

**INFORMATION REMOVED  
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**UNITED STATES OF AMERICA  
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.

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) Docket No. ER00-\_\_\_\_\_  
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**AFFIDAVIT OF JOSEPH E. BOWRING**

I, Joseph E. Bowring, being duly sworn, depose and say as follows:

**I. QUALIFICATIONS AND INTRODUCTION**

I am the Manager of PJM’s Market Monitoring Unit. My professional experience and qualifications are summarized in Exhibit 1, which is attached to this affidavit.

My affidavit provides a market analysis in support of the request, approved by the Members of the PJM Interconnection, L.L.C. (PJM), for market-based pricing of Regulation service.

The Commission set forth guidelines for studies in support of market based pricing for ancillary services in its February 11, 1998 order regarding an application for market based pricing authority to sell ancillary services to the California ISO (the Ocean Vista Order).<sup>1</sup> In the Ocean Vista Order, the Commission stated: “In Order No. 888 the Commission stated that ancillary services are a transmission-related product for which the Commission was unwilling, as a general matter, to grant market rate authority based on market power analyses of generation.” In the Ocean Vista Order, the Commission also reiterated that in Order 888 it had “stated that it would entertain requests for market-based pricing related to ancillary services on a case-by-case basis if supported by analyses which demonstrate that the seller lacks market power in these discrete services.”

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<sup>1</sup> 82 FERC ¶ 61,114. The ancillary services were: regulation service; spinning reserve service; non-spinning reserve service; and blackstart service.

In the Ocean Vista Order, the Commission set forth the standards for the support required for an application to provide an ancillary service at market based rates. In particular, the Ocean Vista Order stated that: “Such support must separately address the nature and characteristics of each ancillary service, as well as the nature and characteristics of generation capable of supplying each service, and must develop market shares for each service.”

The Commission offered as guidance for an appropriate market study in support of market-based rates for ancillary services process the following four components:

1. **Relevant product market.** “A relevant product market would include the applicant’s product, together with other products that - - from the buyer’s perspective - - are good substitutes. Products are generally regarded as good substitutes if each substitute is shown to be comparable in terms of price, quality and availability. We have concluded, as an initial matter, that each ancillary service is a separate product.”
2. **Relevant geographic market.** “Second, a description of the relevant geographic market in which the relevant ancillary service product is sold could include all potential suppliers of the product from whom buyers could purchase to avoid a price increase by the applicant. As part of this analysis, the location of all such suppliers, the important technical characteristics of the facilities from which potential suppliers would supply the relevant product, the physical capabilities of the delivery system and the prices (including the costs of delivering the product) at which each supplier could provide the service are relevant.”
3. **Market shares.** “ Third, market shares for all suppliers of the relevant ancillary service product in the relevant geographic market are valuable as a basis for calculating the levels of market concentration.”

4. **Entry conditions.** “Finally, even if a market appears conducive to the exercise of market power, the ability of competitors to enter the specific ancillary service market could prevent the potential exercise of market power.”

In addition to the above four components of a market analysis, subsequent events in the California ancillary services markets led the Commission to emphasize the importance of the relationship between the energy market and the ancillary services markets. The Commission also made clear its view that market design issues are relevant to the competitiveness of markets for ancillary services. After the approval of market-based rates for ancillary services in the Ocean Vista case, the California ISO “witnessed dramatic spikes in the price for Replacement Reserves capacity.” The California ISO requested and was granted authority to impose price caps in ancillary services markets until various identified market design issues could be resolved.<sup>2</sup>

## **II. RELEVANT PRODUCT MARKET**

In the Ocean Vista Order the Commission stated: “We have concluded, as an initial matter, that each ancillary service is a separate product.” Following that approach, I consider Regulation as a separate product market. The Commission’s approach is reasonable as there are no good substitutes for the Regulation product in the PJM market.

The provision of the Regulation ancillary service, defined by FERC in Order No. 888, is coordinated by PJM. NERC requires that the PJM Control Area maintain regulating capability in order to match short-term deviations in system load. Regulation refers to the PJM control action that is performed to correct for load changes that may cause the power system to operate above or below 60 Hz.<sup>3</sup> The Capacity Resources assigned to meet the PJM Regulation Requirement must be capable of responding to the AR (Area Regulation) signal within five minutes and must increase or decrease their outputs at the

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<sup>2</sup> See 85 FERC ¶ 61,123 issued October 28, 1998 in AES Redondo Beach, L.L.C. et al, Docket No. ER98-2843.

<sup>3</sup> PJM Manual for Pre-Scheduling Operations, Manual M-10, page 4-1.

Ramping Capability rates that are specified in the Offer Data that is submitted to PJM.<sup>4</sup> The Regulation service supplied by individual generating units is: “The capability of a specific generating unit with appropriate telecommunications, control and response capability to increase or decrease its output in response to a regulating control signal.”<sup>5</sup>

Not all generating units are equipped to provide Regulation service and the amount of Regulation that a properly equipped generating unit can supply is generally much less than the amount of energy or capacity that it can supply. Of the 516 generating units in the PJM area<sup>6</sup>, there are 107 generating units that are qualified to provide Regulation.<sup>7</sup> In the PJM area there are more than 56,000 MW of generating capacity while about 2,392 MW of Regulation capability<sup>8</sup> have been identified in this analysis.

The PJM control area establishes separate control area wide Regulation requirements for both the off peak hours (hours ended 0100-0500 hours) and peak hours (hours ended 0600-0000). The peak Regulation requirement is equal to 1.1 percent of the forecast peak load for the forecast period while the off peak requirement is equal to 1.1 percent of the lowest forecast demand for the forecast period.<sup>9</sup> This requirement for the PJM control area is equivalent to approximately 220 MW of Regulation capability for the off-peak period and approximately 575 MW of Regulation capability for the peak period. Within PJM, the Regulation capability of an individual generator is the difference between its current operating level and the level that it could ramp to, either up or down, within five minutes.

Responsibility for the control area’s hourly Regulation requirement is assigned to all Load Serving Entities (LSEs) within the PJM control area based upon each LSE’s share of the control area’s hourly load (PJM Open Access Transmission Tariff, Attachment K--Appendix, Section 3.2.2(a)). The LSE’s Regulation obligation can be met by self-

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<sup>4</sup> PJM Manual for Pre-Scheduling Operations, Manual M-10, page 4-3.

<sup>5</sup> PJM Manual for Scheduling Operations, Manual M-11, page A-30.

<sup>6</sup> Mid Atlantic Area Council, Regional Reliability Council EIA-411 Report, April 1, 1999.

<sup>7</sup> In this analysis, the units which are qualified to provide Regulation are those which have actually provided Regulation during a recent time period. See below for details.

<sup>8</sup> This Regulation capability is net of forced outages based on average forced outage rates.

scheduling of its own generators, bilateral purchases or purchases of Regulation through PJM. (PJM Open Access Transmission Tariff, Attachment K--Appendix, Section 1.11.4(a)). Only the Regulation requirements that are not met via bilateral contracts or via self-scheduled resources will be obtained via the PJM Regulation market. PJM Members are applying for market based pricing authority for these “net” sales of Regulation that will occur through the PJM Regulation market.

### III. RELEVANT GEOGRAPHIC MARKET

Regulation for the PJM Control Area must be supplied by generators that are located within the metered electrical boundaries of the PJM Control Area.<sup>10</sup> Thus, the largest relevant geographic market for Regulation service in PJM is the PJM Control Area. Within the PJM Control Area, there are no geographic restrictions on generators that can supply Regulation service. There are no transmission costs involved in supplying Regulation. In general, even when there are internal transmission constraints within PJM, Regulation still can be supplied from all generators which are electrically within the PJM Control Area. Suppliers in the relevant geographic market include all entities which own generating capacity in the market that can be used to provide Regulation. XXXXXX  
XX  
XXXXXXXXXXXXXXXX<REDACTED>XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

In general, internal transmission constraints do not affect the geographic extent of the Regulation market. However, internal transmission constraints can affect the cost structure of Regulation offers via their impact on opportunity costs, a component of such offers.<sup>11</sup> If, for example, on a day ahead basis, it is determined that the eastern interface is constrained, Regulation to the west of the interface could be more economic than Regulation to the east. The eastern interface constraint would make LMPs higher to the east and thus could increase the Regulation market offers of units in the east by

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<sup>9</sup> PJM Manual for Scheduling Operations, Manual M-11, page 3-4.  
<sup>10</sup> PJM Manual for Pre-Scheduling Operations, Manual M-10, page 4-1.  
<sup>11</sup> Regulation offers will be comprised of a fixed component which is submitted by the bidder, and an opportunity cost component, equal to the difference between the LMP and the energy offer of the unit, which is calculated by PJM.

increasing the opportunity costs of those units relative to the units in the west. If this were the case, the western supply of Regulation could serve the entire system because the amount of Regulation that is required is quite small in comparison to the size of the eastern interface transmission limit and would have no significant impact on operating the system.<sup>12</sup> The actual opportunity costs of specific units would depend both on the LMP and the energy offer of the unit as the opportunity cost is the difference between the LMP and the energy offer. In general, the amount by which the opportunity costs in the east and the west differ would be a function of the LMP differential between east and west and the energy offers of regulating units in the east and west and could vary over a wide range, from positive to negative.

#### **IV. MARKET SHARES**

I calculate market shares using various measures of Regulation capability. This approach is consistent with the Commission's merger policy statement.<sup>13</sup>

As indicated, Regulation service for the PJM Control Area can be supplied only by generating units that are electrically within the PJM Control Area and have specific capabilities. All such generating units, and their associated Regulation capability, must be identified in advance to PJM. PJM currently prepares a document, on a quarterly basis, entitled "Accounting For Regulation Billing Rate Components" (ARBRC). The ARBRC identifies generating units that are available to supply Regulation service in the subsequent quarter, the owners of the units and the amount of Regulation capability that the owner of each regulating unit wishes to offer in the coming quarter. The ARBRC information can be used to quantify Regulation offers by supplier for use in market share calculations.

For the market share calculations, I reviewed the ARBRC Reports issued from June 26,

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<sup>12</sup> For example, transmission capability into the eastern portion of PJM from the rest of PJM is, in general, approximately 6,000 MW. (The precise number varies depending upon actual operating conditions on the network.) The Regulation requirement for the eastern portion of PJM alone would be about 250 MW. The Regulation requirement in the east, net of self-scheduled requirements, would be even lower.

<sup>13</sup> 77 FERC ¶ 61,263, Inquiry Concerning the Commission's Merger Policy Under the Federal Power Act:

1997 to September 27, 1999. In addition to the information from the ARBRCs, I used the results of tests that PJM runs to verify that Regulation capability performs according to standards. This test data contains for each unit, including the test date and time and the MW of Regulation capability that each tested machine was supplying. The test data relied upon in this analysis covers the time period from 1993 to 1999.

From the test data, I determined the maximum amount of Regulation that each unit supplied during the time period studied and compared that to the highest observed level of Regulation for each Regulation-capable unit from the ARBRCs. There were a relatively small number of units that appeared only in the test data and not the ARBRCs. There were other units which tested at a higher level of Regulation service than the ARBRC indicated. In the market share computations I use units that appeared in either the ARBRC or the test data, and took the higher value of Regulation capacity from these sources. The fact that a unit was used, during a recent time period, to provide Regulation service, or provided more Regulation service than the unit owner is offering for the upcoming quarter, provides evidence that the unit can supply Regulation at that higher level.

Data on the Regulation obligation of each Load Serving Entity is calculated by PJM on an hourly basis. The calculations here are based on hourly Regulation obligation data from January 1, 1999 through December 7, 1999.

There are a number of jointly owned units in the PJM area. The choice of how to treat these units for market share analysis has a relatively small impact on the results. Jointly owned units can be considered to be controlled solely by the operating entity or they can be considered to be controlled by each of the owners in proportion to their ownership share. In the absence of information which would contradict this approach, I have taken what appears to be the most logical approach, which is to treat jointly owned units as controlled by each of the owners in proportion to their ownership.













Regulation market but which are not explicitly reflected in the HHI, or structural analysis, above.

The HHI and market share calculations described above do not reflect potential entry by either new generators or increased supply by existing generators. If such entry were to occur, the market shares and overall concentration levels could be lower than those shown in the analysis. There are approximately 140 MW of Regulation capability installed in PJM that have not currently met all the requirements to be certified to provide Regulation. This is a potential source of additional supply with low entry costs.

The structural analysis presented herein does not include the impact of demand conditions. Demand for Regulation is likely to be extremely price inelastic, as the demand is driven by NERC-based reliability requirements.

The structural analysis does not directly include the relationship between market power in the market for Regulation and market power in the energy market. If there were to be market power in the energy market, for example during high demand periods, then that market power is likely to be transferable to the market in Regulation. The Regulation market design ensures that the price of Regulation is linked to the price of energy via the opportunity cost portion of the price of Regulation.

It is my expectation that the development of a market in Regulation will enhance the supply of Regulation, especially during the off peak period. The close connection between the Regulation market and the energy market creates a concern that, in the absence of a Regulation market, there would not be adequate incentives to provide Regulation at certain times. The system has had less than the target amount of Regulation at times during some off peak hours and at times during the transition between off peak and on peak periods. This could well have resulted from the fact that the current payments for Regulation are based on the difference between the current hourly LMP and a fixed Regulation cost that is based on an historical average energy cost calculation. The result, during some off peak hours, is that there may be little incentive to provide

Regulation. The proposed market design would provide more appropriate incentives to owners based on current, unit-specific opportunity costs in addition to the Regulation offer price.

Another mitigating factor is that the Commission has approved PJM's Market Monitoring Plan which requires the monitoring of both energy and ancillary service markets.<sup>21</sup> The PJM Market Monitoring Unit will monitor the Regulation market.

In summary, there are concerns regarding the potential competitiveness of the market due to demand conditions and due to the relationship between the Regulation market and the energy market. In addition, there are concerns regarding the functioning of the market during off-peak periods and during periods of congestion XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXXXXXXXX<REDACTED>XXXXXXXXXXXXXXXXXXXXXXXXXX  
However, the results of the structural analysis, the supply/demand balance in the market, potential entry into the market and the market design imply potential benefits, associated with the introduction of a market, which outweigh those concerns.

## **VI. CONCLUSIONS**

Based on the above analysis, I conclude that it is appropriate to introduce a market in Regulation. The available supply of Regulation together with the market design features provide reasonable confidence that the market will be competitive. PJM's Market Monitoring Unit will monitor this market as it evolves and pay close attention to the identified areas of concern.

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<sup>21</sup> The Market Monitoring Plan was approved in 86 FERC ¶ 61,247 issued March 10, 1999.

Table 1

On Peak Total Regulation Capacity, Market Shares and HHI

<b>XXX</b>	<b>XXX</b>	<b>XXX</b>	<b>XXX</b>
<b>XXXXX</b>	<b>XX</b>	<b>XXXXX</b>	<b>XXX</b>
XXX	XXX	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
	REDACTED	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED		XXX	

Table 2

Off Peak Total Regulation Capacity, Market Shares and HHI

<b>XXX</b>	<b>XXX</b>	<b>REDACTED</b>	<b>XXX</b>
<b>REDACTED</b>	<b>XXX</b>	<b>XXX</b>	<b>XXX</b>
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX		XXX	

Table 3

Summer On Peak Available Regulation Capacity, Market Shares and HHI

XXX	XXX	REDACTED	XXX
<b>REDACTED</b>	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX		XXX	

Table 4

Summer Off Peak Available Regulation Capacity, Market Shares and HHI

XXX	XXX	REDACTED	XXX
<b>REDACTED</b>	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX		XXX	



Table 5

Winter On Peak Available Regulation Capacity, Market Shares and HHI

XXX	XXX	REDACTED	XXX
<b>REDACTED</b>	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX		XXX	

Table 6

Winter Off Peak Available Regulation Capacity, Market Shares and HHI

XXX	XXX	REDACTED	XXX
<b>REDACTED</b>	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX		XXX	

Table 7

Spring/Fall On Peak Available Regulation Capacity, Market Shares and HHI

XXX	XXX	REDACTED	XXX
<b>REDACTED</b>	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX		XXX	

Table 8

Spring/Fall Off Peak Available Regulation Capacity, Market Shares and HHI

XXX	XXX	REDACTED	XXX
<b>REDACTED</b>	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	REDACTED	XXX	REDACTED
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX
XXX		XXX	

Table 9

Total Regulation Capacity and Total Regulation Requirement

XXX	REDACTED	XXX	XXX
XXX	XXX	XXX	REDACTED
XXX	XXX	XXX	XXX
REDACTED	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX
XXX	XXX	REDACTED	XXX

