

BEFORE THE MISSOURI PUBLIC SERVICE COMMISSION

Filed
February 28, 2012
Data Center
Missouri Public
Service Commission

In the Matter of the Application of)
Union Electric Company for Authority)
To Continue the Transfer of Functional)
Control of Its Transmission System to)
the Midwest Independent Transmission)
System Operator, Inc.)

Case No. EO-2011-0128

**REBUTTAL TESTIMONY AND RESPONSE TO COMMISSION QUESTIONS OF
MARLIN J. VRBAS
ON BEHALF OF THE
MISSOURI JOINT MUNICIPAL ELECTRIC UTILITY COMMISSION
SEPTEMBER 14, 2011**

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1 **I. INTRODUCTION AND PURPOSE OF TESTIMONY**

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

3 A: My name is Marlin J. Vrbas. I am a Registered Profession Engineer and an independent
4 consultant doing business as PS Analytics, LLC. My business address is 316 East
5 Klubertanz Drive, Sun Prairie, Wisconsin 53590.

6 **Q 2: Please describe your experience and qualifications**

7 A: I am a Registered Professional Engineer in Nebraska, Minnesota and Wisconsin. I have
8 provided analytical and advisory services related to the Midwest Independent
9 Transmission System Operator, Inc. (MISO), including the procurement of Financial
10 Transmission Rights, Module E resource adequacy compliance, and other market
11 participation services since the MISO market startup in 2005. I received a Bachelor of
12 Science Degree in Electrical Engineering from the University of Nebraska in 1974 and
13 completed post graduate studies in engineering, mathematics and computer science.
14 Upon graduation from the University of Nebraska I was employed by Nebraska Public
15 Power District as a transmission and substation design engineer, and then by the Lincoln
16 Electric System where I was Supervisor of System Planning. Since 1985 I have provided
17 consulting services related to power supply, facility and resource planning, and energy
18 market participation for municipal utilities primarily in Nebraska, Iowa, Minnesota and
19 Wisconsin. In 2005 I formed PS Analytics, LLC and have continued to provide
20 analytical and advisory services related to energy market participation and system
21 operations for municipal utilities, joint action agencies and statewide municipal
22 organizations.

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

2 A: I am appearing on behalf of the Missouri Joint Municipal Electric Utility Commission
3 (“MJMEUC”). MJMEUC is a joint action agency and a political subdivision of the State
4 of Missouri authorized by legislation to construct, operate and maintain jointly owned
5 transmission and generation facilities for the production and transmission of electric
6 power for its members, to purchase and sell electric power and energy, and to enter into
7 agreements with any person for transmission of electric power. It is organized on a
8 statewide basis to promote efficient wheeling, pooling, generation, and transmission
9 arrangements to meet the power and energy requirements of municipal utilities in the
10 state. MJMEUC has 60 municipal utility members, and Citizens Electric Corporation, a
11 rural electric cooperative with more than 21,000 customers, is an Advisory Member of
12 MJMEUC. Together, MJMEUC’s members serve some 347,000 retail customers, with a
13 combined load of approximately 2,100 MW. Fourteen of MJMEUC’s members are
14 directly embedded in Ameren Missouri’s transmission system and take transmission
15 service through MISO.

16 MJMEUC also administers a power pool formed by some of MJMEUC’s members. The
17 Missouri Public Energy Pool #1 (“MoPEP”) currently has 34 members, whose 2009
18 summer peak load was approximately 476 MW. MoPEP is the full-requirements supplier
19 for its members. MoPEP has pool loads and resources located within the transmission
20 systems of MISO.

1 **Q 3: Please describe the scope of your testimony.**

2 A: MJMEUC requested that I review the proposal by Ameren Missouri to extend its
3 participation in the MISO market and to assist in preparing its response to the Missouri
4 Public Service Commission (MoPSC). The purpose of this testimony is to describe
5 certain concerns with regard to the Ameren Missouri proposal related to current and
6 proposed MISO market designs, which I have recommended that MJMEUC bring to the
7 attention of the MoPSC.

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

12 **II. SUMMARY**

13 **Q 4: Do you have any overall concerns with the proposal by Ameren Missouri to**
14 **continue and extend its membership in MISO that the MoPSC should consider?**

15 A: Yes. Ameren Missouri requests MoPSC authorization to remain a transmission-owning
16 member of MISO through May 31, 2015, and annually thereafter, with no further analysis
17 of public benefits after this proceeding. Ameren Missouri's request to extend its MISO
18 membership is based on a series of studies beginning with an analysis submitted with the
19 "2008 Stipulation", which was then updated with more current data and submitted as the
20 "Fall 2010 Analysis" and the "July 2011 Analysis." Studies presented by Ameren
21 Missouri to date that are intended to demonstrate public benefits related to MISO market

1 participation are mostly based solely on MISO's transmission reliability coordination
2 functions and energy and ancillary services market participation in MISO. These studies
3 did not, and could not reasonably have been expected to, take into consideration
4 fundamental changes in MISO market designs that have been recently proposed by
5 MISO.

6 MISO is now in the process of a transformation from an energy and ancillary services
7 market into an energy, ancillary services and capacity market. In this proceeding,
8 Ameren Missouri has not presented any formal studies of expected benefits or harm to its
9 ratepayers with regard to MISO's proposed capacity construct redesign. (See MISO's
10 July 20, 2011 filing in FERC Docket No. ER11-
11 4081, [https://www.midwestiso.org/Library/Repository/Tariff/FERC%20Filings/2011-
12 07-20%20Docket%20No.%20ER11-4081-000.pdf](https://www.midwestiso.org/Library/Repository/Tariff/FERC%20Filings/2011-07-20%20Docket%20No.%20ER11-4081-000.pdf).)

13 Instead, as described by Ameren Missouri's only witness, Mr. Ajay Arora, Ameren
14 Missouri's estimated the capacity sales benefits of continued MISO membership simply
15 by multiplying its current annual (excess) capacity position by "current estimates of
16 forward capacity prices developed through consultation with brokers and other market
17 participants." (Arora Direct at 6.) Mr. Arora did not identify the "brokers and other
18 market participants" that Ameren Missouri consulted, nor did he provide or even describe
19 those parties' feedback.

20 Mr. Arora also states, "It has been assumed that if Ameren Missouri were not a member
21 of the MISO the incremental cost of securing transmission service and other compliance
22 requirements would render the sale of capacity uneconomic in the near term." (Arora

1 Direct at 6.) Mr. Arora provided no explanation or support for this assumption. For
2 example, Mr. Arora did not define the “near term” time period to which he referred, nor
3 did he explain why securing transmission service and “other compliance requirements”
4 would be prohibitively costly for Ameren Missouri if it were not a MISO member. Mr.
5 Arora also failed to identify the “other compliance requirements.”

6 Meanwhile, MJMEUC is aware that Ameren Corporation favors a PJM-style capacity
7 market in MISO and expects this would result in increased revenues to Ameren. (See
8 ‘Ameren Corporation CEO Discusses Q4 2010 Results - Earnings Call Transcript’ at
9 [http://seekingalpha.com/article/254285-ameren-corporation-ceo-discusses-q4-2010-
11 results-earnings-call-transcript?source=from_friend](http://seekingalpha.com/article/254285-ameren-corporation-ceo-discusses-q4-2010-
10 results-earnings-call-transcript?source=from_friend)). It is not clear whether or how
12 Ameren Missouri – or the unidentified brokers and other stakeholders it consulted –
13 based their capacity sales estimates on assumptions that MISO would have a PJM-style
14 capacity market within the time period of Ameren Missouri’s analysis. What is more
15 clear, however, is that the experiences by Load Serving Entities (LSEs) in PJM have been
16 negative due mainly to price volatility, increased capacity costs, and overall uncertainty
17 with respect to the provision of energy to retail customers at rates that are just, reasonable
18 and stable. (See also the Rebuttal Testimony of James F. Wilson.)

18 MJMEUC is concerned that, over time, the increased revenues which Ameren expects to
19 receive with the initiation of a PJM-style capacity market in MISO will come at the
20 expense of MJMEUC and other LSEs, including Ameren Missouri and its customers.
21 For these reasons it is appropriate for MJMEUC to oppose Ameren Missouri’s proposal
22 to extend MISO participation because the impact of the proposed MISO capacity market

1 has not been fully considered and neither MISO nor Ameren Missouri have agreed to
2 hold MJMEUC harmless from the effects of MISO's proposed capacity market.

3 I have also recommended that MJMEUC urge the MoPSC to require Ameren, as a
4 condition for any immediate or future approval of an extension of Ameren's MISO
5 membership authorization, to provide (a) an analysis of the projected public benefit or
6 harm related to the initiation of the MISO market based capacity construct, after the
7 revised tariff has been finalized, in a manner commensurate with that which has been
8 provided in the past by Ameren in its quantification of public benefits related to ISO
9 reliability coordination, and energy and ancillary service market participation, and (b)
10 after the new capacity construct's implementation, provide additional reports with respect
11 to the actual impact the new capacity construct has on bilateral capacity purchase costs
12 and the overall cost of capacity.

13 III. OBSERVATIONS AND CONCERNS

14 **Q 5: What is your understanding of the objectives of the capacity market as proposed by**
15 **MISO?**

16 A: MISO has said that the capacity market design is needed to facilitate the availability of
17 adequate supply resources, to encourage the proper mixture of planning resources, to
18 enhance reliability in the MISO, and to encourage the efficient and reliable location of
19 planning resources by creating locational capacity market mechanisms. MISO claims
20 that the changes in resource adequacy constructs being proposed in conjunction with the
21 auction-based capacity market will achieve these objectives.

1 **Q 6: Describe your understanding of the proposed MISO capacity market design**
2 **mechanisms.**

3 A: MISO will conduct an annual capacity auction in which resources (as required by the
4 anti-withholding market rules) must either (a) make price offers, (b) be “self-scheduled,”
5 which is the equivalent of being a “price taker” by making zero price offers, or (c) be
6 included in a Fixed Resource Adequacy Plan (FRAP) under the opt-out provision.
7 MISO’s proposal also includes a Minimum Offer Price Rule (MOPR), would place lower
8 limits on offer prices for at least portions of certain new gas-fired generating plants
9 (where the proposed MOPR would generally only apply to LSEs’ excess capacity from
10 such resources).

11 The auction will be conducted annually and will be structured as a solution to a
12 constrained optimization problem in which the main constraints are (a) the transfer
13 capability between Locational Resource Zones (LRZ) and (b) each zonal Local Clearing
14 Requirement (LCR). The LCR requires that a certain amount of the total capacity
15 required for the zone be physically located within the zone.

16 The clearing price for each zone will be determined as a function of the resource offer
17 prices, the zonal demand, and constraints of either type if they become “binding.” If
18 constraints become binding, then there could be differences in clearing prices between
19 zones depending on relevant offer prices in the respective zones.

20 LSEs with load in zones different than those of their respective resources that choose to
21 opt-out via the FRAP option, and do not have a hedge of one of the two types potentially

1 available, will be charged a Zonal Distribution Charge (ZDC) if the clearing price in the
2 load zone exceeds that for the zone in which the resource is located. LSEs that do not
3 opt-out via FRAP, or that offer into the auction resources in excess of their load, will
4 receive net credits if their offers clear and the clearing price in the resource zone is
5 greater than in the load zone.

6 **Q 7: Is the proposed capacity market design similar to the existing energy market**
7 **design?**

8 A: No. The proposed capacity market design is fundamentally different than the existing
9 energy market design in several significant ways. In the energy market, offer prices are
10 largely based on the actual incremental cost of energy each hour for the offered units
11 based on fuel costs and the characteristics, i.e. the efficiency or incremental heat rates, of
12 the respective units. There is a day-ahead market, which is largely a financial market that
13 reflects physical transmission system characteristics in a manner very close to the way in
14 which it is actually operated, and a real-time market which also reflects actual operating
15 conditions. Several self-correcting features are included, such as virtual bids and offers
16 which tend to draw day-ahead and real-time prices together on a daily and hourly basis.

17 In contrast, the capacity auction clearing process MISO proposes would essentially use
18 the offered prices to establish a merit order that likely will not reflect the actual dispatch
19 used during peak periods (unless MISO's capacity auction modeling happens to
20 accurately capture actual peak conditions). Further, MISO's proposed capacity market
21 will include a single annual auction that will determine all prices paid and received by
22 participants for the entire planning year. Importantly, this provides no opportunity for the

1 type of on-going periodic self-correction or price discovery within the planning year
2 analogous to what occurs in the energy market.

3 In addition, while the fuel cost and heat rate bases of energy clearing prices is relatively
4 well understood, the basis of capacity auction clearing prices under MISO's proposal is
5 not likely to be nearly as apparent or as well understood. Some capacity offer prices
6 might be based on the estimated annual cost of availability minus the owners' forecast of
7 net revenue from the energy and ancillary services markets, which are speculative
8 considerations that are not common across market participants or otherwise apparent to
9 market participants and observers (like interested state regulators). Other capacity offer
10 prices may be simply based on expectations of what the market will bear, which is also
11 highly speculative and, again, not common across market participants or otherwise
12 apparent.

13 **Q 8: Can you explain the extent to which MISO's proposed capacity construct is**
14 **expected to meet MISO's objectives stated above?**

15 A: I disagree with MISO's suggestion that its proposal will "encourage the development of
16 Planning Resources in the locations where they are most needed." (MISO Transmittal
17 Letter at 7.) Likewise, I disagree with MISO witness Mr. Clair J. Moeller's claim that
18 MISO's proposed capacity construct will create "transparent market signals" that will
19 "allow Market Participants to make informed decisions on where to site new Planning
20 Resources." (Moeller Testimony at 9.)

1 Contrary to such claims, I do not expect the proposed capacity construct will encourage
2 the proper mixture of planning resources, and encourage the efficient and reliable
3 location of planning resources. Instead, I think there are good reasons to expect MISO's
4 proposed capacity construct will in fact inhibit long-range, least-cost planning of future
5 resources by unnecessarily introducing significant complexity and uncertainty.

6 First, auction clearing prices are likely to be quite volatile from year to year. Offer prices
7 for potentially marginal resources are likely to be volatile from year to year as resource
8 owners' financial conditions, business strategies, and market expectations (energy,
9 operating reserves, and capacity) change. Also, the inter-zonal transfer capability and
10 LCR constraints could change year to year. Taken together, these considerations suggest
11 MISO's proposed annual capacity auction is likely to produce volatile zonal clearing
12 prices.

13 Second, MISO's proposal will not adequately protect LSEs from the expected zonal price
14 volatility. Under the proposed construct, participation by Missouri utilities in a new
15 project in a Local Resource Zone (LRZ) that does not include Missouri, would expose
16 those utilities to the risk of zonal auction clearing price separation even if some or all of
17 the needed transmission capacity for deliverability to Missouri load were already
18 available. Instead, the proposed market design will encourage the construction of
19 smaller, less efficient plants that can be built with less lead time solely on the basis that
20 they can be built within the LRZ in which the LSE's load is located. Furthermore, zonal
21 price separation risk is compounded by the potential for MISO to change existing LRZ
22 boundaries (e.g. split the Missouri LRZ) or create a new LRZ (e.g. Entergy).

1 The proposed zonal construct is unnecessarily restrictive with regard to participation in
2 new or existing resources in adjacent zones, which are otherwise available to meet
3 capacity and energy needs, by placing price separation risk solely on the respective
4 participants. The proposed design effectively assumes that the current inter-zonal
5 transactions are optimal and that any changes in inter-zonal transactions, even if they
6 provide counterflow, are somehow suboptimal. The proposed capacity market design
7 disregards the possibility that some level of inter-zonal resource and system usage can be
8 beneficial to a sufficiently broad section of market participants to justify the sharing of
9 the cost of upgrades that may be needed in the future to support the transactions as
10 Market Efficiency Projects or Baseline Reliability Projects as defined in the tariff. This
11 is the construct that the MISO proposes to be in place if and when new capacity is needed
12 to replace existing capacity that may be retired due to emerging EPA requirements, which
13 the MISO has estimated may include up to 30% of the existing capacity in the MISO
14 footprint. This is also the construct that MISO proposes to be in place when new Multi-
15 Valued Projects are completed, both of which will impact power flows and inter-zonal
16 transfers, and potentially incur ZDC charges in highly unpredictable ways, or in the
17 converse, will result in increases in inter-zonal transmission capacity that will go
18 unallocated because of price separation uncertainty and lack of appropriate hedge
19 mechanisms.

20 The zonal construct may have some advantages over the current universal or aggregate
21 deliverability construct that was previously applied to the extent that capacity offered into
22 the proposed market need only be shown to be deliverable to load within the respective
23 zone, thereby avoiding costly universal or aggregate deliverability studies and the

1 subsequent uncertainties related to future transmission capacity availability. This allows
2 MISO and other transmission planners to focus on maintaining deliverability within
3 smaller regions. However, this should be viewed more as a correction of a prior
4 construct that was found to be unworkable than an enhancement to improve reliability or
5 efficiency.

6 **Q 9: Do you expect that the proposed market will have detrimental effects on MISO**
7 **LSEs, including Ameren Missouri and its customers? If so, please explain.**

8 A: The immediate impact on LSEs may be minimal and may be limited to additional
9 administrative requirements simply to continue operating as they are currently doing.
10 Near term impacts may be felt if capacity market clearing prices are higher than
11 current bilateral trades, which may tend to drive up the price of bilateral trades and the
12 costs to LSEs who rely on bilateral capacity purchases. The longer range impact could be
13 substantial.

14 If new resource opportunities are proposed or developed in adjacent zones, such as in
15 Illinois or Arkansas after Entergy joins the MISO, MJMEUC and other Missouri LSEs,
16 including Ameren Missouri, will be deterred from participation due to the potential for
17 future price separation risk. High costs could be incurred in the form of ZDCs if the LSE
18 enters into participation followed by unexpected and harmful price separation, or in the
19 form of the development of less efficient alternatives within the Missouri LRZ. Other
20 risks may occur depending upon the final FERC rulings on 'slippery slope' issues such as
21 the slope of the administratively determined auction demand curve, or certain exemptions

1 related to the Minimum Offer Price Rule and others. (See also the Rebuttal Testimony of
2 James F. Wilson.)

3 **Q 10: How are the information and opinions expressed in this affidavit relevant to the**
4 **issue of Ameren Missouri's request for extended MISO participation?**

5 A: Ameren Missouri is proposing to extend its participation through May 31, 2015, and
6 annually thereafter, with no further analysis of public benefits on the basis of prior
7 studies, and is proposing no future studies which take into consideration the re-
8 formulated MISO market design which will include a capacity market via revisions to
9 MISO tariff Module E (Resource Adequacy) and potentially other changes in Module B
10 (Interconnection and Transmission Service) and Attachment FF (Transmission Expansion
11 Planning Protocol), which may be needed to coordinate and integrate the Module E
12 revisions.

13 If the Ameren Missouri request is approved, this may essentially preclude meaningful,
14 prudent reviews of the public benefit impact related to the capacity market for the
15 intervening years. In this regard, I strongly disagree with Mr. Arora's claim that it would
16 be appropriate for the MoPSC to consider transitioning from the current review process
17 to a process where the permission to participate continues until such time as substantial
18 evidence exists that continued participation would be detrimental to the utility and its
19 customers. (Arora Direct at 11.) This would improperly (but conveniently for Ameren
20 Missouri) shift the burden of demonstrating the public interest of Ameren Missouri's
21 continued MISO membership away from Ameren Missouri and onto affected parties that
22 would lack the data necessary to make such a public interest determination.

1 MJMEUC should seek provisions for updated reviews that would be prudent in order to
2 determine if unwarranted capacity cost increases have resulted directly or indirectly from
3 the institution of a new MISO capacity construct. If no such reviews are required, then
4 MJMEUC should object to the Ameren proposal – especially given that neither MISO
5 nor Ameren have agreed to hold MJMEUC harmless with respect to the MISO’s new
6 capacity construct,.

7 **IV. CONCLUSIONS**

8 **Q 11: How would you propose that the MoPSC rule on the Ameren request?**

9 A: A full acceptance of the Ameren proposal may be taken by Ameren and the MoPSC to
10 mean that no further review or analysis of public benefit or harm related to Ameren
11 Missouri’s MISO participation is warranted during the extended period(s) based on prior
12 studies that do not consider known or likely changes to fundamental aspects of the MISO
13 market, primarily the introduction of a market based capacity construct.

14 Given the vast number of inter-dependent elements of MISO’s market based capacity
15 construct proposal, I am concerned about unintended consequences of (a) the failure of
16 MISO, and potential failure of FERC, to properly address concerns raised by stakeholders
17 related to the proposed MISO tariff related to the integration of the proposed revisions to
18 Module E (Resource Adequacy) with respect to Module B (Transmission Service) and
19 Attachment FF (Transmission Expansion Planning Protocol), and (b) FERC requiring
20 changes in elements contained in the proposed tariff that could harm MJMEUC’s interest
21 in other ways.

1 Therefore, as a condition for approval by the MoPSC, I would urge the MoPSC to adopt a
2 plan that provides for reviews of the impact of MISO's capacity construct redesign,
3 including an appropriate level of quantitative analysis commensurate with what has been
4 provided in the past by Ameren Missouri in its quantification of public benefits related to
5 ISO reliability coordination, and energy and ancillary service market participation. At a
6 minimum, it would be prudent of the MoPSC to require Ameren to provide an analysis of
7 this type at such time that FERC rules on the presently filed MISO resource adequacy
8 tariff, at which time the rules will be known. Aspects of the tariff that are of particular
9 concern relate to:

- 10 • The lack of Grandmothered Agreement (GMA) or ZDC Hedge protection for existing
11 resources in the event LRZs are redefined or added;
- 12 • Restrictions on eligibility for ZDC Hedges for new resources or new reservations for
13 existing resources that lie outside the load LRZ;
- 14 • The potential for FERC to limit the ability of LSEs to opt-out, partially or fully, of the
15 annual capacity auction;
- 16 • The potential for FERC to require a sloped demand curve for the auction, and
17 possible associated Planning Reserve Margin adders for opt-out LSEs;
- 18 • The potential for FERC to reduce or eliminate any of MISO's proposed Minimum
19 Offer Price Rule exemptions; and
- 20 • The potential for FERC to require a longer (e.g., 3- or 5-year) auction forward period.
21 (MISO Transmittal Letter at 6, 21.)

1 In addition to the initial review at the time of the final capacity construct tariff
2 implementation, I would suggest that the MoPSC conduct periodic reviews of the impact
3 the new capacity construct has on the cost of capacity acquired by LSEs, bilaterally and
4 in MISO's auction.

5 I would additionally suggest that the MoPSC conduct periodic reviews of MISO market
6 participation based on other conditions that arise after implementation. Appropriate
7 conditions for the MoPSC to initiate such reviews should include significant tariff
8 changes related to the concerns listed above, and on other relevant aspects of MISO
9 participation. For example, a decision by Ameren Illinois to join PJM will raise issues
10 with regard to MJMEUC members' ability to receive capacity and energy from its
11 interest in the Prairie States plant, or associated costs related to pancaked rates or other,
12 which may also be best addressed in relation to Ameren Missouri's extended
13 authorization for MISO membership. Accordingly, MJMEUC would be well advised to
14 seek assurances from Ameren and the MoPSC that it will have an opportunity to address
15 mitigating measures at such time that precipitating events of this type occur.

16 **Q 12: Does this conclude your testimony?**

17 A: Yes.

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OF THE STATE OF MISSOURI**

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Company d/b/a Ameren Missouri for Authority to)
Continue the Transfer of Functional Control of Its) Case No. EO-2011-0128
Transmission System to the Midwest Independent)
Transmission System Operator, Inc.)

AFFIDAVIT OF MARLIN J. VRBAS

STATE OF WISCONSIN)
) ss
COUNTY OF DANE)

Marlin J. Vrbas, being first duly sworn on his oath, states:

1. My name is Marlin J. Vrbas. I am an independent consultant doing business as PS Analytics, LLC in Sun Prairie, Wisconsin.
2. Attached hereto and made a part hereof for all purposes is my Rebuttal Testimony and Response to Commission Questions on behalf of the Missouri Joint Municipal Electric Utility Commission consisting of 16 pages, all of which have been prepared in written form for introduction into evidence in the above-referenced docket.
3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

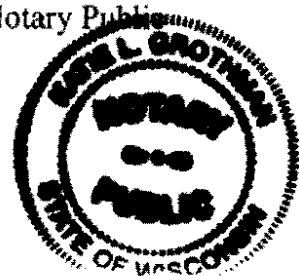
Marlin J. Vrbas

Marlin J. Vrbas

Subscribed and sworn to before me this 14 day of September, 2011.

Kate L. Grothman

Notary Public



My commission expires: 5/11/2014