BEFORE THE
PUBLIC SERVICE COMMISSION
OF THE STATE OF MARYLAND

In the Matter of Baltimore Gas and Electric Company's Proposal to Implement a Rate Stabilization Plan Pursuant to Section 7-548 of the Public Utilities Company Article and the Commission's Inquiry into Factors Impacting Wholesale Electricity Prices	**Case No. 9099**

PREPARED DIRECT TESTIMONY OF
JOSEPH P. BOWRING
ON BEHALF OF PJM INTERCONNECTION, L.L.C.

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Joseph E. Bowring, and my business address is PJM Interconnection, L.L.C., 955 Jefferson Avenue, Valley Forge Corporate Center, Norristown, Pennsylvania, 19403-2497.

Q. What is your current position with PJM Interconnection, L.L.C. ("PJM")?

A. I am the PJM Market Monitor. Since March 1999, I have been responsible for all the market monitoring activities of PJM, as defined by the PJM Market Monitoring Plan, Attachment M to the PJM Open Access Transmission Tariff.

II. PROFESSIONAL EXPERIENCE AND QUALIFICATIONS

Q. Please describe your professional experience and qualifications.

A. I am a Ph.D. economist and have substantial experience in applied energy and regulatory economics. I have taught economics as a member of the faculty at Bucknell University and at Villanova University. I have served as a senior staff economist for the New Jersey Board of Public Utilities and as Chief Economist for the New Jersey Department of the Public Advocate's Division of Rate Counsel. I have also worked as an independent consulting economist.

III. PURPOSE OF TESTIMONY

Q. What is the purpose of your testimony?

A. In this proceeding, the Commission is considering a rate stabilization plan submitted by Baltimore Gas and Electric Company ("BG&E") to phase in rates for its residential customers that otherwise would go to market levels on June 1, 2007. The Commission also is investigating in this proceeding whether BG&E's standard offer service ("SOS") rates are at a market price that permits recovery of the verifiable, prudently incurred costs to procure or produce the electricity, plus a reasonable return. To that end, the Commission has directed its staff and the parties in the proceeding to provide evidence in response to several questions. I am here at the request of Commission staff in order to address the role of market monitoring and the conclusions of our market analyses as they pertain to those questions.

IV. THE ROLE OF MARKET MONITORING IN ENSURING JUST AND REASONABLE WHOLESALE ENERGY PRICES

Q. Can you explain the market monitoring function at PJM?

A. One of the requirements set forth in Order No. 2000 for an RTO is a market monitoring function. The FERC requires that this function " be designed to ensure that there is objective information about the markets that the RTO operates or administers and a vehicle to propose appropriate action regarding any opportunities for efficiency improvement, market design flaws, or market power identified by that information" and that it "evaluate the behavior of market participants … to determine whether their behavior adversely affects the ability of the RTO to provide reliable, efficient and nondiscriminatory transmission service."[1]

By order issued March 10, 1999, the Federal Energy Regulatory Commission ("FERC" or "Commission") accepted the Market Monitoring Plan filed by PJM as part of the PJM Tariff to be effective April 1, 1999.[2] The Commission found the ability of the Market Monitoring Unit ("MMU") to effectively and broadly monitor and investigate the PJM Market to be essential in view of its contemporaneous decision to approve market-based pricing authority on offers to sell energy in PJM.[3]

The MMU's primary objectives, as defined in Section I of the Market Monitoring Plan, are to:[4]

---

1 Order No. 2000 at p. 463.

2 86 FERC ¶ 61,247 (1999) ("March 10 Order").

3 Id. at n.4 (citing Atlantic City Elec. Co., 86 FERC ¶ 61,248 (1999)).

4 PJM Open Access Transmission Tariff, Attachment M, "PJM Market Monitoring Plan".

(1) monitor and report on issues relating to the operation of the PJM Market, including the determination of transmission congestion costs or the potential of any Market Participant(s) to exercise market power within the PJM Region; (2) evaluate the operation of both pool and bilateral markets to detect either design flaws in the PJM Market operating rules, standards, procedures, or practices as set forth in the PJM Tariff, the PJM Operating Agreement, the PJM Reliability Assurance Agreement, The Reliability Assurance Agreement-South, the Reliability Assurance Agreement-West, the PJM Manuals, or PJM Regional Practices Document or to detect structural problems in the PJM Market that may need to be addressed in future filings; (3) evaluate any proposed enforcement mechanisms that are necessary to assure compliance with pool rules; and (4) ensure that the monitoring program will be conducted in an independent and objective manner. The Plan also prescribes reporting procedures that PJM will use to inform governmental agencies and others concerning its market monitoring activities.

Section III of the PJM Market Monitoring Plan states:

> The Market Monitoring Unit shall be responsible for monitoring the following:
>
> **A.** Compliance with the PJM Market Rules.
>
> **B.** Actual or potential design flaws in the PJM Market Rules.
>
> **C.** Structural problems in the PJM Market that may inhibit a robust and competitive market.
>
> **D.** The potential for a Market Participant to exercise market power or violate any of the FERC Market Rules.

Paragraph 2 of FERC's "Policy Statement on Market Monitoring Units" states:[5]

> In order to achieve the stated purpose of enhancing the competitive structure of the ISO/RTO markets, MMUs perform several valuable tasks:
>
> - To identify ineffective market rules and tariff provisions and recommend proposed rule and tariff changes to the ISO/RTO that promote wholesale competition and efficient market behavior.
> - To review and report on the performance of wholesale markets in achieving customer benefits.
> - To provide support to the ISO/RTO in the administration of Commission-approved tariff provisions related to markets administered by the ISO/RTO (e.g., day-ahead and real-time markets).
> - To identify instances in which a market participant's behavior may require investigation and evaluation to determine whether a tariff violation has occurred, or may be a potential Market Behavior Rule

[5] 111 FERC ¶ 61,267 (2005).

violation, and immediately notify appropriate Commission staff for possible investigation.

The MMU posts all public reports, presentations and market messages and selected data at: www.pjm.com/markets/market-monitor/market-monitor.html. The report describing the MMU's activities in 2006 is posted at: www.pjm.com/markets/market-monitor/reports.html.

Q. Can you explain how the market monitoring function at PJM helps to ensure that wholesale electricity prices in PJM and in Maryland are just and reasonable?

A. The MMU performs economic analysis and monitoring of all the PJM markets including the Day-Ahead Energy Market, the Real-Time Energy Market, the Daily Capacity Market, the Interval, Monthly and Multimonthly Capacity Markets, the Regulation Market, the Spinning Reserve Market and the Annual, Monthly and Balance of Planning Period Auction Markets in Financial Transmission Rights (FTRs). The ultimate goal in each case is to determine whether market outcomes are competitive.

The ongoing market analysis and monitoring form the basis for all MMU activities, which can be categorized as monitoring of market participant behavior; market analysis submitted to FERC in formal proceedings; participation in FERC proceedings; provision of data to FERC; formal and informal referrals to FERC; market analysis in the form of published and internal reports; recommendations regarding PJM market rules; participation in PJM committees and working groups; and support of PJM in the administration of Commission-approved tariff provisions.

Just and reasonable rates may be achieved through the competitive operation of markets. While competitive market structures are one indication of whether competitive outcomes may be achieved, the definition of competitive in this context refers to competitive market outcomes. Market outcomes that reflect the exercise of market power are thus not just and reasonable under the FERC standard.

Q. How does the market monitoring unit provide public information regarding the competitiveness of wholesale electricity prices in Maryland and the PJM Region?

A. Every year the MMU produces a rigorous and comprehensive public report to the FERC, to the PJM Board and to the PJM Members Committee, which assesses the state of competition in each market operated by PJM, identifies specific market issues and recommends potential enhancements to improve the competitiveness and efficiency of the markets. The *2006 State of the Market Report*, which reflects the MMU's most recent independent analysis and recommendations, concluded that the PJM energy, capacity, spinning reserves and FTR market results were competitive while the regulation market results could not be determined to have been competitive or noncompetitive.

In addition, the MMU provides monthly reports on general market conditions and for individual states, provides reports to the members as appropriate, provides reports to state public utility commissions when requested, provides data, provides quarterly reports on the operation of the three pivotal supplier test, provides testimony as required and regularly meets with membership committees to present market analysis, recommend changes to rules and to comment on PJM proposed rules changes.

Q. What measures does the MMU use to determine whether wholesale markets are competitive?

A. The MMU analyzes measures of market structure, participant conduct and market performance, including market size, concentration, residual supply index, price-cost markup, net revenue and prices. These measures reflect the approach taken to the analysis of all markets which recognizes that market structure provides the context for participant behavior which together result in market performance. Two measures are particularly important, the markup measure and the net revenue measure.

Q. Please explain the markup measure.

A. Market power is defined as the ability to increase the market price above the competitive level or to decrease the market price below the competitive level. The competitive price level equals the short run marginal cost of the unit setting the market price (the marginal price). Short run marginal cost may appropriately include scarcity rents, risk and opportunity costs.

The price-cost markup index is a measure of conduct or behavior by the owners of generating units. For marginal units, the markup index is a measure of market power. For units not on the margin, the markup index is a measure of the intent to exercise market power or, in cases where the markup results in higher-priced units replacing lower-priced units in the dispatch, is also a measure of market power. A positive markup by marginal units results in a difference between the observed market price and the competitive market price. The goal of the markup analysis is both to calculate the actual markups by marginal units (market conduct) and to estimate the impact of those markups on the difference between the observed market price and the competitive market price (market performance).

The markup index for each marginal unit is calculated as (Price – Cost)/Price.[6] The markup index is normalized and can vary from -1.00, when the offer price is less than marginal cost, to 1.00, when the offer price is higher than marginal cost.[7]

---

6 A marginal unit's offer price does not always correspond to the LMP at the unit's bus. As a general matter the LMP at a bus is equal to the unit's offer. However in practice, actual security-constrained dispatch can create conditions where the LMP at a marginal unit bus does not correspond to the unit's offer. The unit offer price and associated cost are used when calculating measures of participant behavior or conduct, like markup.

7 Marginal costs are defined to include short run marginal cost plus 10 percent per Manual M-15, the Cost Development Guidelines.

This index is similar to the markup index calculations presented in prior state of the market reports,[8] but the calculation method has been improved to more accurately weight the impact of individual unit markups through the use of sensitivity factors.[9] In 2006, the annual average markup index was 0.00 with a maximum of 0.05 in February and a minimum of -0.02 in August.

The markup index is a summary measure of the behavior or conduct of individual marginal units. However the markup conduct measure does not explicitly capture the impact of this behavior on market prices. As an example, if unit A has a $90 cost and a $100 price, while unit B has a $9 cost and a $10 price, both would show a markup of 10 percent, but the price impact of unit A's markup at the generator bus would be $10 while the price impact of unit B's markup at the generator bus would be $1. Depending on each unit's location on the transmission system, those bus-level impacts could also translate to different impacts on total system price.

The MMU has calculated explicit measures of the price component of marginal unit price-cost markup, based on analysis using sensitivity factors. These measures include the system price component of markup on system prices and the zonal price component of markup. In addition, the price component of specific subsets of units is analyzed, including units exempt from offer capping and units on high-load days.

In each case, the calculation shows the markup component of price based on a comparison between the price-based offer and the cost-based offer of each actual marginal unit on the system.[10] The calculation is not based on a full redispatch of the system to determine the marginal units and their marginal costs that would have occurred if all units had made all offers at marginal cost. Thus the results do not reflect a counterfactual market outcome based on the assumption that all units made all offers at marginal cost. Such a counterfactual analysis would reveal the extent to which the actual system dispatch is less than competitive if it showed a difference between dispatch based on marginal costs and actual dispatch. It is possible that the markup, based on a redispatch analysis, would be lower than the markup component of price if the reference point were an inframarginal unit with a lower price and a higher cost than the actual marginal unit. It is also possible that the markup, based on a redispatch analysis, would be higher than the markup component of price if the reference point were a unit, dispatched only under the redispatch, with a higher price and a lower cost than the actual marginal unit.

---

8 In order to normalize the index results (i.e., bound the results between +1.00 and -1.00), the index is calculated as (Price – Cost)/Price when price is greater than cost, and (Price – Cost)/Cost when price is less than cost.

9 In prior state of the market reports, the impact of each marginal unit on load and LMP was based on an estimate when there were multiple marginal units. Sensitivity factors define the impact of each marginal unit on LMP at every bus on the system. See *2006 State of the Market Report*, Volume II, Appendix I, "Sensitivity Factors." See also "PJM 101: The Basics" (September 14, 2006) <http://www.pjm.com/services/training/downloads/ pjm101part1.pdf> (5.7 MB), p. 107.

10 This is the same method used to calculate the fuel-cost-adjusted LMP and the components of LMP.

The price component measure uses load-weighted, price-based LMP and load-weighted LMP computed using cost-based offers for all marginal units. The markup component of price is computed by calculating the system price based on the price-based offers of the marginal units and comparing that to the system price based on the cost-based offers of the marginal units. Both results are compared to the actual system price to determine how much of the LMP can be attributed to markup.

In 2006, $1.54 per MWh of the $53.35 per MWh PJM load-weighted LMP, 2.9 percent, was attributable to markup. In 2006, the markup component of LMP was -$0.10 per MWh off peak and $3.08 per MWh on peak. Of the on-peak markup component, $1.15 per MWh, or 37 percent, occurred on high-load days. Markup on high-load days is likely to be the result of appropriate scarcity pricing rather than market power.[11]

The annual average price component of unit markup is shown for each zone in Table 1. The smallest zonal all hours' markup component was in the DLCO Control Zone, $0.73 per MWh, while the highest all hours' zonal markup component was in the RECO Control Zone, $2.45 per MWh. On peak, the smallest zonal markup was in the DLCO Control Zone, $1.65 per MWh, while the highest markup was in the RECO Control Zone, $4.47 per MWh. Off peak, the smallest zonal markup was in the PENELEC Control Zone, -$0.61 per MWh, while the highest markup was in the PEPCO Control Zone, $0.16 per MWh.

11 For a definition of high-load days, see *2006 State of the Market Report*, Volume II, Section 3, "Energy Market, Part 2," at "High-Load Events, Scarcity and Scarcity Pricing Events." For the analysis of components of LMP, seven high load days are included when high load days are referenced. The seven days are July 17, July 18, July 19, July 31, August 1, August 2 and August 3.

Table 1 Average zonal markup component: Calendar year 2006

Zone	Markup Component (All Hours)	Peak Markup Component	Off-peak Markup Component
AECO	$1.80	$3.74	($0.24)
AEP	$0.94	$2.06	($0.22)
AP	$1.36	$2.75	($0.08)
BGE	$1.95	$3.70	$0.11
ComEd	$1.14	$2.26	($0.07)
DAY	$1.09	$2.22	($0.14)
DLCO	$0.73	$1.65	($0.26)
DPL	$2.08	$4.18	($0.11)
Dominion	$1.61	$3.15	$0.00
JCPL	$1.96	$3.96	($0.29)
Met-Ed	$1.54	$3.17	($0.24)
PECO	$1.83	$3.71	($0.21)
PENELEC	$0.74	$2.00	($0.61)
PEPCO	$2.11	$3.92	$0.16
PPL	$1.47	$3.14	($0.35)
PSEG	$2.21	$4.24	($0.04)
RECO	$2.45	$4.47	$0.00

PJM's offer-capping rules provide that specific units are exempt from offer capping, based on their date of construction. During 2005, two orders issued by the FERC modified the rules governing exemptions from the offer-capping rules. In the January 25, 2005, order, the FERC found "that the exemption for post-1996 units from the offer-capping rules is unjust and unreasonable under section 206 of the Federal Power Act and that the just and reasonable practice under section 206 is to terminate the exemption, with provisions to grandfather units for which construction commenced in reliance on the exemption."[12] The FERC noted, however, that grandfathered units would "still be subject to mitigation in the event that PJM or its market monitor concludes that these units exercise significant market power."[13] In the July 5, 2005, order, the FERC modified the dates governing unit exemptions by zone.[14] The effect of these orders was to reduce the number of units exempt from local market power mitigation rules from 215 to 56 as of the end of 2005 and that number did not change in 2006.

Of the 56 generators that are exempt from offer capping, 43 were marginal in 2006. The 43 marginal exempt units accounted for $0.56, 36 percent, of the total markup component of LMP in 2006. (See Table 2.) Of the 43 units, the top eight

12 110 FERC ¶ 61,053 (2005).

13 110 FERC ¶ 61,053 (2005).

14 112 FERC ¶ 61,031 (2005).

exempt units contributed 90 percent of the total markup component of exempt units, or 33 percent of the total markup component for all of PJM. The average markup per exempt unit is about nine times higher than for non-exempt units, and the average markup for the top eight exempt units is about 43 times higher than for non-exempt units. This analysis does not address whether these units would have been offer capped had they not been exempt and therefore does not address how much the contribution to LMP would have changed if the exemption had been removed.

Scarcity exists when the total demand for power approaches the generating capability of the system. Scarcity pricing means that market prices reflect the fact that the system is close to its available capacity and that competitive prices may exceed accounting short-run marginal costs. Under the current PJM rules, high prices, or scarcity pricing, result from high offers by individual generation owners for specific units when the system is close to its available capacity. These offers give the aggregate energy supply curve its steep upward sloping tail.[15] As demand increases and units with higher markups and higher offers are required to meet demand, prices increase. As a result, markup on high-load days is likely to be the result of appropriate scarcity pricing rather than market power.[16] Under the current PJM rules, administrative scarcity pricing, based on the scarcity pricing provisions in the Tariff, results when PJM takes identified emergency actions and is based on the highest offer of an operating unit.[17]

The markup component of price is higher during peak demand periods. Table 2 shows that $0.60 per MWh, or 39 percent, of the total markup component of price occurs on high-load days. In addition, for units subject to offer capping for local market power (non-exempt units), 50 percent of the total markup component of price occurs on high-load days. For units exempt from offer capping, 20 percent of the total markup component of price occurs on high-load days.

Table 2 Markup contribution of exempt and non-exempt units: Calendar year 2006

	Exempt Markup Component	Non-exempt Markup Component	Total
High-Load Days	$0.11	$0.49	$0.60
Balance of Year	$0.45	$0.49	$0.94
Total	$0.56	$0.98	$1.54

15 See *2006 State of the Market Report*, Volume II, Section 2, "Energy Market, Part I," "Average PJM aggregate supply curves: Summers 2005 and 2006 ."

16 For a definition of high-load days, see *2006 State of the Market Report*, Volume II, Section 3, "Energy Market, Part 2," at "High-Load Events, Scarcity and Scarcity Pricing Events."

17 See *2006 State of the Market Report*, Volume II, Section 3, "Energy Market, Part 2," at "2006 High-Load Events, Scarcity and Scarcity Pricing Events." This administrative scarcity pricing, as defined by PJM rules, is one type of the broader category of scarcity pricing.

Q. What do you conclude from the markup measure results?

A. I conclude that the markup measure results are strong evidence of competitive behavior overall and competitive market performance overall in the PJM energy market. Units setting the price in the PJM energy market, with very few exceptions, offered their energy at or extremely close to short run marginal cost, as would be expected in a competitive market.

Q. Please explain the net revenue measure.

A. Net revenue is an indicator of generation investment profitability and thus is a measure of overall market performance as well as a measure of the incentive to invest in new generation to serve PJM markets. Net revenue quantifies the contribution to capital cost received by generators from all PJM markets. Although it can be expected that in the long run, in a competitive market, net revenue from all sources will cover the fixed costs of investing in new generating resources, including a competitive return on investment, actual results are expected to vary from year to year. Wholesale energy markets, like other markets, are cyclical. When the markets are long, prices will be lower and when the markets are short, prices will be higher.

Under an economic dispatch scenario, the eight-year net revenue averaged $30,212 per installed MW-year for a new entrant combustion turbine (CT) plant, $56,120 per installed MW-year for a new entrant combined-cycle (CC) plant and $150,939 per installed MW-year for a new entrant pulverized coal (CP) plant. Thus, under economic dispatch over the eight-year period, the average net revenue was not adequate to cover the annual levelized fixed costs for the CT, CC or CP plant.

Table 3 Total net revenue and 20-year, levelized fixed cost for new entry CT, CC and CP generators: Economic dispatch

	CT		CC		CP	
	Economic Dispatch Net Revenue	20-Year Levelized Fixed Cost	Economic Dispatch Net Revenue	20-Year Levelized Fixed Cost	Economic Dispatch Net Revenue	20-Year Levelized Fixed Cost
1999	$74,537	$72,207	$100,700	$93,549	$118,021	$208,247
2000	$30,946	$72,207	$47,592	$93,549	$134,563	$208,247
2001	$63,462	$72,207	$86,670	$93,549	$129,271	$208,247
2002	$28,260	$72,207	$52,272	$93,549	$112,131	$208,247
2003	$10,565	$72,207	$35,591	$93,549	$169,510	$208,247
2004	$8,543	$72,207	$35,785	$93,549	$133,125	$208,247
2005	$10,437	$72,207	$40,817	$93,549	$228,430	$208,247
2006	$14,948	$80,315	$49,529	$99,230	$182,461	$267,792
Avg	$30,212	$73,221	$56,120	$94,259	$150,939	$215,690

Zonal revenues reflect differentials in locational marginal price (LMP) across the system and illustrate the substantial impact that locational prices have on economic incentives. For a CT, while the PJM average net revenue in 2006 was $10,996 per MW-day, the maximum zonal CT net revenue was $37,801 in the PEPCO control zone and the minimum was $4,342 in the DAY control zone. For a CC, while the PJM average net revenue in 2006 was $44,692 per MW-day, the

maximum zonal CC net revenue was $91,120 in the PEPCO control zone and the minimum was $18,897 in the DLCO control zone. For a CP, while the PJM average net revenue in 2006 was $177,852 per MW-day, the maximum zonal CP net revenue was $254,964 in the PEPCO control zone and the minimum was $102,923 in the DLCO control zone.

While the maximum zonal CT net revenue was well below the annual fixed costs of a new CT, the maximum CC zonal net revenue was close to the annual fixed costs of a new CC and the maximum CP zonal net revenue was substantially in excess of the annual fixed costs of a new CP. Thus, the higher LMPs in the eastern PJM zones, reflecting transmission limitations and congestion, have a positive impact on the incentive to invest in those areas.

Q. What do you conclude from the net revenue measure results?

A. The net revenue results demonstrate that revenues from all PJM markets, including energy, capacity and ancillary services markets have not been adequate to cover the total costs of new generating units in PJM and that this shortfall resulted both from lower, less volatile energy market prices and lower capacity credit market prices in the last several years.

While net revenue in PJM has been almost sufficient to cover the costs of new peaking units in some years and was sufficient to cover the costs of a new coal plant in 2005 and close to covering those costs in 2006 in some eastern zones, net revenue has generally been below the level required to cover the full costs of new generation investment for several years and below that level on average for all unit types for the entire eight-year market period. The fact that investors' expectations have not been realized in every year could be taken as a reflection of cyclical supply-demand fundamentals in PJM markets. However, it is also the case that there are some units in PJM, needed for reliability, that have revenues that are not adequate to cover annual going forward costs and that their owners, therefore, wish to retire. This suggests that market price signals and reliability needs are not fully synchronized.

Q. Can you explain how market power is addressed in PJM in order to ensure that wholesale electricity prices in Maryland and the PJM Region are just and reasonable?

A. PJM markets are designed to promote competitive outcomes derived from the interaction of supply and demand in each of the PJM markets. Market design itself is the primary means of achieving and promoting competitive outcomes in the PJM markets. One of the MMU's primary goals is to identify actual or potential market design flaws.

PJM's market power mitigation goals have focused on market designs that promote competition (a structural basis for competitive outcomes) and on limiting market power mitigation to instances where market structure is not competitive and thus where market design alone cannot mitigate market power. In the PJM Energy Market, this occurs only in the case of local market power. When a

transmission constraint creates the potential for local market power, PJM applies a structural test (the three pivotal supplier test) to determine if the local market is competitive, applies a behavioral test to determine if generator offers exceed competitive levels and applies a market performance test to determine if such generator offers would affect the market price.

PJM offer caps units only when their owners would otherwise exercise local market power. Offer capping is an effective means of addressing local market power. Offer-capping levels have historically been low in PJM and generally declined in 2006.

Q. Could you explain how the three-pivotal supplier test operates, and how it is superior to the available alternatives?

A. The structural test for suspending offer capping set forth in the PJM Amended and Restated Operating Agreement (OA) Schedule 1, Sections 6.4.1(e) and (f) is the three pivotal supplier test. The three pivotal supplier test is applied by PJM on an ongoing basis in order to determine whether offer capping is required for any constraint not exempt from offer capping. The three pivotal supplier test defined in the OA represents a significant improvement in accuracy over the offer capping approach in place prior to March 2006 because the current application of the test uses real-time data and tests constraints as they actually arise with all the actual system features that exist at the time including transmission constraints, load and generator availability.

As a result of PJM's implementation of the three pivotal supplier test in real time, the actual competitive conditions associated with each binding constraint are analyzed in real time as they arise. The three pivotal supplier test replaced the prior approach which was to offer cap all units required to resolve a binding constraint. The application of the three pivotal supplier test has meant a reduction in the application of offer capping to unit owners. As a result of the application of the three pivotal supplier test, offer capping is applied only at times when the local market structure is not competitive and only to those participants with structural market power.

A test for local market power based on the number of pivotal suppliers has a solid basis in economics and is clear and unambiguous to apply in practice. There is no perfect test, but the three pivotal supplier test for local market power strikes a reasonable balance between the requirement to limit extreme structural market power and the goal of limiting intervention in markets where competitive forces are adequate. The three pivotal supplier test for local market power is a reasonable application of the logic contained in FERC's market power tests.

The FERC adopted market power screens and tests in the AEP Order.[18] The AEP Order defined two indicative screens and the more dispositive delivered price test. The Commission's delivered price test for market power defines the relevant

[18] 107 FERC ¶ 61,018 (2004) (AEP Order).

market as all suppliers who offer at or below the clearing price times 1.05 and using that definition, applies pivotal supplier, market share and market concentration analyses. These tests are failed if the supplier in question is pivotal, has a market share in excess of 20 percent or if the Herfindahl-Hirschman Index (HHI) in the relevant market exceeds 2500. A supplier is pivotal under the screen if it is pivotal in the relevant market as defined by the delivered price test. The Commission also recognized that there are interactions among the results of each screen under the delivered price test and that some interpretation is required and, in fact, is encouraged.[19]

The three pivotal supplier test, as implemented, is consistent with the FERC's market power tests, encompassed under the delivered price test. The three pivotal supplier test is an application of the delivered price test to both the Real-Time Market and hourly Day-Ahead Market. The three pivotal supplier test explicitly incorporates the impact of excess supply and implicitly accounts for the impact of the price elasticity of demand in the market power tests. The three pivotal supplier test includes more competitors in its definition of the relevant market than the delivered price test. While the delivered price test defines the relevant market to include all offers with costs less than or equal to 1.05 times the market price, the three pivotal supplier test includes all offers with costs less than or equal to 1.50 times the clearing price for the local market.

The goal of defining the relevant market is to determine those units that are actual competitors to the units that clear in a market. The FERC definition would indicate, if the marginal unit set the clearing price based on an offer of $200 per MWh, that all units with costs less than or equal to $210 per MWh have a competitive effect on the offer of the marginal unit. These units are all defined to be meaningful competitors in the sense that it is assumed that their behavior constrains the behavior of the marginal and inframarginal units. The three pivotal supplier definition would indicate that, if the marginal unit set the clearing price based on an offer of $200 per MWh, that all units with costs less than or equal to $300 per MWh have a competitive effect on the offer of the marginal unit. These units are all defined to be meaningful competitors in the sense that it is assumed that their behavior constrains the behavior of the marginal and inframarginal units. Clearly, the three pivotal supplier test incorporates a definition of meaningful competitors that is at the high end of inclusive. It is certainly questionable whether a $300 offer meaningfully constrains the offer of a $200 unit. This broad market definition is combined with the recognition that multiple owners can be meaningfully jointly pivotal. The three pivotal supplier test includes three pivotal suppliers while the Commission test includes only one pivotal supplier.

The three pivotal supplier test is also consistent with the delivered price test in that it tests for the interaction between individual participant attributes and features of the relevant market structure. The three pivotal supplier test is an

---

[19] 107 FERC ¶ 61,018 (2004).

explicit test for the ability to exercise unilateral market power as well as market power via coordinated action, based on economic theory, which accounts simultaneously for market shares and the supply-demand balance in the market.

The results of the three pivotal supplier test can differ from the results of the HHI and market share tests. The three pivotal supplier test can show the existence of structural market power when the HHI is less than 2500 and the maximum market share is less than 20 percent. The three pivotal supplier test can also show the absence of market power when the HHI is greater than 2500 and the maximum market share is greater than 20 percent. The three pivotal supplier test is more accurate than the HHI and market share tests because it focuses on the relationship between demand and the most significant aspect of the ownership structure of supply available to meet it. A market share in excess of 20 percent does not matter if the holder of that market share is not jointly pivotal and is unlikely to be able to affect the market price. A market share less than 20 percent does not matter if the holder of that market share is jointly pivotal and is likely to be able to affect the market price. Similarly, an HHI in excess of 2500 does not matter if the relevant owners are not jointly pivotal and are unlikely to be able to affect the market price. An HHI less than 2500 does not matter if the relevant owners are jointly pivotal and are likely to be able to affect the market price.[20]

The three pivotal supplier test was designed in light of actual elasticity conditions in load pockets in wholesale power markets in PJM. The price elasticity of demand is probably the most critical variable in determining whether a particular market structure is likely to result in a competitive outcome. A market with a specific set of market structure features is likely to have a competitive outcome under one range of demand elasticity conditions and a noncompetitive outcome under another set of elasticity conditions. It is essential that market power tests account for actual elasticity conditions and that evaluation of market power tests neither ignore elasticity nor make counterfactual elasticity assumptions. As the Commission stated, "In markets with very little demand elasticity, a pivotal supplier could extract significant monopoly rents during peak periods because customers have few, if any, alternatives."[21] The Commission also stated:

> In both of these models, the lower the demand elasticity, the higher the mark-up over marginal costs. It must be recognized that demand elasticity is extremely small in electricity markets; in other words, because electricity is considered an essential service, the demand for it is not very responsive to price increases. These models illustrate the need for a conservative approach in order to ensure competitive outcomes for customers because many customers lack one of the key protections against market power: demand response.[22]

---

20 For detailed examples, see Joseph E. Bowring, PJM Market Monitor, "MMU Analysis of Combined Regulation Market," PJM Market Implementation Committee Meeting (December 20, 2006).

21 107 FERC ¶ 61,018 (2004).

22 107 FERC ¶ 61,018 (2004).

The three pivotal supplier test is a reasonable application of the Commission's delivered price test to the case of load pockets that arise in a market based on security-constrained, economic dispatch with locational market pricing and extremely inelastic demand. The three pivotal supplier test also exists in the context of a local market power mitigation rule that relies on a structure test, a participant behavior test and a market impact test. The three pivotal supplier test explicitly incorporates the relationship between supply and demand in the definition of pivotal and it provides a clear test for whether excess supply is adequate to offset other structural features of the market and result in an adequately competitive market structure. The greater the supply relative to demand, the less likely that three suppliers will be jointly pivotal, all else equal.

The results for 2006 confirm that the three pivotal supplier test results in offer capping when the local market is structurally noncompetitive and does not result in offer capping when that is not the case. Local markets are noncompetitive when there is a small number of suppliers. The number of hours in which one or more suppliers pass the three pivotal supplier test and are exempt from offer capping increases as the number of suppliers in the local market increases. For example, the regional constraints have a larger number of suppliers and more than 64 percent of the three pivotal supplier tests have one or more passing owners. In contrast, more local constraints like Gardners-Hunterstown in the Met-Ed Control Zone have only one or two suppliers and therefore are always structurally noncompetitive.

The three pivotal supplier test represents a significant modification of the previously existing PJM local market power rule, which did not include an explicit market structure test. The goal of the applying a market structure test is to continue to limit the exercise of market power by generation owners in load pockets but to lift offer capping when the exercise of market power is unlikely. The goal of the three pivotal supplier test, proposed by PJM, was not to weaken the local market power rules but to make them more flexible by adding an explicit market structure test. As recognized by PJM when the local market power rule was proposed in 1997 and has continued to be the case, the local markets created by transmission constraints are generally not structurally competitive. Nonetheless, it is appropriate to have a clear test as to when a local market is adequately competitive to permit the relaxation of local market power mitigation. The three pivotal supplier test proposed by PJM is not a guarantee that suppliers will behave in a competitive manner in load pockets. The three pivotal supplier test is a structural test that is not a perfect predictor of actual behavior. The existence of this risk is the reason that the PJM Tariff language also includes the ability of the MMU to request that the Commission reinstate offer caps in cases where there is not a competitive outcome.

Q. Does this complete your direct testimony?

A. Yes.