will create "transparent market signals" that will "allow Market Participants to make informed decisions on where to site new Planning Resources" (p. 9). Do you expect the auction prices will fulfill these functions?

A: No. As was seen in PJM, market participants apparently largely discount and ignore highly volatile capacity market prices. In PJM, market participants have not responded to

[12] Statement of Patrick McCullar on Behalf of the Delaware Municipal Electric Corporation and the American Public Power Association, FERC technical conference held July 28, 2011, Docket No. ER11-2875.

them and brought relatively more incremental capacity to those zones where prices were much higher, as I explained earlier. I would expect that MISO's construct, as a capacity spot market, will mainly influence low-investment and short lead-time decisions to provide incremental capacity for a single delivery year, as RPM has done.

Q 49: MISO's witness Richard Doying states (p. 3) that MISO's filing will establish "appropriate locational capacity market mechanisms to encourage the proper mixture of Planning Resources (e.g., Capacity Resources, Demand Resources, Behind the Meter Generation, Energy Efficiency Resources) to be available in the right locations in the MISO Region during the right times, in the most economic and efficient manner." Do you agree that MISO's filing will essentially accomplish least-cost integrated resource planning for the MISO region?

A: No, it will not accomplish this at all. This statement reflects the same confusion that I described with respect to RPM – hopes for performance like a long-term market or planning mechanism, despite design of a one-year spot market. A capacity spot market cannot direct efficient choices among resources with useful lives of 20 years or longer, resources that have various attributes (such as fuel and fuel flexibility, environmental characteristics, operating characteristics) that are not considered or priced within the spot capacity market mechanism. Instead, market participants will determine which resources will be built based on their long-term analyses that consider all attributes of candidate resources, as they have in the past. A capacity spot market will only determine which available resources the system will rely on in the upcoming summer to meet reliability objectives, influencing only short-term choices, for instance, to retire or not retire a plant.

Q 50: You described how RPM stakeholders have struggled over many details and parameters over time. Do you expect that MISO stakeholders will also likely be motivated to struggle over such details?

A: Yes. The extended discussions leading up to MISO's application may be indicative. In particular, the ways in which MISO's construct differs from other FERC-approved capacity constructs such as RPM are likely to attract continuing attention.

Q 51: You stated in your summary that there are reasons to expect MISO's capacity construct will become more like RPM over time. Please elaborate.

A: FERC is likely to reject some of the proposed elements and provide guidance that would move MISO's construct in the direction of the approaches it has approved for other RTOs such as PJM and ISO New England. Once the mechanism is approved, we can expect stakeholders, and especially asset owners, to push for further changes from time to time.

In recent years MISO has seen some of its transmission owners leave and join other RTOs, and it has been suggested that capacity markets were a consideration in these choices. MISO may come under pressure to support changes to the capacity construct in order to maintain membership or attract additional membership.

Q 52: The "opt out" provision proposed by MISO is more flexible than PJM's analogous Fixed Resource Recovery ("FRR") provision. Do you expect stakeholders to push to place additional restrictions on this provision?

A: Yes. PJM stakeholders opposed a more flexible opt out provision, arguing that it would allow load-serving entities to "game" RPM or to unfairly lean on the system, and would reduce participation in RPM. Based at least partly on such arguments, the FRR provisions require a load-serving entity to opt out for 100% of the capacity obligation for a minimum of five years, subject to substantial penalties. In addition, FRR entities are not permitted to purchase through RPM and sales are subject to a threshold and other limitations. It can be expected that MISO stakeholders will push to make the opt out provision less attractive.

Q 53: The minimum offer price rule proposed by MISO is much more limited in application than PJM's rule. Would you expect MISO stakeholders to push for this rule to be more like PJM's?

A: Yes. MISO's proposed rule is much more reasonable than PJM's and requires a finding of intent to manipulate prices, among other provisions that will limit its applicability. By contrast, PJM's MOPR is designed to prevent "uneconomic" entry, judged based on administrative Net CONE values and RPM's volatile clearing prices. There are a number of other differences between MISO's proposal and RPM's provision. It can be expected that, even if FERC approves many of the proposed elements, asset owners will continue to strive to change MISO's provision to be more like PJM's.

Q 54: MISO's proposal calls for the auctions to be held months before the Planning Year, while under RPM, the auctions are held three years in advance. Would you expect MISO stakeholders to push for the auctions to be held further forward?

A: Yes. As I have described, holding the auctions years forward raises capacity prices for a number of reasons, and is especially attractive to capacity sellers for this reason. There was considerable discussion of this issue in the stakeholder process, and in its filing (p. 21) MISO states that "MISO plans to continue discussions with stakeholder regarding possibly extending the forward term…".

Q 55: MISO's proposal suggests there will be seven capacity zones. Would you expect MISO stakeholders to push for more geographically granular capacity pricing?

A: Yes. Stakeholders, and especially generation asset owners, are consistently in favor of more granular pricing in capacity markets, which usually results in higher prices and stronger ability and incentive to raise prices through withholding.

VI. CONCLUSION

Q 56: Please summarize your conclusions regarding RPM performance and its relevance to the issue before the Commission in this proceeding.

A: RPM has imposed high cost on consumers without commensurate benefit. MISO's proposed capacity construct is likely to become more like RPM before it is approved by FERC, and over time through additional stakeholder and regulatory processes. Therefore, from the consumers' perspective, the prospect of the new capacity construct in MISO is a negative aspect of Ameren Missouri's continued participation in MISO.

Q 57: Ameren Missouri at present is a net seller of capacity. Should this mitigate concerns over the prospect of an RPM-like capacity market in MISO?

A: For customers provided capacity through Ameren Missouri, if Ameren Missouri's capacity is located in the same zones as the loads, there is not exposure to capacity market prices and zonal price differentials for the time being. Customers are not exposed to capacity market prices and costs as long as the load-serving entity that serves them is a net seller of capacity in their zones. However, such customers may become exposed in the future as load grows, if Ameren Missouri retires or sells generating capacity, when power purchase agreements end, if zone definitions change, or as a result of RAR rules changes. Some of these changes are not under Ameren Missouri's control, although the company can attempt to influence rules changes through participation in stakeholder processes and FERC proceedings. Customers are also exposed to the ongoing costs of participating in stakeholder processes with respect to the capacity market.

Q 58: Does this complete your testimony?

A: Yes it does.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Union Electric Company for Authority To Continue the Transfer of Functional Control of Its Transmission System to the Midwest Independent Transmission System Operator, Inc.	))))))	Case No. EO-2011-0128

AFFIDAVIT OF JAMES F. WILSON

STATE OF MARYLAND)
) **ss**
COUNTY OF Montgomery)

James F. Wilson, being first duly sworn on his oath, states:

My name is James F. Wilson. Attached hereto and made a part hereof for all purposes is my Rebuttal Testimony and Response to Commission Questions on behalf of the Missouri Joint Municipal Electric Utility Commission consisting of 30 pages, and Exhibits JFW 1-4, all of which have been prepared in written form for introduction into evidence in the above-referenced docket.

I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

James F. Wilson

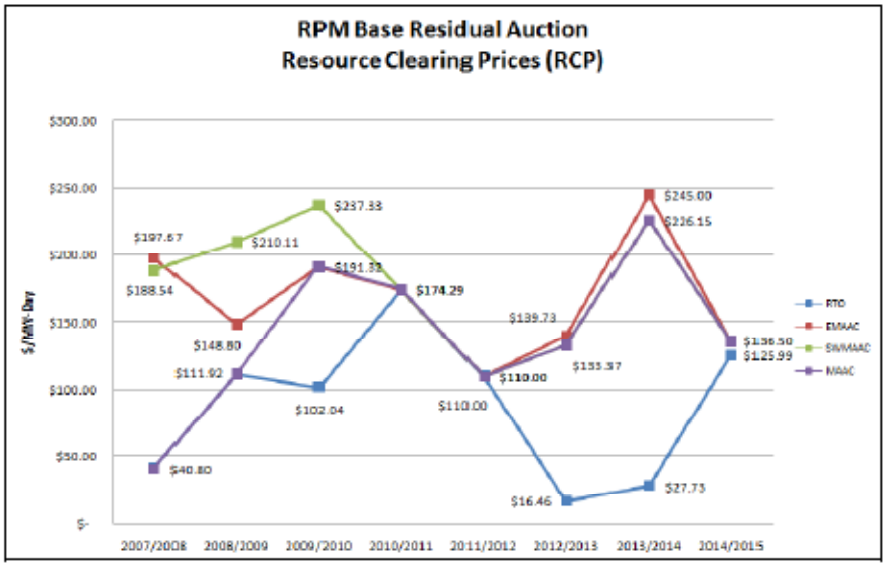
Subscribed and sworn to before me this 13th day of September, 2011.

Notary Public

My commission expires:

SAIDU B. YANSANEH
Notary Public
Montgomery County
Maryland
My Commission Expires Feb 25, 2015

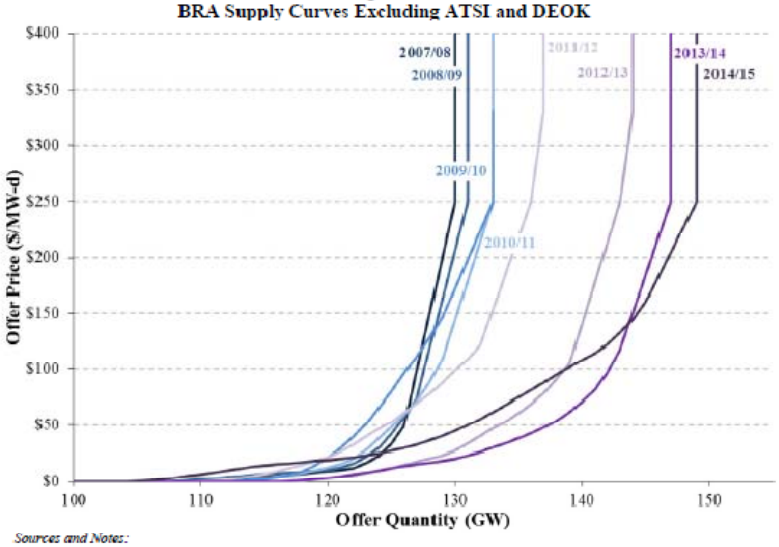
Exhibit JFW-1



Source: PJM, *2014/2015 Base Residual Auction Results*, p. 13.

Exhibit JFW-2

Figure 6
BRA Supply Curves Excluding ATSI and DEOK



Sources and Notes:
Curves exclude supply from ATSI and DEOK zones. Smoothed to mask confidential market data.
From PJM supplier bidding data, PJM (2011a).

Source: The Brattle Group, Second Performance Assessment of PJM's Reliability Pricing Model, August 26, 2011, p. 21.

Exhibit JFW-3

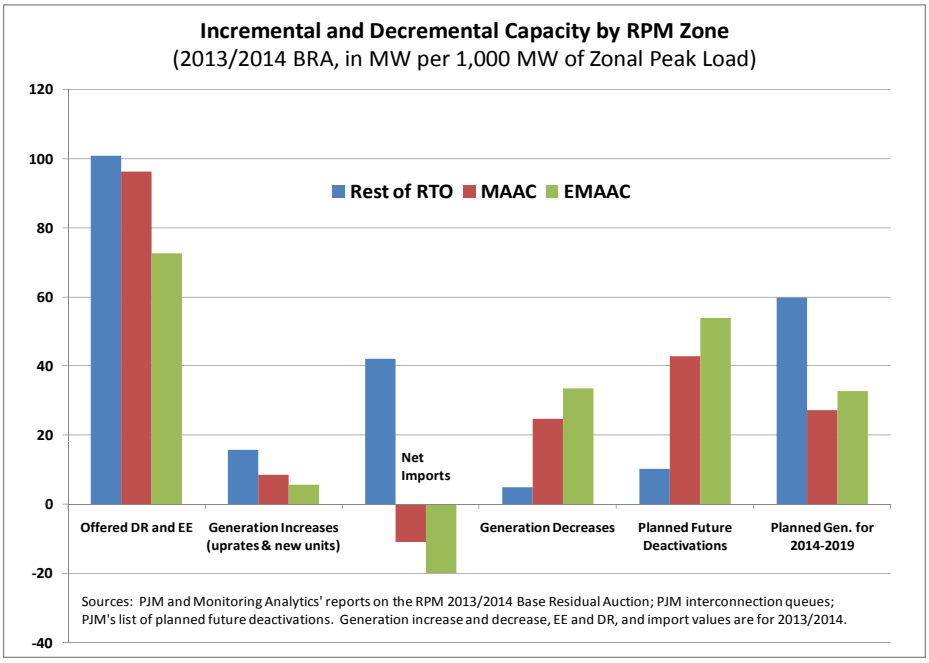
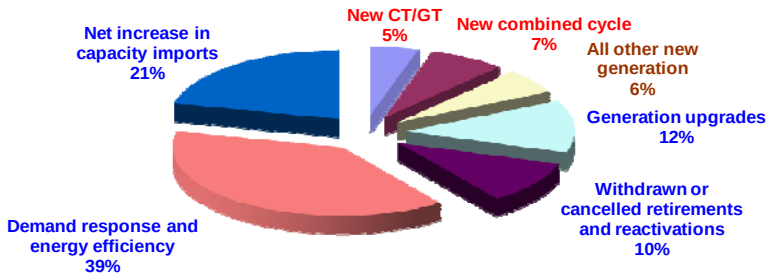


Exhibit JFW-4

Incremental Capacity Resources: First Eight PJM RPM Base Residual Auctions

Short Lead Time Resources have been 82% of the incremental resources over eight delivery years, and 88% in the most recent auction (2014/2015)
(plant upgrades, reactivations, withdrawn or cancelled retirements, demand response, energy efficiency, net imports)



Source: PJM, *2014/2015 RPM Base Residual Auction Results*, Tables 7 and 9, which present offered capacity expressed in installed capacity terms.

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SUMMARY

James F. Wilson has over 25 years of consulting experience, primarily in the electric power and natural gas industries. Many of his assignments have pertained to the economic and policy issues arising from the interplay of competition and regulation in these industries, including restructuring policies, market design, market analysis and market power. Other recent engagements have involved resource adequacy and capacity markets, contract litigation and damages, forecasting and market evaluation, pipeline rate cases and evaluating allegations of market manipulation. Mr. Wilson has been involved in electricity restructuring and wholesale market design for over twenty years in California, PJM, New England, Ontario, Russia and other regions. He also spent five years in Russia advising on the reform, restructuring and development of the Russian electricity and natural gas industries.

Mr. Wilson has submitted affidavits and testified in Federal Energy Regulatory Commission and state regulatory proceedings. His papers have appeared in the *Energy Journal*, *Electricity Journal*, *Public Utilities Fortnightly* and other publications, and he often presents at industry conferences.

Prior to founding Wilson Energy Economics, Mr. Wilson was a Principal at LECG, LLC. He has also worked for ICF Resources, Decision Focus Inc., and as an independent consultant.

EDUCATION

MS, Engineering-Economic Systems, Stanford University, 1982

BA, Mathematics, Oberlin College, 1977

RECENT ENGAGEMENTS

- Affidavit on minimum offer price rules for Regional Transmission Organization (RTO) centralized capacity markets.
- Evaluated electric utility avoided cost in a tax dispute.
- Advised on pricing approaches for RTO backstop short-term capacity procurement.
- Affidavit evaluating the potential impact on reliability of demand response products limited in the number or duration of calls.
- Evaluated changing patterns of natural gas production and pipeline flows, developed approaches for pipeline tolls and cost recovery.
- Evaluated an electricity peak load forecasting methodology and forecast; evaluated regional transmission needs for resource adequacy.
- Participated on a panel teleseminar on natural gas price forecasting.
- Affidavit evaluating a shortage pricing mechanism and recommending changes.
- Testimony in support of proposed changes to a forward capacity market mechanism.

- Reviewed and critiqued an analysis of the economic impacts of restrictions on oil and gas development.
- Advised on the development of metrics for evaluating the performance of Regional Transmission Organizations and their markets.
- Prepared affidavit on the efficiency benefits of excess capacity sales in readjustment auctions for installed capacity.
- Prepared affidavit on the potential impacts of long lead time and multiple uncertainties on clearing prices in an auction for standard offer electric generation service.

EARLIER PROFESSIONAL EXPERIENCE

LECG, LCC, Washington, DC 1998–2009.
Principal

- Reviewed and commented on an analysis of the target installed capacity reserve margin for the Mid Atlantic region; recommended improvements to the analysis and assumptions.
- Evaluated an electric generating capacity mechanism and the price levels to support adequate capacity; recommended changes to improve efficiency.
- Analyzed and critiqued the methodology and assumptions used in preparation of a long run electricity peak load forecast.
- Evaluated results of an electric generating capacity incentive mechanism and critiqued the mechanism's design; prepared a detailed report. Evaluated the impacts of the mechanism's flaws on prices and costs and prepared testimony in support of a formal complaint.
- Analyzed impacts and potential damages of natural gas migration from a storage field.
- Evaluated allegations of manipulation of natural gas prices and assessed the potential impacts of natural gas trading strategies.
- Prepared affidavit evaluating a pipeline's application for market-based rates for interruptible transportation and the potential for market power.
- Prepared testimony on natural gas industry contracting practices and damages in a contract dispute.
- Prepared affidavits on design issues for an electric generating capacity mechanism for an eastern US regional transmission organization; participated in extensive settlement discussions.
- Prepared testimony on the appropriateness of zonal rates for a natural gas pipeline.
- Evaluated market power issues raised by a possible gas-electric merger.
- Prepared testimony on whether rates for a pipeline extension should be rolled-in or incremental under FERC policy.
- Prepared an expert report on damages in a natural gas contract dispute.
- Prepared testimony regarding the incentive impacts of a ratemaking method for natural gas pipelines.
- Prepared testimony evaluating natural gas procurement incentive mechanisms.
- Analyzed the need for and value of additional natural gas storage in the southwestern US.
- Evaluated market issues in the restructured Russian electric power market, including the need to introduce financial transmission rights, and policies for evaluating mergers.
- Affidavit on market conditions in western US natural gas markets and the potential for a new merchant gas storage facility to exercise market power.
- Testimony on the advantages of a system of firm, tradable natural gas transmission and storage rights, and the performance of a market structure based on such policies.
- Testimony on the potential benefits of new independent natural gas storage and policies for providing transmission access to storage users.
- Testimony on the causes of California natural gas price increases during 2000-2001 and the possible exercise of market power to raise natural gas prices at the California border.

- Advised a major US utility with regard to the Federal Energy Regulatory Commission (FERC) proposed Standard Market Design and its potential impacts on the company.
- Reviewed and critiqued draft legislation and detailed market rules for reforming the Russian electricity industry, for a major investor in the sector.
- Analyzed the causes of high prices in California wholesale electric markets during 2000 and developed recommendations, including alternatives for price mitigation. Testimony on price mitigation measures.
- Summarized and critiqued wholesale and retail restructuring and competition policies for electric power and natural gas in select US states, for a Pacific Rim government contemplating energy reforms.
- Presented testimony regarding divestiture of hydroelectric generation assets, potential market power issues, and mitigation approaches to the California Public Utilities Commission.
- Reviewed the reasonableness of an electric utility's wholesale power purchases and sales in a restructured power market during a period of high prices.
- Presented an expert report on failure to perform and liquidated damages in a natural gas contract dispute.
- Presented a workshop on Market Monitoring to a group of electric utilities in the process of forming an RTO.
- Authored a report on the screening approaches used by market monitors for assessing exercise of market power, material impacts of conduct, and workable competition.
- Developed recommendations for mitigating locational market power, as part of a package of congestion management reforms.
- Provided analysis in support of a transmission owner involved in a contract dispute with generators providing services related to local grid reliability.
- Authored a report on the role of regional transmission organizations in market monitoring.
- Prepared market power analyses in support of electric generators' applications to FERC for market-based rates for energy and ancillary services.
- Analyzed western electricity markets and the potential market power of a large producer under various asset acquisition or divestiture strategies.
- Testified before a state commission regarding the potential benefits of retail electric competition and issues that must be addressed to implement it.
- Advised a Canadian electric utility on restructuring issues, including: market design and trading arrangements; contractual approaches to mitigating market power; measures for ensuring adequate generating capacity.
- Prepared a market power analysis in support of an acquisition of generating capacity in the New England market.
- Advised a California utility regarding reform strategies for the California natural gas industry, addressing a broad range of market power issues and policy options for providing system balancing services.

ICF RESOURCES, INC., Fairfax, VA, 1997–1998.
Project Manager

- Reviewed, critiqued and submitted testimony on a New Jersey electric utility's restructuring proposal, as part of a management audit for the state regulatory commission.
- Assisted a group of US utilities in developing a proposal to form a regional Independent System Operator (ISO).
- Researched and reported on the emergence of Independent System Operators and their role in reliability, for the Department of Energy.
- Provided analytical support to the Secretary of Energy's Task Force on Electric System Reliability on various topics, including ISOs. Wrote white papers on the potential role of markets in ensuring reliability and on liability issues.

- Recommended near-term strategies for addressing the potential stranded costs of non-utility generator contracts for an eastern utility; analyzed and evaluated the potential benefits of various contract modifications, including buyout and buydown options; designed a reverse auction approach to stimulating competition in the renegotiation process.
- Designed an auction process for divestiture of a Northeastern electric utility's generation assets and entitlements (power purchase agreements).
- Participated in several projects involving analysis of regional power markets and valuation of existing or proposed generation assets.

IRIS MARKET ENVIRONMENT PROJECT, 1994–1996.
Project Director, Moscow, Russia

Established and led a policy analysis group advising the Russian Federal Energy Commission and Ministry of Economy on economic policies for the electric power, natural gas, oil pipeline, telecommunications, and rail transport industries (*the Program on Natural Monopolies,* a project of the IRIS Center of the University of Maryland Department of Economics, funded by USAID). Major activities and projects included:

- Advised on industry reforms and the establishment of federal regulatory institutions.
- Advised the Russian Federal Energy Commission on electricity restructuring, development of a competitive wholesale market for electric power, tariff improvements, and other issues of electric power and natural gas industry reform.
- Developed policy conditions for the IMF's $10 billion Extended Funding Facility.
- Performed industry diagnostic analyses with detailed policy recommendations for electric power (1994), natural gas, rail transport and telecommunications (1995), oil transport (1996).

Independent Consultant stationed in Moscow, Russia, 1991–1996

Projects for the WORLD BANK, 1992-1996:

- Bank Strategy for the Russian Electricity Sector. Developed a policy paper outlining current industry problems and necessary policies, and recommending World Bank strategy.
- Russian Electric Power Industry Restructuring. Participated in work to develop recommendations to the Russian Government on electric power industry restructuring.
- Russian Electric Power Sector Update. Led project to review developments in sector restructuring, regulation, demand, supply, tariffs, and investment.
- Russian Coal Industry Restructuring. Analyzed Russian and export coal markets and developed forecasts of future demand for Russian coal.
- World Bank/IEA Electricity Options Study for the G-7. Analyzed mid- and long-term electric power demand and efficiency prospects and developed forecasts.
- Russian Energy Pricing and Taxation. Developed recommendations for liberalizing energy markets, eliminating subsidies and restructuring tariffs for all energy resources.

Other consulting assignments in Russia, 1991–1994:

- Project leader for start-up phase of the joint Russian-American Electric Power Alternatives Study on power sector development and investment; also participated in a project on electric power restructuring.
- Advised the US Agency For International Development on the establishment of energy industry technical assistance programs in Russia.
- Advised on projects pertaining to Russian energy policy and the transition to a market economy in the energy industries, for the Institute For Energy Research of the Russian Academy of Sciences.
- Presented seminars on the structure, economics, planning, and regulation of the energy and electric power industries in the US, for various Russian clients.

DECISION FOCUS INC., Mountain View, CA, 1983–1992
Senior Associate, 1985-1992.

- For the Electric Power Research Institute, led projects to develop decision-analytic methodologies and models for evaluating long term fuel and electric power contracting and procurement strategies. Applied the methodologies and models in numerous case studies, and presented several workshops and training sessions on the approaches.
- Analyzed long-term and short-term natural gas supply decisions for a large California gas distribution company following gas industry unbundling and restructuring.
- Analyzed long term coal and rail alternatives for a midwest electric utility, including alternative coal supply regions, suppliers and contract structures; spot/contract mix; rail arrangements; power purchases; conversion to gas.
- Led project to evaluate bulk power purchase alternatives and strategies for a New Jersey electric utility. Developed model for analyzing power purchases.
- Performed a financial and economic analysis of a proposed hydroelectric project.
- For a natural gas pipeline company serving the Northeastern US, forecasted long-term natural gas supply and transportation volumes. Developed a forecasting system for staff use.
- Analyzed potential benefits of diversification of gas suppliers for a mid-continent gas pipeline company.
- Led project to evaluate and make recommendations on uranium contracting strategies, including long-term contract purchases, spot purchases, and stockpiling actions, for an electric utility.
- Analyzed telecommunications services markets under deregulation, developed and implemented a pricing strategy model. Evaluated potential responses of residential and business customers to changes in the client's and competitors' telecommunications services and prices.
- Analyzed coal contract terms and supplier diversification strategies for an eastern electric utility.
- Analyzed long-term natural gas supply strategies and spot purchasing strategies for a California natural gas distribution company.
- Analyzed oil and natural gas contracting strategies for a California electric utility. Evaluated standby supply options for low-sulfur fuel oil.

TESTIMONY AND AFFIDAVITS

PJM Interconnection, L.L.C., and PJM Power Providers Group v. PJM Interconnection, L.L.C., Federal Energy Regulatory Commission Docket Nos. ER11-2875 and EL11-20 (Minimum Offer Price Rule), Affidavit in Support of Protest of New Jersey Division of Rate Counsel, March 4, 2011, and Affidavit in Support of Request for Rehearing and for Expedited Consideration of New Jersey Division of Rate Counsel, May 12, 2011.

PJM Interconnection, L.L.C., Federal Energy Regulatory Commission Docket No. ER11-2288 (Demand response “saturation” issue), Affidavit in Support of Protest and Comments of the Joint Consumer Advocates, December 23, 2010.

North American Electric Reliability Corporation, Federal Energy Regulatory Commission Docket No. RM10-10, Comments on Proposed Reliability Standard BAL-502-RFC-02: Planning Resource Adequacy Analysis, Assessment and Documentation, December 23, 2010.

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United States Association for Energy Economics

Natural Gas Roundtable

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August 2011