UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

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PJM Interconnection, L.L.C.	**)**	**Docket No. EL08-47-000**
	)	

REPLY COMMENTS OF THE INDEPENDENT MARKET MONITOR FOR PJM

NOVEMBER 5, 2008

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Pursuant to Rule 211 of the Commission's Rules and Regulations[1] and its letter order issued July 25, 2008, in this proceeding, Monitoring Analytics, LLC, in its capacity as the Independent Market Monitor for PJM[2] ("Market Monitor"), respectfully submits these reply comments. On October 6, 2008, the Market Monitor and a number of parties submitted comments ("Comments") in response to the Commission's investigation "to consider the continued justness and reasonableness of PJM's existing market power screen."[3] This reply focuses on those comments raising certain criticisms of the TPS test and the way that it has been applied by PJM.[4]

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1 18 CFR § 385.211 (2008).

2 PJM Interconnection, L.L.C., a FERC approved Regional Transmission Organization. Capitalized terms not otherwise defined herein shall have the same meaning as defined in the PJM Open Access Transmission Tariff ("OATT") or the PJM Operating Agreement ("OA"). Citations to Schedule 1 of the OA omit parallel references to the Appendix to Attachment K of the OATT.

3 *PJM Interconnection, L.L.C.*, 123 FERC ¶61,169 at P 1, 59 & Ordering Para. (B) (2008) ("Investigation Order").

4 These include: Public Service Electric and Gas Company, PSEG Power LLC and PSEG Energy Resources & Trade LLC ("PSEG Companies"); DTE Energy Trading, Inc. ("DTET"); Reliant Energy, Inc. ("Reliant"); Appalachian power Company, Columbus Southern Power Company, Indiana Michigan Power Company, Kentucky Power Company, Kingsport Power Company, Ohio Power Company and Wheeling Power Company ("AEP"); Exelon Corporation ("Exelon"); Mirant Energy Trading, LLC, Mirant Chalk Point, LLC, Mirant Mid-Atlantic, LLC, Mirant Potomac River, LLC ("Mirant"), including, , an attached affidavit of Robert B. Stoddard ("Stoddard Affidavit"); a coalition of indicated PJM suppliers including Constellation Energy Commodities Group, Inc., Constellation Power Source Generation, Inc., Constellation NewEnergy, Inc., Dayton Power and Light Company, Duke Energy Corporation on behalf of Duke Energy Kentucky, Inc., Duke Energy Ohio, Inc., Duke Energy Indiana, Inc., Duke Energy Carolinas, LLC, and Duke Energy Shared Services, Inc., Liberty Electric Power, LLC, PPL Electric Utilities Corporation, PPL EnergyPlus, LLC, PPL Susquehanna, LLC, PPL University Park, LLC, and Lower Mount Bethel Energy, LLC ("Constellation, et al."), including an attached Affidavit of Scott M. Harvey, Ph.D. ("Harvey Affidavit"); Shell Energy North America ("Shell Energy").

Before turning to some of the specific points raised, it is important to emphasize that despite years of considering and evaluating the TPS test by PJM and its stakeholders, and by the Commission in various proceedings, there is still no evidence to support the proposition that the TPS test, first filed by PJM September 30, 2003, is unjust, unreasonable or unduly discriminatory. Instead, some intervenors, applying an analytical standard to the TPS test far stricter that the generous standard that they would have the Commission apply to detecting market power, allege certain imperfections in the detailed mechanics of the TPS test. As explained below, the intervenors fail to substantiate even these allegations. The TPS test has performed as an administratively efficient and economically appropriate adaptation of the Commission's Delivered Price Test for automatic application following PJM's dispatch software. The evidence strongly supports the argument that the results of the TPS test in PJM markets are just and reasonable.

PJM's TPS test is a product of negotiation, implemented after an uncontested settlement, agreed to and executed by most of the participants in this proceeding. The TPS test works and has allowed PJM markets to produce competitive results.

While the Market Monitor agrees that the tariff's mechanisms for scarcity could be improved with respect to the energy market, such improvements are not required in order to assure appropriate investment incentives. Those incentives are currently provided by a combination of locational energy prices and locational capacity prices.

RPM has made a significant impact, resulting in total payments to generation of about $31.5 billion total to date and about $6.3 billion annually, ensuring sufficient net revenues for supply and sending appropriate signals for attracting new entry.[5]

Some supporters of the TPS test, such as PSEG (at 3), have characterized the test as "conservative."[6] Both PSEG and Reliant, among others, recognize the role of effective market power mitigation in helping to maintain confidence in PJM markets. This is a rational approach in light of the impact of higher energy prices on consumers and the corresponding requirement that market monitors and policy makers be able to assure all market participants that high prices are not the result of market power.[7] The Market Monitor agrees with the characterization of the TPS test as "conservative" in the sense that the Federal Power Act takes a conservative approach to the regulation of the electric industry by requiring that the Commission take affirmative action necessary to ensure just and reasonable rates for electricity.

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5 Witness Stoddard's view (at 4) that RPM is somehow deficient as an incentive for retaining an appropriately level of capacity because "RPM price signals work on broad scales of both time and geography" misses the point of the capacity market and its relationship to the energy market. The Market Monitor has offered some reasons (at 66-69) why it may be preferable to allow for the recovery of some scarcity revenues from the energy markets rather than rely exclusively on the capacity market, but these considerations do not concern whether the PJM market construct overall appropriately compensates supply and provides sufficient incentives to attract economic new entry.

6 S*ee also*, AEP at 2, which does not necessarily endorse the test, but agrees recognizes that it is lawful in that "it does not produce unjust and unreasonable mitigation results"; Brattle Report at 99.

7 PSEG at 3; *see also*, Reliant (at 4) which maintains its critical position on the TPS test but acknowledges that "[s]uch rules are important to help ensure confidence in the market and individual market participant behavior."

The Market Monitor also considers the TPS test "liberal," as one would expect from a test that emerged from a broad consensus of PJM stakeholders. The TPS test does not prevent all exercises of local market power. The TPS test allows suppliers to calculate their own costs, subject to verification, and to work out acceptable cost definitions through the Cost Development Task Force ("CDTF"). The definition of costs includes a 10 percent adder to calculated short-run marginal costs ("SRMC") in order to account for the potential uncertainties in measurement. The local market power mitigation rules afford still more significant adders to protect units frequently subject to mitigation, the FMU and AU adders. The TPS test defines the relevant market as all supply up to 150 percent of the shadow price rather than the much more conservative 105 percent level used by the Commission in its Delivered Price Test.[8]

No party has yet offered any support for claims that the application of the TPS test has resulted in the under compensation of any resource owner in PJM. Instead there are general assertions of harm[9] that are belied by the evidence that the TPS test has contributed to PJM markets achieving competitive results.

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8 The shadow price of a constraint is the incremental cost of relieving the constraint under a given set of system conditions. It is defined at the point of intersection between the incrementally available constraint relief supply curve and the amount of constraint relief needed. Assuming a single constraint, the shadow price is equal to the incremental cost of the relieving resource (Offer of a unit c) net of System Marginal Price (SMP), divided by the DFAX of the relieving resource (c) to the constraint (i) in question.

9 *See*, *e.g.*, Mirant at 10–16;

I. TPS BASICS

A. <u>Review of TPS</u>

In the PJM Energy Market, offer capping occurs only as a result of structurally noncompetitive local markets and noncompetitive offers in the Day-ahead and Real-time Energy Markets. There are no explicit rules governing market structure or the exercise of market power in the aggregate energy market. PJM's market power mitigation goals have focused on market designs that promote competition and that limit market power mitigation to situations where market structure is not competitive and thus where market design alone cannot mitigate market power.

PJM has clear rules limiting the exercise of local market power.[10] The rules provide for offer capping when conditions on the transmission system create a structurally noncompetitive local market (as measured by the TPS test), when units in that local market have made noncompetitive offers and when such offers would set the price above the competitive level in the absence of mitigation. Offer caps are set at the level of a competitive offer. Offer-capped units receive the higher of the market price or their offer cap. Thus, if broader market conditions lead to a price greater than the offer cap, the unit receives the higher market price. The rules governing the exercise of local market power recognize that units in certain areas of the system would be in a position to extract monopoly profits, but for these rules.

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[10] See OA Schedule 1, § 6.4.2.

Under existing rules, PJM exempts suppliers from offer capping in the presence of transmission constraints when structural local market conditions, as measured by the TPS test, indicate that such suppliers are reasonably likely to behave in a competitive manner. The goal is to apply a clear rule to limit the exercise of market power by generation owners in load pockets, but to apply the rule in a flexible manner in real time and to lift offer capping when the exercise of market power is unlikely based on the real-time application of the market structure screen.

PJM's TPS test represents the practical application of the FERC market power tests in real time.[11] The TPS test is passed if no three generation suppliers in a load pocket are jointly pivotal. Stated another way, if the incremental output of the three largest suppliers in a load pocket is removed and enough incremental generation remains available to solve the incremental demand for constraint relief, where the relevant competitive supply includes all incremental MW at a cost less than, or equal, to 1.5 times the clearing price, then offer capping is suspended.

B. The Evidence Shows that PJM Now Has Sustainable Competitive Markets

The ultimate goal of market design is a sustainable, competitive market. While PJM markets are not perfect and there is work left to be done, the available evidence is that PJM markets meet that goal. PJM has a complete set of markets including the Day-

[11] See the PJM *2007 State of the Market Report*, Volume II, Appendix L, "(Three Pivotal Supplier Test)."

ahead Energy market, the Real-time Energy Market, the capacity market (RPM) and ancillary services markets. There is scarcity pricing in the PJM energy market and in the PJM capacity market. Both the energy market and the capacity market provide locational price signals. PJM markets are revenue adequate. PJM markets result in revenues adequate to cover the forward looking cost of new capacity. PJM markets results in appropriate, locational price signals. These are facts, supported by evidence.

While PJM markets have historically not generally provided net revenues sufficient to provide appropriate investment incentives, the introduction of the RPM has changed the results and therefore changed that conclusion. Net revenue results for the first full year of RPM, the planning year from June 1, 2007 through May 31, 2008, show that net revenues exceed the cost of new capacity, as anticipated for that planning year, for all technology types for the eastern, constrained RPM Locational Deliverability Areas ("LDAs"). The underlying price signals from the energy market are locational as are the underlying price signals from the capacity market. Net revenues are substantially higher in the eastern, constrained LDAs where capacity is relatively tight than in western LDAs where capacity is relatively plentiful.

PJM has provided evidence that RPM incentives have resulted in new investment.[12] The MMU has also provided evidence to support the conclusion that RPM

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12 *See* the PJM website < http://www.pjm.com/markets/rpm/operations.html.>

incentives have contributed to investment in both existing and new generating capacity that likely would not have occurred absent the RPM design.[13]

Figure 1, Figure 2 and Figure 3 compare the net revenue from all PJM markets by zone to the forward looking annual fixed cost of capacity for the period of PJM markets.[14] The final data points include the period from June 1, 2007 through May 31, 2008.

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13 *See* "Analysis of APIR Investment and MW Added Under RPM: 2007-2011 RPM Auction" (September 8, 2008)located on the PJM Website at (<*http://www.pjm.com/markets/market-monitor/downloads/20080908-apir-report-2007-2011.pdf*.>

14 *See* "Testimony of Joseph E. Bowring Independent Market Monitor for PJM" at 8-10: (October 23,2008) Posted on the PJM website at <*http://www.pjm.com/markets/market-monitor/downloads/20081023-final-bowring-testimony-papuc.pdf*>

Figure 1 CT Net revenue from all markets and fixed costs

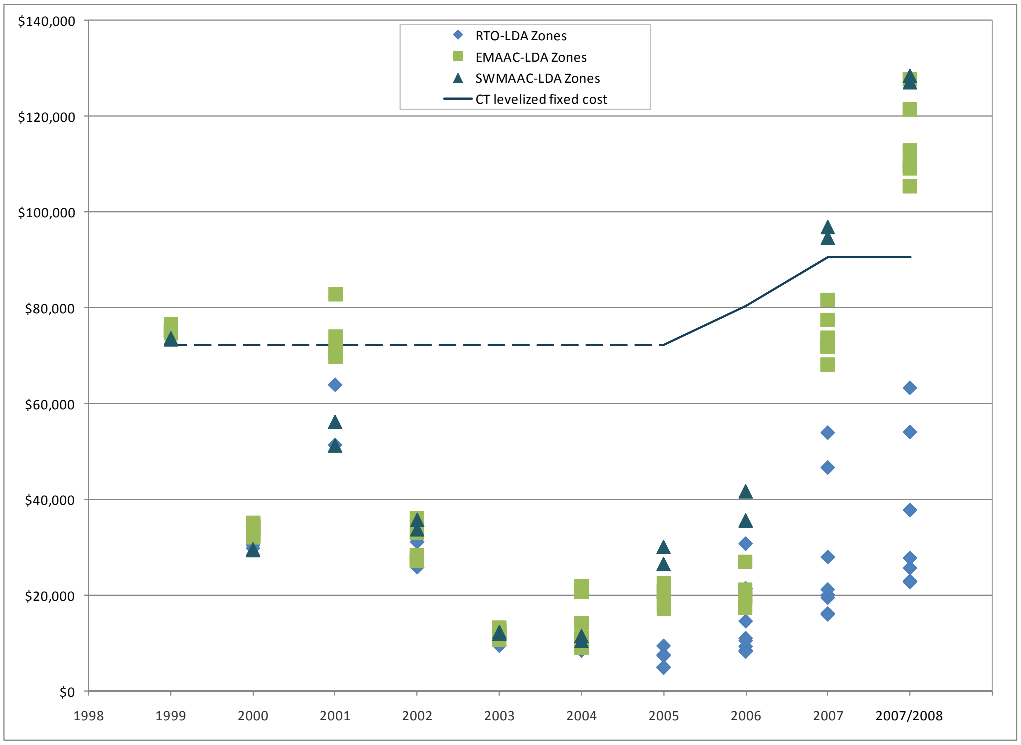

Figure 2 CC Net revenue from all markets and fixed costs

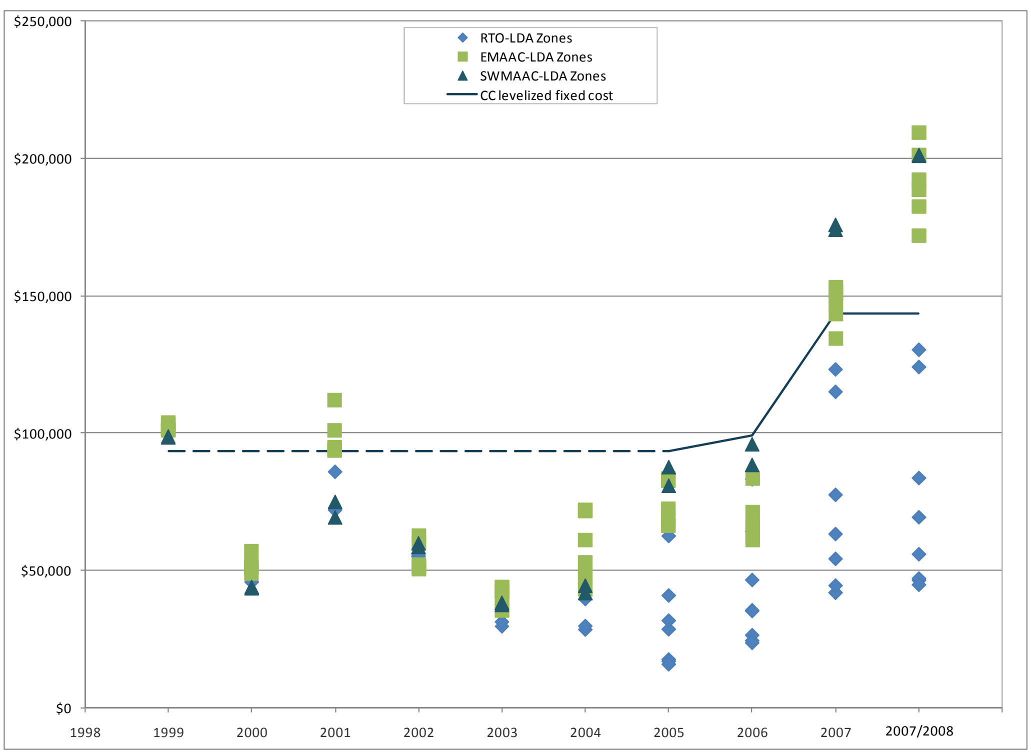

Figure 3 CP Net revenue from all markets and fixed costs

PJM market design and the PJM TPS test pass the acid test of actual use. Market power mitigation has not resulted in a shortfall of revenues that must be made up through the permitted exercise of market power.

C. <u>The Data Show That The TPS Test Mitigates Appropriately</u>

The data strongly support the assertion that the TPS test mitigates appropriately. The TPS test focuses narrowly on local markets that are not structurally competitive and the result is the targeted and limited mitigation required to maintain competitive markets. The data do not support the claim that the TPS test over mitigates. The data do not support the claim that the TPS test has a negative impact on market outcomes or incentives. The MMU has provided comprehensive data and analysis on the application of the TPS test. The State of the Market Reports and certain quarterly reports are the two primary sets of reports where the MMU has regularly reported on the results of the TPS test.[15]

No party to this proceeding makes the assertion that any particular unit is revenue deficient as the result of offer capping. The data would not support such an assertion.

The introduction of the TPS test has resulted in less offer capping in the energy market.[16] Participants can and do pass the TPS test when the test fails to find the presence of structural market power. The risk of under mitigation is substantially larger and the general order of magnitude is documented elsewhere in these Reply Comments. The TPS test does not mitigate all market power.

Table 1 shows that historical levels of offer capping in PJM have been low. In 2007, only 1.1 percent of unit hours and only 0.2 percent of MW were offer capped in the

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15 *See* PJM MMU Analysis of the Three Pivotal Supplier Test: March 1, 2007–June 30 2007, included below as Attachment A.

16 See the *2007 State of the Market Report*, Volume II, Part 1.

real-time market. In 2007, only 0.2 percent of unit hours and only 0.0 percent of MW were offer capped in the day-ahead market. [17]

Table 1 Annual offer-capping statistics: Calendar years 2003 to 2007

	Real Time		Day Ahead	
	Unit Hours Capped	MW Capped	Unit Hours Capped	MW Capped
2003	1.1%	0.3%	0.4%	0.2%
2004	1.3%	0.4%	0.6%	0.2%
2005	1.8%	0.4%	0.2%	0.1%
2006	1.0%	0.2%	0.4%	0.1%
2007	1.1%	0.2%	0.2%	0.0%

Offer capping tends to be concentrated in a relatively small number of units that are in local markets created by transmission constraints and characterized by market power. Table 2 shows data on the frequency with which units were offer capped in 2007 by run hours and percentage of total run hours that were offer capped. For example, in 2007, only 15 units were offer capped for greater than, or equal to, 80 percent and less than 90 percent of their run hours and had 500 or more offer-capped run hours. Only 27 units in PJM had run hours greater than or equal to 300 hours and were offer capped for more than 10 percent of their run hours.[18]

[17] See the *2007 State of the Market Report*, Vol. II, Part 1, "Annual offer-capping statistics" at Table 2-5.

[18] See the *2007 State of the Market Report*, Vol. II, Part 1,"(Offer-capped unit statistics) "at Table 2.6

Table 2 Offer-capped unit statistics: Calendar year 2007

Run Hours Offer-Capped, Percent Greater Than Or Equal To:	2007 Offer-Capped Hours					
	Hours ≥ 500	Hours ≥ 400 and < 500	Hours ≥ 300 and < 400	Hours ≥ 200 and < 300	Hours ≥ 100 and < 200	Hours ≥ 1 and < 100
90%	2	1	3	2	6	0
80% and < 90%	15	3	0	14	13	6
75% and < 80%	0	0	0	0	2	4
70% and < 75%	0	0	2	0	1	3
60% and < 70%	0	0	0	1	3	24
50% and < 60%	1	0	0	0	0	21
25% and < 50%	0	0	0	0	0	51
10% and < 25%	0	0	0	3	12	37

In 2007, the PSEG, AP, AEP, Met-Ed, JCPL, PENELEC, Dominion, DPL, AECO and DLCO control zones experienced congestion resulting from one or more constraints binding for 100 or more hours. Using the TPS test results for calendar year 2007, actual competitive conditions associated with each of these frequently binding constraints were analyzed in real time. The ComEd, BGE, PECO, PPL, RECO, Pepco and DAY Control Zones were not affected by constraints binding for 100 or more hours.

Overall, the results confirm that the TPS test results in offer capping when the local market is not structurally competitive and does not result in offer capping when the local market is structurally competitive.[19] Local markets are not competitive when there is a small number of suppliers. The number of hours in which one or more suppliers pass the TPS 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

[19] See the PJM *2007 State of the Market Report*, Vol. II, at 20 – 32.

larger number of suppliers and more than 59 percent of the TPS tests have one or more passing owners. In contrast, more local constraints like Gardners–Hunterstown in the Met-Ed Control Zone have only two suppliers and therefore are never structurally competitive.[20]

II. ISSUES

A. Short Run Marginal Costs Are the Correct Metric for Competitive Offers

Short run marginal costs are the correct metric for competitive offers and therefore are the appropriate level to which non-competitive offers should be mitigated. Both Mr. Stoddard (at 40) and Dr. Harvey (at 16)recognize that short run marginal costs are the correct metric for competitive offers while indicating that they believe there are measurement issues.

Dr. Harvey states (at 23): "If offer price mitigation always reduced offer prices to the economically efficient level, then there would be no cost to mitigation."

Importantly, no party asserts that some defined mark up over short run marginal costs should be included based on economic theory. There is no theoretical basis for such a mark up.

The actual arguments about relaxing the TPS test metrics are based on policy goals about appropriate levels of competition rather than on theoretical arguments about the appropriate metric for competitive offers.

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20 See Attachment B.

Calculating marginal costs accurately is not as difficult as Mirant would have it. The Brattle Report concedes this point (at 21): "given available heat rate and fuel cost information, generation costs arguably are easier to observe than production costs in many other industries, which may create further incentive to more closely monitor and mitigate market power in electricity markets."

The arguments about measuring marginal costs ignore the fact that the marginal costs are calculated by the generators themselves, that there is a well defined process using the Cost Development Task Force (CDTF) for addressing cost-related issues and that the generators have not made any complaint about those calculations or raised any issues in the CDTF process.

Witness Stoddard turns economic theory on its head when he argues(at para. 38) that the use of "benchmark economic bids cleared from a resource when it is *not* flagged under the TPS test" are "*per se* economic and competitive" and "better … than an administrative accounting of marginal costs" [(emphasis added).] This circular logic begs the question of how to define a metric for determining whether a market is competitive. This approach would treat undifferentiated competitive and non-competitive bids together as an appropriate metric for competitive offers. Witness Stoddard ignores the generally accepted point that reliance on reference bids can be gamed and that a significant degree of market power would therefore be built into his benchmark. Witness Stoddard also ignores the fact that the offers of PJM generation units generally are at the level of short run marginal cost as defined by the Cost Development Manual and used in the TPS test.

B. <u>The TPS Test Appropriately Defines the Market</u>

1. The Electrical System Defines the Market

Constellation, et al. (at 5–6) affirms that, "[f]undamental to any market mitigation test is the proper definition of the geographic market being analyzed," but then proceeds to argue for an outdated and static definition of a geographical market that is unrelated to real markets. It is a strength of the TPS test that it reflects the actual local markets created by transmission constraints. Such local markets are the result of the operation of the actual wholesale power network and such local markets are precisely where market power may be exercised. The TPS test makes explicit and direct use of the incremental, effective MW of supply available to relieve the constraint at a distribution factor (DFAX) greater than, or equal to, the DFAX used by PJM in operations. This market-based approach has been part of PJM local market power mitigation since markets were introduced on April 1, 1999 and the predecessor utilities to Constellation, et al., signed on to that construct.

a) The TPS Test Should Not Ignore Market Power—Even if Allegedly Transitory

The exercise of market power to increase market prices is not transitory if it can repeatedly and even predictably reoccur. The market power mitigation rules should not ignore structural market power in such circumstances. It is not correct that hourly changes in market conditions mean that the opportunities to use market power are transitory and should not be mitigated. This is the case even prior to considering the fact that market power under such circumstances can result in substantial wealth transfers in very short periods of time.

Generation owners operate in the context of what economists term a "repeated game." Generation owners face similar market conditions on a regular basis and those market conditions are predictable based on prior experience and knowledge of the system. There are clear, observable patterns in hourly load, LMP and congestion. It is also known that the price elasticity of demand is extremely low, which facilitates the exercise of market power.

Constellation argues (at 7) that "[a]ny exercise of market power would require the ability to detect one day in advance the specific constraints that would emerge during the operating day, competing offers made in those markets and the profitability of raising price above competitive levels." PJM market participants are highly sophisticated. While the requirement to submit only a single offer for a day is an important limiter of market power, especially in the aggregate market, it does not prevent market power, as the evidence shows. If Constellation were correct, no anti-competitive behavior would ever be observed and offer capping would not be necessary because all offers would be competitive. Constellation's claim strains credulity. The data on offers and offer capping flatly contradict Constellation's claims. Without providing a guide to the exercise of market power, PJM rules permit units to self schedule whenever they wish, with 20 minutes notice, and to go back on their price schedules with the same 20 minute notice. Units can self schedule when profitable, regardless of whether their price-based offer exceeds LMP, and can switch back to a high price-based offer if market information indicates a relevant binding constraint that would permit the unit to set the price based on their offer. In addition, units can modify key operating parameters hourly during the day. Such parameters can, together with price offers, be a mechanism for the exercise of market power.

Contrary to Constellation, et al.'s claim (at 6) that there is "real doubt that any market power could be successfully exercised during such short time periods," there is evidence that a degree of market power is exercised in the absence of local market power mitigation and there is evidence that even in the presence of local market power mitigation rules the TPS test does not prevent all exercises of market power.

The evidence of the ability to exercise market power under the conditions referenced by Constellation, et al., is provided by the actual behavior of units that were exempt from offer capping for local market power and the evidence of the impacts of such behavior on the markets is the measured impacts of such exempt units on market prices in PJM.

Prior to the recent FERC ruling ending exemptions, some units were exempt from the offer-capping rules for local market power based on the date of their construction. [21] Such exempt units could and did exercise market power, at times, that would not have been permitted if the units had not been exempt. Historically, a small number of exempt units have accounted for a disproportionate share of markup. The supporting evidence was reported in the 2006 and the 2007 PJM State of the Market Reports.

In 2006, the units that were exempt from offer capping for local market power accounted for $0.56 per MWh, or 36 percent, of the markup for all days. This was a disproportionate share, given that only 43 of 56 exempt units were marginal and that only eight exempt units of the 43 accounted for $0.50, or 90 percent, of this markup component of price. The average markup per exempt unit was about nine times higher than for non-exempt units, and the average markup for the top eight exempt units was about 43 times higher than for non-exempt units.[22]

In 2007, the units that were exempt from offer capping for local market power accounted for $1.34 per MWh, or 23 percent, of the markup for all days. This was a disproportionate share, given that only 44 of 56 exempt units were marginal and that only eight exempt units of the 44 accounted for $1.15, or 86 percent, of this markup component of price. The average markup per exempt unit was about four times higher

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21 Maryland Public Service Commission v. PJM Interconnection, L.L.C., 123 FERC ¶61,169, (2008)

22 See the *2006 State of the Market Report*, Volume II, Part 1.

than for non-exempt units, and the average markup for the top eight exempt units was about 21 times higher than for non-exempt units.[23]

There is also evidence that market participants are able to pass the TPS test and still exercise market power. As noted in the MMU's October 31, 2008 presentation to FERC Litigation Staff and to participants in this proceeding, there was a recent incident, recorded on October 28 at 11:14, where a non-environmentally limited unit with a submitted cost offer of $288.68 and a price offer of $360.85 passed the TPS test and was marginal based on price.[24] This unit had a significant impact on prices in the Pepco zone, the Baltimore Gas and Electric Company zone and the Dominion zone.

Constellation, et al., also misreads (at 11) the Commission directions to the CAISO that it "reconsider its annual approach to determining the competitiveness of transmission constraints and to 'develop a competitive assessment study that designates a [transmission] path as either competitive or non-competitive on a seasonal basis with seasonal designations.'" The Commission sought to enhance the accuracy of the test by moving from an annual to a seasonal analysis, thus narrowing the applicable time frame.[25] The TPS test appropriately narrows the analysis to real-time, further enhancing

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23 See the *2007 State of the Market Report*, Volume II, Part 1.

24 October 28, 2008, MA presentation to FERC Litigation Staff, "Three Pivotal Supplier Test Discussion", at. 42, which is included below as attachment C.

25 *See California Independent System Operator Corporation*, 116 FERC ¶61,274 at P 1031 (2006).

its accuracy, consistent the Commission's preference that the rule "accurately mitigate pivotal resources."[26]

b) The TPS Test Appropriately Considers How a Single Unit Affects Multiple Constraints

The complaint of Constellation, et al. (at 7) that PJM's application of the TPS test "fails to account for the fact that the output of a single generating unit can affect multiple transmission constraints" also is misplaced. If "the application of the TPS test on a constraint-by-constraint basis," as Constellation claims, "puts the same generating unit in multiple 'markets,' which inherently may misrepresent the competitive arena in which the generating unit actually operates," then the effect is to enhance rather than reduce the amount of supply considered, and thereby reduce the amount of times that the test applies.

More importantly, the TPS test is applied based on the actual dispatch decisions of the PJM dispatch software. Thus the TPS test appropriately and accurately reflects the local markets created and cleared by PJM dispatch software.

2. The TPS Test Broadly Defines Competitive Supply

a) The TPS Test Considers Supply Economically Relevant to a Constraint

A number of intervenors claim that the definition of the relevant market using 150 percent of the constraint's shadow price is too strict, even though it is considerably

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[26] *Id.*

greater than the Commission's 105 percent cut off used in its Delivered Price Test.[27] The 150 percent level was established by agreement of the parties in the settlement in Docket No. EL03-236-000. The definition of the relevant market to include only actual economic substitutes, actual competitors, in the analysis is necessary for all of the reasons identified in the Commission's Delivered Price Test. In fact, the 150 percent threshold clearly includes units that are not actual economic substitutes or meaningful competitors. It is difficult to argue that a $300 per MWh unit is a meaningful competitor for a $200 per MWh unit.

Constellation, et al., argues (at 7–8, 23) against a 150-percent price threshold for the identification of "eligible supply" observing that, "in practice, a system operator will dispatch any unit that is physically available within the time needed." They complain that a 150-percent level is arbitrary, but do not recommend any alternative, much less offer support for an alternative, or explain why the default should not be the 105-percent level included in the Commission's Delivered Price Test. Mirant goes further (at 17, 24) to recommend the removal of all "price limitation on the definition of 'eligible supply'."[28]

Constellation, et al., asserts (at 23) that "a system operator will dispatch any unit that is physically available within the time needed." PJM makes a similar comment (at

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[27] *See* Constellation, et al. at 7–8; Reliant at 5; Mirant at 17, 24.

[28] See also Stoddard Affidavit at ¶ 34.

22-23).[29] But this misstates the issue. If a PJM dispatcher needs 20 MW of effective relief for a constraint and has 40 MW at a price of $200 per MWh and another 40 MW at a price of $300 per MWh, the dispatcher will proceed in economic order to dispatch the cheapest units available to resolve the constraint. The dispatcher will not "dispatch any unit physically available within the time needed," if there are more MW available than needed. In this example, the dispatcher will call on 20 MW at $200 per MWh. The 150 percent market definition does not limit the dispatchers in any way, but it does reflect a measure of what the relevant market is. In this example, the relevant market will include substantially more MW than required to resolve the constraint.

If the dispatcher needs 60 MW, the dispatcher will call on 60 MW and the price will be $300 per MWh. In this case the relevant market using the 150 percent rule would also include the 30 MW available at $450 per MWh.

If a dispatcher, in an unusual circumstance, takes a unit that is not recommended by the dispatch software and that is out of local merit order, to resolve a constraint, this does not mean that there is an issue with the TPS test. Rather, it should be recognized as an exception that results from an unexpected circumstance. Ultimately, improvements in PJM dispatch software will come even closer to eliminating such circumstances, but the relevant market for the TPS test should not be determined based on unusual circumstances that require unusual dispatcher actions.

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29 *See* Report of PJM Interconnection, L.L.C, (September 5, 2008)

b) Variances of Supply at Different Price Levels Are Expected

Constellation, et al. argues that using the definition of available supply "creates counter-intuitive variances in the determination of available supply for congestion relief," claiming (at 8) that "when transmission constraints bind more tightly, the shadow price increases and more supply is available to relieve the constraint under this higher threshold" and conversely, that "when the transmission constraint binds less, the shadow price decreases and less supply is available to relieve the constraint under this lower threshold."

Constellation's intuition is unclear. This criticism could also apply to the definition of supply in the Commission's Delivered Price Test.

In any event, the determinative factor is the relative shape of the relevant portions of the supply curve, which fully explains the relationship between the price and quantity of available relief. A relatively flat supply curve at lower prices and a relatively steep curve at higher prices will result in a different relationship between price and quantity.

This is a non issue.

C. <u>The TPS Test Performs Well as Designed.</u>

1. The TPS Test Should Not Excuse Small Suppliers

A number of intervenors complain that the TPS test unnecessarily mitigates small suppliers when competitive forces could be relied upon to discipline the pricing for residual quantities of supply.[30] For example, intervenors argue that "small" suppliers, in a market with one or two dominant suppliers, cannot have market power. The argument is that, in a market with one or two dominant suppliers, it is the dominant suppliers, not the small suppliers that possess market power. In these examples, it is assumed that the small suppliers, by virtue of their size alone, form a "competitive fringe" that cannot wield market in the residual market left to them by the dominant supplier(s).

Such arguments, while they may have some superficial appeal, rely on a number of demonstrably inaccurate assumptions, most notably that the dominant supplier(s) in a particular market are the least cost supplier(s) and therefore always dispatched first, that the small suppliers all have identical or similar higher costs, and that the small suppliers face a uniformly elastic residual demand curve after the dominant suppliers have been dispatched.

There is no factual basis for the assumption that the largest potential suppliers in the defined market have the units with the lowest effective costs, or that the small suppliers will have the highest costs. In practice, any one supplier can have one or more assets in the supply curve and these assets will have effective costs that are distributed in various portions of the supply curve for the defined market. The effective costs of the units are a function of the unit technology, unit fuel costs, unit performance and unit distribution factor to the constraint. An efficient, low cost unit can have a high effective

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30 *See* Shell Energy at 5–6; DTET at 3–4.

cost if it has a low distribution factor to the relevant constraint. The data do not support the assumption that large generators always have the lowest effective costs in local markets. The data do support the view that ownership is spread across the supply curve for local constraints.

The assertions that "small" suppliers cannot, by definition, exercise market power ignore the fact that the definition of a "small" supplier and whether that supplier has market power depends on the structure of the specific market. An arbitrary definition of small is not a relevant measure. "Small" has not been defined by those making assertions about the competitiveness of small suppliers. The terms "dominant" and "small" supplier are not defined terms. Their use in this discussion illustrates the dangers of using vague, qualitative concepts in making assertions about market structure. A very large generation owner can be a small supplier in a local market. The MW of supply in a market are a function of the electrical location of units and thus their relationship (distribution factor) to the relevant constraint. Pivotal supplier analysis explicitly measures the relative importance of a supplier, or a group of suppliers, in the context of a specific market structure including the total supply that is available and the amount of demand that needs to be met. Depending on the details of the market structure, a relatively small supplier could be in a position to exercise market power. A small supplier need not be the high cost supplier and a large supplier need not be the low cost supplier. This makes the cost order, and the ownership of supply curve segments in that cost order relative to the clearing point in the market, more important than absolute size in determining market dominance. The TPS test is an explicit, well defined test of the ability of a participant to exercise market power in the context of the specific market structure that accounts for both the size and cost of participants in a mathematically well defined way.

2. The TPS Test Properly Accounts for Units That Can Be Dispatched Down

Constellation, et al. also claims (at 8) that "the calculation of effective supply for relieving a transmission constraint only accounts for generation that would be dispatched up to solve the constraint and does not account for generation that would be dispatched down" and that "it is possible that much of the generation dispatched up to solve the constraint would have less of an impact on the constraint than generation that could be dispatched down." Constellation is concerned (at 8–9) that, "[a]s a result, the TPS test could dramatically overstate the amount of generation re-dispatch that is needed by only considering generation that could be dispatched up to resolve the constraint"

Contrary to Constellation's assertions, PJM's dispatch and the TPS test consider lower helps in the calculation of effective supply for relieving a transmission constraint. Lower helps are handled by PJM's dispatch and the TPS test in exactly the same way as raise helps, on the basis of available and effective MW and on the basis of the effective incremental cost of the resource to provide relief for the constraint. Whether a raise or a lower help, the incremental cost of relief from a given resource (j) is determined on the basis of the relevant offer of the unit ($Offer_j$) being considered net of the system marginal price divided by the load distributed reference based DFAX of the resource (j) to the constraint (j). So long as this value is less than 1.5 times the shadow price determined by the intersection of incremental available supply and the relief requirement, the resource in question will be considered as part of available and effective supply.[31]

3. Alleged Pricing Problems for Units Dispatched for Operational Reasons Are Irrelevant to the TPS Test

Mirant alleges (at 21–23) a problem with PJM's calculation of LMP that causes "CTs dispatched to relieve the same constraint … not to receive the same price even if they are providing identical service," citing the example of facilities dispatched near the Dickerson substation on August 4, 2007. These units were dispatched for operational reasons, were compensated for their costs through operating reserves (uplift), and did not set LMP. Mr. Stoddard has mischaracterized the detailed facts of the case he describes. Mr. Stoddard does not know for what constraints specific units were dispatched nor has he established that there was any issue with PJM dispatch. While it is always appropriate to review the actual dispatch rules of PJM, there is no evidence presented by Mr. Stoddard that there is an issue. To the extent there is an issue here, it

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[31] The offer of the unit must meet the following condition to be considered: $1.5 \times \lambda_i \geq \left(\frac{Offer_j - SMP}{DFAX_{ij}}\right)$

relates to PJM's operational dispatch rules. There is no indication that Mirant brought this issue to either PJM or the MMU at the time it occurred. Whatever the merits of further examination of this issue in another proceeding, the identified dispatch issue is plainly irrelevant to this one. One of the key strengths of the TPS test is that it reflects, exactly, the dispatch software used by PJM. If there is an issue with the dispatch rules, it does not make sense to distort the TPS test in order to solve it. Rather, the issue should be addressed directly and the TPS test will follow the resultant definition of the market.

4. The TPS Test Must Consider Multiple Constraints

Constellation, et al. makes a related argument (at 9). Constellation suggests that there is "a mismatch between the methodology used to determine the relief needed on a particular transmission constraint and the process used to calculate the amount of supply available to relieve the transmission constraint."

Constellation, et al. does not provide any data to support the assertion or any arguments about the alleged extent or impact of the assertion and Constellation does not suggest a solution to the alleged issue.

Again, one of the key strengths of the TPS test is that it reflects, exactly, the dispatch software used by PJM. If there is an issue with the dispatch rules, the issue should be addressed directly and the TPS test will follow the resultant definition of the market.

5. The TPS Test Appropriately Processes DEC Bids

Constellation, et al. argues (at 9) that "the TPS test appears to omit price-capped load bids and DEC bids (virtual demand) from the available supply to relieve a transmission constraint in the day ahead market."

This is not correct. The application of the TPS test in the day-ahead market accounts for all supply offers and all demand bids.

6. The TPS Test Adequately Accounts for Ramp Rate Limitations

Constellation, et al. argues (at 9) "it is unclear from the available documentation how ramp rate limitations are accounted for in the TPS test." Dr. Harvey raises this issue at page 15.

There is no mismatch between the operation of the PJM dispatch software and the application of the TPS test. An essential feature of the TPS test is that it relies entirely upon PJM dispatch software for the definition of the market including both incremental supply and incremental demand. To the extent that the PJM dispatch software was relying on a relatively short look ahead period, PJM has indicated that the implementation of the look ahead UDS software will address that issue. Nonetheless that is an issue with the PJM dispatch software and not with the TPS test.

7. The TPS test is Simple and Transparent.

Constellation, et al. (at 13–14), complains that the TPS test "suffers from a lack of transparency" and echoes the Brattle Report's conclusion that "it is difficult for market participants and industry analysts to understand the test and resulting mitigation." Constellation (at 14) claims that "more details are needed regarding how PJM determines the demand for congestion relief and effective supply of congestion relief for individual interfaces" and asserts that "lack of transparency 'necessarily leads to confusion, and a possibly exaggerated perception of over mitigation, all of which could serve to undermine the confidence of market participants and deter investment in new generation'."

This complaint is ultimately about the transparency of the PJM calculation of LMP, particularly when there are binding constraints. In addition, the Three Pivotal Supplier Task Force (TPSTF) met 18 times over 17 months and a substantial part of the effort was to ensure that participants understood the TPS test. There was no complaint by Constellation, et al., in the TPSTF process that they needed additional education on the operation of the test.

The TPS test is built into PJM's market software to ensure that mitigation reflects actual market conditions in conformance with the PJM tariff, the PJM manuals and the mechanics set forth in Section II.E.3 of the Market Monitor's Comments (at 39–43). All that a market participant really needs to know is that its competitors will be submitting competitive offers even when dynamic conditions on the system are insufficient to induce them. The results may not always be intuitive to the casual observer any more than the results of the FTR auctions, LMP or the engineering properties of the electric grid. The Market Monitor is prepared to go into whatever level of detail is necessary to explain to market participants and regulatory authorities how the TPS test works and will continue to provide extensive analysis of the performance of the TPS test.

Constellation, et al. also makes an odd claim (at 14) that " because the TPS test limits the prices public utilities may charge for sales of electric power at wholesale, it constitutes a filed rate and, therefore, the details of the TPS test should be contained in the PJM Tariff." The "filed rate" is the market clearing price, not the capped offer. In a context where the market structure not does sufficiently constrain market power, mitigation is an essential prerequisite for reliance on markets to produce just and reasonable rates, as free as possible from the influence of market power.

Constellation does not explain why it singles out as unduly complex this particular element of a complex overall market design rather than LMP or FTRs or CETO/CETL or why it believes that alternative approaches for mitigating market power, which rely more on the discretion of those implementing them, are less opaque.

D. **Proposed Modifications to the TPS Test**

A number of parties propose modifications to the test, discussed below, none of which have merit. Because no party has demonstrated that any aspect of the TPS test is unjust and unreasonable, the statutory burden has not been carried to the point where any of the proposed alternations should be considered.[32] However, in order to increase the Commission's confidence in continuing use of the TPS test in PJM in spite of complaints that are as persistent and emphatic as they are misguided, the Market Monitor evaluates a number of alternatives proposed in this proceeding that would hamper or severely compromise the performance of the TPS test and are worthy of specific rejection by the Commission.

This is not to say that the Market Monitor believes that the TPS test is perfect, and it will continue to analyze its performance and recommend improvements so that it can provide the maximum protection against the exercise of market power without interfering with appropriate investment incentives in PJM markets. Nor does the Market Monitor fail to appreciate how new developments in the system architecture and other improvements to the PJM market rules may also require future adjustments. What is important is the Commission not alter the TPS test in a manner that restores a degree of market power that has been successfully mitigated in PJM's markets. This would be the likely result if the recommendations of the parties to modify the TPS test were accepted.

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32 PJM has filed this rate pursuant to Section 205, but does not bear the same burden of proof that would be applicable if the proposed TPS test increased rates. *See* Federal Power Act § 205(e), 18 U.S.C. § 824d(e).

1. There is No Reason to Switch to or Supplement the TPS Test with a Conduct and Impact Test

Mirant argues (at 19–23) that the Commission should replace the TPS test with the conduct and impact test or make the TPS test a "first-stage" screen prior to the conduct and impact test. Mr. Stoddard fails to recognize that the TPS test includes structure, behavior (conduct) and performance (impact) screens as currently implemented.[33] The fundamental point, although not stated very clearly, is that the TPS should be relaxed to permit the exercise of additional market power. The TPS test includes very clear and explicit conduct and impact thresholds. Mr. Stoddard wants to relax the TPS standards to permit additional market power. Mr. Stoddard never makes an explicit recommendation as to how much additional market power he believes is acceptable nor does he explain why additional market power is required for efficient and competitive markets. Mr. Stoddard warns (at para. 37) about the risk of prices rising above the levels that "should result from a workably competitive market" but fails to provide any guidance as to what this means. The term "workably competitive" has no clear definition and Mr. Stoddard provides no definition or even guide as to how much market power could be exercised before it would be a concern for him.

Mr. Stoddard also fails to provide a clear recommendation as to the appropriate definition of a competitive price. He states that it is basically impossible to calculate

33 See Monitoring Analytics, LLC Comments of the Independent Market Monitor for PJM at 57-59.

marginal costs but then suggests that such costs could be embedded in conduct thresholds. This is nonsensical. If the costs cannot be quantified, they cannot be embedded in a conduct threshold. Mr. Stoddard simply fails to address the definition of a competitive price for use in the local market power test.

In sum, Mr. Stoddard's recommendation to implement a conduct and impact test lacks any substance. Mr. Stoddard fails to provide any detailed recommendations on any of the key parameters of any local market power test.

2. There Is No Practical Benefit to Adding a Net Position Component to the TPS Test

Dr. Harvey suggests that the net position of sellers should be considered when implementing the TPS test for local market power. This is an argument about incentives. Dr. Harvey suggests that participants who are net buyers do not have an incentive to increase market prices. While this is logically correct, the question is whether this should change the implementation of the TPS test. It is difficult or impossible to evaluate the actual net position of a market participant in real time given the complex financial positions that may be taken by participants. It is even possible that those submitting offers on behalf of generation owners may not be fully aware of the net financial position of the company for each hour of the day. It is unlikely that generation owners would want to share such information. More importantly however is the fact that the worst case for Dr. Harvey is that generation owners behave competitively as a result. If this is true, then the application of the TPS test to such a generation owner's units will have no impact and certainly no negative impact.

3. There is No Reason to Create a "Sequential TPS Test"

Mirant Witness Stoddard proposes in his affidavit (at para. 32) to replace the TPS test with a "Sequential TPS test" that would identify and remove single pivotal suppliers along with a matching quantity of demand from further consideration." DTET also proposes (at 3–6) a sequential TPS test, but the DTET approach would remove jointly pivotal suppliers along with a matching quantity of demand. Both Mirant and DTET claim that their proposals would provide better recognition of dominant suppliers in a market and limit the offer capping of smaller suppliers.

Both sequential proposals are based on false assumptions. Both proposals assume a market where participants compete in a sequential, rather than simultaneous, market, and a market where participants are considered, and dispatched, in order of size rather than effective cost, to provide relief for a constraint. Both proposals assume that singly pivotal suppliers, once identified, can no longer have any impact on the potential for the exercise of market power by the remaining suppliers.

The assumption that units are dispatched in size order because large participants have lower costs is incorrect and renders the balance of the analysis irrelevant because it incorrectly defines the market structure by assumption. In addition, by assuming a sequential dispatch rather than a simultaneous dispatch, the sequential tests fail to maintain a consistent definition of the relevant market across the suppliers being tested. After the first iteration, when the supply of the larger suppliers and a matching amount of demand are removed from the defined market, each subsequent iteration of the test analyzes a market structure that is further and further removed from the actual market structure. The markets analyzed under the sequential approaches bear no relationship to the actual market structure as defined by the dispatch of PJM.

Under the TPS test, each participant is tested in the same market, a market defined by the dispatch rules of PJM. That is, market supply and demand are the same for all participants. Under the TPS test the results for market participants are consistent with and dependent on their relative importance in the defined market and not on the order in which they may be listed in the test.

The TPS test provides a straightforward and internally consistent examination of the relevant market. The same cannot be said of the sequential pivotal tests. The sequential tests provide results that demonstrably do not reflect the market structure or the role of individual participants within that market structure and provide results that are frequently arbitrary.

The sequential pivotal supplier tests are based on faulty assumptions, rely on market definitions that have no relationship to the real PJM market dynamics, lead to arbitrary results and are not based on any factual analysis or evidence or even plausible examples.

4. The TPS Test Is Compatible with the Development and Deployment of the "Look-Ahead Unit Dispatch System"

Constellation, et al. argues (at 21) that "PJM should be directed to refine the application of the TPS test in conjunction with operations and unit dispatch," and supports, in particular, "recent changes made by PJM to apply the TPS test on a two-hour forward basis (the so-called "Look-Ahead Unit Dispatch System or "Look-Ahead UDS")." However, Constellation, et al., notes (at 22) that use of the TPS test "must be conditioned on the viability of the Look Ahead UDS" and "requests that the Commission direct PJM to make a quarterly reports … detailing whether the Look-Ahead UDS provides a sufficient control for transient applications of the TPS test." Constellation, et al. claims (at 22) that such reports will enable a determination of whether "the new application of the test parameters is optimally modeling the incremental forecast dispatch changes compared to the current short-term basis" and if it improves "the future system visibility for PJM operators by optimally accounting for hydro schedules, unit on/off schedules, unit start-up time capability, and load curve changes."

Constellation wants to use the TPS test as the basis for making a detailed examination of PJM's UDS dispatch software to ensure that it is working accurately. Again, this is outside the scope of this proceeding. It is correct that PJM markets rely upon the proper functioning of the PJM dispatch software and that the TPS test similarly relies upon the proper functioning of this software. FERC should act as necessary to continue to assure itself that PJM software is working correctly.

E. Proposed Modifications to the Cost Development Process

1. Development of Opportunity Costs for Energy-Limited Units

A number of intervenors[34] raise issues related to PSEG's argument (at 5) that "Cost Development Task Force (CDTF) levels used to set reference prices should include all appropriate variable costs, including 'opportunity costs'."[35]

The Market Monitor agrees that appropriate opportunity costs should be included in the definition of generation marginal costs. In fact, the Market Monitor took the lead in including opportunity costs in the definition of marginal costs several years ago in the PJM manual, M15: Cost Development Guidelines. The Market Monitor has consistently supported the inclusion of appropriate opportunity costs in marginal costs.

Mirant raises the issue of opportunity costs to assert that over mitigation may result. But Mirant does not have a solution to the problem other than permitting an undefined level of market power. In fact Mirant asserts, without justification, that it is impossible to properly calculate opportunity costs. PJM and the MMU are currently in the process of defining exactly those calculations and are in discussions with a number of market participants on these issues.

The issue of opportunity costs does not have anything necessary to do with the TPS test. As with a number of elements of the markets, this is an area that needs to be

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34 *See* Constellation, et al. at 25–26 and its Harvey Affidavit at 19; Mirant at 2 and its Stoddard Affidavit at 18; Reliant at 6; AEP at 3–4.

35 *See* PSEG at 5

improved and when it is, it will be appropriately reflected in the markets and in the TPS test. In fact, only one generation owner has made a systematic proposal to address opportunity costs and the MMU reached agreement with that generator more than seven years ago.[36] The MMU made public presentations about the defined approach to opportunity costs at that time and since then. It is the responsibility of generation owners who believe that opportunity costs are an issue to address it directly via the processes available to them. They have failed to do so.

2. Verification of Start Costs

Constellation, et al., Witness Harvey relates (at 26) concern that some generators will be unable to recover start-up costs because they have executed "[m]aintenance contracts [that] often contain confidential terms that assess maintenance costs to the generation owner based on the number of starts on the generator" but are unable to include such costs because "some vendors will not permit disclosure of the contractual terms absent a non-disclosure agreement signed by the third party examining the contract." Constellation, et al., complains that this puts "the generator seeking to recover costs is in a quandary; violating the contract terms to disclose the maintenance agreement for the purpose of including start up costs in its cost-based offers, or foregoing a very large portion of the incremental cost to operate the facility."

[36] *See* Complaint of Reliant Mid-Atlantic Power Holdings ("Reliant") against PJM Interconnection, L.L.C., filed in Docket No. EL03-116 at 3 (dated April 2, 2003), wherein Reliant indicates that the agreement was reached August 3, 2001 and terminated at Reliant's request just over 18 months later.

Constellation, et al., asks (at 26) that approval of the TPS test be "conditioned upon a directive to PJM and the PJM MMU to provide explicit non-disclosure agreements as required by maintenance vendors to assure that all relevant costs are eligible to be included in the cost-based offer."

Constellation, et al., have not demonstrated, as they must in order to obtain the relief requested, that PJM's existing rules for protecting the confidentiality of its members' commercially sensitive information, which apply by extension to the Market Monitor, are inadequate in any respect. Indeed, PJM has a lengthy track record of handling of such information without incident. Nor has Constellation, et al., shown why the Commission should force PJM or the Market Monitor to accept terms imposed on them as a result of their contracts for services with vendors, or even why PJM or the Market Monitor have any direct involvement with such contracts. On the contrary, the Commission would more appropriately place the burden on PJM's approximately 500 members to ensure that their contracts are consistent with the Commission-approved rules and requirements established for participation in PJM, and there is no reason why issues that relate to legacy contracts cannot be resolved in a cooperative manner, perhaps with the Commission's assistance.

Constellation, et al. imply that this is a systemic issue. It is not. The matter referenced involves a single owner and a single contract. The issue has had no impact on the offer capping of any unit.

3. Lack of Data on Wear and Tear

Constellation, et al., Witness Harvey also complains (at 27) that new units often lack such historical data on wear and tear, "restricting them from including wear and tear in their cost based offers."

This is not correct. The Cost Development Guidelines Manual has explicit procedures for using data from comparable units in order to establish the VOM (variable operation and maintenance costs) component of marginal costs. Wear and tear, while not technical terms recognized by those who address VOM issues, are directly included in VOM costs. In fact, the MMU led the successful effort to have additional VOM costs, previously capitalized by generation owners, included in the definition of marginal costs.

F. **<u>The TPS Test is Compatible with Scarcity Pricing Reforms, and Does Not Result in Under Compensation to Supply</u>**

A number of intervenors stress the importance of reforming PJM's provisions for scarcity pricing.[37] The Market Monitor emphasizes that the reform to the capacity market with the implementation of RPM eliminates the need to have scarcity pricing in order to ensure adequate investment incentives. The worries of some that scarcity pricing rules cannot be successfully reconciled with the TPS test are fundamentally misplaced. There is ample evidence that PJM's market structure, inclusive of RPM, has ensured more than

[37] *See* PSEG at 3; Constellation, et al. at 2; Mirant at 19; Reliant at 6.

sufficient net revenues to attract new investment and to retain economic capacity. It is not necessary, therefore, that the Commission address scarcity pricing in confirming the TPS test.

Nevertheless, the Market Monitor has long supported, and continues to support reform to PJM's scarcity pricing rules in order to assure price signals that reflect economic fundamentals both in the energy market and in the capacity market where a scarcity pricing offset is required while protecting against the exercise of market power. But scarcity pricing can and should be addressed carefully and thoroughly in the membership process. The scarcity pricing issue does not need to be resolved in this proceeding.

G. Costs of Over and Under Mitigation

The data support the conclusions that the TPS test does not result in over mitigation, that there are no costs associated with the implementation of the TPS test and that the costs of weakening or removing the TPS test would be significant.

The data provided herein and by reference to MMU reports provide the evidence to support the statement that the TPS test does not result in over mitigation. Mitigation occurs only infrequently. The TPS test is targeted to local markets with local market power where the local market definitions are those identified by the PJM dispatch software.

There are assertions in the Initial Comments that there are costs associated with the implementation of the TPS test. These costs are the result of alleged over mitigation. The parties fail to provide any detailed analysis either factual or theoretical of the costs of any alleged over mitigation resulting from the application of the TPS test. Mr. Stoddard assumes (at para. 15) that the TPS has the "potential" to over mitigate but provides no supporting data and cites the similarly unsupported claims made by the Brattle Group. Mr. Stoddard suggests that over mitigation is "corrosive" to the health of competitive markets without citing specifics. Mr. Stoddard asserts (at para. 32) that the TPS results in a high rate of "false positives" that is finding structural market power when there is none, but Mr. Stoddard again has no evidence to support this fundamental claim. He cites PJM's "claim that the TPS test has a low rate of false negatives" but explains in a footnote that this statement does not actually provide support for his claim, except by assumption.[38] Moreover, after years of effort, no one has explained how the TPS test produces false positives or provided any evidence to support such a claim.

Dr. Harvey identifies potential costs of mitigation associated with the correct identification of costs. The first such cost is associated with appropriately identifying opportunity costs, the second is the identification of appropriate marginal costs

[38] Stoddard affidavit at para. 29 & n.33.

associated with maintenance contracts and the third is “wear and tear” costs, which are addressed elsewhere.

Dr. Harvey’s conclusion (at 23) however is that, “If offer price mitigation always reduced offer prices to the economically efficient level, then there would be no cost to mitigation.” This is a very different conclusion from that reached by Mr. Stoddard.

Both Mr. Stoddard and Dr. Harvey recognize the need to ensure that market power is not exercised and that there are substantial costs associated with the exercise of market power. While apparently having a very high tolerance for under mitigation, Mr. Stoddard references (at 9) the potential for “windfalls for producers that enhance neither static nor dynamic efficiency.”

The MMU has quantified the impact of removing offer capping for a single state. In response to a request from the Maryland PUC, the MMU calculated the impact of removing offer capping on prices and load payments for 2007. Table 3 shows the details. The total impact for Maryland would have been about $84 million in 2007.[39]

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[39] See MMU Response to MDPSC Questions, pp 21-22. http://www.pjm.com/markets/market-monitor/reports-2007.html

Table 3 Effect of removing offer capping from PJM area 2006 marginal units on monthly load-weighted average Maryland LMP

Affected area	Month	Load-weighted LMP	Load-weighted LMP without capping	Load-weighted net LMP effect of no capping	Percent change in LMP	Total dollar effect of removing capping (1000s)
MD	January	$64.66	$65.32	$0.66	1.02%	$4,138
MD	February	$65.95	$66.37	$0.42	0.64%	$2,501
MD	March	$64.81	$64.84	$0.03	0.04%	$159
MD	April	$52.92	$53.04	$0.12	0.23%	$596
MD	May	$60.28	$61.13	$0.85	1.41%	$4,596
MD	June	$59.54	$60.07	$0.54	0.90%	$3,368
MD	July	$82.88	$86.26	$3.39	4.09%	$25,881
MD	August	$104.00	$108.87	$4.87	4.68%	$36,809
MD	September	$38.48	$38.60	$0.12	0.30%	$629
MD	October	$43.24	$43.84	$0.59	1.38%	$3,184
MD	November	$51.01	$51.27	$0.26	0.52%	$1,421
MD	December	$50.00	$50.09	$0.08	0.17%	$517
MD	Annual	$63.44	$64.60	$1.16	1.83%	$83,800

In addition, the Market Monitor has quantified the impact of prior exemptions from offer capping which is also a measure of the impact of removing offer capping. As referenced above, the evidence clearly supports the claim that significant market power would be exercised in the absence of market power mitigation. The actual behavior of exempt units demonstrated the substantial impact on system average prices of unchecked local market power.

III. CONCLUSION

The Market Monitor respectfully requests that the Commission afford due consideration to these reply comments as it completes its investigation of PJM's TPS test for local market power.

Respectfully submitted,

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Dated: November 5, 2008

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania,
this 5th day of November, 2008.

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Attachment A

Market Monitoring Unit

Analysis of the Three Pivotal Supplier Test: March 1, 2006 through June 30, 2007

PJM Market Monitoring Unit

November 19, 2007

Summary

The Market Monitoring Unit (MMU) submits this report in compliance with its obligation to evaluate on a quarterly basis whether any changes in status are appropriate for the exempt and non-exempt interfaces in PJM.

The PJM Operating Agreement (OA) (Schedule 1, Section 6.4.1(d)(i)) states that “offer price caps shall not be applicable to generation resources used to relieve the Western, Central and Eastern reactive limits in the MAAC Control Zone and APS South Interface,” subject to the additional OA provision (Schedule 1, Section 6.4.1(d)(ii)) that “on a quarterly basis, using an analysis no less stringent than the test for suspending offer capping set forth in sections 6.4.1(e) and (f) below, the PJM Market Monitoring Unit will evaluate whether additional interfaces also should be exempt and whether any existing exemptions should be terminated.”

These four identified interfaces, the Western, Central, Eastern and AP South Interfaces are thus currently exempt from offer capping and are referred to in this report as the exempt interfaces. These four interfaces are the only exempt interfaces. Interfaces are one type of potential transmission constraints and these four interfaces are the only exempt constraints.

The test for suspending offer capping set forth in the 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 both the day-ahead and real-time energy markets in order to determine whether offer capping is required for any constraints not exempt from offer capping and for any units not exempt from offer capping.[1] The three pivotal supplier test is applied in real time in both the day-ahead and real-time markets. In the day-ahead market, PJM market operators apply the test as they clear the market. In the real-time market, PJM market operators also apply the test as they clear the market.

The MMU analyzed the results of the three pivotal supplier tests conducted by PJM for the real-time energy market during the period March 1, 2006, through June 30, 2007. In this report, for a comprehensive view of the results, the MMU presents the results for the first sixteen months during which the three pivotal supplier test was applied.[2] A summary of the results of PJM’s application of the three pivotal supplier test is presented for all constraints, including interfaces currently exempt from the application of the offer mitigation rules and interfaces currently subject to the application of the offer mitigation rules.

The MMU could not analyze the results of the three pivotal supplier test for exempt interfaces in the day-ahead market because, in contrast to PJM’s approach in the real-time market, PJM does not consistently apply the three pivotal supplier test to these constraints in the day-ahead market and the results are not reliably documented. As a

1 For additional information on the three pivotal supplier test, see *2006 State of the Market Report*, Volume II, pp. 40 – 55 and Appendix J, “Three Pivotal Supplier Test.”

2 The three pivotal supplier test was implemented effective March 1, 2006. This report covers the sixteen month period through June 30, 2007.

result, it is not possible for the MMU to analyze the market structure associated with exempt interfaces in the day-ahead market in the same way as the MMU analyzes the market structure associated with exempt interfaces in the real-time market. In response to the MMU's recommendation in its quarterly report on three pivotal supplier testing for the period ending December 31, 2006, PJM has begun a dialogue with the MMU on a process to capture and retain three pivotal supplier test results from the day-ahead market. There remains the need to continue to improve the process to explicitly identify, validate and retain an historical record of the final three pivotal supplier testing results conducted and applied within the context of executing the day-ahead market. PJM and the MMU are working together to accumulate a reliable history of three pivotal supplier testing inputs and results to allow for future examination and process improvement. When this identification and retention process permits, the MMU will include in quarterly reports an analysis of three pivotal supplier testing in the day-ahead market.

As an illustration of the importance of extending the analysis to the day-ahead market, the currently exempt interfaces accounted for $160 million in day-ahead congestion costs in 2006 and $6 million in balancing congestion costs. In addition, the exempt interfaces were constrained for more hours in the day-ahead market than in the real-time market. During 2006, the exempt interfaces were constrained 2,643 hours in the day-ahead market and 591 hours in the real-time market.[3]

As a result of PJM's implementation of the three pivotal supplier test, decisions about offer capping are based on real-time analysis of the actual competitive conditions associated with each binding constraint as they occur in both the day-ahead and real-time energy markets. The three pivotal supplier test replaced the prior approach which was to offer cap all units required to resolve a binding constraint.

Recommendations

As a result of the fact that the three pivotal supplier test ensures that offer capping will be applied only when required by market conditions, the MMU recommends that no interfaces or constraints be granted a blanket exemption. The MMU recommends that offer capping be based on the application of the three pivotal supplier test to actual market structures for all constraints in both the day-ahead and real-time energy markets, including those interfaces now exempt from offer capping.

The MMU recommends that three pivotal supplier testing be immediately and consistently applied to all constraints in the clearing of the day-ahead energy market and the results reliably documented, so that the results of the day-ahead market can be replicated and analysis of the day-ahead market results can be performed.

The MMU recommends that PJM modify its existing practice in the day-ahead market to ensure that watch list facilities are fully and completely subject to application of the three pivotal supplier test. The MMU also recommends that as part of PJM's cooperation with the MMU's review of the implementation of the three pivotal supplier test, PJM provide the MMU with a detailed explanation of the process used to determine which schedule a

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[3] See *2006 State of the Market Report*, Volume II, p. 43.

unit is placed on when brought on out of economic merit order for a watch list constraint in the initial dispatch solution.

The MMU recommends that PJM create an auditable method for identifying the specific test result used in making a decision about whether to impose or not impose mitigation in the day-ahead market on specific units.

The MMU recommends that PJM create an automated and auditable method for identifying the specific real-time test result used in making a decision about whether to impose or not impose mitigation when starting an offline unit to resolve a transmission constraint.

The MMU has clearly indicated that the PJM scarcity pricing rules should be clarified and extended to ensure that economic scarcity conditions are actually reflected in prices.[4] Scarcity pricing, in every case, would mean that offer capping would not be imposed.

The MMU recommends that PJM cooperate with the MMU to facilitate a complete and thorough review by the MMU of the actual implementation of the three pivotal supplier test in both the day-ahead and real-time markets including a detailed review and testing of the relevant software and operating procedures. Such a review has not been done and such a review is critical to ensure that the test is being properly applied.

Background

By order issued April 18, 2005, the United States Federal Energy Regulatory Commission (the Commission or the FERC) set for hearing, in Docket No. EL04-121-000, PJM's proposal (a) to exempt the AP South Interface from PJM's offer-capping rules and (b) to conduct annual competitive analyses to determine whether additional exemptions from offer capping are warranted.

By order issued July 5, 2005, the Commission also set for hearing, in Docket No. EL03-236-006, PJM's three pivotal supplier test used to determine whether suppliers have market power when units must be called out of merit order in order to resolve transmission constraints. The Commission further set for hearing issues related to the appropriateness of implementing scarcity pricing in PJM. In the July order, the Commission consolidated Docket No. EL04-121-000 and Docket No. EL03-236-006.

On November 16, 2005, PJM filed a settlement agreement resolving all issues set for hearing in these two proceedings. On December 20, 2005, the presiding administrative law judge certified the settlement agreement to the Commission as uncontested. On January 27, 2006, in Docket Nos. EL03-236-006, EL04-121-000, 001 and 002 the Commission ordered that the settlement agreement, including the amendments to the PJM Tariff and Operating Agreement, was in the public interest and was thereby

4 See *2006 State of the Market Report*, Volume II, Section 1, “Introduction,” at “Recommendations.”

approved and accepted for filing and made effective as set forth in the settlement agreement.[5]

Prior Analyses

The Commission conferred blanket exemptions from offer capping for local market power on four of the largest interfaces in PJM, prior to the development and implementation of the three pivotal supplier test. The current exemption of the Western, Central and Eastern Interfaces (reactive limits) in the MAAC Control Zone is based on a study completed in 1997 and submitted as part of PJM's initial application to the Commission.[6] That study examined Herfindahl-Hirschman Index (HHI) statistics for a then recent historical period and determined that concentration was generally not high enough to be a concern for these interfaces. The study did not examine the markets defined by the demand for effective MW to resolve the identified interface constraints and associated incremental MW of effective supply available to meet that demand, but analyzed the total capacity in the areas created by the interfaces, taking account of estimated costs as well as a market definition for total capacity consistent with the delivered price test approach. As a result of data limitations, that study did not account for distribution factor impacts on effective supply or the effective cost of that supply. That study also concluded that local market power was a concern for the local markets created by other transmission constraints.

The current exemption of the AP South Interface is based on an October 2004 report of the PJM market monitor. On October 26, 2004, PJM submitted a "Report of the PJM Market Monitor Regarding Offer Capping of Major Transmission Constraints" in which the PJM market monitor concludes that the continued exemption of the Western, Central and Eastern Interfaces was supported by competitive analysis as was exemption of the AP South Interface.[7] In the October 2004 report, a delivered price test was performed based on supply curves simulated using GE MAPS and representative loads for each constraint analyzed. The supply curve was divided into four quartiles, representing relatively competitive resources within each quartile of the supply curve, for each system load condition. Load duration analysis was used to divide load levels into four quartiles for each constraint where the difference among the four quartiles was the system load and the corresponding system price. The demand for MW levels of control actions was determined by reviewing a range of actual system conditions and selecting a representative high requirement for control actions taken by PJM where these data were available from PJM and using estimates where the data were not available. Within the markets defined in this manner, a pivotal supplier analysis was performed to determine the extent to which one or more suppliers were individually or jointly pivotal in the market to provide required control for the identified major transmission constraints.[8]

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5 114 FERC ¶ 61,076.

6 *PJM Supporting Companies*, Transmittal Letter, Docket No. ER97-3729-000 (July 14, 1997).

7 See "Report of the PJM Market Monitor" filed October 26, 2004, in Docket Nos. ER04-539-001, 002, EL04-121-000 at P 27.

8 *Id* at P 16.

The conclusions of the October report differ from the recommendations in this report for a number of reasons, primarily that offer capping is now applied in real time based on the results of the three pivotal supplier test that takes account of actual, real-time system conditions including generator availability and transmission system conditions. Given this real-time application of a test for competition, there is no longer a need to make a general determination about the competitiveness of any constraint, including the currently exempt interfaces.

The 1997 decision to exempt the Western, Central and Eastern Interfaces and the 2004 recommendation to exempt the AP South Interface made sense at the time based on analytical limitations and based on the associated broad brush application of offer capping to all units required to operate to control a constraint. These decisions made sense at the time given that the local markets created by the interfaces were generally structurally competitive based on the analysis at the time, and given that offer capping could not be limited to periods when the local markets were not structurally competitive or to the specific owners who had structural market power and who would otherwise exercise market power.

The three pivotal supplier test defined in the OA represents a significant evolution in accuracy over both the 1997 analysis and the 2004 analysis because the three pivotal supplier 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.

Three Pivotal Supplier Results for All Constraints: Real-Time Energy Market

The analysis here relies on the output from the application of the three pivotal supplier test in the real-time energy market by PJM. The MMU does not apply the three pivotal supplier test in the execution of either the day-ahead or real-time energy markets. The three pivotal supplier test utilizes software systems developed, operated and maintained solely by PJM. The MMU does not determine any components of the three pivotal supplier test calculation, but relies entirely on the test inputs and results as determined by PJM's market software. The analysis here reflects the actual test outcomes as determined by PJM and utilized in the conduct of the real-time energy market. PJM may apply the three pivotal supplier test for a constraint as frequently as every five minutes or less frequently, depending on actual system conditions. The results reported here reflect the actual frequency with which the test is applied by PJM.

Peak Hours

There were a total of 74,539 three pivotal supplier tests applied across 517 constraints during peak hours for the period March 1, 2006, through June 30, 2007.[9] Of the 517 constraints tested during peak hours, all but two demonstrated market structures which resulted in one or more owners failing the three pivotal supplier test for at least one tested interval. Of the 74,539 tests conducted during peak hours, 72,598 were applied to

9 Peak hours are defined as weekdays between hours ending 0800 and 2300, excluding NERC holidays.

non-exempt constraints.[10] Of these 72,598 peak hour tests, 11,505, or 16 percent, resulted in one or more suppliers passing the three pivotal supplier test. Under PJM's prior offer mitigation rules, all suppliers would have been subject to offer capping. A summary of these results is presented in Table 1.

Off-Peak Hours

There were a total of 60,410 tests applied across 331 different constraints during off-peak hours for the period March 1, 2006, through June 30, 2007. Of the 331 constraints tested during off-peak hours, all but four demonstrated market structures which resulted in one or more owners failing the three pivotal supplier test for at least one tested interval. Of the 60,410 tests conducted during off-peak hours, 59,303 were applied to non-exempt constraints. Of these 59,303 off-peak hour tests, 19,427, or 33 percent, resulted in one or more suppliers passing the three pivotal supplier test. Under PJM's prior offer mitigation rules, all suppliers would have been subject to offer capping. A summary of these results is presented in Table 1.

Table 1 PJM Application of Three Pivotal Supplier Test to All Constraints

	Peak hours	Off-peak hours
Total tests applied		
All constraints	74,539	60,410
Non-exempt constraints	72,598	59,303
Exempt Constraints	1,941	1,107
Tests resulting in one or more passing owners		
All constraints	13,195	20,366
Non-exempt constraints	11,505	19,427
Exempt Constraints	1,690	939
Percent of tests resulting in one or more passing owners		
All constraints	18%	34%
Non-exempt constraints	16%	33%
Exempt Constraints	87%	85%

Three Pivotal Supplier Results for Interfaces

Offer caps currently do not apply to generation resources used to relieve the Western, Central and Eastern reactive limits in the MAAC Control Zone or the AP South Interface. Nonetheless, during the period March 1, 2006, through June 30, 2007, three pivotal supplier test results for the real-time energy market were calculated by PJM for all four currently exempt interfaces. This section compares the results of the application of the

10 Offer price caps currently are not applicable to generation resources used to relieve the Western, Central and Eastern reactive limits in the MAAC Control Zone and AP South Interface.

three pivotal supplier test to exempt and non-exempt interfaces in the real-time energy market.

Interface Testing Results: Peak Hours

Exempt Interfaces

There were a total of 1,941 three pivotal supplier tests applied in the real-time energy market to the exempt interfaces during peak hours for the period March 1, 2006, through June 30, 2007. Of the 1,941 three pivotal supplier tests applied to exempt interfaces during peak hours, 371, or 19 percent of those, resulted in one or more suppliers failing the three pivotal supplier test. Under PJM's current offer mitigation rules, these suppliers were not subject to offer capping. A summary of the exempt interface results is presented in Table 2. A breakdown of the results for exempt interfaces is presented in Table 3. Table 3 shows that 613, or 32 percent, of the tests applied to exempt interfaces during on-peak periods were applied to the AP South Interface with the remainder applied to the other three exempt interfaces. Table 3 also shows that 301, or 81 percent, of the three pivotal supplier tests during on-peak periods with one or more failing owners were for the AP South Interface, again with the remainder for the other three exempt interfaces.

Non-Exempt Interfaces

There were a total of 5,396 tests applied in the real-time energy market to non-exempt interfaces during peak hours for the period March 1, 2006, through June 30, 2007.[11] Of the 5,396 three pivotal supplier tests applied to non-exempt interfaces during peak hours, 2,217, or 41 percent of those, resulted in one or more suppliers failing the three pivotal supplier test. Under PJM's current offer mitigation rules, these suppliers were subject to offer capping. A summary of these results is presented in Table 2.

[11] Non-exempt transfer interfaces are those constraints defined as transfer interfaces and not subject to exemption from offer mitigation per section 6.4.1(d)(i) of the PJM Operating Agreement. Non-exempt transfer interfaces for which the three pivotal supplier test was applied during the study period and included in this analysis are the 5004/5005, Bedington-Black Oak, Kanawha-Matt Funk and PL North transfer interfaces. A list of interfaces used by PJM in real-time operations and in the day-ahead energy market may be found at www.pjm.com/markets/energy-market/downloads/20031017-interface-definitions.xls (35 KB).

Table 2 PJM Application of Three Pivotal Supplier Test to Non-Exempt and Exempt Interfaces

	Peak hours	Off-peak hours
Total tests applied		
Non-exempt interfaces	5,396	8,411
Exempt interfaces	1,941	1,107
Tests resulting in one or more failed owners		
Non-exempt interfaces	2,217	3,671
Exempt interfaces	371	250
Percent of tests resulting in one or more failed owners		
Non-exempt interfaces	41%	44%
Exempt interfaces	19%	23%

Interface Testing Results: Off-Peak Hours

Exempt Interfaces

There were a total of 1,107 tests applied in the real-time energy market to exempt interfaces during off-peak hours for the period March 1, 2006, through June 30, 2007. Of the 1,107 three pivotal supplier tests applied to exempt interfaces during off-peak hours, 250, or 23 percent of those, resulted in one or more suppliers failing the three pivotal supplier test. Under PJM's current offer mitigation rules, these suppliers were not subject to offer capping. A summary of the exempt interface results is presented in Table 2. A breakdown of the results for exempt interfaces is presented in Table 3. Table 3 shows that 288, or 26 percent, of the tests applied to exempt interfaces during off-peak periods were applied to the AP South Interface with the remainder applied to the other three exempt interfaces. Table 3 also shows that 160, or 64 percent, of the three pivotal supplier tests during off-peak periods with one or more failing owners were for the AP South Interface, again with the remainder for the other three exempt interfaces.

Non-Exempt Interfaces

There were a total of 8,411 tests applied in the real-time energy market to non-exempt interfaces during off-peak hours for the period March 1, 2006, through June 30, 2007. Of the 8,411 three pivotal supplier tests applied to non-exempt interfaces during off-peak hours, 3,671, or 44 percent of those, resulted in one or more suppliers failing the three pivotal supplier test. Under PJM's current offer mitigation rules, these suppliers were subject to offer capping.

Results for Regional Constraints

Regional constraints are constraints that occur on the 500 kV system. The exempt and non-exempt interfaces are a subset of regional constraints. For comparison, three pivotal supplier test results are presented for non-exempt regional constraints which occurred during the period March 1, 2006, through June 30, 2007.

Several regional transmission constraints occurred during the period March 1, 2006 through June 30, 2007 in the real-time energy market. The 5004/5005, AP South, Bedington-Black Oak, Western, Central and Eastern Interfaces all occurred during the study period.[12] The three pivotal supplier test was applied to all of these constraints. The AP South, Western, Central and Eastern Interfaces are those constraints for which generation owners are exempt from offer capping.

Table 3 includes information on the three pivotal supplier test results for the regional constraints in the real-time energy market during the study period.[13] For the listed regional constraints that are not exempt, the percentage of tested intervals resulting in one or more owners passing ranged from 80 percent to 83 percent during peak hours and from 85 percent to 86 percent during off-peak hours. For the listed regional constraints that are not exempt, the percentage of tested intervals resulting in one or more owners failing ranged from 28 percent to 33 percent during peak hours and 28 percent during off-peak hours. For the listed regional constraints that are exempt, the percentage of tested intervals resulting in one or more owners passing ranged from 62 percent to 98 percent during peak hours and from 0 percent to 94 percent during off-peak hours. For the listed regional constraints that are exempt, the percentage of tested intervals resulting in one or more owners failing ranged from 4 percent to 49 percent during peak hours and from 7 percent to 100 percent during off-peak hours.

Table 3 PJM Application of Three Pivotal Supplier Test to Regional Constraints

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
5004/5005 Interface	Peak	1,060	878	83%	296	28%
	Off Peak	310	266	86%	86	28%
Bedington - Black Oak	Peak	3,557	2,835	80%	1,188	33%
	Off Peak	5,899	5,017	85%	1,656	28%
AP South	Peak	613	398	65%	301	49%
	Off Peak	288	174	60%	160	56%
Western	Peak	1,280	1,256	98%	56	4%
	Off Peak	803	751	94%	88	11%
Central	Peak	27	23	85%	6	22%
	Off Peak	15	14	93%	1	7%
Eastern	Peak	21	13	62%	8	38%
	Off Peak	1	0	0%	1	100%

12 The 5004/5005 Interface is comprised of two 500 kV lines, which include the Keystone-Juniata 5004 and the Conemaugh-Juniata 5005. These two lines are located between central and western Pennsylvania.

13 The number of tests with one or more failing owners plus the number of tests with one or more passing owners can exceed the total number of tests applied. A single test can result in one or more owners passing and one or more owners failing. In such a case, the interval would be counted as including one or more passing owners and one or more failing owners.

Results for Regional Constraints: Additional Details

Additional information is provided for the listed regional constraints, including the average MW required to relieve a constraint, the average supply available, the average number of owners included in each test and the average number of owners that passed or failed each test.

Table 4 shows that, on average, during peak periods, the local market created by the 5004/5005 Interface had an average of 18 owners with available supply during the peak period, of which an average of 15 passed the three pivotal supplier test.[14] During off-peak periods, the local market created by the 5004/5005 Interface had an average of 16 owners with available supply during the peak period, of which an average of 14 passed the three pivotal supplier test. The local market created by Bedington-Black Oak had an average of 12 owners with available supply during on-peak hours of which an average of nine owners passed the three pivotal supplier test. During off-peak hours, the local market created by Bedington-Black Oak had an average of 11 owners with available supply of which an average of nine owners passed the three pivotal supplier test. The local market created by AP South had an average of 17 owners with available supply during on-peak hours and an average of 16 during off-peak hours, of which 10 owners passed during on-peak periods and 9 owners passed during off-peak periods. The local market created by the Western Interface had an average of 18 owners with available supply during on-peak hours and an average of 17 during off-peak hours, of which 18 owners passed during on-peak periods and 16 owners passed during off-peak periods.

Table 4 Three Pivotal Supplier Test Results for Regional Constraints – Additional Details

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
5004/5005 Interface	Peak	109	399	18	15	3
	Off Peak	97	356	16	14	3
Bedington - Black Oak	Peak	57	224	12	9	3
	Off Peak	62	237	11	9	2
AP South	Peak	98	267	17	10	7
	Off Peak	89	292	16	9	7
Western	Peak	151	837	18	18	0
	Off Peak	168	772	17	16	1
Central	Peak	145	611	18	15	3
	Off Peak	159	876	19	18	1
Eastern	Peak	205	703	14	11	3
	Off Peak	187	695	12	0	12

[14] The average number of owners passing and the average number of owners failing are rounded to the nearest whole number and may not sum to the average number of owners, also rounded to the nearest whole number.

The local market created by the Central Interface had an average of 18 owners with available supply during on-peak hours and an average of 19 during off-peak hours, of which 15 owners passed during on-peak periods and 18 owners passed during off-peak periods. Table 4 shows that, on average, the local market created by the Eastern Interface had 14 owners during peak periods of which 11 passed the test. The local market created by the Eastern Interface had 12 owners during off-peak periods of which none passed the test.

Process and MMU Recommendations

Section 6.4.1(d)(ii) of Schedule 1 of the PJM Operating Agreement states:

> On a quarterly basis, using an analysis no less stringent than the test for suspending offer capping set forth in sections 6.4.1(e) and (f) below, the PJM Market Monitoring Unit will evaluate whether additional interfaces also should be exempt and whether any existing exemptions should be terminated. Considering the recommendations of the PJM Market Monitoring Unit, the Office of the Interconnection shall determine whether to make a filing with the FERC proposing that an additional interface should be exempt or an existing exemption should be terminated. Any change in the exempt status of the interface shall become effective upon FERC acceptance. The Office of the Interconnection shall post a summary of the results of the PJM Market Monitoring Unit's quarterly analyses and the Office of the Interconnection's determination whether to make a filing with the FERC.

Section 6.4.1(e) of the PJM Operating Agreement states in part:

> Notwithstanding the number of jointly pivotal suppliers in any hour, if the Market Monitoring Unit determines that a reasonable level of competition will not exist based on an evaluation of all facts and circumstances, it may propose to the Commission the removal of offer-capping suspensions otherwise authorized by this section. Such proposals shall take effect only upon Commission acceptance or approval.

Terminate Current Interface Exemptions

The MMU recommends that the Commission terminate the exemption from offer capping currently applicable to generation resources used to relieve the Western, Central and Eastern reactive limits in the MAAC Control Zone and the AP South Interface. The PJM market monitor recommends that all constraints, including these interfaces, be subject to three pivotal supplier testing as specified in the PJM Operating Agreement.

The current exemption of the Western, Eastern and Central Interfaces is based on an analysis performed in 1997 and supported by the October 2004 report cited above. The current exemption of the AP South Interface is based on the October 2004 report. Neither analysis was as accurate as the current application of the three pivotal supplier test by PJM. The 1997 analysis was based on HHI and market share results for broad areas of the system and did not incorporate distribution factor impacts or analysis of incremental supply and demand associated with constraints. The October 2004 report was described above.

The primary reason to remove the exemptions for the identified interfaces is that they are no longer necessary given PJM's dynamic implementation of the three pivotal supplier test based on actual market conditions in real time. It is not necessary to make an *ex ante* decision about the market structure associated with individual interface constraints that applies for an extended period. Prior to the implementation of the three pivotal supplier test, all units required to resolve a constraint were offer capped whenever the constraint was binding. For the identified exempt interfaces, this could have resulted in the offer capping of a large number of units even when the relevant market was structurally competitive. That is no longer the case. Under the current PJM dynamic approach, offer capping will be applied only as necessary and will be applied on a non-discriminatory basis for all units operating for all constraints.

The fact that some non-exempt constraints had no generation resources that failed the three pivotal supplier test during the period analyzed does not lead to the conclusion that such constraints should always be exempt from offer capping for local market power. The same logic applies to currently exempt interface constraints. Even if no generation resources associated with any of the exempt interface constraints failed the three pivotal suppler test during the study period, that does not mean that such interfaces should always be exempt from offer capping for local market power. The fact that one or more generation resources required to resolve these interfaces did fail the three pivotal supplier test at times simply reinforces the point. If the generation resources associated with these interfaces always pass the three pivotal supplier test, there will be no offer capping and conversely if such resources at times fail the three pivotal supplier test, appropriate offer capping will be applied.

Local market power is clearly defined in the PJM Tariff and the appropriate local market power mitigation is also clearly defined in the PJM Tariff. The definition of local market power should apply to all constraints and the appropriate market power mitigation should also apply to all constraints.

Additional Recommendations

In addition to recommending the termination of the current interface exemptions, the MMU also recommends that PJM take certain actions to improve the application of the three pivotal supplier test. A more detailed discussion of these additional recommendations follows.

It is not currently possible to comprehensively analyze PJM's application of the three pivotal supplier test in the day-ahead market. The MMU recommends that three pivotal supplier testing be immediately and consistently applied to all constraints in the clearing of the day-ahead energy market and the results reliably documented, so that analysis of the day-ahead market results can be performed. The MMU recommends that PJM continue to improve its efforts to explicitly identify, validate and retain an historical record of the final three pivotal supplier test results conducted and applied within the context of executing the day-ahead market.

The MMU recommends that PJM create an auditable method for identifying the specific test result used in making a decision about whether to impose or not impose mitigation in the day-ahead market on specific units.

The MMU recommends that PJM modify its existing practice in the day-ahead market to ensure that watch list facilities are fully and completely subject to application of the three pivotal supplier test. The MMU also recommends that as part of PJM's cooperation with the MMU's review of the implementation of the three pivotal supplier test, that PJM provide the MMU with a detailed explanation of the process used to determine which schedule a unit is placed on when brought on out of economic merit order for a watch list constraint in the initial dispatch solution.

The MMU recommends that PJM create an automated and auditable method for identifying the specific real-time three pivotal supplier test result used in making a decision about whether to impose or not impose mitigation when starting an offline unit to resolve a transmission constraint. At present, PJM cannot identify the real-time test result that is used to decide whether or not to offer cap a unit.

Analytical Issues

The MMU has identified a number of analytical issues with respect to the application of the three pivotal supplier test. In addition, PJM has responded to issues raised in several of the quarterly reports. This section identifies analytical issues, responds to PJM points where relevant and suggests resolutions. PJM makes the general claim that the MMU's recommendation to terminate the exemption from offer capping of certain interfaces is not supported by sufficient analysis. PJM neither defines what would constitute sufficient analysis nor offers any analysis to support maintaining the exemption.

Application of Three Pivotal Supplier Test in the Day-Ahead Market

The MMU recommends that three pivotal supplier testing be immediately and consistently applied to all constraints in the clearing of the day-ahead energy market and the results reliably documented, so that analysis of the day-ahead market results can be performed.

Day-Ahead TPS Test Data

The MMU has identified the need to test PJM's implementation of the three pivotal supplier test to ensure that it is being applied as intended. In addition, the MMU has identified the need to save data which will permit a reproducible, detailed analysis of the application of the three pivotal supplier test in the day ahead market and the identification of the link between test inputs, test results and market operator decisions with respect to offer capping in the day ahead market as well as in the real time market.

In response to the MMU's recommendation in its quarterly report on three pivotal supplier testing for the period ending December 31, 2006, PJM has begun a dialogue with the MMU on a process to capture and retain three pivotal supplier test results from the day-ahead market. There remains the need to continue to improve the process to explicitly identify, validate and retain an historical record of the final three pivotal supplier test results conducted and applied within the context of executing the day-ahead market. PJM and the MMU are working together to accumulate a reliable history of three pivotal supplier test inputs and results to allow for future examination and process improvement. As this identification and retention process provides reliable data, the MMU will include in upcoming quarterly reports an analysis of three pivotal supplier testing in the day-ahead market.

The MMU recommends that PJM cooperate with the MMU to facilitate a complete and thorough review by the MMU of the actual implementation of the three pivotal supplier test in both the day-ahead and real-time markets including a detailed review of the relevant software and operating procedures. Such a review has not been done, and it is critical to ensure that the test is being properly applied.

Watch List

In the clearing of the day-ahead market, PJM currently controls for certain constraints without subjecting those constraints to three pivotal supplier testing. In developing an initial day-ahead dispatch case, PJM assigns these constraints to what PJM terms a "watch list." It is the MMU's understanding that the ratings of these watch list facilities are respected, but units brought on out of economic merit order to control for these facilities are not subject to application of the local market power mitigation rules. It is not clear how PJM assigns an offer schedule for these out of merit resources without applying the market power mitigation rule. This initial dispatch case becomes the basis for the clearing of the day-ahead market, with those generator offer schedule selections carried into the real-time energy market. After this initial dispatch case is developed, PJM tests all constraints in clearing the day-ahead market, including those on the watch list. At that point, it is the MMU's understanding that the watch list constraints have already been largely resolved, so only incremental requirements for out of merit dispatch are subject to the local market power mitigation rule.

The MMU recommends that PJM modify its existing practice to ensure that watch list facilities are fully and completely subject to application of the three pivotal supplier test. The MMU also recommends that as part of PJM's cooperation with the MMU's review of the implementation of the three pivotal supplier test, that PJM provide the MMU with a detailed explanation of the process used to determine which schedule a unit is placed on when brought on out of economic merit order for a watch list constraint in the initial dispatch solution.

Linking Test Results to Offer Capping Decisions

The MMU recommends that PJM create an automated and auditable method for identifying the specific real-time test result used in making a decision about whether to impose or not impose mitigation when starting an offline unit to resolve a transmission constraint. At present, PJM cannot identify the real-time test result that is used to decide whether or not to offer cap a unit.

Application of TPS Test

The MMU in its quarterly report on PJM's application of the three pivotal supplier test provides the results of all three pivotal supplier tests in the real-time energy market, whether resulting in mitigation or not and whether resulting in a decision or not. The existence of a test does not mean that a decision was made based on the test result. The existence of a failed test result does not mean that mitigation was imposed. A test is triggered whenever PJM's Unit Dispatch System (UDS) software detects the need to provide incremental relief for a transmission constraint. The universe of three pivotal supplier tests is all intervals in which PJM's UDS software identifies the need to provide incremental relief for a transmission constraint.

When incremental relief is required for a transmission constraint, the three pivotal supplier test is executed. The test is an analysis of the ownership structure of units which are available to the operators to relieve the constraint. The relevant supply curve for providing incremental constraint relief includes increases in output from units already operating, reductions in output from units already operating and output from offline units that can provide the required relief in the time defined by the operators. Only offline units are subject to offer capping. In the majority of cases, the relevant supply curve consists of units which are already operating. Units which are already operating and selected to provide relief for a constraint are not subject to offer capping, regardless of the three pivotal supplier test result. Once a unit is started on its price schedule, it may not be offer capped due to a subsequent failure of a three pivotal supplier test. Mitigation is only applied to units started out of economic merit order for the purpose of relieving a constraint and which fail the test. An offline unit is brought on only if that unit provides a more cost effective solution than modifying the output of units which are already operating. Table 5 shows the proportion of units included in the three pivotal supplier tests which would have been eligible for mitigation for the currently exempt interfaces and which were eligible for mitigation for two frequently occurring non-exempt interfaces. That proportion is quite small for each of these interface constraints. Eligible for mitigation does not mean that these units were or would have been offer-capped. The results simply indicate the existence of an offline unit capable of providing relief to the constraint which failed the three pivotal supplier test. These units would have been subject to offer capping only in the event that the least cost solution to the constraint dictated starting one of these units rather than altering the output of a unit which was already online.

Table 5 Units Eligible for Mitigation

Constraint	Period	Average Number Units	Average Number of Units Eligible for Mitigation	Average Percent of Units Eligible for Mitigation
5004/5005 Interface	Peak	412.5	2.6	1.1%
	Off Peak	354.2	1.5	0.4%
Bedington - Black Oak	Peak	253.6	1.8	0.8%
	Off Peak	227.3	1.2	0.5%
AP South	Peak	372.0	5.5	1.8%
	Off Peak	330.6	3.9	1.1%
Western	Peak	426.7	0.3	0.1%
	Off Peak	392.4	0.7	0.1%
Central	Peak	448.7	0.7	0.3%
	Off Peak	434.1	0.0	0.0%
Eastern	Peak	257.8	10.6	6.5%
	Off Peak	292.0	42.0	14.4%

PJM responded to this MMU analysis of the average number of units eligible for mitigation and suggested that this average alone may not appropriately convey the range of possible outcomes.[15] The MMU's analysis of real-time offer capping experience shows similar results.[16] In addition, PJM failed to suggest an alternative approach.

Linking Test Results to Offer Capping Decisions

The universe of three pivotal supplier test results shows the structural conditions for all transmission constraints when PJM's UDS software determined that additional relief was required to resolve the constraint. Only a subset of those test results formed the basis for a decision to impose or not impose mitigation on a newly started unit.

PJM does not currently log which specific occurrence of the three pivotal supplier test forms the basis for a decision to impose mitigation or not to impose mitigation for a specific unit for a specific constraint at a specific time. PJM logs a "called-on" and a "start time" for the unit, but does not flag the test result relied upon in making the decision whether or not to impose mitigation. There is a time lag between when the mitigation decision is made, contact is initiated with the unit's owner and the request is logged by PJM. During this time, multiple three pivotal supplier tests may be applied by the PJM system software.

Given the actual application of the test, the fact that a small proportion of failed three pivotal supplier tests result in offer capping does not mean that the test has inconsistent results. Only when PJM creates a clear link between test inputs, test results and dispatcher action will it be possible to more completely understand this relationship. There is no evidence that the results of the three pivotal supplier test are inconsistent, are not based on the underlying market dynamics or result in excessive mitigation. PJM also refers to "false positive" test results without defining this term.[17] There is no evidence that the three pivotal supplier test ever results in a failed test that is not appropriate. PJM has provided no data or examples to support this assertion.

In response to the MMU recommendation that PJM automate a process for identifying which three pivotal supplier test result supported a decision to impose mitigation, PJM states that it is not possible to define such a linkage due to the simultaneity of constraints.[18] The MMU does not agree that this is a legitimate reason for not creating a verifiable audit trail of decision support materials to explain why a unit was mitigated. While constraints do occur simultaneously, there exists a manual process by which the dispatcher reviews and approves recommended generation resource configurations (UDS cases) to resolve constraints. Each of these UDS cases has an associated set of three pivotal supplier test results which drive the selection of a unit's price or cost schedule. The three pivotal supplier test results are themselves stored with an index key referencing their associated approved UDS case. If the UDS solution recommended

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15 http://www.pjm.com/committees/mic/postings/20070828-pjm-response-to-mmu-quarterly-report-04.pdf.

16 See *2006 State of the Market Report*, Volume II, Table 2-5.

17 http://www.pjm.com/committees/mic/postings/pjm-response-to-the-quarterly-mmu-interface-report.pdf.

18 http://www.pjm.com/committees/mic/postings/20070828-pjm-response-to-mmu-quarterly-report-04.pdf.

starting an offline unit and mitigated its offer, the associated three pivotal supplier test results should provide the justification for such action. Even if a unit were providing relief to several constraints simultaneously, that unit's effect on each of these constraints is examined separately by the three pivotal supplier test and the results of those tests stored. Ultimately, the decision to offer cap a unit must be based on an identifiable three pivotal supplier test. PJM should save a record of that identifiable test.

Short-term Changes in Test Results

The three pivotal supplier test measures actual, real-time system market structure based on actual system conditions and the test results reflect the dynamic nature of actual supply and demand. The time lag between running a test and actual unit response and the dynamic nature of the actual system conditions can result in changed pass/fail results for the owner of a given unit within a short period of time. (PJM refers to this result as oscillation.)[19] Such changes in pass/fail results for the owner of a given unit are only relevant to offer capping if the specific unit is offline and is selected to be started for the constraint. In addition, such changes are only of interest if they occur within a relatively short period of time.[20] It is therefore critical to be able to link specific test results to the decision to offer cap or not offer cap a particular unit. While the overwhelming majority of three pivotal supplier test results do not change over short periods, short term changes in test results cannot be analyzed without a link between test result and dispatcher action. PJM has not defined oscillation and cannot measure it in a meaningful way without this link.

In the presence of dynamic supply/demand conditions for a constraint, there should be no opportunity for the exercise of discretion in deciding whether to impose mitigation. Under such conditions, it is critical that PJM and the MMU be able to link the specific test and the test inputs relied upon in making a decision with respect to offer capping. Once a decision is made to start a unit on its price or cost schedule, the dispatcher may not make a subsequent change to that schedule due to a change in three pivotal supplier test result. As an example, if the dispatcher elects to bring on a combustion turbine for a constraint and the current three pivotal supplier test result shows that the unit should run on its price schedule, the dispatcher should not be able to require the unit to run on its cost schedule based on the next test result. Similarly, if the test result shows that the unit should run on its cost schedule, the dispatcher should not be able to require the unit to run on its price schedule based on the next test result. To allow such discretion would be analogous to a motorist challenging a ticket for running a red light because the light turns green while the police officer is writing the ticket.

For these reasons, the MMU recommends that PJM create an automated and auditable method for identifying the specific test result used in making a decision about whether to

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[19] The term oscillation refers to changes occurring in a regular cycle. To the extent that the underlying conditions result in changed test results, it does not appear to be happening in a regular cycle.

[20] The potential for such short term changes in test results exists in the real-time energy market and not in the day-ahead market. In the real-time energy market, dispatch decisions are made in real time and reflect the changing characteristics of the underlying system while in the day-ahead energy market, dispatch decisions reflect market operators' more comprehensive knowledge of system conditions throughout the day.

impose or not impose mitigation when starting an offline unit to resolve a transmission constraint.

Once PJM incorporates the ability to link offer capping decisions with the supporting three pivotal supplier test result and saves the related data, the MMU will include an analysis of this subset of tests in its quarterly reports. As part of its analysis, the MMU will evaluate the offer behavior of those offline resources selected to run for a constraint, along with the frequency of any associated offer capping. The MMU will also analyze the system conditions underlying specific cases where test results change for specific units within a short period of time.

Rather than explain a technical obstacle to implementing the MMU's recommendation in this regard, PJM suggests that the MMU report appears to agree that observed oscillation in the three pivotal supplier test results over short periods of time can create uncertainty for the PJM dispatcher which needs to be eliminated. This description of the MMU's recommendation is inaccurate. The MMU in fact recommended the linkage between test result and mitigation be automated and auditable not because of uncertainty for the dispatcher, but because of an inability by PJM to justify why specific units are mitigated. PJM further suggests that the MMU has failed to explain the "oscillation" of test results. PJM has to date failed to explain a single instance in which a change in test result was indicative of anything other than a structural change in the market interval being examined. PJM's contention that this suggests an inaccuracy in the test results remains without explanation or support.

Ultimately, changes in test results reflect changes in the underlying UDS solutions. When those solutions change frequently, the resultant test results may also change. That is an expected and a desired result. The test is intended to reflect the actual market situation faced by the market operators. It is the understanding of the MMU that PJM is currently engaged in modifications to the UDS application that may result in fewer changes to the UDS solutions.

Impact

A documented link among test inputs, test results and offer capping decisions is also required in order to analyze the impact of not offer capping for exempt constraints. This is true for the day-ahead and the real-time markets. When that data is available, the MMU will analyze the data.

As a general matter, any analysis of the impact of offer capping or not offer capping must be comprehensive. The LMP impact in a single hour of not offer capping a unit does not capture the full impact of that decision. A comprehensive analysis must begin with the day-ahead market, the potential impacts of offer capping in the day-ahead market and the effects of such offer capping on the selection of units which ultimately run in real time. The analysis in real time must begin with these units committed day-ahead and analyze the impacts of offer capping subsequently imposed throughout the operating day. An impact analysis also needs to consider operating reserve payments to units running for constraints. Take for example a CT with a minimum run time of 6 hours which is needed for a constraint for two hours. After the second hour of operation, the unit may no longer be needed for the constraint but must continue to operate to satisfy its minimum run time requirement. If LMP falls below the unit's offer price, operating reserve charges would be incurred. This is part of the impact of not offer capping.

The mark up of units that are part of the supply curve for resolving specific constraints is a measure of the potential impact of not offer capping. The mark up measures the difference between the price offers and the cost offers of units in the relevant supply curve and thus is a measure of the potential increase in price when offer capping is not implemented and market power is exercised as a result.

Scarcity

In its response to the MMU's quarterly report, PJM stated that "The offer exemption is necessary because it reduces the potential for excessive mitigation during times of regional scarcity."[21] This statement is not supported in the PJM document and the statement is not correct.

PJM has well defined FERC approved scarcity pricing rules.[22] The three pivotal supplier test has no impact on offer capping during times of regional scarcity. The scarcity rules explicitly state that all offer caps are relaxed during scarcity conditions for the scarcity region and that offer caps may not be reinstated until the scarcity event has been formally concluded, regardless of three pivotal supplier testing results.

The MMU has clearly indicated that the PJM scarcity pricing rules should be clarified and extended to ensure that economic scarcity conditions are actually reflected in prices.[23] Scarcity pricing, in every case, would mean that offer capping for local market power would not be imposed.

Incentives

PJM suggests that the use of a single price-based offer curve by generators each day makes it unlikely that a generation owner could exercise market power when a constraint has a non-competitive test result for only a few intervals.[24] The fact that the test fails for a small number of intervals is not a measure of the incentives to market participants to attempt the exercise of market power, which can have a substantial impact on portfolio revenues and which can persist for long periods of time once established. There are a number of strategies for exercising market power in such a case, absent offer capping, for a single unit or for a portfolio of units.

Relevant Market

The Appendix to PJM's May 31, 2007 document addresses the definition of the relevant market for purposes of defining competition. The document states that to "measure the overall competitiveness of the sub-region" one must analyze the times when

21 http://www.pjm.com/committees/mic/postings/pjm-response-to-the-quarterly-mmu-interface-report.pdf

22 114 FERC ¶ 61,076 (2006).

23 See *2006 State of the Market Report*, Volume II, Section 1, "Introduction," at "Recommendations."

24 http://www.pjm.com/committees/mic/postings/pjm-response-to-the-quarterly-mmu-interface-report.pdf.

transmission constraints create a smaller market and the times when there is no constraint.[25]

When there are no binding transmission constraints, the relevant market is the entire PJM footprint. When the entire PJM footprint is the relevant market, there is a presumption of competitiveness in PJM and there is no offer capping. When there is a binding transmission constraint, the relevant market is defined by the constraint and includes both the incremental demand for MW to relieve that constraint and the incremental supply available to solve the constraint. When evaluating the competitiveness of that market, this is the only relevant supply and demand. The overall competitiveness of the subregion does not refer to an identifiable market. Rather it refers to two or more specific markets which must be analyzed separately.

PJM's suggestion that the two markets be analyzed as if they were one market is not consistent with economic logic. Each is a separate market and each must be analyzed as a separate market. Nonetheless, PJM combines the markets and calculates that when the number of tests with at least one failing owner is compared to the total number of intervals, the number is a small percent. On this basis PJM concludes, incorrectly, that market power concerns are virtually eliminated. If applied previously, PJM's logic would have resulted in not including the actual local market power mitigation in the initial 1996 PJM FERC filing and in the absence of all local market power mitigation now.[26]

Market Certainty

PJM suggests that there should be no offer capping for the exempt interfaces because these interfaces are used as reference points for bilateral trading and providing market certainty is an important objective. It is not clear why retaining the interface exemption from offer capping would provide certainty. It is not clear what PJM considers to be certainty in this context. While market outcomes are never certain, it is a reasonable objective to have certainty about the definition and application of market rules. It would be preferable for the markets to have the certainty that the interface prices are not and cannot be subject to market power but are the outcome of competitive forces. It is not reasonable to pursue "certainty" by permitting the potential exercise of market power. PJM's goal is to ensure robust, competitive markets.

[25] http://www.pjm.com/committees/mic/postings/pjm-response-to-the-quarterly-mmu-interface-report.pdf.

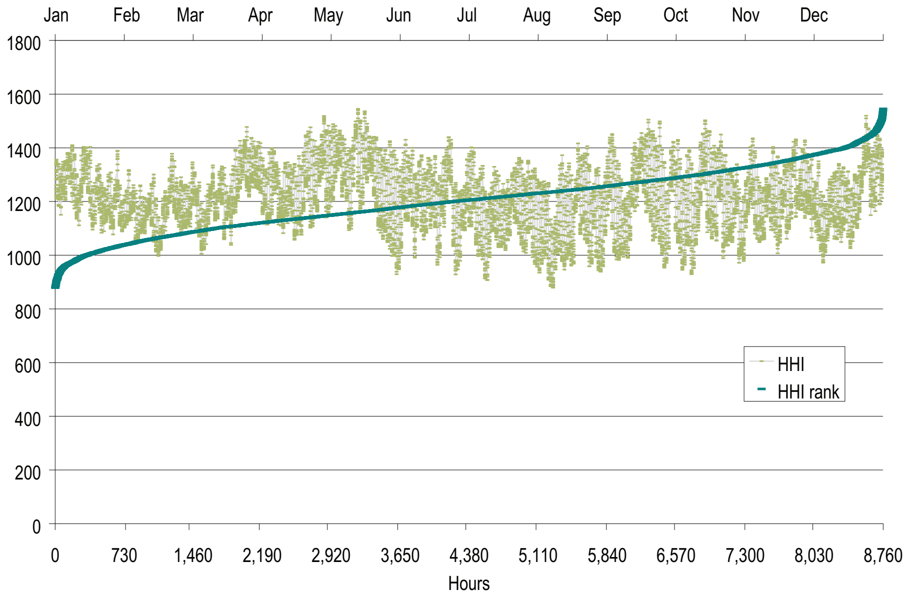
[26] As a factual matter, it is not true that PJM runs the three pivotal supplier test for every five minute interval as stated in the Appendix and reflected in Table 1. The three pivotal supplier test is run when there is incremental relief required for a constraint.

Attachment

B

Figure 2-3 presents the 2007 hourly HHI values in chronological order and an HHI duration curve that shows 2007 HHI values in ascending order of magnitude. The HHI values were in the unconcentrated range for 4 percent of the hours while HHI values were in the moderately concentrated range in the remaining 96 percent of hours, with a maximum value of 1545, as shown in Table 2-3.

Figure 2-3 PJM hourly Energy Market HHI: Calendar year 2007



Local Market Structure and Offer Capping

In the PJM Energy Market, offer capping occurs only as a result of structurally noncompetitive local markets and noncompetitive offers in the Day-Ahead and Real-Time Energy Markets. There are no explicit rules governing market structure or the exercise of market power in the aggregate Energy Market. PJM's market power mitigation goals have focused on market designs that promote competition and that limit market power mitigation to situations where market structure is not competitive and thus where market design alone cannot mitigate market power.

PJM has clear rules limiting the exercise of local market power.[14] The rules provide for offer capping when conditions on the transmission system create a structurally noncompetitive local market (as measured by the three pivotal supplier test), when units in that local market have made noncompetitive offers and when such offers would set the price above the competitive level in the absence of mitigation. Offer caps are set at the level of a competitive offer. Offer-capped units receive the higher of the market price or their offer cap. Thus, if broader market conditions lead to a price greater than the offer cap, the unit receives the higher market price. The rules governing the exercise of local market power recognize that units in certain areas of

14 See PJM. "Amended and Restated Operating Agreement (OA)," Schedule 1, Section 6.4.2. (January 19, 2007).

the system would be in a position to extract monopoly profits, but for these rules. The offer-capping rules exempt certain units from offer capping based on the date of their construction. Such exempt units can, and do, exercise market power, at times, that would not be permitted if the units were not exempt.

Under existing rules, PJM exempts suppliers from offer capping when structural market conditions, as measured by the three pivotal supplier test, indicate that such suppliers are reasonably likely to behave in a competitive manner. The goal is to apply a clear rule to limit the exercise of market power by generation owners in load pockets, but to apply the rule in a flexible manner in real time and to lift offer capping when the exercise of market power is unlikely based on the real-time application of the market structure screen.

PJM's three pivotal supplier test represents the practical application of the FERC market power tests in real time.[15] The three pivotal supplier test is passed if no three generation suppliers in a load pocket are jointly pivotal. Stated another way, if the incremental output of the three largest suppliers in a load pocket is removed and enough incremental generation remains available to solve the incremental demand for constraint relief, where the relevant competitive supply includes all incremental MW at a cost less than, or equal, to 1.5 times the clearing price, then offer capping is suspended.

Levels of offer capping have historically been low in PJM, as shown in Table 2-5.

Table 2-5 Annual offer-capping statistics: Calendar years 2003 to 2007

	Real Time		Day Ahead	
	Unit Hours Capped	MW Capped	Unit Hours Capped	MW Capped
2003	1.1%	0.3%	0.4%	0.2%
2004	1.3%	0.4%	0.6%	0.2%
2005	1.8%	0.4%	0.2%	0.1%
2006	1.0%	0.2%	0.4%	0.1%
2007	1.1%	0.2%	0.2%	0.0%

Table 2-6 presents data on the frequency with which units were offer capped in 2007. Table 2-6 shows the number of generating units that met the specified criteria for total offer-capped run hours and percentage of total run hours that were offer-capped for 2007.[16] For example, in 2007, 15 units were offer-capped for greater than, or equal to, 80 percent and less than 90 percent of their run hours and had 500 or more offer-capped run hours.

15 See the *2007 State of the Market Report*, Volume II, Appendix L, "Three Pivotal Supplier Test."

16 Offer-capped statistics in Table 2-6 are presented in a different format than previous years. The offer-capped percentage categories were also changed slightly to be consistent with the criteria for FMU eligibility. For example, the greater than 60 percent category was changed to greater than, or equal to, 60 percent which is consistent with the criteria for the Tier 1 adder (greater than, or equal to, 60 percent and less than 70 percent). Offer-capped statistics for prior years are shown in the revised format and with the revised percentage categories in the *2007 State of the Market Report,* Volume II, Appendix C, "Energy Market." Data quality improvements have caused values in these tables to vary slightly from previously published results.

Table 2-6 Offer-capped unit statistics: Calendar year 2007

	2007 Offer-Capped Hours					
Run Hours Offer-Capped, Percent Greater Than Or Equal To:	Hours ≥ 500	Hours ≥ 400 and < 500	Hours ≥ 300 and < 400	Hours ≥ 200 and < 300	Hours ≥ 100 and < 200	Hours ≥ 1 and < 100
90%	2	1	3	2	6	0
80% and < 90%	15	3	0	14	13	6
75% and < 80%	0	0	0	0	2	4
70% and < 75%	0	0	2	0	1	3
60% and < 70%	0	0	0	1	3	24
50% and < 60%	1	0	0	0	0	21
25% and < 50%	0	0	0	0	0	51
10% and < 25%	0	0	0	3	12	37

Table 2-6 shows that a small number of units are offer capped for a significant number of hours or for a significant proportion of their run hours. For example, only 47 units (about 4 percent of all units) that had offer-capped run hours of at least 200 hours (about 2 percent of all hours) in 2007 were offer capped for 10 percent or more of their run hours. Only 22 units (or about 2 percent of all units) had greater than, or equal to, 400 offer-capped run hours.

When compared to the 2006 offer-capped statistics, 25 percent of the categories show an increase in the number of units; 29 percent of the categories show no change and 46 percent of the categories show a decrease in the number of units.[17]

When compared to the 2005 offer-capped statistics, 31 percent of the categories show an increase in the number of units; 21 percent of the categories show no change and 48 percent of the categories show a decrease in the number of units.[18]

Units that are offer capped for greater than, or equal to, 60 percent of their run hours are designated as frequently mitigated units (FMUs). An FMU or units that are associated with the FMU (AUs) are entitled to include adders in their cost-based offers that are a form of local scarcity pricing.

Local Market Structure

In 2007, the PSEG, AP, AEP, Met-Ed, JCPL, PENELEC, Dominion, DPL, AECO and DLCO control zones experienced congestion resulting from one or more constraints binding for 100 or more hours. Using the three pivotal supplier results for calendar year 2007, actual competitive conditions associated with each of these frequently binding constraints were analyzed in real time.[19] The ComEd, BGE, PECO, PPL, RECO, Pepco and DAY control zones were not affected by constraints binding for 100 or more hours.

17 See the *2007 State of the Market Report*, Volume II, Appendix C, "Energy Market" Table C-22 for 2006 data.
18 See the *2007 State of the Market Report*, Volume II, Appendix C, "Energy Market" Table C-21 for 2005 data.
19 See the *2007 State of the Market Report*, Volume II, Appendix L, "Three Pivotal Supplier Test" for a more detailed explanation of 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 to prevent the exercise of local market power for any constraint not exempt from offer capping. The MMU analyzed the results of the three pivotal supplier tests conducted by PJM for the Real-Time Energy Market for the period January 1, 2007, through December 31, 2007.

Overall, the results 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 59 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 two suppliers and therefore are always structurally noncompetitive.

The fact that some non-exempt constraints never had any generation resources that failed the three pivotal supplier test during the period analyzed does not lead to the conclusion that such constraints should always be exempt from offer capping for local market power. The same logic applies to currently exempt interface constraints. Even if no generation resources associated with any of the exempt interface constraints failed the three pivotal suppler test during the period analyzed, that does not mean that such interfaces should always be exempt from offer capping for local market power. The fact that one or more generation resources, required to resolve these interfaces, did fail the three pivotal supplier test at times simply reinforces the point. If the generation resources associated with these interfaces always pass the three pivotal supplier test, there will be no offer capping; and conversely if such resources at times fail the three pivotal supplier test, appropriate offer capping will be applied.

The MMU also recommends that three pivotal supplier testing be applied to all constraints in the clearing of the PJM Day-Ahead Energy Market. While PJM applies three pivotal supplier testing to the exempt interfaces in real time, the test is not applied consistently to the exempt interfaces in the Day-Ahead Market and the results of the test are not saved. As a result, it is not possible to analyze the market structure associated with the exempt interfaces in the Day-Ahead Market. The currently exempt interfaces accounted for $167.6 million in day-ahead and -$5.3 million in balancing congestion costs during 2007. The exempt interfaces were constrained for more hours in the Day-Ahead Market than in the Real-Time Market. During 2007, the exempt interfaces were constrained 2,703 hours in the Day-Ahead Market and 501 hours in the Real-Time Market.

Information is provided for each constraint including the number of tests applied and the number of tests in which one or more owners passed and/or failed the three pivotal supplier test.[20] Additional information is provided for each constraint including the average MW required to relieve a constraint, the average supply available, the average number of owners included in each test and the average number of owners that passed or failed each test.

- Regional 500 kV Constraints. In 2007, several regional transmission constraints occurred for more than 100 hours. The Kammer 765/500 kV transformer, along with four interface constraints (5004/5005,

20 The three pivotal supplier test in the Real-Time Energy Market is applied by PJM as necessary and may be applied multiple times within a single hour for a specific constraint. Each application of the test is done in a five-minute interval.

AP South, Bedington – Black Oak and West) all experienced more than 100 hours of congestion.[21] The three pivotal supplier test was applied to all of these constraints. The AP South and West interfaces are two of the four interfaces for which generation owners are exempt from offer capping.

Table 2-7 includes information on the three pivotal supplier test results for the regional constraints.[22] For the three regional constraints that are not exempt, the percentage of tested intervals resulting in one or more owners passing ranged from 81 percent to 89 percent while 21 percent to 34 percent of the tests show one or more owners failing. For the AP South and West interfaces, which are exempt from offer capping, the percentage of tested intervals resulting in one or more owners passing ranged from 59 percent to 96 percent while 8 percent to 54 percent of the tests show one or more owners failing.

Table 2-7 Three pivotal supplier results summary for regional constraints: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
5004/5005 Interface	Peak	646	576	89%	147	23%
	Off peak	274	228	83%	84	31%
AP South	Peak	276	176	64%	140	51%
	Off peak	157	92	59%	85	54%
Bedington - Black Oak	Peak	3,184	2,577	81%	1,071	34%
	Off peak	5,000	4,291	86%	1,405	28%
Kammer	Peak	1,487	1,327	89%	318	21%
	Off peak	2,518	2,114	84%	746	30%
West	Peak	718	689	96%	59	8%
	Off peak	656	618	94%	58	9%

Table 2-8 shows that, on average, during 2007 peak periods, the local markets created by the 5004/5005 Interface and the Kammer transformer had 21 owners with available supply and 20 owners with available supply, respectively. Of those owners, an average of 18 passed the test for the 5004/5005 Interface and an average of 17 passed the test for the Kammer transformer.[23] Bedington – Black Oak, on average, had 13 owners with available supply and 10 owners passed the test. For AP South, on average, 10 out of 17 owners passed the test during both on-peak and off-peak periods. For the West Interface, on average, 19 out of 20 owners passed the test during on-peak periods, and 17 out of 18 owners passed the test during off-peak periods.

21 The 5004/5005 Interface is comprised of two, 500 kV lines, which include the Keystone – Juniata 5004 and the Conemaugh – Juniata 5005. These two lines are located between central and western Pennsylvania.

22 The number of tests with one or more failing owners plus the number of tests with one or more passing owners can exceed the total number of tests applied. A single test can result in one or more owners passing and one or more owners failing. In such a case, the interval would be counted as including one or more passing owners and one or more failing owners.

23 The average number of owners passing and the average number of owners failing are rounded to the nearest whole number and may not sum to the average number of owners, also rounded to the nearest whole number.

Table 2-8 Three pivotal supplier test details for regional constraints: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
5004/5005 Interface	Peak	109	424	21	18	3
	Off peak	96	356	17	14	3
AP South	Peak	96	306	17	10	7
	Off peak	91	301	17	10	7
Bedington - Black Oak	Peak	62	234	13	10	3
	Off peak	63	240	11	9	2
Kammer	Peak	87	377	20	17	3
	Off peak	72	307	16	12	3
West	Peak	158	758	20	19	1
	Off peak	146	716	18	17	1

- East Interface and Central Interface. The remaining two exempt interfaces, the East and Central interface constraints occurred for fewer than 100 hours. The East Interface constraint occurred for five hours in 2007, while the Central Interface constraint occurred for 25 hours in 2007. Table 2-9 shows that the percentage of tested intervals resulting in one or more owners passing ranged from 56 percent to 97 percent while 14 percent to 100 percent of the tests showed one or more owners failing.

Table 2-9 Three pivotal supplier results summary for the East and Central interfaces: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Central	Peak	28	24	86%	5	18%
	Off peak	29	28	97%	4	14%
East	Peak	9	5	56%	7	78%
	Off peak	1	0	0%	1	100%

Table 2-10 shows that, on average, the local market created by the East Interface had 15 owners during peak periods and seven passed the test. No owners passed the test during off-peak periods in 2007. The local market created by the Central Interface had 19 owners during off-peak periods and all passed the test. During on-peak periods, 17 of 19 passed the test for the Central Interface.

Table 2-10 Three pivotal supplier test details for the East and Central interfaces: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Central	Peak	87	445	19	17	3
	Off peak	168	914	19	19	1
East	Peak	363	1,009	15	7	8
	Off peak	187	694	12	0	12

- PSEG Control Zone Constraints. In 2007, five constraints in the PSEG Control Zone occurred for more than 100 hours. Table 2-11 and Table 2-12 show the results of the three pivotal supplier tests applied to these constraints. For four of the five constraints, the average number of owners with available supply was four or less. The three pivotal supplier test results reflect this, as the average number of owners that passed is significant only for the Cedar Grove – Roseland 230 kV line, which had more than four owners, on average. The Cedar Grove – Roseland 230 kV line had more owners and more effective supply and thus a higher percentage of tests with one or more owners that passed the three pivotal supplier test.

Table 2-11 Three pivotal supplier results summary for constraints located in the PSEG Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Branchburg - Flagtown	Peak	227	0	0%	227	100%
	Off peak	90	0	0%	90	100%
Branchburg - Readington	Peak	1,780	119	7%	1,760	99%
	Off peak	689	27	4%	683	99%
Brunswick - Edison	Peak	164	0	0%	164	100%
	Off peak	84	0	0%	84	100%
Cedar Grove - Roseland	Peak	148	26	18%	132	89%
	Off peak	210	28	13%	198	94%
Edison - Meadow Rd	Peak	270	0	0%	270	100%
	Off peak	34	0	0%	34	100%

Table 2-12 Three pivotal supplier test details for constraints located in the PSEG Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Branchburg - Flagtown	Peak	23	21	3	0	3
	Off peak	26	4	3	0	3
Branchburg - Readington	Peak	27	64	4	0	3
	Off peak	23	68	4	0	4
Brunswick - Edison	Peak	11	84	1	0	1
	Off peak	10	76	1	0	1
Cedar Grove - Roseland	Peak	51	124	8	1	7
	Off peak	50	140	9	1	8
Edison - Meadow Rd	Peak	7	37	1	0	1
	Off peak	5	25	1	0	1

- AP Control Zone Constraints. In 2007, there were nine constraints that occurred for more than 100 hours in the AP Control Zone. Table 2-13 and Table 2-14 show the results of the three pivotal supplier tests applied to the constraints in the AP Control Zone. For six of the nine constraints, the average number of owners with available supply was six or less. The three pivotal supplier test results reflect this, as the average number of owners that passed is significant only for the three constraints with a larger number of owners, on average. Three constraints, the Mount Storm – Pruntytown 500 kV line, the Sammis – Wylie Ridge 345 kV line and the Wylie Ridge transformer had more owners and more effective supply and thus a higher percentage of tests with one or more owners that passed.

Table 2-13 Three pivotal supplier results summary for constraints located in the AP Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Bedington	Peak	2,017	4	0%	2,017	100%
	Off peak	548	0	0%	548	100%
Bedington - Nipetown	Peak	603	0	0%	603	100%
	Off peak	153	0	0%	153	100%
Elrama - Mitchell	Peak	975	209	21%	915	94%
	Off peak	1,930	397	21%	1,834	95%
Meadow Brook	Peak	1,974	0	0%	1,974	100%
	Off peak	213	0	0%	213	100%
Mitchell - Shepler Hill	Peak	344	0	0%	344	100%
	Off peak	325	0	0%	325	100%
Mitchell - Union Jct	Peak	265	0	0%	265	100%
	Off peak	113	0	0%	113	100%
Mount Storm - Pruntytown	Peak	168	132	79%	82	49%
	Off peak	481	410	85%	148	31%
Sammis - Wylie Ridge	Peak	39	18	46%	23	59%
	Off peak	394	285	72%	169	43%
Wylie Ridge	Peak	1,283	594	46%	759	59%
	Off peak	1,895	1,436	76%	712	38%

Table 2-14 Three pivotal supplier test details for constraints located in the AP Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Bedington	Peak	27	4	2	0	2
	Off peak	29	6	2	0	2
Bedington - Nipetown	Peak	9	5	2	0	2
	Off peak	15	5	2	0	2
Elrama - Mitchell	Peak	27	75	6	1	5
	Off peak	28	50	5	1	5
Meadow Brook	Peak	34	1	2	0	2
	Off peak	20	1	2	0	2
Mitchell - Shepler Hill	Peak	8	10	2	0	2
	Off peak	10	7	2	0	2
Mitchell - Union Jct	Peak	13	47	2	0	2
	Off peak	13	29	2	0	2
Mount Storm - Pruntytown	Peak	127	368	13	9	4
	Off peak	104	379	11	9	2
Sammis - Wylie Ridge	Peak	42	73	15	8	7
	Off peak	43	110	16	10	5
Wylie Ridge	Peak	34	104	11	9	2
	Off peak	50	167	16	12	4

- AEP Control Zone Constraints. In 2007, there were five constraints that occurred for more than 100 hours in the AEP Control Zone. Table 2-15 and Table 2-16 show the results of the three pivotal supplier tests applied to the constraints in the AEP Control Zone. For three of the five constraints, the average number of owners with available supply was two or less. The three pivotal supplier test results reflect this, as the average number of owners that passed is significant only for the two constraints with the largest number of owners, on average. Two constraints, the Cloverdale – Lexington 500 kV line and the Cloverdale transformer, had more owners and more effective supply and thus a higher percentage of tests with one or more owners that passed.

Table 2-15 Three pivotal supplier results summary for constraints located in the AEP Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Amos	Peak	529	0	0%	529	100%
	Off peak	89	0	0%	89	100%
Cloverdale	Peak	122	60	49%	82	67%
	Off peak	460	317	69%	227	49%
Cloverdale - Lexington	Peak	1,955	1,482	76%	874	45%
	Off peak	7,494	5,287	71%	3,819	51%
Darwin - Eugene	Peak	792	0	0%	792	100%
	Off peak	19	0	0%	19	100%
Mahans Lane - Tidd	Peak	340	0	0%	340	100%
	Off peak	474	0	0%	474	100%

Table 2-16 Three pivotal supplier test details for constraints located in the AEP Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Amos	Peak	33	19	2	0	2
	Off peak	24	19	2	0	2
Cloverdale	Peak	91	215	12	5	7
	Off peak	74	232	11	7	4
Cloverdale - Lexington	Peak	101	352	17	12	5
	Off peak	97	290	14	9	6
Darwin - Eugene	Peak	30	61	1	0	1
	Off peak	38	74	2	0	2
Mahans Lane - Tidd	Peak	10	16	1	0	1
	Off peak	20	12	1	0	1

- Met-Ed Control Zone Constraints. In 2007, there were four constraints that occurred for more than 100 hours in the Met-Ed Control Zone. Table 2-17 and Table 2-18 show the results of the three pivotal supplier tests applied to the constraints in the Met-Ed Control Zone. For three of the four constraints, the average number of owners with available supply was two or less. The three pivotal supplier test results reflect this, as the average number of owners that passed is significant only for the one constraint with the largest number of owners, on average. The Brunner Island – Yorkana 230 kV line had more owners and more effective supply and thus a higher percentage of tests with one or more owners that passed.

Table 2-17 Three pivotal supplier results summary for constraints located in the Met-Ed Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Brunner Island - Yorkana	Peak	531	277	52%	354	67%
	Off peak	230	105	46%	194	84%
Gardners - Hunterstown	Peak	375	1	0%	375	100%
	Off peak	58	0	0%	58	100%
Hunterstown	Peak	209	0	0%	209	100%
	Off peak	12	0	0%	12	100%
Jackson	Peak	290	0	0%	290	100%
	Off peak	5	0	0%	5	100%

Table 2-18 Three pivotal supplier test details for constraints located in the Met-Ed Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Brunner Island - Yorkana	Peak	28	70	12	7	5
	Off peak	32	65	9	5	5
Gardners - Hunterstown	Peak	9	14	2	0	2
	Off peak	9	17	2	0	2
Hunterstown	Peak	10	27	2	0	2
	Off peak	8	41	2	0	2
Jackson	Peak	14	18	2	0	2
	Off peak	7	17	1	0	1

- JCPL Control Zone Constraints. In 2007, the Atlantic — Larrabee 230 kV line was the only constraint in the JCPL Control Zone to occur for more than 100 hours. Table 2-19 and Table 2-20 show the results of the three pivotal supplier tests applied to this constraint. The average number of owners with available supply was five on peak and three off peak. The three pivotal supplier test results reflect this, as 91 percent of the tests applied on peak and 100 percent of the tests applied off peak resulted in one or more owners failing the test.

Table 2-19 Three pivotal supplier results summary for constraints located in the JCPL Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Atlantic - Larrabee	Peak	175	35	20%	160	91%
	Off peak	320	9	3%	320	100%

Table 2-20 Three pivotal supplier test details for constraints located in the JCPL Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Atlantic - Larrabee	Peak	32	25	5	1	5
	Off peak	35	36	3	0	3

- **PENELEC Control Zone Constraints.** In 2007, the East Towanda transformer and the East Towanda – South Troy line were the only constraints to occur for more than 100 hours in the PENELEC Control Zone. Table 2-21 and Table 2-22 show the results of the three pivotal supplier tests applied to the constraints in the PENELEC Control Zone. The average number of owners with available supply was three on peak and three off peak for the East Towanda transformer and one on peak and one off peak for the East Towanda – South Troy line. The three pivotal supplier test results reflect this, as all tests were failed.

Table 2-21 Three pivotal supplier results summary for constraints located in the PENELEC Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
East Towanda	Peak	1,813	14	1%	1,806	100%
	Off peak	342	0	0%	342	100%
East Towanda - S.Troy	Peak	3	0	0%	3	100%
	Off peak	19	0	0%	19	100%

Table 2-22 Three pivotal supplier test details for constraints located in the PENELEC Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
East Towanda	Peak	12	4	3	0	3
	Off peak	6	4	3	0	3
East Towanda - S.Troy	Peak	4	17	1	0	1
	Off peak	7	3	1	0	1

- **Dominion Control Zone Constraints.** In 2007, there were three constraints in the Dominion Control Zone that occurred for more than 100 hours. Table 2-23 and Table 2-24 show the results of the three pivotal supplier test applied to the constraints in the Dominion Control Zone. The average number of owners with available supply was one on peak and one off peak for the Beechwood – Kerr Dam and the Halifax – Mount Laurel lines and six on peak and six off peak for the Clover transformer constraint. The three pivotal supplier test results reflect this, as nearly all tests were failed.

Table 2-23 Three pivotal supplier results summary for constraints located in the Dominion Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Beechwood - Kerr Dam	Peak	649	0	0%	649	100%
	Off peak	62	0	0%	62	100%
Clover	Peak	620	149	24%	601	97%
	Off peak	47	12	26%	47	100%
Halifax - Mount Laurel	Peak	584	46	8%	538	92%
	Off peak	384	54	14%	330	86%

Table 2-24 Three pivotal supplier test details for constraints located in the Dominion Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Beechwood - Kerr Dam	Peak	6	5	1	0	1
	Off peak	5	4	1	0	1
Clover	Peak	39	110	6	1	5
	Off peak	58	101	6	0	6
Halifax - Mount Laurel	Peak	11	2	1	0	1
	Off peak	11	2	1	0	1

- DPL Control Zone Constraints. In 2007, the Greenbush — Hallwood 69 kV line was the only constraint in the DPL Control Zone to occur for more than 100 hours. Table 2-25 and Table 2-26 show the results of the three pivotal supplier test applied to this constraint. The average number of owners with available supply was one. The three pivotal supplier test results reflect this, as all tests were failed.

Table 2-25 Three pivotal supplier results summary for constraints located in the DPL Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Greenbush - Hallwood	Peak	73	0	0%	73	100%
	Off peak	37	0	0%	37	100%

Table 2-26 Three pivotal supplier test details for constraints located in the DPL Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Greenbush - Hallwood	Peak	3	11	1	0	1
	Off peak	3	14	1	0	1

- AECO Control Zone Constraints. In 2007, there were two constraints in the AECO Control Zone that occurred for more than 100 hours. Table 2-27 and Table 2-28 show the results of the three pivotal supplier test applied to the constraints in the AECO Control Zone. The average number of owners with available supply was one. The three pivotal supplier test results reflect this, as all tests were failed.

Table 2-27 Three pivotal supplier results summary for constraints located in the AECO Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Beckett - Paulsboro	Peak	885	0	0%	885	100%
	Off peak	277	0	0%	277	100%
Churchtown	Peak	203	0	0%	203	100%
	Off peak	177	0	0%	177	100%

Table 2-28 Three pivotal supplier test details for constraints located in the AECO Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Beckett - Paulsboro	Peak	5	5	1	0	1
	Off peak	2	6	1	0	1
Churchtown	Peak	28	22	1	0	1
	Off peak	3	26	1	0	1

- DLCO Control Zone Constraints. In 2007, two constraints in the DLCO Control Zone experienced more than 100 hours of congestion. Table 2-29 and Table 2-30 show the results of the three pivotal supplier test applied to the constraints in the DLCO Control Zone. The average number of owners with available supply was one on peak and one off peak for the Cheswick – Evergreen line and two on peak and two off peak for the Collier – Elwyn line. The three pivotal supplier test results reflect this, as nearly all tests were failed.

Table 2-29 Three pivotal supplier results summary for constraints located in the DLCO Control Zone: Calendar year 2007

Constraint	Period	Total Tests Applied	Tests with One or More Passing Owners	Percent Tests with One or More Passing Owners	Tests with One or More Failing Owners	Percent Tests with One or More Failing Owners
Cheswick - Evergreen	Peak	263	0	0%	263	100%
	Off peak	21	0	0%	21	100%
Collier - Elwyn	Peak	415	1	0%	414	100%
	Off peak	296	0	0%	296	100%

Table 2-30 Three pivotal supplier test details for constraints located in the DLCO Control Zone: Calendar year 2007

Constraint	Period	Average Constraint Relief (MW)	Average Effective Supply (MW)	Average Number Owners	Average Number Owners Passing	Average Number Owners Failing
Cheswick - Evergreen	Peak	9	42	1	0	1
	Off peak	10	37	1	0	1
Collier - Elwyn	Peak	29	10	2	0	2
	Off peak	14	19	2	0	2

Characteristics of Marginal Units

Ownership of Marginal Units

Table 2-31 shows the contribution to PJM annual, load-weighted LMP by individual generation owner, utilizing generator sensitivity factors.[24] The contribution of each marginal unit to price at each load bus is calculated for the year and summed by the company that offers the unit into the Energy Market. The results show that, during calendar year 2007, the offers of one company contributed 13 percent of the annual load-weighted, average PJM system LMP and that the offers of the top four companies contributed 40 percent of the annual load-weighted, average PJM system LMP. There were 46 companies with individual contributions less than 4 percent and a combined contribution of 29 percent.

Table 2-31 Marginal unit contribution to PJM annual, load-weighted LMP (By company): Calendar year 2007

Company	Percent of Price
1	13%
2	10%
3	9%
4	8%
5	8%
6	7%
7	7%
8	5%
9	4%
Other (46 companies)	29%

24 See the *2007 State of the Market Report*, Volume II, Appendix K, "Calculation and Use of Generator Sensitivity/Unit Participation Factors."

Attachment C

Three Pivotal Supplier Test Discussion

FERC Litigation Staff Meeting

October 31, 2008

Joe Bowring

Howard Haas

Monitoring Analytics

The Independent Market Monitor for PJM

Role of Competition

- Market monitoring is required by Federal Power Act
  - Associated FERC Orders
- Role of competition under the FPA
  - Mechanism to regulate prices
  - Competitive outcome = just and reasonable
- Relevant model of competition is not laissez faire
- Competitive outcomes are not automatic
- Detailed rules required – like other markets/exchanges

- Approach to market analysis
  - Structure
    - Concentration
    - Pivotal suppliers
  - Conduct/Behavior
    - Economic withholding
    - Physical withholding
  - Performance
    - System markup
    - Net revenue
  - Definition of the market
    - Relevant competitors

- Structure/conduct/performance
  - Structural measures
    - Concentration of ownership: HHI
    - Individual company Market Share: MS
    - Pivotal supplier(s): RSI
  - Conduct/behavior measures
    - Markup (unit): (P – C)/P
    - Offer behavior - parameters
  - Performance measures
    - Markup (clearing price)
    - Net revenue

- Ability to increase/decrease market clearing price above/below competitive price level
  - Market structure permits participant behavior with an impact on market performance

- Competitive price level is the short run marginal cost of unit setting market clearing price
  - Risk
  - Opportunity costs

Market Design

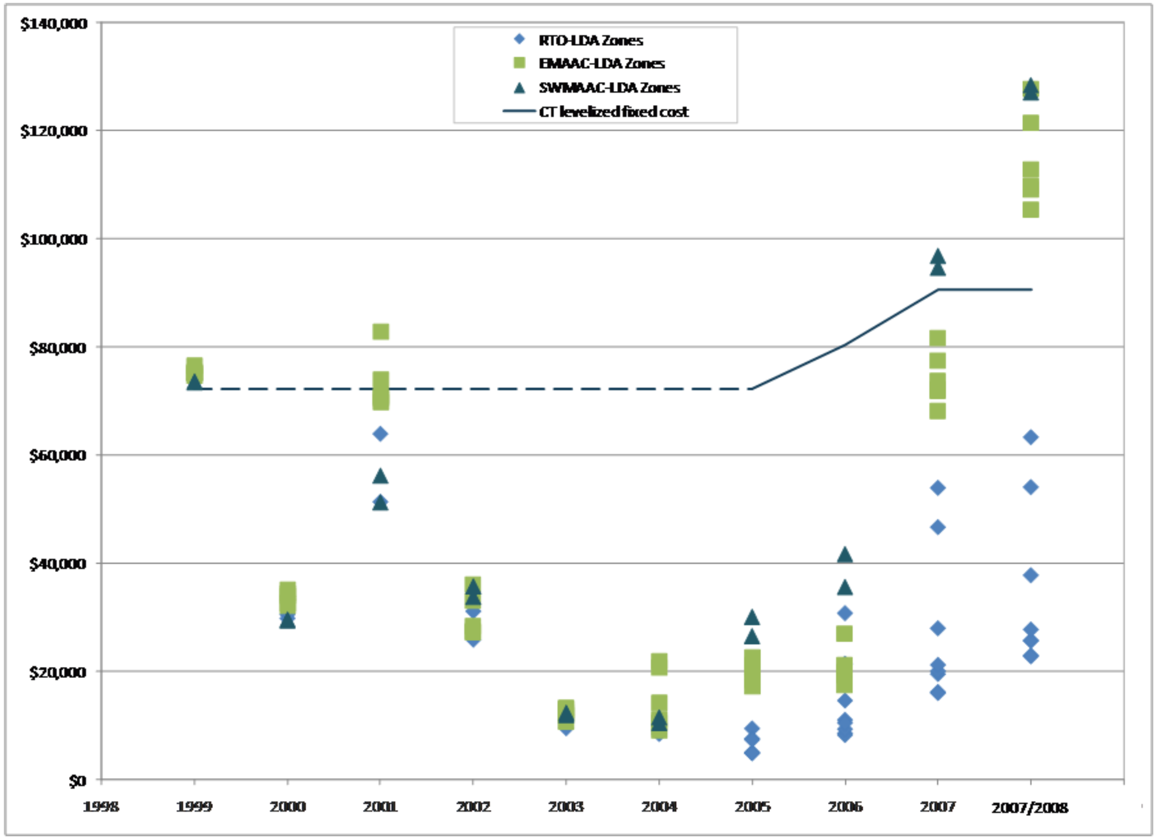
- Goal is sustainable, competitive market design
  - Competitive markets that result in investment incentives
  - Sustainable market design cannot rely upon market power
- PJM markets are complete
  - Day ahead and real time energy markets
  - Capacity market
  - Ancillary services markets
- PJM markets are revenue adequate
- PJM markets provide investment incentives
  - Locational marginal prices
  - Locational RPM

Scarcity

- Scarcity revenues are captured in the RPM design
  - RPM revenues are a substitute for the scarcity revenues that would result in an all-energy market
- Scarcity revenues in the energy market are an offset to the scarcity revenues in the capacity markets
- PJM has clearly defined, FERC approved scarcity pricing rules.
- Local market power mitigation is not applied during scarcity conditions.

Monitoring Analytics

CT Net Revenue from All Markets and Fixed Costs



Monitoring
Analytics

MW added under RPM: 2007 – 2011 RPM auctions

	UCAP (MW)
Total internal capacity @ 31-May-07	154,967.6
New generation	3,139.2
Reactivated units	**796.8**
Generation capmods	1,713.5
DR mods	**2,117.2**
Reclassification of Duquesne units	(3,009.5)
Net EFORd effect	**157.9**
Total internal capacity changes	4,915.1
Total internal capacity @ 01-Jun-11	159,882.7
Reclassification of Duquesne units	**3,009.5**
Adjusted internal capacity @ 01-Jun-11	162,892.2
Net exchange (imports-exports) @ 01-Jun-11	2,480.7
ALM/ILR @ 01-Jun-11	**370.0**
Postponed/withdrawn retirements/deactivations @ 01-Jun-11	1,790.8
Total MW added under RPM @ 01-Jun-11	12,566.1

- The three pivotal supplier test is applied in the PJM Day-Ahead Energy Market.
- The three pivotal supplier test is applied in the PJM Real-Time Energy Market.
- The three pivotal supplier test is applied in the PJM RPM (capacity) Market.

FERC's Delivered Price Test

- Derived from FERC's Delivered Price Test
  - 107 FERC ¶ 61,018 (2004) (AEP Order)
  - Market power screens
  - Market power tests
- Definition of the relevant market – supply available at 1.05 times clearing price
- Metrics
  - HHI test
  - Market share test
  - Pivotal supplier test

Consistent with FERC Methodology

- FERC considers a supplier to have market power if the FERC screens are failed for any one of the identified demand conditions.
  - Screens and tests
- FERC approach is historical
  - Relies on data samples from representative periods
- FERC approach requires the application of judgment
- FERC outcome is a decision that applies for three years
  - Relies upon mitigation rules in organized markets
- TPS is applied in real time using a market definition based on PJM’s actual dispatch logic
- TPS is for local markets only

Three Pivotal Supplier Test

- Definition of competitive local market structure
- Replaces offer capping of all units for local markets created by constraints
- Real-time analysis of market structure
- Offer caps based on cost data from each unit

Local Markets

- In an LMP-based market, constraints create smaller, local markets with different structural characteristics than the aggregate market.
- In a local market, all units do not have an equivalent ability to compete.
- The ability to compete is a function of:
  - Unit offer price or cost
  - Unit impact on the constrained facility.
- The local market includes only resources that can deliver relief to specific constraints at a competitive price within a defined time.
- Same logic for locational RPM market design.

13

Distribution factors

- Consider two units with the same 100 MW capacity and identical energy offers of $150 at a time when the PJM LMP is $100.
- Unit A is located electrically close to the constrained facility and has a distribution factor of 90 percent, while unit B is electrically distant with a 5 percent distribution factor.
- Unit A is able to provide (100 MW * (-0.90)) = -90 MW of relief at an effective cost of ($100 - $150)/(-0.90) = $55.56 per MW
- Unit B can provide (100 MW * (-0.05)) = -5 MW of relief at an effective cost of ($100 - $150)/(-0.05) = $1000

TPS

- TPS is a dynamic, real-time application that measures market structure based on PJM's market logic and rules
- Pivotal means that the output of the defined suppliers is necessary to clear the market
- Three pivotal suppliers means that the output of three suppliers is necessary to clear the market

TPS - Components

- Demand
  - Incremental, effective MW
  - Requirement for constraint relief
  - MW measured at constraint
- Supply
  - Incremental, effective MW
  - Operationally available
  - Unit MW reflecting distribution factor to constraint
- Market definition
  - Supply available at less than or equal to 1.50 times clearing price

Context of TPS Test Results

- TPS test is triggered in real time whenever PJM's Unit Dispatch System (UDS) dispatch software detects the need to provide incremental relief for a transmission constraint.
- The universe of real-time TPS tests is all intervals in which PJM's UDS software identifies the need to provide incremental relief for a transmission constraint.

Units Subject to Offer Capping

- Only offline units are subject to offer capping
- In the majority of cases, the relevant supply curve consists of units which are already operating
- Such units (already operating) are not subject to offer capping, regardless of the TPS test result

Use of actual dispatch and operational parameters

- The application of TPS test uses PJM's actual dispatch of units to solve a constraint.
- Detailed unit characteristics are explicitly accounted for:
  - distribution factors;
  - operational status;
  - fuel type;
  - start and notification time;
  - minimum run time;
  - steam units' ramp rates;
  - economic maximum and economic minimum limits.

Three Pivotal Supplier Test

- A generation owner is pivotal when output of its units required to meet demand
- RSI = (Total supply – supply_1) / (Total demand)
- If RSI < 1.0, owner is pivotal
- Generation owners are jointly pivotal when output of owners' units required to meet demand
- RSI = (Total supply – $\text{supply}_{1,2,3}$) / (Total demand)
- If RSI < 1.0, owners are jointly pivotal

Details: Three Pivotal Supplier Test

- Incrementally *Available* supply (S_i) is measured as incremental effective MW of supply:

$$MW \bullet DFAX$$

Example: 100 MW 15 minute start CT with a DFAX of .05 to the constraint would contribute 5 MW to Incrementally available MW relative to the constraint.

TPS – Supply, Shadow Prices, LMP

- With one constraint, LMP at any given bus j is given by:

$$LMP_j = SMP + \lambda_i \times DFAX_{ij}$$

- If LMP = the offer (Offer) of the marginal unit that cleared the constraint:

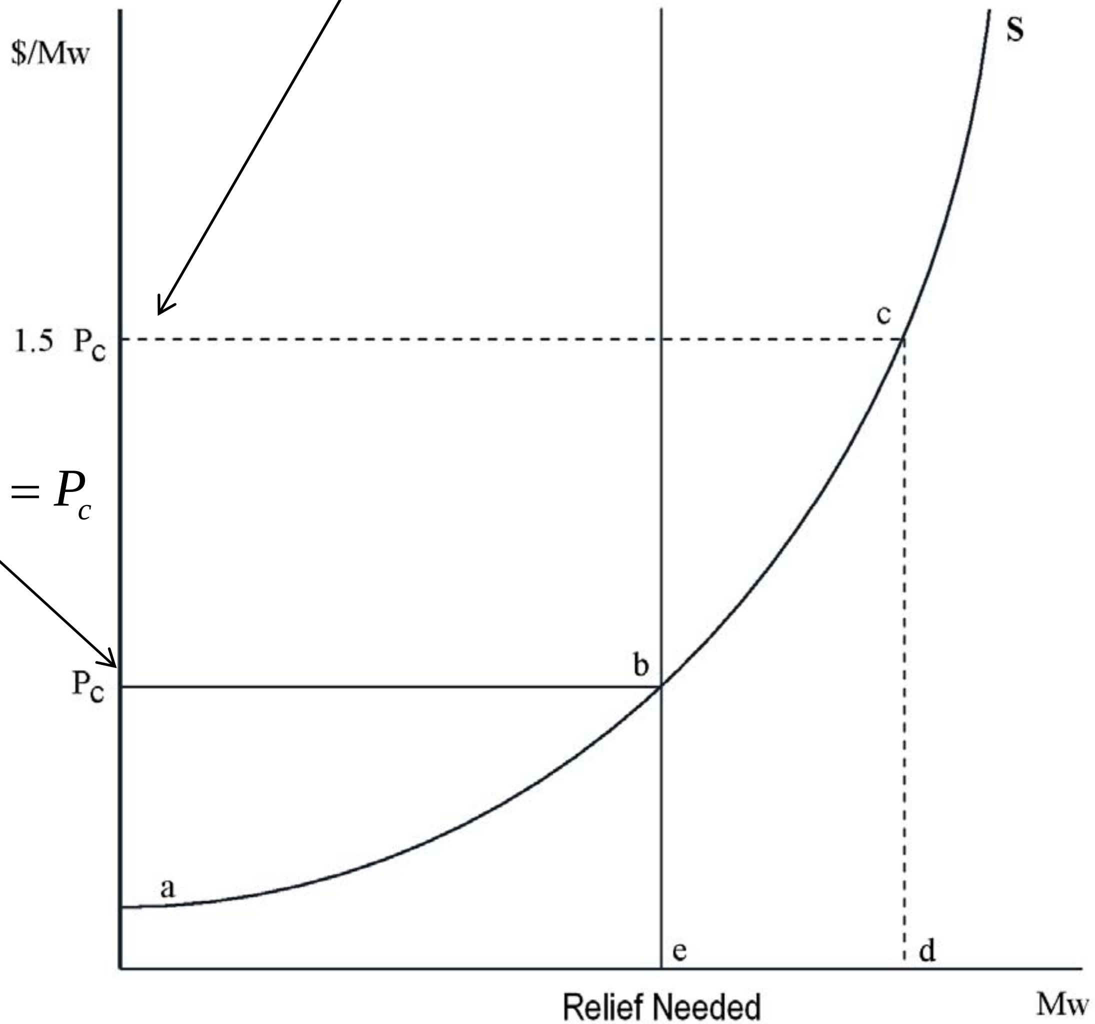
$$\lambda_i = \frac{Offer_c - SMP}{DFAX_{ic}} = P_c$$

- For purposes of the test, this defines the shadow price (the clearing price) at the point of intersection between incrementally available supply and the amount of relief needed.

TPS – Effective Supply

$$1.5\times\lambda_i = 1.5\times\left(\frac{Offer_c - SMP}{DFAX_{ic}}\right) = 1.5\times P_c$$

$$\lambda_i = \frac{Offer_c - SMP}{DFAX_{ic}} = P_c$$



TPS – Effective Supply

- Incrementally available and *effective* supply from Supplier j:

$$S_j = MW_j(Offer_j) \times DFAX_{ij}$$

- Where

$$1.5 \times \lambda_i \geq \left(\frac{Offer_j - SMP}{DFAX_{ij}}\right)$$

- or

$$SMP + 1.5 \times \lambda_i \times DFAX_{ij} \geq Offer_j$$

TPS – Total Effective Supply

- Where S_i is the effective supply of supplier I
- Total incremental, effective supply for suppliers i=1 to n:

$$S = \sum_{i=1}^{n} S_i$$

- Each effective supplier is ranked, from largest to smallest relevant effective supply, relative to the constraint for which it is being tested.
- In the first iteration of the test, the two largest suppliers are combined with the third largest supplier, and this combined supply is subtracted from total relevant effective supply.
- The result, effective supply from all other suppliers, is divided by the total relief required (D).

TPS - Application

- Where j defines the supplier being tested in combination with the two largest suppliers (initially the third largest supplier with j=3):
- Where this ratio (RSI3) is less than or equal to one, the three participant portfolios of effective and relevant supply tested fail the TPS test

$$RSI3_j = \frac{\sum_{i=1}^{n} (S_i) - \sum_{i=1}^{2} (S_i) - S_j}{D}$$

TPS - Application

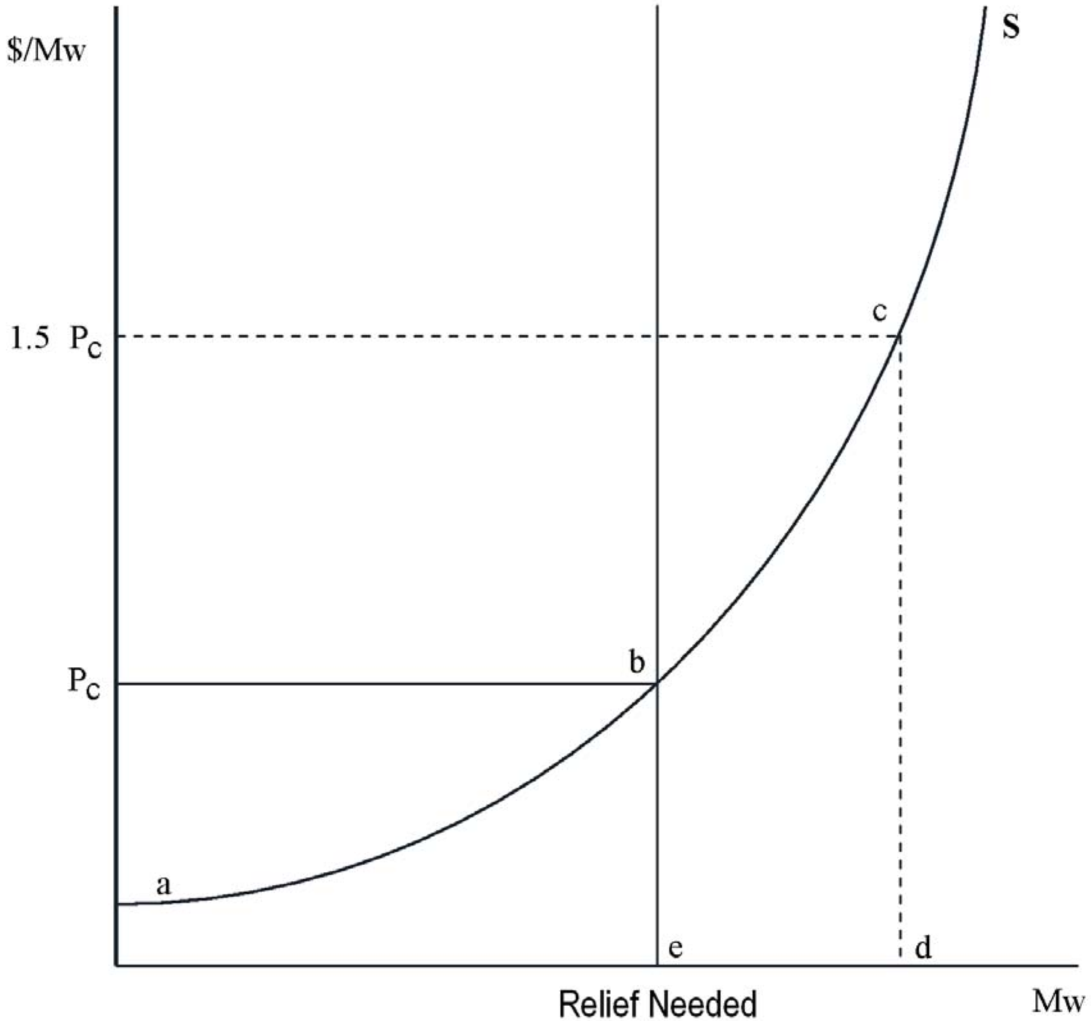
- In each iteration, when RSI is less than 1.0, it indicates that the tested supplier, in combination with the two largest suppliers, has failed the test.
- Iterations of the test continue until the combination of the two largest suppliers and a supplier j achieve a result of RSI3 greater than 1.0.
- When the result of this process is that RSI3j is greater than 1.0, the remaining suppliers will pass the test.

TPS – Offer Capping

- If a supplier fails the TPS test for a constraint, units that are part of a supplier’s effective supply with respect to the constraint can have their offers capped at cost + 10% (or cost plus relevant adders for frequently mitigated units and associated units).

- Offer caps are applied only if the supplier’s relevant units are offered at greater than cost + 10% and are dispatched to contribute to the relief of the constraint

TPS - Supply



Units Eligible for Mitigation - Results

- The results indicate that a very small proportion of the units failing TPS are eligible for mitigation.
- Units actually mitigated are a subset of the units that both fail the TPS and are eligible for mitigation.
- Most available constraint relief is from units that are currently operating.
- Units that fail the TPS are mitigated only when they are the least cost solution to the constraint and they are brought on to relieve the constraint.

Monitoring Analytics

Units Eligible for Mitigation - Results

Constraint	Period	Average Number Units	Average Number of Units Eligible for Mitigation	Average Percent of Units Eligible for Mitigation
5004/5005 Interface	Peak	409.9	2.6	1.1%
	Off Peak	354.0	1.3	0.4%
Bedington - Black Oak	Peak	250.7	1.8	0.8%
	Off Peak	228.1	1.2	0.5%
AP South	Peak	373.3	5.6	1.8%
	Off Peak	336.4	4.2	1.1%
Western	Peak	427.2	0.3	0.1%
	Off Peak	401.5	0.5	0.1%
Central	Peak	448.7	0.7	0.3%
	Off Peak	458.4	0.0	0.0%
Eastern	Peak	257.8	10.6	6.5%
	Off Peak	292.0	42.0	14.4%

Over and Under Mitigation

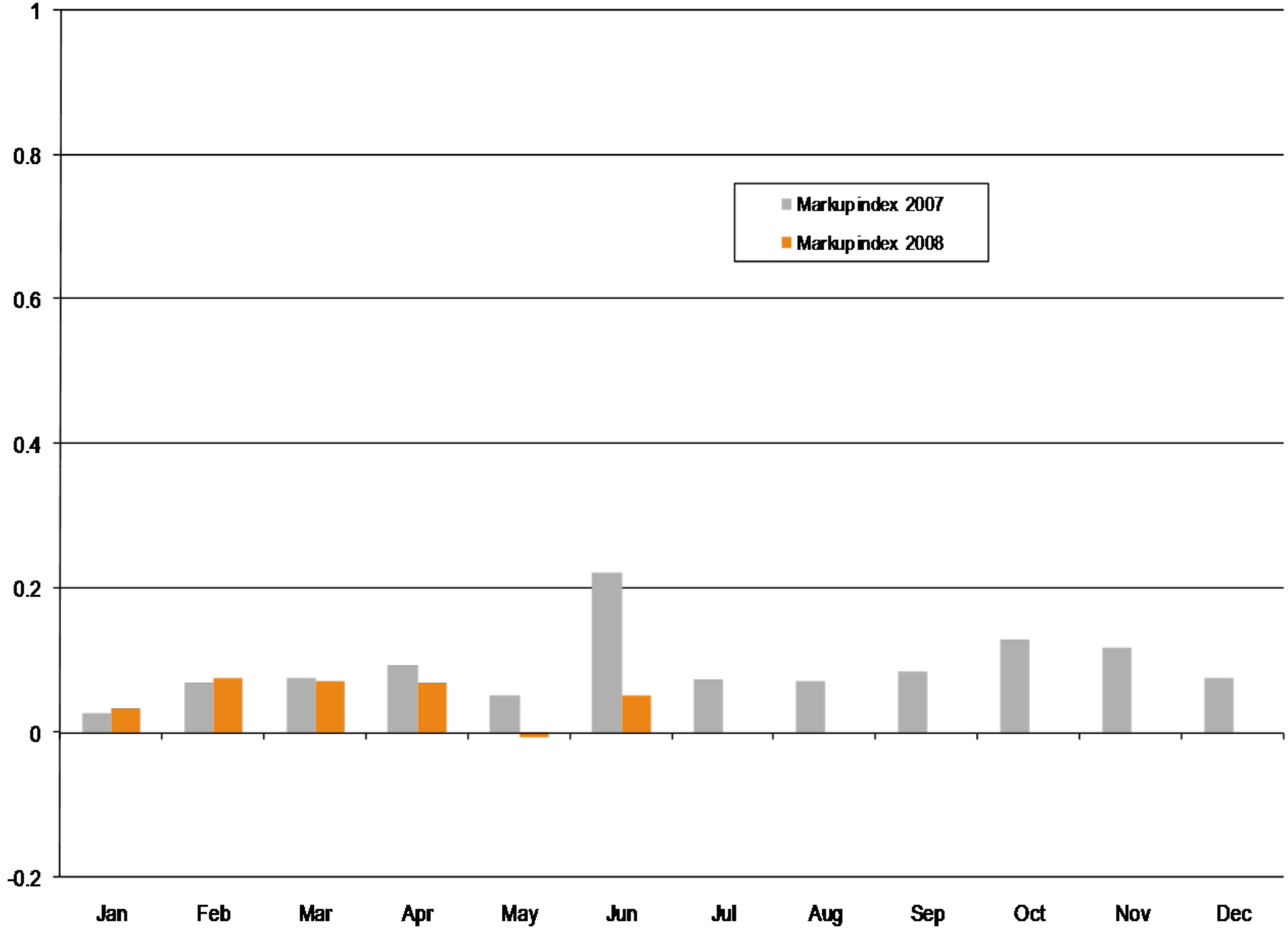
- Costs of over mitigation
- Costs of under mitigation
- Suggestions that the TPS test may result in “excessive” mitigation or “false positive” results, but this is not clearly defined.
- Small number of tests which may result in mitigation.
- The results of the three pivotal supplier test are based on actual, underlying market dynamics as faced by dispatchers in real time.

Components of PJM annual, load-weighted, average LMP: January 2008 through July 2008

Element	Contribution to LMP	Percent
Coal	$37.30	47.5%
Gas	$17.97	22.9%
Oil	$4.37	5.6%
Wind	$0.00	0.0%
SO2	$3.21	4.1%
VOM	$2.87	3.7%
Markup	$6.34	8.1%
Constrained off	$3.36	4.3%
NOx	$0.84	1.1%
NA	$2.23	2.8%

Monitoring Analytics

Load-weighted unit markup index: 2007 to July 2008



Monitoring Analytics

Effect of removing offer capping from PJM area 2006 marginal units on monthly load-weighted average Maryland LMP

Affected area	Month	Load-weighted LMP	Load-weighted LMP without capping	Load-weighted net LMP effect of no capping	Percent change in LMP	Total dollar effect of removing capping (1000s)
MD	January	$64.66	$65.32	$0.66	1.02%	$4,138
MD	February	$65.95	$66.37	$0.42	0.64%	$2,501
MD	March	$64.81	$64.84	$0.03	0.04%	$159
MD	April	$52.92	$53.04	$0.12	0.23%	$596
MD	May	$60.28	$61.13	$0.85	1.41%	$4,596
MD	June	$59.54	$60.07	$0.54	0.90%	$3,368
MD	July	$82.88	$86.26	$3.39	4.09%	$25,881
MD	August	$104.00	$108.87	$4.87	4.68%	$36,809
MD	September	$38.48	$38.60	$0.12	0.30%	$629
MD	October	$43.24	$43.84	$0.59	1.38%	$3,184
MD	November	$51.01	$51.27	$0.26	0.52%	$1,421
MD	December	$50.00	$50.09	$0.08	0.17%	$517
MD	Annual	$63.44	$64.60	$1.16	1.83%	$83,800

Table 2-38 Comparison of exempt and non-exempt markup component: January and February of 2008

	Units Marginal	Markup Component
Non-exempt units	427	$6.62
Exempt units	28	$1.44

Comparison of exempt and non-exempt markup component: January 2008 through July 2008

	Units Marginal	Markup Component
Non-exempt units	664	$5.55
Exempt units	42	$0.80

Monitoring Analytics

Comparison of exempt and non-exempt markup component effect on Maryland load-weighted hourly average LMP by location of marginal unit: Calendar year 2006

Unit Type	Zone	Marginal Units	Markup Component	Percent contribution to total mark-up component of hourly average LMP	Dollar impact of markup component on zone (1000s)
Non-Exempt Units	MD	667	$0.97	44.4%	$69,797
Exempt Units Not In MD	MD	26	$0.49	22.3%	$35,063
Exempt Units In MD	MD	17	$0.73	33.4%	$52,492
Total		710	$2.18	100.0%	$157,352

Monitoring Analytics

Passing the test: Market Power Event

- An example of one of several recent events (Wednesday of this week):

SCHEDULE_ID	LPA_DATE	STATUS	DES_MW	UDS_LMP	MARGINAL_COST	marginal	BUS LMP	CONGCOMP	LOSSCOMP	SE MW
1	28Oct2008:11:14:00	econ	24	432.64	288.68	1	360.85	199.8	3.9	3.2

	Segment	MW	Price
COST	1	19	$288.68
PRICE	1	19	$360.85

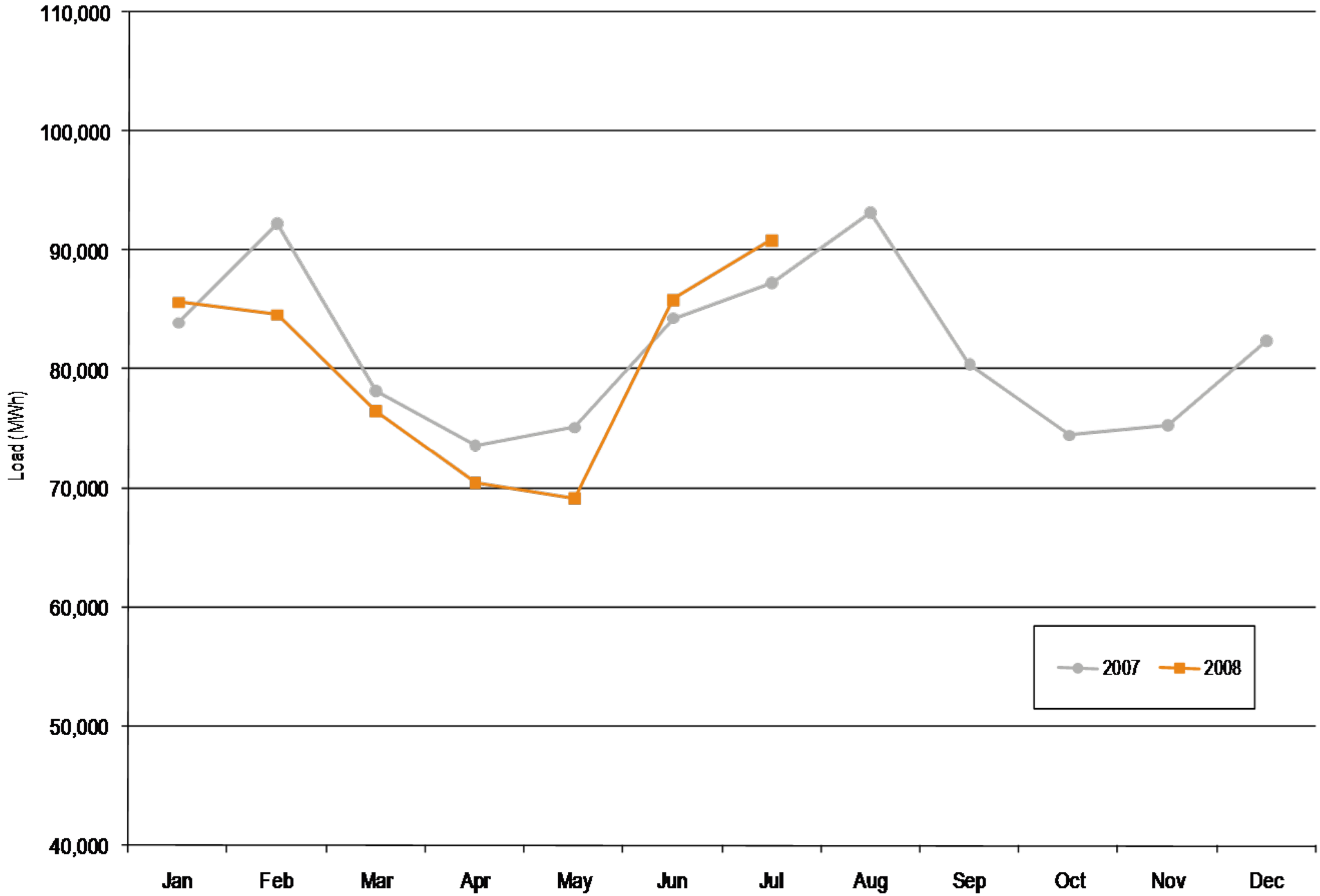
- Unit passed the TPS test, was marginal on price and had an impact on prices in PEPCO ($473), BC ($378) and DOM ($301).

Ability to Exercise Market Power

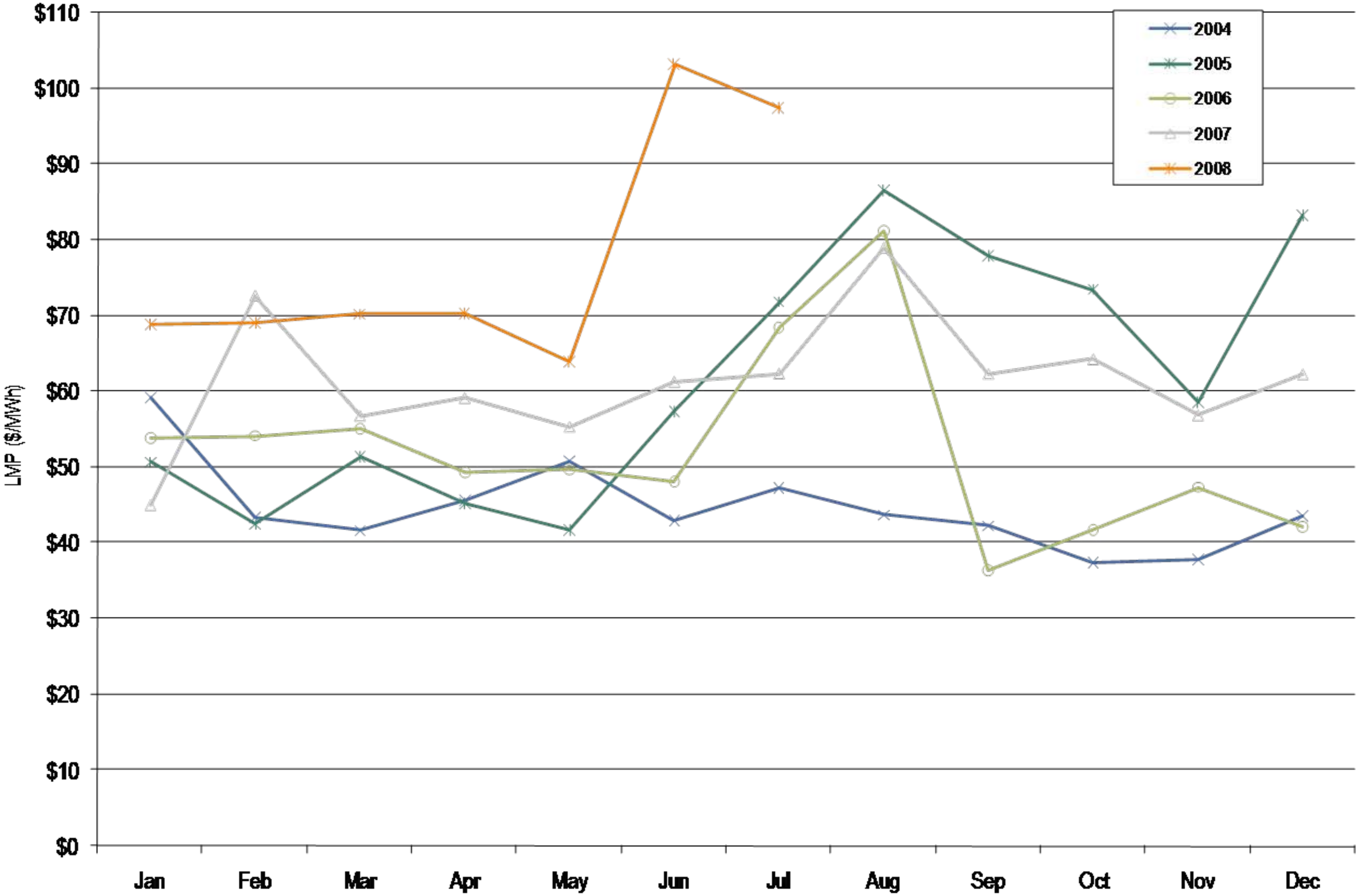
- Does the use of a single price-based offer curve by generators each day make it unlikely that a generation owner could exercise market power when an owner has a non-competitive test result for only a few intervals.
- There are a number of daily strategies for exercising market power in such a case, absent offer capping.
  - Repeated game
    - Observable patterns in hourly load, LMP and congestion
    - Exempt unit behavior
  - High offer; self scheduling
  - Intraday strategies (tail blocks, min and max)
- In addition, it is possible to pass the test and exercise market power.

Monitoring Analytics

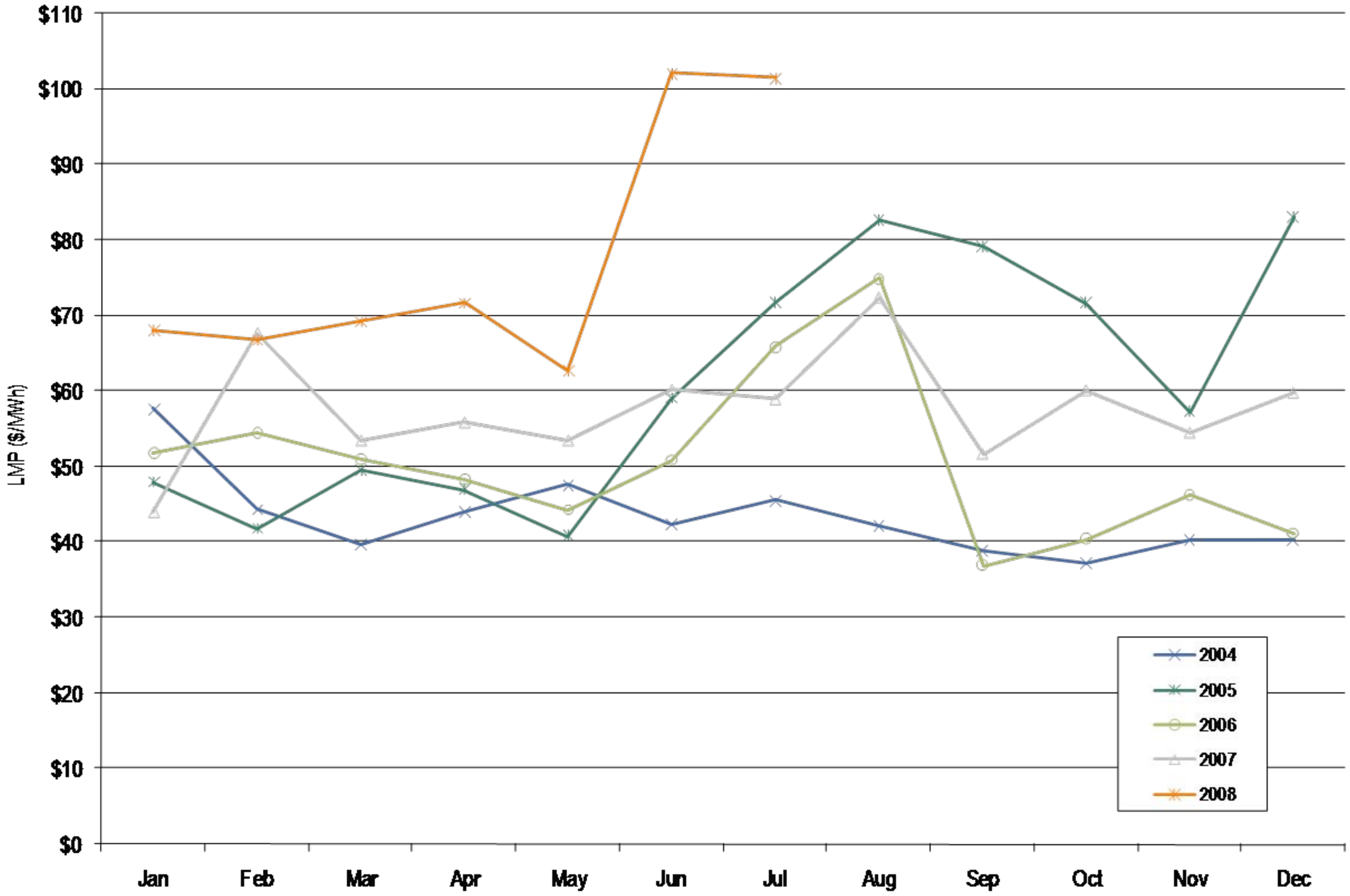
PJM monthly average real-time load: 2007 to July 2008



PJM monthly load-weighted, average real-time LMP: 2004 to July 2008

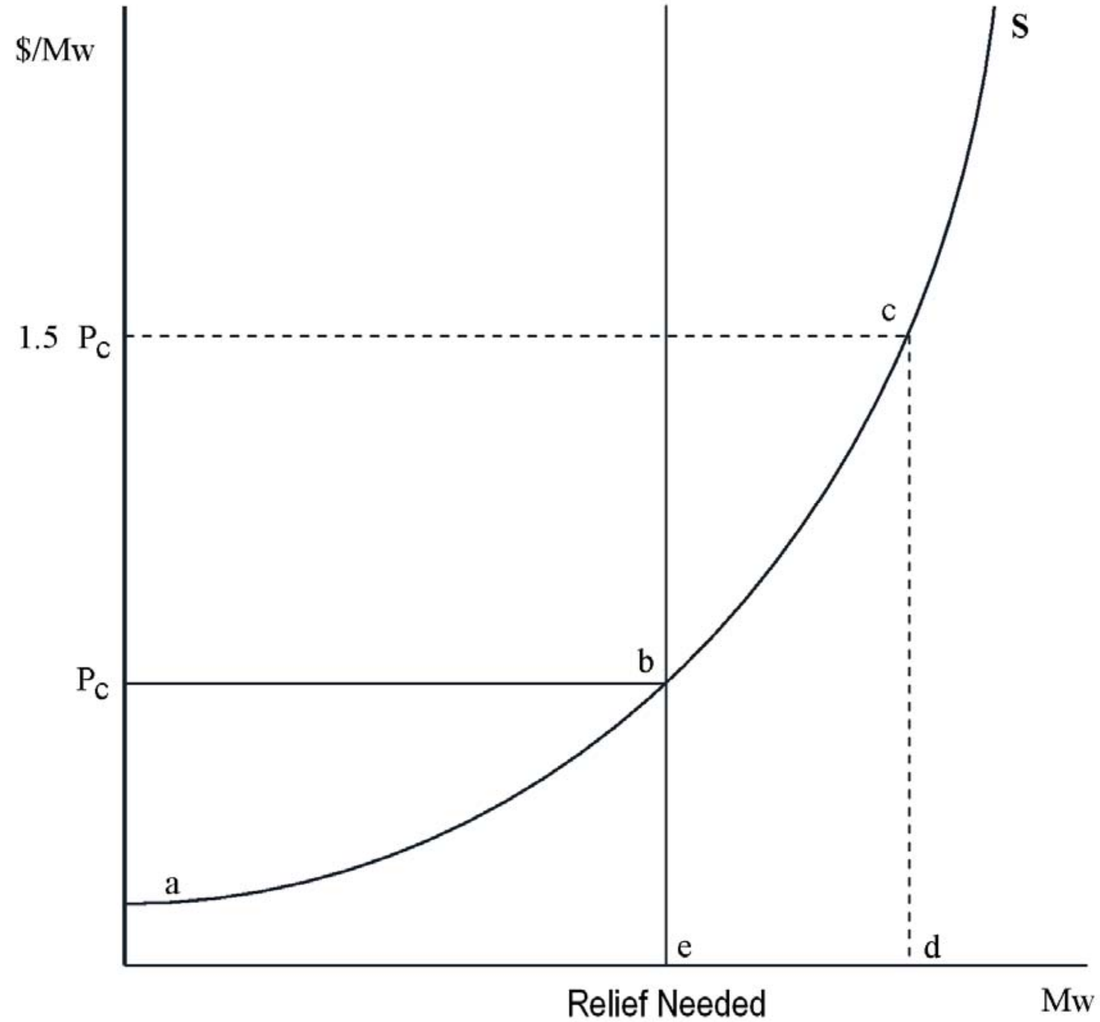


PJM monthly load-weighted, average day-ahead LMP: 2004 to July 2008



TPS – Examples

TPS - Supply



TPS – Relief Needed = 101 MW

Supplier	Effective MW	Test Score
A	40.52	0.694158416
B	35.73	0.694158416
C	20.68	0.694158416
D	**20.51**	**0.695841584**
E	20.14	0.69950495
F	**13.05**	**0.76970297**
G	7.47	0.824950495
H	**2.72**	**0.871980198**
I	2.57	0.873465347
J	**1.87**	**0.88039604**
K	0.52	0.893762376
L	**0.4**	**0.894950495**
M	0.36	0.895346535
N	**0.28**	**0.896138614**
O	0.11	0.897821782
P	**0.11**	**0.897821782**
	167.04	

TPS - Supply

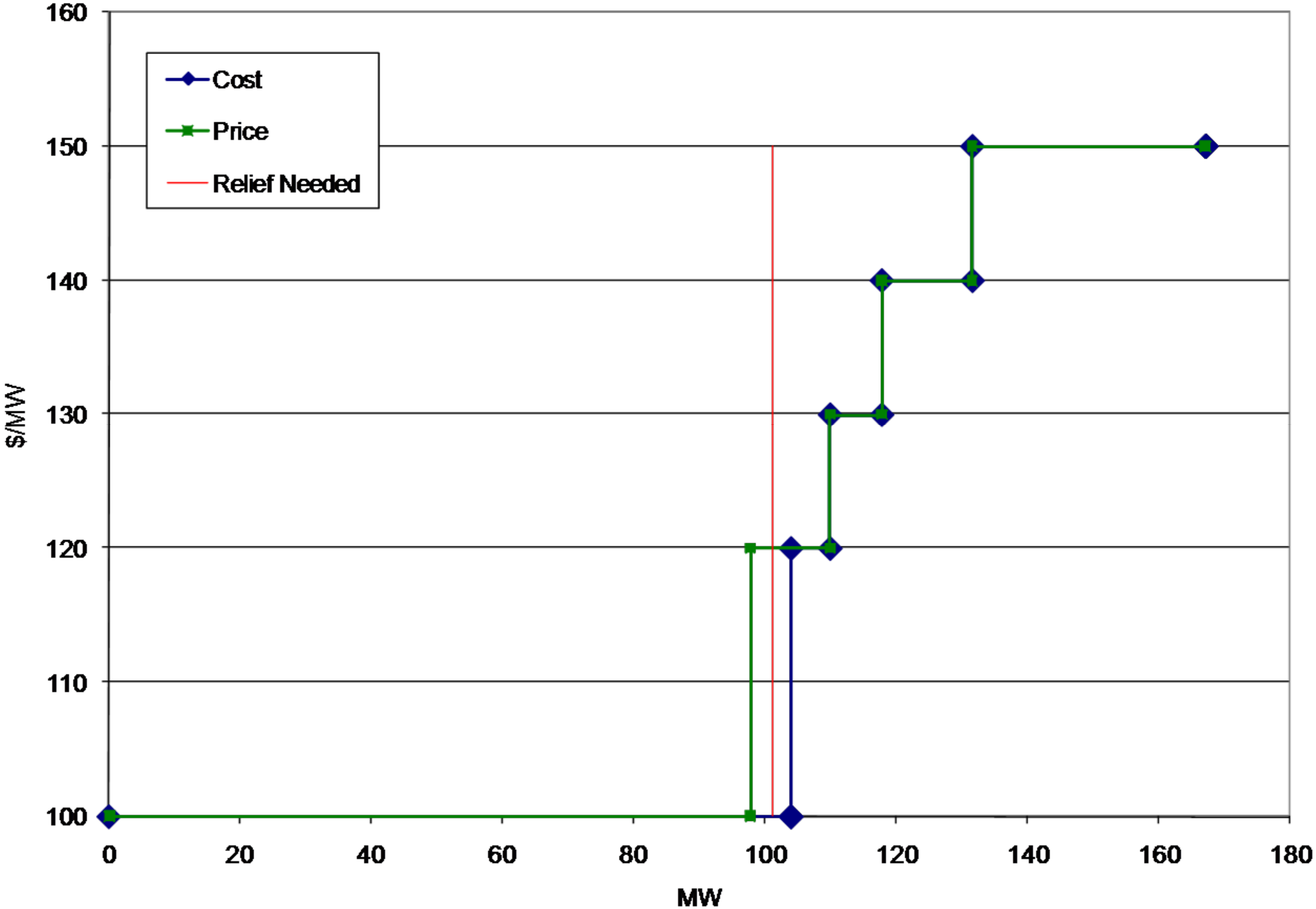
	Cost Points						
Supplier	$ 100.00	$ 110.00	$ 120.00	$ 130.00	$ 140.00	$ 150.00	Total
A	16.208	0	0	0	0	24.312	40.52
B	10.719	0	3.573	0	10.719	10.719	35.73
C	20.68	0	0	0	0	0	20.68
D	20.51	0	0	0	0	0	20.51
E	20.14	0	0	0	0	0	20.14
F	13.05	0	0	0	0	0	13.05
G	0	0	0	7.47	0	0	7.47
H	0	0	0	0	2.72	0	2.72
I	2.57	0	0	0	0	0	2.57
J	0	0	1.87	0	0	0	1.87
K	0	0	0.52	0	0	0	0.52
L	0	0	0	0.4	0	0	0.4
M	0	0	0	0	0.36	0	0.36
N	0	0	0	0	0	0.28	0.28
O	0	0	0	0	0	0.11	0.11
P	0	0	0	0	0	0.11	0.11
Cost specific supply	103.877	0	5.963	7.87	13.799	35.531	
Cumulative Supply	**103.877**	**103.877**	**109.84**	**117.71**	**131.509**	**167.04**	**167.04**

Monitoring Analytics

Supplier C

Supplier	Price Points $ 100.00	$ 110.00	$ 120.00	$ 130.00	$ 140.00	$ 150.00	Total
A	16.208	0	0	0	0	24.312	40.52
B	10.719	0	3.573	0	10.719	10.719	35.73
C	14.476	0	6.204	0	0	0	20.68
D	20.51	0	0	0	0	0	20.51
E	20.14	0	0	0	0	0	20.14
F	13.05	0	0	0	0	0	13.05
G	0	0	0	7.47	0	0	7.47
H	0	0	0	0	2.72	0	2.72
I	2.57	0	0	0	0	0	2.57
J	0	0	1.87	0	0	0	1.87
K	0	0	0.52	0	0	0	0.52
L	0	0	0	0.4	0	0	0.4
M	0	0	0	0	0.36	0	0.36
N	0	0	0	0	0	0.28	0.28
O	0	0	0	0	0	0.11	0.11
P	0	0	0	0	0	0.11	0.11
Cost specific supply	97.673	0	12.167	7.87	13.799	35.531	
Cumulative Supply	97.673	97.673	109.84	117.71	131.509	167.04	167.04

Supplier C changes the shadow price and changes LMPs



Monitoring Analytics

TPS – Sequential TPS Result: Same Market

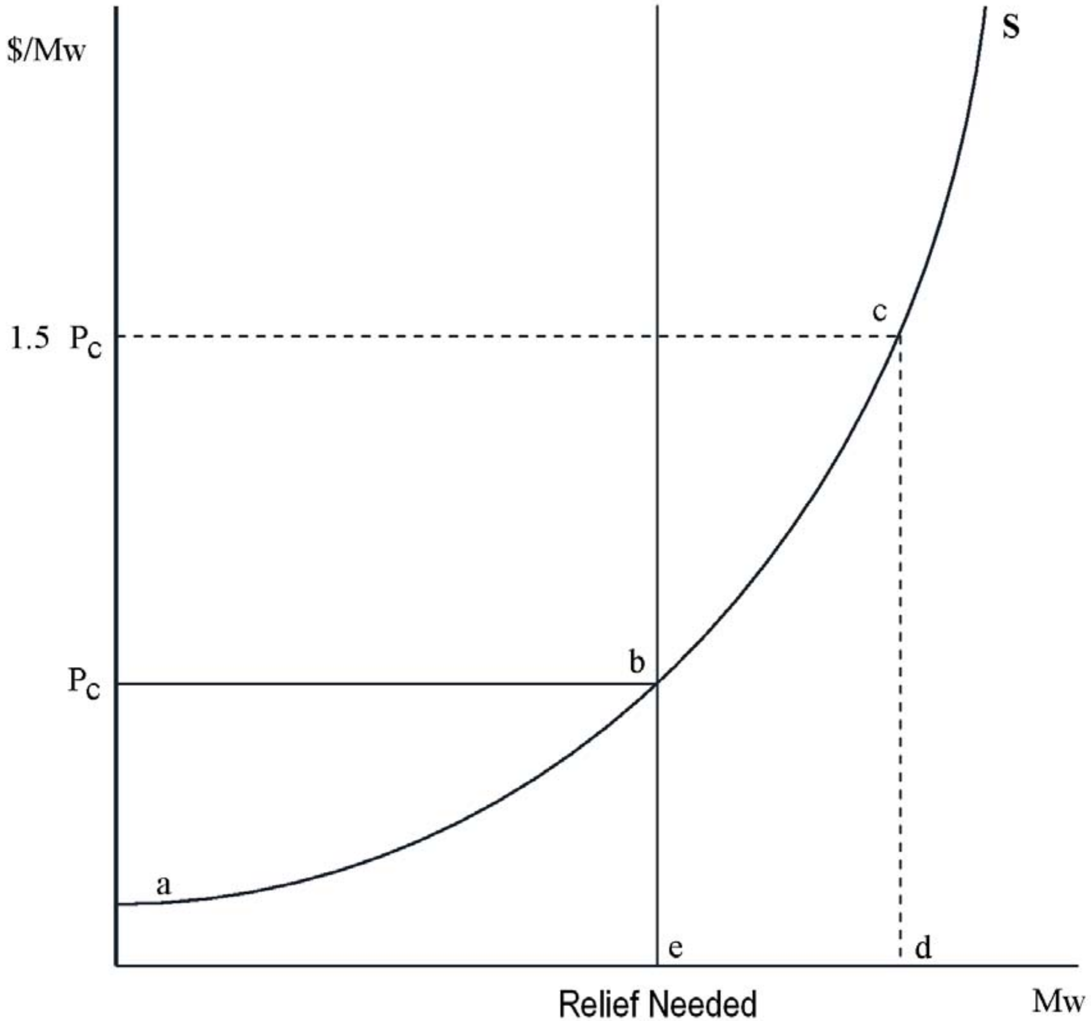
Supplier	Supply	Round 1 Score (Standard TPS)	Result 1 (Standard result)	Round 2 Score (Sequential TPS)	Result 2 (Sequential)	Round 3 Score (Sequential TPS)	End State (Sequential TPS)
A	40.52	0.694	Fail		Fail		Fail
B	35.73	0.694	Fail		Fail		Fail
C	20.68	0.694	Fail	1.190	Pass		Pass
D	20.51	0.696	Fail	1.190	Pass		Pass
E	20.14	0.700	Fail	1.190	Pass	NA	Pass
F	13.05	0.770	Fail	1.477	Pass	NA	Pass
G	7.47	0.825	Fail	1.702	Pass	NA	Pass
H	2.72	0.872	Fail	1.894	Pass	NA	Pass
I	2.57	0.873	Fail	1.900	Pass	NA	Pass
J	1.87	0.880	Fail	1.928	Pass	NA	Pass
K	0.52	0.894	Fail	1.983	Pass	NA	Pass
L	0.4	0.895	Fail	1.988	Pass	NA	Pass
M	0.36	0.895	Fail	1.989	Pass	NA	Pass
N	0.28	0.896	Fail	1.993	Pass	NA	Pass
O	0.11	0.898	Fail	2.000	Pass	NA	Pass
P	0.11	0.898	Fail	2.000	Pass	NA	Pass

One Pivotal Supplier Test and Sequential One Pivotal Supplier Test

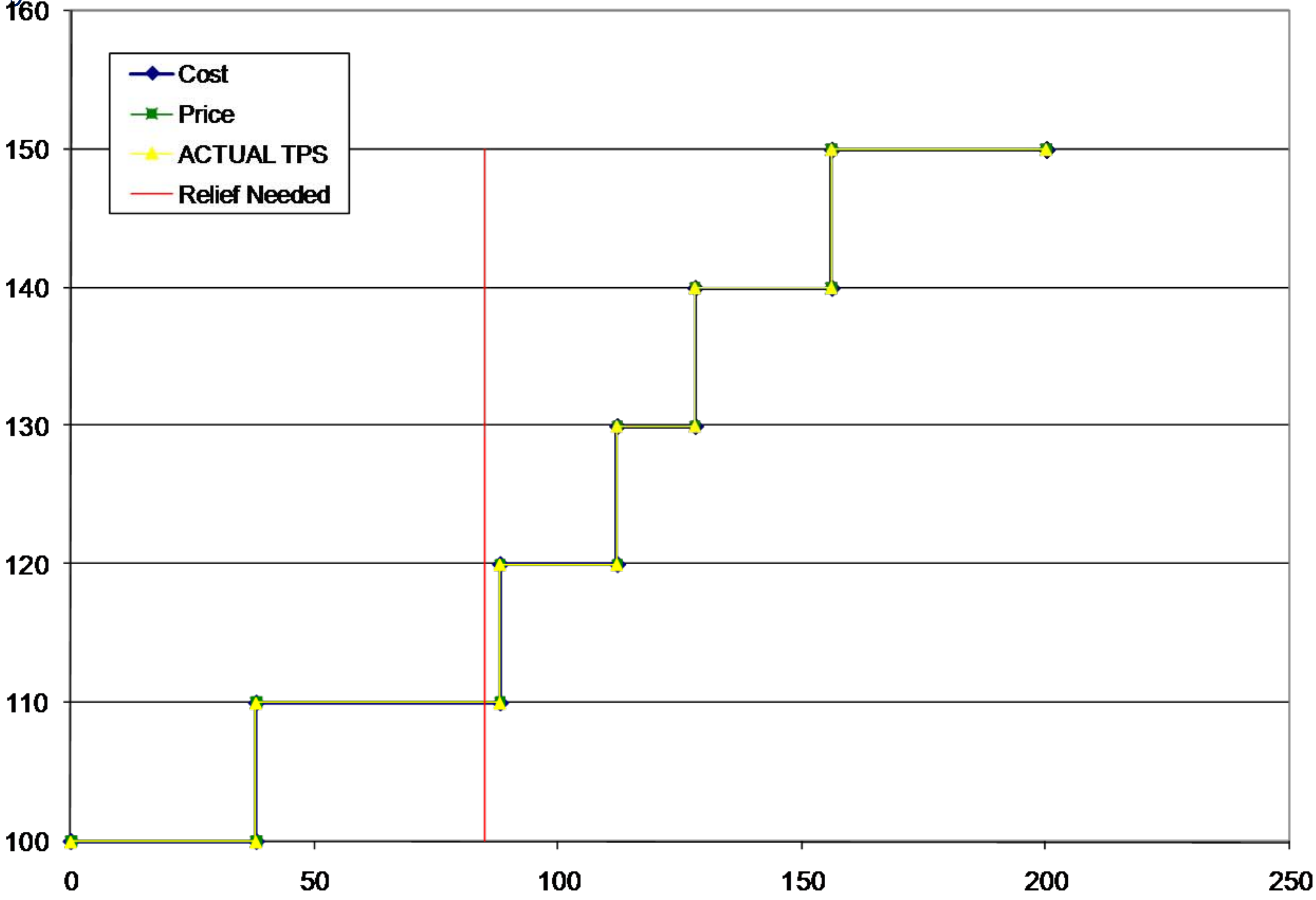
Note defined market is different

Supplier	1.05 X Defined Supply	One Pivotal Supplier Test (Step 1)	Sequential One Pivotal Supplier Test (Step 2)	Sequential One Pivotal Supplier Test (Step 3)	Sequential One Pivotal Supplier Test (Step 4)	Sequential One Pivotal Supplier Test (Step 5)	Sequential One Pivotal Supplier Test (Step 6)	Sequential One Pivotal Supplier Test (Step 7)	Sequential End State 1PS)
C	20.68	0.824							Fail
D	**20.51**	**0.825**	**0.780465637**						**Fail**
E	20.14	0.829	0.785072211	0.711					Fail
A	**16.208**	**0.868**	**0.834026394**	**0.777**	**0.664**				**Fail**
F	13.05	0.899	0.873344124	0.830	0.744	0.566			Fail
B	**10.719**	**0.922**	**0.902365538**	**0.869**	**0.802**	**0.666**	**0.247**		**Fail**
I	2.57	1.003	1.003822211	1.005	1.008	1.013	1.029	0.000	Fail
G	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
H	0	NA	NA	NA	NA	NA	NA	NA	NA
J	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
K	0	NA	NA	NA	NA	NA	NA	NA	NA
L	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
M	0	NA	NA	NA	NA	NA	NA	NA	NA
N	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
O	0	NA	NA	NA	NA	NA	NA	NA	NA
P	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total Supply	103.877								

TPS - Supply



TPS - Supply



Cost
Price
ACTUAL TPS
Relief Needed
160
150
140
130
120
110
100
0
50
100
150
200
250

TPS - Supply

Supplier	Effective MW	Test Score
A	40	0.941176471
B	40	0.941176471
C	40	0.941176471
D	**40**	**0.941176471**
E	10	1.294117647
F	**10**	**1.294117647**
G	10	1.294117647
H	**10**	**1.294117647**
I		
J		
K		
L		
M		
N		
O		
P		
	200	
Relief needed	**85**	

TPS - Supply

	Cost Points						
Supplier	$ 100.00	$ 110.00	$ 120.00	$ 130.00	$ 140.00	$ 150.00	Total
A	0	8	0	4	4	24	40
B	4	0	12	4	8	12	40
C	0	4	4	8	16	8	40
D	24	8	8	0	0	0	40
E	10	0	0	0	0	0	10
F	0	10	0	0	0	0	10
G	0	10	0	0	0	0	10
H	0	10	0	0	0	0	10
I	0	0	0	0	0	0	0
J	0	0	0	0	0	0	0
K	0	0	0	0	0	0	0
L	0	0	0	0	0	0	0
M	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0
O	0	0	0	0	0	0	0
P	0	0	0	0	0	0	0
Cost specific supply	38	50	24	16	28	44	
Cumulative Supply	**38**	**88**	**112**	**128**	**156**	**200**	**200**

TPS – Sequential TPS

Supplier	Supply	Round 1 Score (Standard TPS)	Result 1 (Standard result)	Round 2 Score (Sequential TPS)	Result 2 (Sequential)	Round 3 Score (Sequential TPS)	End State (Sequential TPS)
A	40	0.941	Fail		Fail		Fail
B	40	0.941	Fail		Fail		Fail
C	40	0.941	Fail	6.000	Pass		Pass
D	40	0.941	Fail	6.000	Pass		Pass
E	10	1.294	Pass	6.000	Pass	NA	Pass
F	10	1.294	Pass	6.000	Pass	NA	Pass
G	10	1.294	Pass	6.000	Pass	NA	Pass
H	10	1.294	Pass	6.000	Pass	NA	Pass
I	0	1.412	Pass	8.000	Pass	NA	Pass
J	0	1.412	Pass	8.000	Pass	NA	Pass
K	0	1.412	Pass	8.000	Pass	NA	Pass
L	0	1.412	Pass	8.000	Pass	NA	Pass
M	0	1.412	Pass	8.000	Pass	NA	Pass
N	0	1.412	Pass	8.000	Pass	NA	Pass
O	0	1.412	Pass	8.000	Pass	NA	Pass
P	0	1.412	Pass	8.000	Pass	NA	Pass
Total	200						

Single Pivotal Supplier and Sequential Single Pivotal Supplier

Supplier	1.05 X Defined Supply	One Pivotal Supplier Test (Step 1)	Sequential One Pivotal Supplier Test (Step 2)	Sequential One Pivotal Supplier Test (Step 3)	Sequential One Pivotal Supplier Test (Step 4)	Sequential One Pivotal Supplier Test (Step 5)	Sequential One Pivotal Supplier Test (Step 6)	Sequential One Pivotal Supplier Test (Step 7)	Sequential One Pivotal Supplier Test (Step 8)	Sequential One Pivotal Supplier Test (Step 9)	Sequential End State 1PS)
D	32	0.659									Fail
E	**10**	**0.918**	**0.867924528**								**Fail**
F	10	0.918	0.867924528	0.837							Fail
G	**10**	**0.918**	**0.867924528**	**0.837**	**0.788**						**Fail**
H	10	0.918	0.867924528	0.837	0.788	0.696					Fail
A	**8**	**0.941**	**0.905660377**	**0.884**	**0.848**	**0.783**	**0.615**				**Fail**
B	4	0.988	0.981132075	0.977	0.970	0.957	0.923	0.800			Fail
C	**4**	**0.988**	**0.981132075**	**0.977**	**0.970**	**0.957**	**0.923**	**0.800**	**0.000**		**Fail**
I	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
J	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
K	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
M	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
O	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P	**0**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total Supply	88										

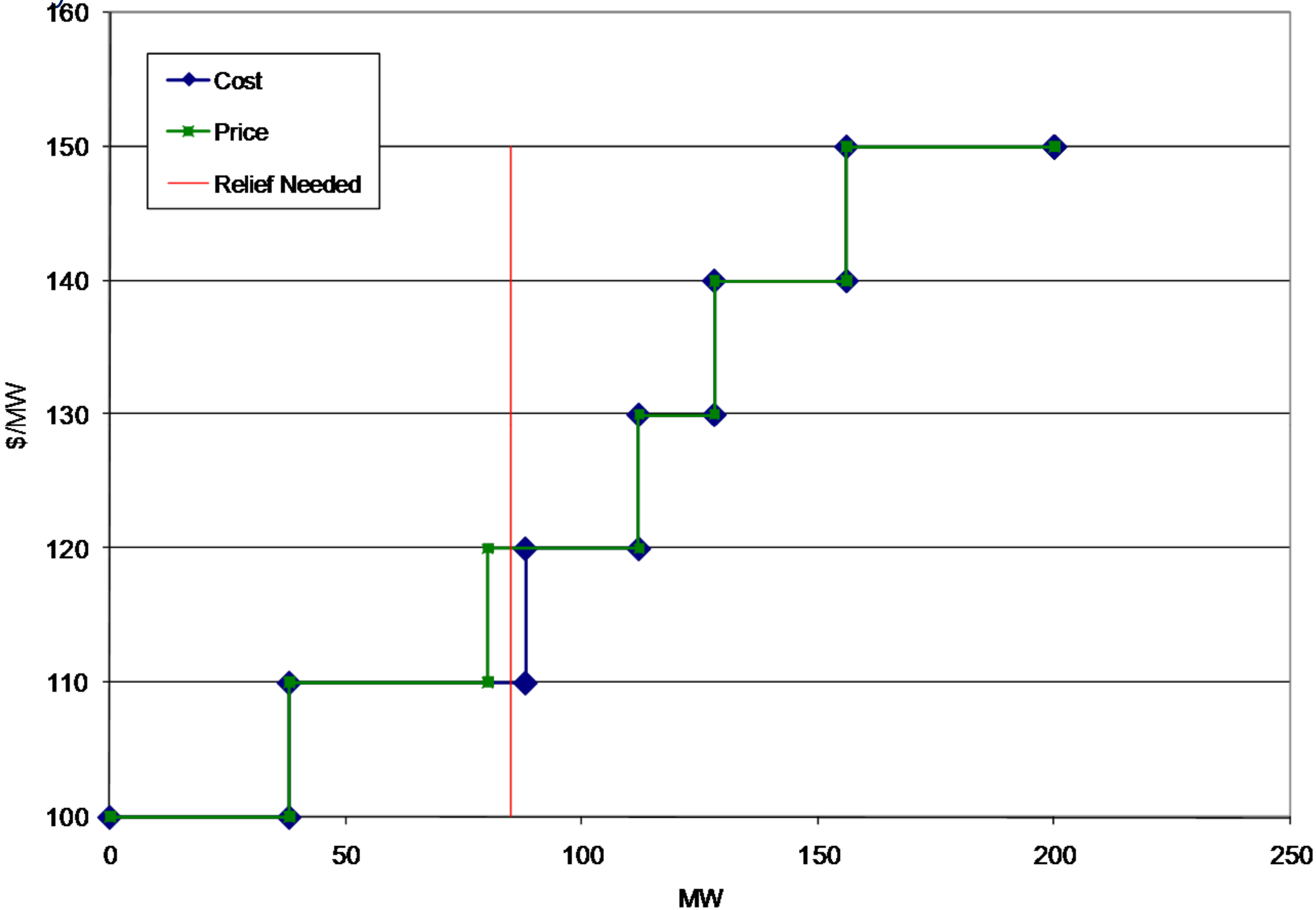
Monitoring Analytics

Supplier D's Price Strategy

Supplier	$ 100.00	$ 110.00	$ 120.00	$ 130.00	$ 140.00	$ 150.00	Total
	Price Points						
A	0	8	0	4	4	24	40
B	4	0	12	4	8	12	40
C	0	4	4	8	16	8	40
D	24	0	16	0	0	0	40
E	10	0	0	0	0	0	10
F	0	10	0	0	0	0	10
G	0	10	0	0	0	0	10
H	0	10	0	0	0	0	10
I	0	0	0	0	0	0	0
J	0	0	0	0	0	0	0
K	0	0	0	0	0	0	0
L	0	0	0	0	0	0	0
M	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0
O	0	0	0	0	0	0	0
P	0	0	0	0	0	0	0
Cost specific supply	38	42	32	16	28	44	
Cumulative Supply	**38**	**80**	**112**	**128**	**156**	**200**	**200**

Monitoring Analytics

Supplier D changes the shadow price and LMPs



Supplier E's Price Strategy

Supplier	Price Points $ 100.00	$ 110.00	$ 120.00	$ 130.00	$ 140.00	$ 150.00	Total
A	0	8	0	4	4	24	40
B	4	0	12	4	8	12	40
C	0	4	4	8	16	8	40
D	24	8	8	0	0	0	40
E	6	0	4	0	0	0	10
F	0	10	0	0	0	0	10
G	0	10	0	0	0	0	10
H	0	10	0	0	0	0	10
I	0	0	0	0	0	0	0
J	0	0	0	0	0	0	0
K	0	0	0	0	0	0	0
L	0	0	0	0	0	0	0
M	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0
O	0	0	0	0	0	0	0
P	0	0	0	0	0	0	0
Cost specific supply	34	50	28	16	28	44	
Cumulative Supply	**34**	**84**	**112**	**128**	**156**	**200**	**200**

Monitoring
Analytics

Supplier E changes the shadow price and LMPs