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| Issues: | Fuel Adjustment Clause |
| Witness: | Michael S. Proctor |
| Sponsoring Party: | MO PSC Staff |
| Type of Exhibit: | Rebuttal Testimony |
| Case No.: | ER-2008-0318 |
| Date Testimony Prepared: | October 14, 2008 |

# MISSOURI PUBLIC SERVICE COMMISSION

# UTILITY OPERATIONS DIVISION

# REBUTTAL TESTIMONY

# OF

# MICHAEL S. PROCTOR

# UNION ELECTRIC COMPANY
# d/b/a AmerenUE

# CASE NO. ER-2008-0318

**Jefferson City, Missouri**
**October 2008**

**BEFORE THE PUBLIC SERVICE COMMISSION**

**OF THE STATE OF MISSOURI**

| | | |
|---|---|---|
| In the Matter of Union Electric Company d/b/a AmerenUE for Authority to File Tariffs Increasing Rates for Electric Service Provided to Customers in the Company's Missouri Service Area. | ) ) ) ) ) | Case No. ER-2008-0318 |

**AFFIDAVIT OF MICHAEL S. PROCTOR**

**STATE OF MISSOURI** )
) **ss**
**COUNTY OF SAINT LOUIS** )

Michael S. Proctor, of lawful age, on his oath states: that he has participated in the preparation of the following Rebuttal Testimony in question and answer form, consisting of 32 pages of Rebuttal Testimony to be presented in the above case, that the answers in the following Rebuttal Testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such matters are true to the best of his knowledge and belief.

Michael S. Proctor
Michael S. Proctor

Subscribed and sworn to before me this 8th day of October, 2008.

JEREMY HAGEMEYER
Notary Public - Notary Seal
State of Missouri - County of St. Louis
My Commission Expires Feb. 17, 2009
Commission #05668582

Notary Public

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**MICHAEL S. PROCTOR**

**UNION ELECTRIC COMPANY**
**d/b/a AmerenUE**

**CASE NO. ER-2008-0318**

**Q. What is your name and business address?**

A. My name is Michael S. Proctor. My business address is 9900 Page Avenue, Suite 103, Overland, MO 63132.

**Q. By whom are you employed and in what capacity?**

A. I am employed by the Missouri Public Service Commission (Commission) as Chief Regulatory Economist in the Energy Department.

**Q. What is your education background and work experience?**

A. I have Bachelor and Master of Arts Degrees in Economics from the University of Missouri at Columbia, and a Ph.D. degree in Economics from Texas A&M University. Prior to coming to work for the Commission, I was an Assistant Professor of Economics at Purdue University and at the University of Missouri at Columbia. Since June 1, 1977, I have been on the Staff of the Commission and have presented testimony on various issues related to weather normalized energy usage and rate design for both electric and natural gas utilities. With respect to electric issues, I have worked in the areas of load forecasting, resource planning and transmission pricing. Currently, I am serving as chairman of the Southwest Power Pool Regional State Committee's Cost Allocation Working Group, chairman of the

Organization of Midwest ISO States' (OMS') Financial Transmission Rights Working Group and co-chairman of the OMS' Transmission Pricing Working Group.

**Q. What are your current duties in the Energy Department as Chief Regulatory Economist?**

A. I am actively involved with the activities of the Southwest Power Pool, Inc. (SPP) and the Midwest Independent Transmission System Operator, Inc. (MISO). These Regional Transmission Organizations (RTOs) coordinate the planning of the transmission system on a regional basis and operate the regional power grid with the goals of increasing efficiency and reliability in the competitive wholesale supply of electricity. In meeting these goals both SPP and MISO facilitate the operations of regional electricity markets.

I am also responsible for testifying before the Commission on various issues where I have relevant expertise and experience, with an emphasis in the economic analysis of utility policy. In addition, I consult with other Staff of the Commission on matters related to transmission expansion and wholesale electricity markets.

## BACKGROUND - INTRODUCTION

**Q. On what issues are you filing rebuttal testimony in this proceeding?**

A. My rebuttal testimony will address the direct testimony of AmerenUE Witness Ajay K. Arora. Mr. Arora's direct testimony addresses the study used by AmerenUE to assess the risks associated with the uncertainty of net fuel expenses.

**Q. What is net fuel expense?**

A. At this Commission for ratemaking purposes, net fuel expense includes the delivered cost of fuels and the cost of purchased power less revenues received from sales of electricity in the wholesale electricity markets.

**Q. Why is it important to address the risks associated with the uncertainty of net fuel expense?**

A. AmerenUE's downside risk related to net fuel expense is the potential for significant expense increases in net fuel subsequent to a determination by the Commission of these costs in a rate case. As proposed by AmerenUE, this downside risk can be mitigated by allowing for rates to AmerenUE's retail customers that periodically increase between rate cases to cover higher net fuel expense. If the downside risk associated with net fuel expense is relatively low, then there is little need for a Fuel Adjustment Clause (FAC) as provided for by Section 383.266 and the Commission's rules, 4 CSR 240 240-3.161 and 4 CSR 240-20.090.

**Q. Doesn't the fact that fuel costs for AmerenUE are increasing imply a high downside risk in net fuel expense on a going forward basis?**

A. No. I addressed this issue in my rebuttal testimony in AmerenUE's previous rate case - Case No. ER-2007-0002. At page 6 of that rebuttal testimony I made the following statement:

> "Second, while changing fuel prices and wholesale electric prices impact the level of profit margins, AmerenUE has not presented any studies to show what this impact is. In essence, since there is a high level of correlation between fuel prices and spot market prices for electricity, the net impact of changing prices on profit margins could be fairly minimal, and I will present evidence to show that this is the case."

On page 26 of its Report and Order in Case No. ER-2007-0002, the Commission found that "A future rate case, not a fuel adjustment clause is the proper means by which AmerenUE should recover its rising fuel costs.

**Q. Does the study submitted by AmerenUE in this case support the position of the Staff in the previous AmerenUE rate case No. ER-2007-0002?**

A. No. While the AmerenUE study purportedly addresses the issue regarding the interaction between net fuel expense and electricity prices, it does not arrive at the same conclusion as the Staff in the previous AmerenUE rate case. The purpose of my rebuttal testimony in this case is to provide the Commission with my analysis of the study performed by AmerenUE and filed in this case.

## EXECUTIVE SUMMARY

**Q. Do you agree with the study submitted by Mr. Arora?**

A. No, I do not. While the overall concepts that the study purportedly addresses appear to be sound, the implementation of the study is flawed in several critical respects. In this regard, the Commission has no new evidence from Case No. ER-2007-0002 on which to change its decision to deny AmerenUE's request for a FAC.

**Q. What specific flaws did you find in your review of the AmerenUE risk assessment study for net fuel expense?**

A. In this summary section I will list these flaws, and will explain why these are flaws in the following sections of my rebuttal testimony.

1. Wrong Estimates of Uncertainty for Electricity and Natural Gas Prices: AmerenUE's estimation of uncertainty for electricity prices and natural gas prices uses the incorrect data to estimate the uncertainty for the model which was used to calculate net fuel expense within each of the periods for which the study was performed. The result is a significant over estimation of the variability in net fuel expense.

2. Wrong Estimate of Uncertainty for Coal Prices: AmerenUE's estimation of uncertainty for coal prices, which uses a different type of data than what was used for electricity and natural gas prices, also uses the wrong data, and fails to account for the correlation that exists between spot-market electricity prices and spot-market coal prices.

3. Incorrect Analysis of Correlations Among Variables: AmerenUE's analysis of correlation between electricity prices and coal prices used daily changes in forward prices. This analysis tests a hypothesis that, if true, may imply correlation in forecasts of the spot-market price for these two variables, but is not a necessary

condition for correlation. In addition, AmerenUE presents an incorrect analysis of annual average prices of the correlation of historical levels for coal, natural gas and electricity prices. Finally, AmerenUE confuses causation with correlation in the discussion of why AmerenUE's generation facilities do not cause the electricity prices in the Midwest ISO's day-ahead energy market.

4. Results Do Not Meet A Sanity Check: The results for AmerenUE's 250 scenarios for each period of the study indicate too high of a level of dispersion in the test-year when correctly compared to historical data, and actually show declining uncertainty for the out-year periods. The uncertainty should have increased in the out-years to reflect an increasing level of forecasting uncertainty.

**Q. Based on these flaws in the AmerenUE implementation of its risk assessment study, what is your recommendation to the Commission?**

A. The Commission should find that AmerenUE's risk assessment study for net fuel expense does not provide the support necessary for it to approve AmerenUE's request for a FAC.

**Q. How is the remainder of your rebuttal testimony structured?**

A. First, I will address the way in which AmerenUE risk assessment study of net fuel expense should have been structured. Then, I will address each of the flaws in the way that the study was implemented.

## STRUCTURING ISSUES REGARDING AMERENUE'S RISK ASSESSMENT OF NET FUEL EXPENSE

**Q. Have you previously addressed structuring a study for assessing the risk of net fuel expense?**

A. Yes, I have. At page 6 of my rebuttal testimony in Case No.ER-2007-0002 I made the following statement:

> "There would be several elements that should be included in such a study, and I would be more than willing to be involved with AmerenUE in the specific design. For purposes of this testimony, I will present a basic structure that should be followed."

**Q. What was the basic structure you set out in your previous testimony?**

A. I set out five steps for a study that would incorporate evaluating the impact of uncertainty on net fuel expense. These steps are summarized below, and were covered in greater detail on pages 6 through 11 of my rebuttal testimony in ER-2007-0002:

1. Determine the specific uncertain variables.
2. Determine statistical measures for the uncertain variables.
3. Determine correlations among uncertain variables.
4. Set out all of the scenarios involving uncertain variables to be analyzed.
5. Run production cost models to determine the level of profit margins associated with each scenario.

**Q. Prior to filing its study in this case, did AmerenUE involve you, or to your knowledge, any Staff in the specific design of what was filed by Mr. Arora?**

A. I was not contacted with respect to the implementation specifics used by AmerenUE in the study it filed in this case. I am not aware of any other Staff having been contacted prior to AmerenUE's filing of its study in this case.

**Q. Did AmerenUE follow the five basic steps that you had set out in your previous testimony on this matter?**

A. Essentially, AmerenUE's study covered each of the five steps listed above. In addition, AmerenUE expanded these five steps to include specifics regarding the future time periods to be evaluated with respect to net fuel risk.

**Q. What time periods were covered by AmerenUE's study?**

A. AmerenUE's study covered the test year, 2009, 2010, 2011 and 2012.

**Q. Do you agree that analysis of each of these time periods is relevant for the Commission's determination of need for a FAC in this case?**

A. No, I do not. As included in Section IX of the *Staff Report: Cost of Service* filed on August 28, 2008 (re-filed on September 8, 2008) in this case, AmerenUE is in the process of performing environmental upgrades to its existing coal units that are due for completion in December of 2009 and April of 2010. Thus, AmerenUE will likely file a rate case to include the cost of these upgrades in rate base at some point prior to the in-service dates for these environmental upgrades. Moreover, the results for 2011 and 2012 are not relevant, and the results for 2010 are on the margin of being relevant.

**Q. While AmerenUE followed the five steps that you set out in its previous rate case, was the implementation of these steps performed in a manner that supports the reasonableness of the results?**

A. No, they were not. Specifically, the study did not properly specify the elements of uncertainty that should have been included, and therefore did not correctly estimate uncertainty for the key variables that include electricity price, natural gas prices and coal prices. The study also included uncertainty for nuclear fuel costs, load, and forced outages on generation units. While emission prices are not included as a part of net fuel expense, these prices are also needed in order to get the proper dispatch built into the calculation of net fuel expense. My rebuttal testimony focuses on electricity prices, natural gas prices and coal prices.

**Q. For these three variables, what measures of uncertainty are necessary to perform a proper study?**

A. There are three distinct classes of uncertainty that are necessary to perform a proper study.

1. Profile Uncertainty: Profiles relate to changes in the variables that occur for time frames within a given year, such as hourly (load and electricity prices), daily

(natural gas prices) or monthly (coal prices). For load, electricity prices and, to a lesser extent, natural gas prices, these changes are driven by changes in weather, and the variability in these changes are driven by the variability in weather.

2. Average Annual Uncertainty: When running simulations of a given year, the profile uncertainty described above will result in variations in the average annual levels for each of the variables. To the extent that profile uncertainty is driven by the variability in weather, the deviations in average annual levels of the variables should be similar to the deviations of the average annual levels for weather. However, when factors other than weather play a role in profile uncertainty, there will be some differences.

3. Forecast Uncertainty: When uncertainty is included for years beyond the test year, it is necessary to forecast the average annual levels for each variable. These forecasts may include uncertainty due to weather, but can also include additional uncertainty to the extent there are other drivers for the forecast. It is important to include correlations among the variables to properly calculate the forecasts and the uncertainty associated with these forecasts.

**Q. What price forecasts are required for each of these variables?**

A. All forecasts should be of the annual average level of each variable. In addition to the forecast of the annual average level of each variable, various profiles must also be determined. For load and electricity prices, hourly profiles are required. For fuel prices, monthly profiles are required, and for pricing of natural gas, AmerenUE's study also used daily price profiles.

## WRONG ESTIMATES OF UNCERTAINTY FOR ELECTRICITY AND NATURAL GAS PRICES

**Q. What was the overriding issue in the measure of statistical dispersion in the AmerenUE study?**

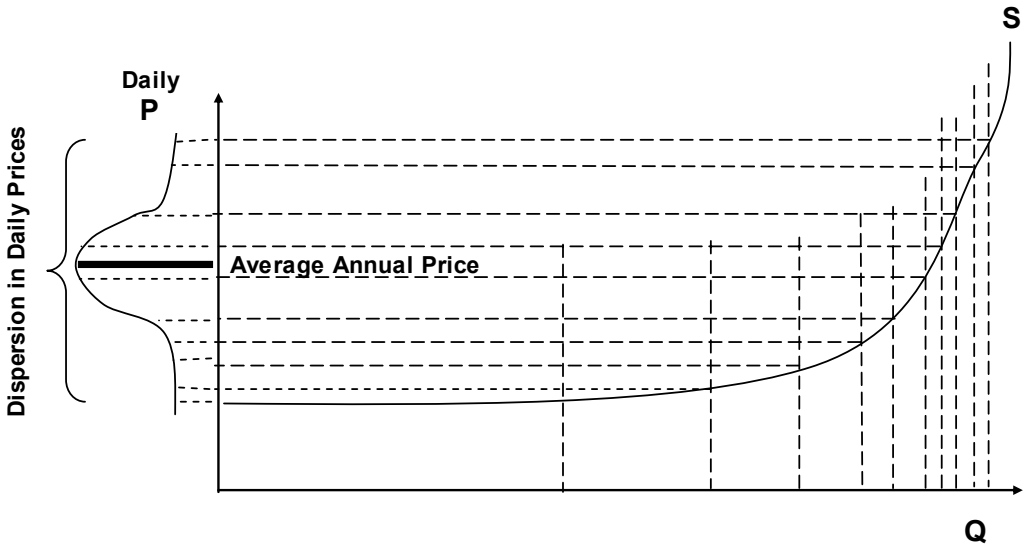
A. As I stated previously, there is a difference between the uncertainty for an annual average level of a variable compared to uncertainty for a profile (monthly, daily or hourly), and there are differences in the levels of uncertainty associated with each. In statistics, this difference is illustrated by the difference between the measures of dispersion around an average compared to the measure of dispersion for that average. Unfortunately,

AmerenUE's measures of uncertainty confuse these concepts and therefore, incorrectly measures the uncertainty associated with each.

**Q. Can you illustrate this difference in the context of uncertainty related to electricity prices?**

A. Yes. The following graph is an illustration of the variability that occurs in daily electric prices with changes in weather that result in varying levels of demand.

Figure 1
Daily Price Dispersion



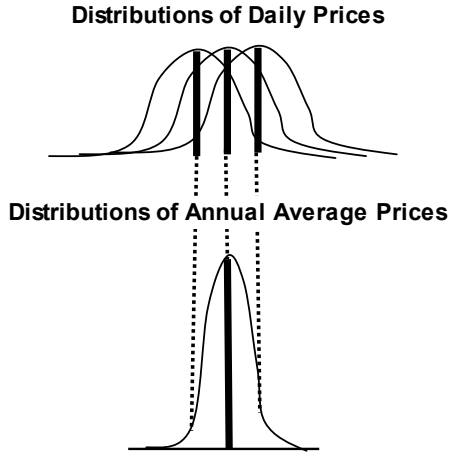

As weather changes, demand shifts and where the resulting demand for electricity intersects with the supply curve for electricity determines the daily price. This is shown in the graph by dashed lines for varying levels of demand along the horizontal (Quantity) axis and where these intersect with the supply curve, the dashed lines are extended to the vertical (Price) axis to indicate the determination of a daily price.

The distribution curve drawn to the left of the price axis illustrates the dispersion that occurs throughout the year because of the daily changes in weather. In the center of this distribution the average of the daily prices is represented by the dark line. This distribution of

daily prices is the type of distribution that was estimated in the AmerenUE study for dispersion in both electricity and natural gas prices. However, this is not the end of the story.

AmerenUE then constructed 250 simulations of these daily price distributions for each of the periods set out in its study (i.e., test year, 2009, 2010, 2011 and 2012). What is at issue here is the distribution of the 250 simulations. The figure below illustrates the difference in the distribution of daily prices when compared to the distribution of the average annual prices calculated for each of the 250 scenarios.

Figure 2




In the top of this figure the daily distributions for various scenarios are represented by their individual distributions around the annual average. In the lower part of the figure, a much narrower distribution represents the distribution of the annual averages that are calculated for each of the scenarios. I will provide evidence in this section of my rebuttal testimony that the distribution of the average annual prices is much narrower than for the distribution of daily prices within a year. Because the AmerenUE study used the daily distribution to represent the distribution of the annual averages, it has significantly over-estimated the variability associated with electricity and natural gas prices.

**Q. From a statistical perspective, what is the difference between the measure of dispersion around an average and a measure of dispersion for that average?**

A. As an example, the dispersion around an average is illustrated by the measure of the deviations of monthly observations on a variable from the average annual levels for those monthly observations. The dispersion of an average comes from repeating the calculation of the annual average over multiple trials and calculating the deviation from the overall mean of the averages calculated in each trial. Schedule 1 attached to my rebuttal testimony illustrates this difference using two-day weighted average for daily mean temperatures (2/3 today, 1/3 yesterday). I used daily data from 1970 through 2007. Two-day weighted average for daily mean temperatures is the weather variable that Staff uses to correlate with daily load for AmerenUE.

**Q. What do these example calculations illustrate?**

A. The standard deviation is a measure of dispersion of the data around its average, and the ratio of the standard deviation to the average calculates the percentage dispersion of the data around its average. This example shows the significant difference between the dispersion of a daily weather profile when compared to the dispersion of annual averages calculated from a repeated sample of daily profiles. The dispersions of daily observation around their mean for the profiles are larger than the dispersion of the annual averages calculated from a repeated sample of monthly profiles.

The specific results are that the standard deviations of daily temperatures around the average annual temperature varied from as low as 16.3 degrees to as high as 21.8 degrees, with ratios of the standard deviations to the mean in each year varying from a low of 29.3% to a high of 41.6%. This shows there is a lot of variation in temperature within a single year.

However, when the mean and standard deviation of the thirty-seven years of annual average temperatures is calculated, the standard deviation is only 1.76 degrees with a ratio to the overall mean of 3.17%. As I will explain in greater detail, AmerenUE's analysis of uncertainty mixes these two different concepts by estimating profile dispersion of prices using daily variations and then applying these estimates to repeated samples (scenarios) of annual averages.

**Q. How did AmerenUE's study apply its estimates of uncertainty factors to the issue of risk associated with electricity prices?**

A. Using estimates of "annual uncertainty factors," Mr. Arora calculates 250 scenarios/trials of joint outcomes for the uncertain variables that he states were designed to reflect both the "annual dispersions around the base forecasts" and the "estimated correlations between the variables." The results are shown on Schedule AKA-E1 attached to Mr. Arora's direct testimony.

**Q. What measures of uncertainty did AmerenUE use for electricity prices?**

A. The measures varied for each variable. The details of what AmerenUE measured as uncertainty are found in section III of Mr. Arora's direct testimony starting on page 5 and going through page 14. Mr. Arora characterizes the estimates of uncertainty by what he calls the "annual uncertainty factor," which is defined at page 4 of his direct testimony as "a measure of the average annual dispersion around the base forecast" for each uncertain variable, and later at page 7, as the ratio of the standard deviation to the average annual level for the variable.

**Q. How did AmerenUE measure the uncertainty associated with the "average annual dispersion around the base forecast" for electricity prices?**

A. The AmerenUE's study did not measure the uncertainty associated with a forecast of average annual electricity prices. Instead, it used measures of uncertainty for daily price changes from historical profiles. In addition, the uncertainties associated with those daily average electric prices were incorrectly estimated, resulting in too high estimates of dispersion for year-to-year variations for its 250 scenarios.

**Q. How did Ameren UE measure the uncertainty associated with the average price of electricity?**

A. The daily average price was calculated for each of the four pricing periods (Week day on-peak - 5x16, Saturday on-peak - 1x16, Sunday on-peak - 1x16 and off-peak - 7x8). For each month (January 2006 through December 2007) the standard deviation was calculated as the sum of the squared differences between the mean price for that month and the observed daily average price divided by the number of observations minus one.

**Q. Is the measure of uncertainty used by AmerenUE for daily average electricity price uncertainty the appropriate measure to use for annual average electricity price forecast uncertainty?**

A. No, it is not. While it properly measures the standard deviation of daily average electricity prices, this measure cannot be used to measure the dispersion associated with changes in average annual levels for electricity prices. As Schedule 1 indicates, using daily deviations in prices to represent deviations for annual changes in prices will significantly overestimate the amount of variation for annual price levels.

**Q. Is the standard deviation of daily average electricity price the appropriate measure to use for daily average electricity price uncertainty?**

A. No it is not. Daily average electricity prices are highly correlated with daily weather. This relationship should have been estimated and weather uncertainty should then have been used to determine the uncertainty associated with daily profiles for average electricity prices.

**Q. Do you agree with the comparison Mr. Arora makes of his results to average annual electricity prices in the Annual Average ATC Power Price table shown on his Schedule AKA-E2?**

A. No I do not. Mr. Arora is comparing oranges and apples. The data on Schedule AKA-E2 are average annual prices over time. The standard deviations used for average annual prices over time shown in this table should not be compared to a calculation of the standard deviation for daily average prices (see Mr. Arora's Schedule AKA-E1 for a summary of the results of these trials). What Mr. Arora calculated in Schedule AKA-E1 was the average annual price for the 250 iterations/trails performed for the test year along with the standard deviation for these 250 iterations. These 250 iterations of electricity prices are based on the standard deviations of daily average prices he inappropriately estimated from the 2006 and 2007 time period. He divides the standard deviation by the average from the 250 iterations, calling the result the "annual uncertainty factor." He then compares this to the annual uncertainty factor calculated from annual average prices over the period 1999 through 2007.

**Q. Why are the comparisons of the results for 250 iterations for the test year to historical prices not appropriate?**

A. These comparisons are inappropriate for several reasons. First, what drives price uncertainty within a year is totally different from what drives price uncertainty over a

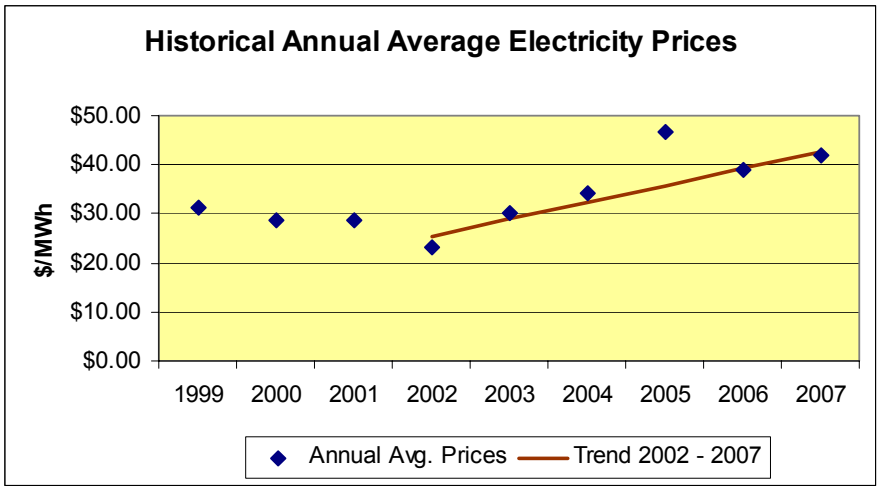
sequence of years. Specifically, within a given month, the supply curve for electricity is relatively constant as fuel costs are relatively fixed. The driver for differences in daily average prices within a month is the change in demand that is being driven by weather. However, over time, the supply curve for electricity is changing due to changes in fuel costs. While differences in demand due to differences in annual weather will contribute to the determination of average annual prices over time, it is not comparable to differences that occur within a fixed time frame when the supply curve is not changing, or is only changing in minor ways compared to changes that occur over multiple years. Moreover, there is no reason to expect the uncertainty factors within a year to be the same as those that would be measured over multiple years.

**Q. Can you give specific examples of how fuel cost drove the uncertainty factor in Schedule AKA-E2?**

A. Yes. Notice that 2005 was an exceptionally high price year. This was the result of two primary drivers, the rail problems with western coal and hurricanes Katrina and Rita. If the data from 2005 is removed from the set and the uncertainty factor is recalculated, the uncertainty factor drops significantly from 22% to 18.75%. The change is not due to weather, but is due to a major upward shift in the supply curve for electricity caused by coal supply restrictions and high natural gas prices.

In addition to eliminating the unusual shift that occurred in the supply for 2005, a plot of the data shows an upward shift in electricity prices due to costs trending upward from 2002 through 2007.

Figure 3




The following table shows the results of these prices with the unusual increase in 2005 and the upward price trends removed. These calculations show the significant difference in the standard deviation and its ratio as a percent of the average when the shifts in supply between years are removed. The standard deviation drops to less than 25% of the original and the ratio drops to about 26% of the standard deviation calculated from the observed data.

Table 1
Electricity Prices With Annual Supply Shifts Removed

| Year | Observed | Detrended |
|---|---|---|
| 1999 | $31.34 | $31.34 |
| 2000 | $28.74 | $28.74 |
| 2001 | $28.73 | $28.73 |
| 2002 | $23.19 | $25.78 |
| 2003 | $30.31 | $29.43 |
| 2004 | $34.25 | $29.90 |
| 2005 | $46.74 | $28.00 |
| 2006 | $39.01 | $27.72 |
| 2007 | $41.94 | $27.18 |
| Average | $33.81 | $28.53 |
| St Dev | $7.44 | $1.62 |
| Ratio | 22.02% | 5.68% |

Moreover, Mr. Arora's comparison mixes deviations from movements along a supply curve driven by changes in demand associated with changing weather (illustrated by the detrended data) with deviations that occur from shifts in the supply curve (illustrated by the

observed data). Had calculations similar to those presented in Table 1 been performed as a reasonableness check against the results, this error could have been avoided.

**Q. How were daily changes in observed prices used to calculate uncertainty for natural gas price?**

A. AmerenUE estimated the standard deviation of daily natural gas prices for each month during the period January 2006 through December 2007. This approach appears to be similar to what it used for electricity prices. These results were also inappropriately applied to create the 250 scenarios for each period in AmerenUE's study. Mr. Arora also compares the dispersion results of these 250 scenarios from the test year to multiple year dispersions shown on Schedule AKA-E2. As with electricity prices, this is an inappropriate comparison

## WRONG ESTIMATE OF UNCERTAINTY FOR COAL PRICES

**Q. Did AmerenUE use the same methodology for coal prices as it used for estimating the uncertainty for electricity prices?**

A. No. For coal prices, something like forecast uncertainty was calculated using forward prices as the forecasting tool for the commodity component of coal.

**Q. Is there significant profile uncertainty associated with coal prices?**

A. Because AmerenUE hedges what it pays for coal, there is not significant uncertainty associated with coal prices within any given year. The greatest uncertainty associated with coal costs are from forecasts of the prices and delivery costs for future periods.

**Q. How were forward prices used to calculate coal commodity price uncertainty?**

A. AmerenUE did not compare future price forecasts to actual prices for purposes of estimating forecasting uncertainty. Instead, AmerenUE simply calculated the standard deviation of forward prices that had occurred over the period from January 2006 through December 2007 for delivery of coal in 2009 and 2012. Daily changes in forward prices have little to due with forecast uncertainty. These changes simply reflect the daily changes in commodity traders' expectations about prices at a fixed future date. This is not the proper measure of the uncertainty surrounding a forecast of future prices.

**Q. Can you provide an example of how AmerenUE should have estimated the uncertainty associated with a one-year ahead forecast of coal prices?**

A. Yes. I will provide two such examples, one using forward prices as the forecast and a second using the United States Department of Energy's (DOE) forecasts. First, if future prices are chosen as the base forecast for price one-year ahead, the first decision is what future prices to use as the basis for the forecast. Daily futures prices are likely to be too volatile as a forecasting mechanism. AmerenUE chose to use the two-year average of daily futures prices over 2006-2007 as the basis for its forecast for 2009 coal prices. A one-year average or less of future prices would have been preferable. For example a one-year average of future coal prices from 2006 to forecast the one-year average actual coal prices for 2007 would be a one-year ahead forecast. This approach could be repeated over multiple years going back in time to determine deviations between forecasts and observed prices. A similar approach could be used using DOE's one-year ahead forecasts of coal prices and comparing them to observed prices.

These two alternatives were used as illustrations, not as the only forecasts to be considered, I recommend seeking out other forecasts for comparison; e.g., published forecasts

from various forecasting groups, and perhaps internal forecasts generated by AmerenUE. I would then compare the alternatives looking at recent forecasting accuracy, choosing the forecast that has been most accurate.

**Q. Do you also disagree with Mr. Arora's comparison of the results of the 250 scenarios/trials with the year-to-year data for coal prices on Schedule AKA-E2?**

A. Yes. As with electricity prices, AmerenUE is comparing oranges and apples. One should not compare deviations from averages within a year to deviations from the average calculated over multiple years.

**Q. Were uncertainty factors calculated for other variables?**

A. Yes. In addition to the commodity component of coal price, AmerenUE calculated uncertainty factors for the diesel fuel surcharge in a similar fashion to what it calculated for coal commodity costs. I have already addressed the methodological issues with this approach. In addition, AmerenUE witness Mr. Robert K. Neff estimated uncertainty factors for other coal price components and nuclear fuel prices. Uncertainty factors for generating unit availability were calculated by AmerenUE witness Mr. Timothy D. Finnell from the work he does on production cost simulations. I am not discussing these components in my rebuttal testimony. Finally, load uncertainty was calculated by correlating load with weather and modeling 250 monthly weather patterns. I am not addressing the accuracy of the regression models used or whether or not the appropriate weather data was used. There are other Staff experts in these areas, and to my knowledge AmerenUE did not consult with those Staff experts in its development of the load uncertainty.

## INCORRECT ANALYSIS OF CORRELATIONS AMONG VARIABLES

**Q. What correlations among uncertain variables did AmerenUE use in its study of net fuel expense?**

A. Apparently the only correlations used by AmerenUE are among loads, electricity prices and natural gas prices. AmerenUE did this by correlating daily loads, electricity prices and natural gas prices with daily temperatures using data from January 2006 through December 2007.

**Q. Do you generally agree with the correlations used by AmerenUE?**

A. For purposes of creating profiles, I agree that daily electricity prices and daily loads are highly correlated with daily weather. I also agree that monthly natural gas prices tend to exhibit a seasonal pattern, with higher prices during the winter and lower prices during the summer. I am somewhat concerned about the daily correlations within months between daily temperatures and daily gas prices. However, the results on Mr. Arora's Schedule AKA-E10 show that these have very poor correlations.

**Q. What is the purpose of the types of correlations that were used in the AmerenUE study of net fuel expense?**

A. These correlations to weather are used to model variation in patterns within a given year that are consistent. Moreover, within a given year weather variations can create different patterns in prices and loads. Using the correlations to match prices and loads to the same weather ensures that price and load patterns are not mismatched.

**Q. Did AmerenUE attempt to correlate the forecasts of the uncertain variables?**

A. No. In fact, Mr. Arora's direct testimony is that there exists no correlation among the average annual prices of coal, natural gas and electricity. He discusses this absence of correlation on pages 15 through 26.

**Q. Do you agree with AmerenUE's finding of no correlation among the price of coal, natural gas and electricity?**

A. No, I do not. AmerenUE did not correctly analyze the historical data, and used the wrong data and wrong type of analysis to measure correlations.

**Q. What evidence of lack of correlation of historical prices did Mr. Arora present?**

A. The historical prices for AmerenUE's coal and natural gas prices are presented on Mr. Arora's Schedule AKS-E5. He calculates percentage changes by year and draws arrows either up or down to show lack of correlation. This is not a proper analysis of correlation for historical prices. Instead, Mr. Arora should have plotted the prices against each other to see if there was a pattern of correlation. If he had done this, he would have seen that, except for 2005, the prices are highly correlated. I have plotted these data and they are shown on Schedules 2.A and 2.B attached to my rebuttal testimony.

**Q. What happened in 2005 to cause the correlations to deviate from the regression lines that fit the remaining data?**

A. In 2005, two major events impacted electricity markets. First, the rail problems for the Powder River Basin (PRB) coal deliveries affected coal supplies from these crucial sources of low sulfur coal. Because of this coal supply shortage, those offering electricity into the MISO energy markets increased their offer prices and to some extent lowered the amounts they were willing to burn to sell into the market, realizing that they may

be at risk for having an insufficient coal supply to meet their own native loads. In addition, with hurricanes Katrina and Rita, natural gas prices increased significantly because of a concern for lack of supply. Thus, two unexpected events affected the electricity markets, particularly through the summer and fall of 2005. This resulted in unusually high market prices for electricity compared to the increase in coal prices, and unusually high market prices for natural gas compared to electricity and coal prices. While unexpected events can, and do impact markets in unusual ways, the underlying correlation between prices was restored as shown by the graphs in Schedules 2.A and 2.B that include data from both 2006 and 2007.

**Q. Mr. Arora also pointed out the lack of correlation between delivered (hedged) coal prices and electricity prices. Do you agree with this lack of correlation?**

A. To some extent, I do agree that AmerenUE's hedged coal costs are not as highly correlated with spot-market prices for electricity, coal or natural gas. However, one would not expect for there to be as high a level of correlation between a hedged cost and spot-market costs as between spot-market prices themselves. This is because AmerenUE's and other utilities offers into the MISO spot-markets for electricity incorporate what AmerenUE calls dispatch cost. Dispatch coal costs differ from hedged coal costs as they reflect spot-market prices for fuels, while hedged coal costs are more directly related to forward coal prices. Schedule 3 attached to this rebuttal testimony shows the relationship between hedged coal costs and spot market coal costs.

**Q. What does Schedule 3 show as the relationship between hedged coal costs and spot-market coal costs?**

A. Schedule 3 shows that over the last several years, the hedged cost of coal at AmerenUE has been below the spot-market price for coal, producing significant savings for

AmerenUE's retail customers. At the same time, Schedule 3 shows that both the dollars per MMBtu of savings as well as the percent of savings varies from year-to-year. The dollars per MMBtu of savings trended up from 2003 through 2005, where it reached it highest level. While hedged coal costs appear to be correlated with spot-market prices over these three years, one would have anticipated the dollars per MMBtu of savings to max out in 2005, as this was the year when spot-market prices for coal increased dramatically because of the rail problems associated with the PRB coal. In 2006, the savings from hedging leveled off, but still stayed at a relatively high level. As the markets for coal normalized in 2007, the savings from hedging declined.

**Q. How does Schedule 3 relate to the issue of downside risk respecting net fuel costs?**

A. The most important lesson to learn from Schedule 3 is that when unexpected events drive spot-market coal prices up, hedging that price before those unexpected events occur is a prudent strategy. It may be possible that an unexpected event could also drive spot-market coal prices down, resulting in additional costs from hedging coal costs before the downturn in spot market prices. However, the recent history in coal markets does not provide any examples, and therefore, it would be difficult to find data to support estimating the probability of this occurring.

**Q. How did AmerenUE treat hedging of coal costs in its study of risk associated with net fuel expense?**

A. AmerenUE's treatment of hedged coal costs is described on pages 8 and 9 of Mr. Arora's direct testimony. For purposes of the study submitted by Mr. Arora the hedge ratios for coal cost applied to the test year were 100% and for the 2009 through 2012 years the

hedge ratios used were "the actual hedge ratios in place for those years as of February 2008." The un-hedged portion of coal costs then is subject to the same uncertainty as the spot-market for coal.

**Q. Do you agree with the approach taken by AmerenUE for treating hedged coal costs in its study of risk associated with net fuel expense?**

A. Initially, using the hedge ratios at the time the AmerenUE study was performed appears to be reasonable. However, by the time rates go into effect from this case most if not all of the coal scheduled for delivery in 2009 is hedged and the percent hedged for 2010 will have increased from what it was in February of this year. Moreover, AmerenUE has a specific schedule for hedging its coal cost, and the Commission would get a better picture of downside risk for future net fuel expense had this schedule been incorporated into the study on a forward-looking basis.

**Q. Mr. Arora devoted several pages of his direct testimony to arguing that MISO's electricity prices at AmerenUE are not correlated to AmerenUE's fuel costs. Do you agree with this argument?**

A. No. At pages 15 through 18, Mr. Arora presents reasons that he believes support the hypothesis that MISO's electricity prices at AmerenUE are not caused by the fuel costs at AmerenUE's generation facilities. Even if Mr. Arora's arguments are correct, the fact that fuel costs at AmerenUE's generation facilities do not set the electricity prices is neither a necessary nor sufficient condition for AmerenUE's fuel cost to not be correlated with MISO's electricity prices. Moreover, correlation and direct causation are different concepts.

Consider the following simple example that illustrates this difference. Utility A, like AmerenUE has the low cost, base-load generation, predominately fired by coal. Utility B has

higher cost, base-load generation, some fired by coal and some fired by natural gas. Almost always, Utility B's generation sets the market price for electricity. Thus, Utility A's generation rarely sets the market price, but benefits from the higher price by being able to sell excess generation not needed to serve its own load into the market. Suppose now the price of coal increases for both utilities. This also impacts the spot-markets for natural gas, as more generation from natural gas becomes competitive to coal-fired generation, and with the increase in demand for natural gas, natural gas prices also increase. With higher coal prices and higher natural gas prices, the price for electricity increases. Notice that while Utility A's generation still does not set the market price for electricity, its coal costs and the price it receives for sales of electricity to the market have increased, resulting in a correlation between the two without direct causation.

**Q. What would happen if the coal costs to only Utility B had increased, but not to Utility A?**

A. The direct answer to this question is that if this occurred, the correlation between Utility A's fuel costs and electricity prices would be broken. However, this hypothetical situation is not likely to occur even if Utility A and Utility B have different coal supplies. This is because the various markets for coal are not isolated for extended periods of time. Many coal-fired plants can burn mixes of various types of coal. When the spot-market price goes up for one type of coal, the lower priced coal will be substituted for the higher price coal, increasing the demand and therefore the price for the lower cost coal. While we can discuss in great detail the relationships among various markets for fuel, such discussions are theoretical, not empirical. What the Commission should look for is not theoretical arguments about whether or not MISO's electricity prices are caused by AmerenUE's fuel

costs, rather it should look at the empirical evidence of correlation such as is demonstrated in Schedules 2.A and 2.B attached to this rebuttal testimony.

**Q. Regarding empirical evidence, don't the plots on Mr. Arora's Schedules AKA-E6-2 indicate a lack of correlation between coal prices and electricity price?**

A. No, they do not. These plots show the lack of correlation between daily changes in forward prices for the PRB coal markets and electricity markets that occurred over the period January 2006 through December 2007 for delivery in 2009. Specifically, this analysis is an empirical test of the hypothesis that commodity traders in these two markets react to the same information resulting in simultaneous changes in forward prices in both markets. Mr. Arora's own direct testimony supports that this is the hypothesis being tested. At page 21, lines 8 through 12, Mr. Arora states: "If, for example, power price uncertainty and coal price uncertainty were highly correlated then we would expect information that moves power forward prices would correspondingly move coal forward prices, and vice-versa. Hence we compute our correlations using simultaneous movements in prices (i.e. price changes) to see which uncertainties are likely to have coincident high or low outcomes." I disagree with the first sentence of Mr. Arora's statement, but included it because it clearly indicates the hypothesis being tested is that information that moves electric forward prices will also move coal forward prices.

**Q. Why do you disagree with the first sentence that you have quoted from Mr. Arora's direct testimony?**

A. First, Mr. Arora's condition of correlation between electricity price uncertainty and coal price uncertainty is misplaced by looking at changes in forward prices over time. Instead and as stated previously in my rebuttal testimony, the time period of the forecast

should be fixed and uncertainty with respect to a fixed time forward should be estimated by looking at the deviations of the forecasts from observed levels for the variable, not by looking at changes in forward prices through time. Thus, Mr. Arora uses the wrong data and is measuring the wrong type of uncertainty. Second, the hypothesis tested by Mr. Arora is not that price uncertainty in the two markets are correlated, the hypothesis is that over time, traders in these two markets act simultaneously in the same way with the same information. Mr. Arora's analysis proves that hypothesis to not be supported by the data, but that in itself does not prove that the spot-market prices for electricity and coal are not correlated, nor does it prove that forecasts of the spot-market prices for electricity and coal are not correlated. Moreover, while the hypothesis that, over time, traders in these two markets act simultaneously in the same way with the same information might be a sufficient condition for spot-market prices for electricity and coal or forecasts of these spot-market prices to be correlated, it is not a necessary condition.

**Q. Why is it not a necessary condition for coal and electricity spot-markets to be correlated that traders in futures markets act simultaneously in the same way with the same information?**

A. I have already presented in this rebuttal testimony clear empirical evidence of the correlation between spot-market prices for coal and electricity. Forward prices must converge to spot-market prices as the period forward approaches real time. In the same way, the uncertainty surrounding these forecasts must narrow as the period forward approaches real time. Imposing the condition on futures prices that are two to three years away from the future date does not recognize the fact that uncertainty is greater the further away the forecast is from real time.

Finally, I most strongly disagree with the fundamental basis for Mr. Arora's test of correlation for spot market prices – the correlation of forward price changes two to three years out from the date of the spot market as a necessary condition for there to be correlation between prices in the spot markets. Mr. Arora's test does not recognize the possibility that by looking two to three years out from the date of the spot market, forward price changes in one market can be in a sequence that does not match the sequence of forward price changes in the other market, and yet these forward prices converge to spot market prices that are correlated. Moreover, as is evidenced by the data in this case, different patterns of forward price changes two to three years out from the date of the spot market, that do not appear to be correlated, do converge to spot market prices that are correlated.

**Q. Yet, doesn't AmerenUE's analysis provide strong evidence that we should not expect price forecasts for coal price and electricity price to be correlated?**

A. No. Instead AmerenUE's test of a hypothesis related to the behavior of participants in the electricity and coal futures markets simply eliminates one of many possible ways in which price forecasts could be correlated. However, the hypothesis tested by AmerenUE provides a highly unlikely way for coal and electric price forecasts to be correlated. In addition, it only looks at one possible type of forecast that uses forward prices. Ultimately, the Commission should look at the evidence that shows spot-market prices among coal, electricity and natural gas are highly correlated, and ask what is the value of forecasts that do not recognize this fact? Apparently, the forecasts and the uncertainty related to those forecasts used by AmerenUE in its study did not take this correlation into account.

**Q. What are the implications of the high level of correlation among spot-market prices for coal, natural gas and electricity?**

A. Just as the high level of correlations of load, electricity price and to a lesser extent, natural gas prices to weather are used to construct consistent scenarios for the profiles of these variables, the high level of correlation of electricity, coal and natural gas spot-market prices should have been used to construct scenarios for forecasts of their average annual levels. The issue here is **consistency**. Instead, AmerenUE took the position that no such correlations existed, used the wrong analysis to measure uncertainty and did not incorporate any consistency in its base forecasts and the uncertainty surrounding these forecasts in its study.

## RESULTS DO NOT MEET A SANITY CHECK

**Q. Did AmerenUE set out all of the scenarios involving uncertain variables to be analyzed?**

A. It appears that they did. But I have significant concerns with what is shown as the results of these scenarios. For example, on Mr. Arora's Schedule AKA-E1, is a table showing a summary of the results for 250 scenarios developed for electricity prices and natural gas prices for the test year and for 2009 through 2012. These results are intended to show consistency among the various years having almost identical uncertainty factors within each year and with decreasing standard deviations in the out years. But in this instance, sameness in results across years is a major problem.

**Q. Why is having the same or nearly the same uncertainty factors across the various years a major problem?**

A. Due to increasing uncertainty associated with forecasts, one would expect the uncertainty of the forecasts to increase over time. While the uncertainty factors for profiles within each year should be the same, as they are correlated to the same uncertainty in weather,

when these profiles interact with increasing uncertainty related to forecasts, the overall result should have been an increase in standard deviations over time, which would result in higher uncertainty the further out the forecasts.

Specifically, in the test year, there is no forecast uncertainty, and the only uncertainty that should have been in the results is the uncertainty resulting from weather as it relates to the power prices and natural gas prices. Yet, the uncertainty factor for electricity price in the test year is actually higher than for 2009. While this in part might be a result of a lower average price in the test year compared to 2009, the uncertainty factor in the test year is significantly too high for variations in the annual average price of electricity simply due to changes in weather scenarios. Comparing the 10% and 90% strata means to the overall average results for the test year show an average annual price variation from the overall mean of +34% and -38%. In essence, the test year should represent a case with changes in demand from weather variation, but minimal changes in supply. This level of variation in the annual average price for the MISO electricity markets is simply too high from changing profiles that should have been driven by changing weather.

In addition both the standard deviations and the uncertainty factors for electricity price for 2009 and 2010 are higher than for 2011 and 2012. This is not possible with correct modeling that incorporates higher load forecast uncertainty the further out the forecast. Bottom line, the results of the scenarios generated do not meet a basic check for reasonableness.

**Q. Can you illustrate the problem associated with the results from AmerenUE's generation of scenarios for the test year?**

A. Yes. In AmerenUE's previous rate case I performed an analysis of monthly on-peak electricity prices in which the trend was removed from monthly average on-peak prices over the period from 2003 through 2006. Removing the trend from this data is equivalent to removing the impact that a changing supply curve from year-to-year has on these prices. Using that same data, I then calculated the mean (average annual price) and standard deviation over the four years. The results of these calculations are shown on Schedule 4 attached to this rebuttal testimony. While this is a small sample compared to those in Schedule 1 for weather variations, it does provide an order of magnitude for the price variations against which to check the results of AmerenUE's results for the test year. In this calculation, the ratio of the standard deviations to the mean is 5.09%, significantly lower than the 26% from AmerenUE's results for the test-year. As a check against this calculation, I repeated the calculations for the observed data from the four years period that includes the shifts that occurred in the supply curve for electricity. The result is a ratio of the standard deviation to the mean of 20.97%, a significant increase, yet still below the results AmerenUE reports for the test year. Moreover, including the supply shifts that occurred over a four-year period is analogous to the including the uncertainty that is introduced by something akin to a four-year forecast, except in this case the unexpected events of 2005 have been introduced into the forecast uncertainty. My conclusion from these calculations is that the variability included for the test year in the AmerenUE study are of an order of magnitude five (5) times larger than what I would have expected.

**Q. Did AmerenUE run a production cost model to determine the level of net fuel costs associated with each scenario?**

A. Yes. The results of these runs are shown on Mr. Arora's Schedule AKA-E11. Mr. Arora presents an analysis of these results on pages 28 through 33 of his direct testimony.

**Q. Do you agree with Mr. Arora's analysis of these net fuel results?**

A. If faced with the same results, my analysis of those results would be similar to that presented by Mr. Arora. Having said that I don't disagree with Mr. Arora's analysis of the results should in no way be taken to mean that I agree with the results or what the results have to say about the downside risk faced by AmerenUE for net fuel costs. For example, Table 2 on page 31 of Mr. Arora's direct testimony indicates a significant risk in net fuel cost for the test year due to the uncertainty attributed to electricity prices as reflected in significant variation in revenues for off-system sales. But recall, AmerenUE used the wrong measure for the variability in electricity prices, and the results on Mr. Arora's Schedule AKA-E1 show greater variability in electricity prices for the test year than for any of the forecasted years of 2009 through 2012. The test year should have only contained variability in the various profiles, with no variability associated with the forecast of average annual levels. Thus, while Mr. Arora's analysis of the results is correct, the conclusions are wrong for the test year because the variability introduced into the test year is wrong.

**Q. What are your conclusions upon reviewing the AmerenUE study of risk related to net fuel expense?**

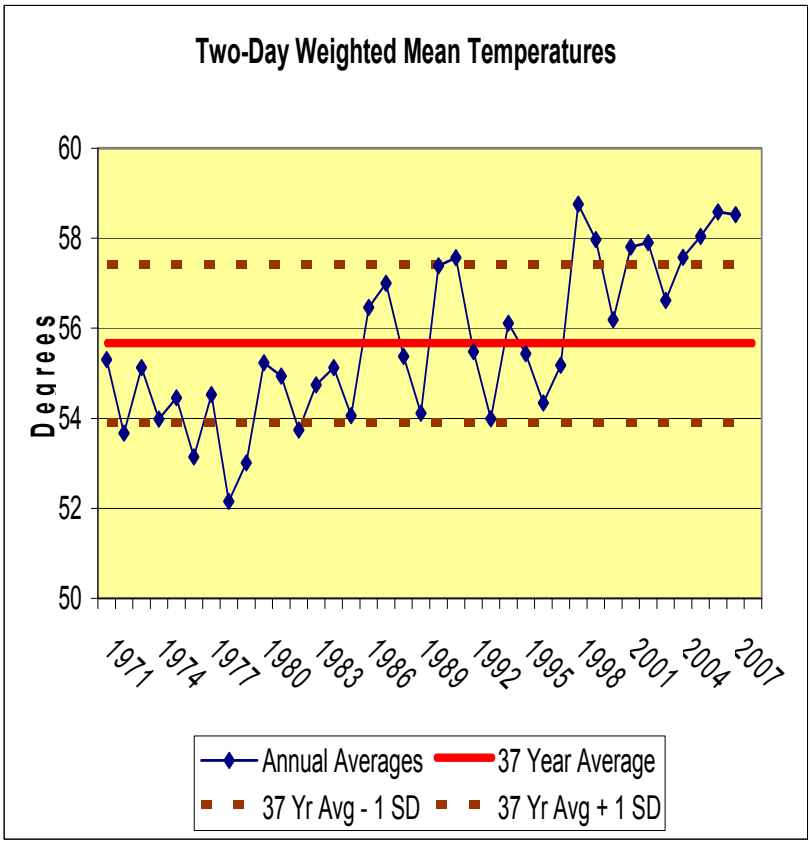
A. The concept of the study is sound, but the implementation contained major flaws that likely increased the variability in the 250 scenarios by a factor of five times. This is not a minor flaw; instead it so critical that the results of the study cannot be relied upon. Therefore, I recommend that the Commission find that the AmerenUE risk assessment study for net fuel expense does not provide a basis for support of AmerenUE's request for a FAC.

**Q. Does this complete your rebuttal testimony?**

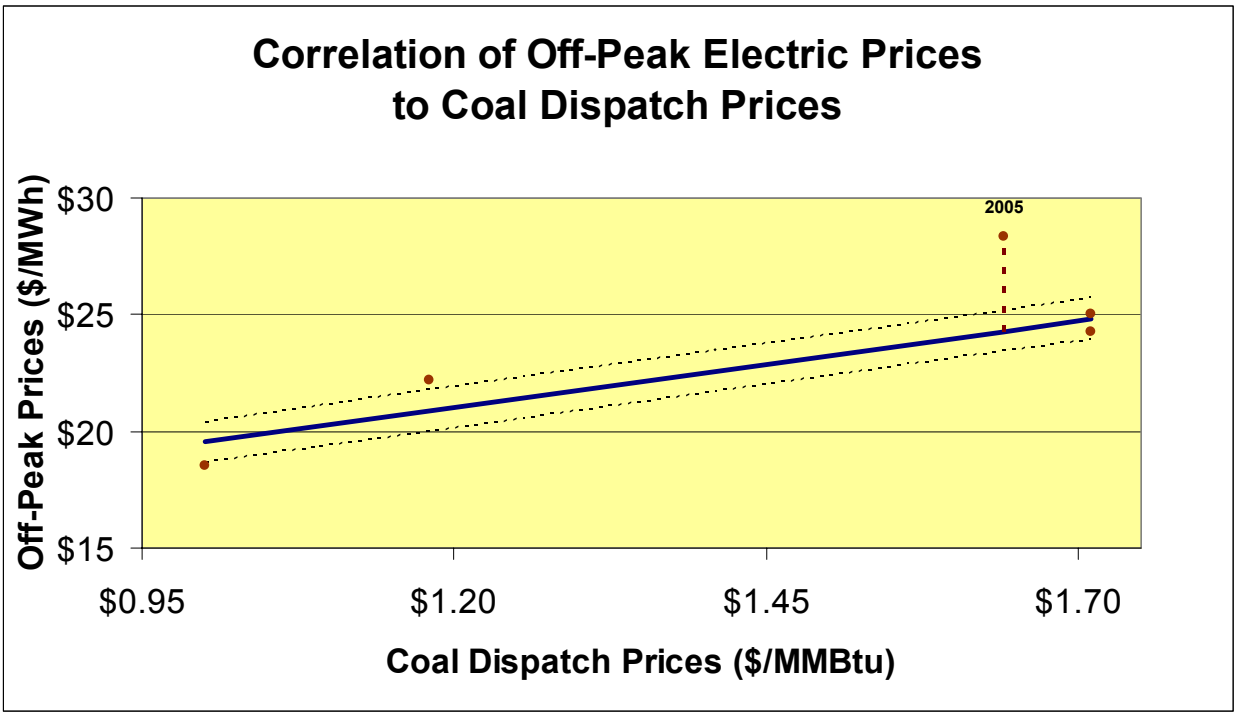
A. Yes, it does.

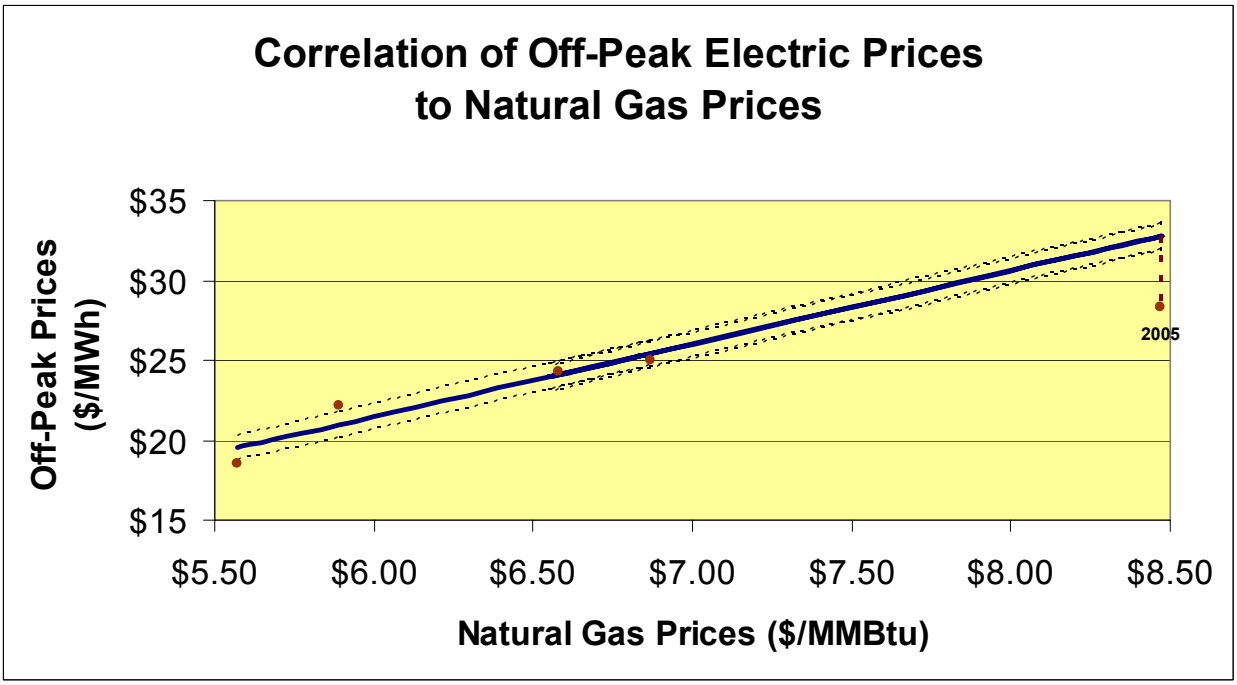
# Annual Averages for Two-Day Weighted Daily Mean Temperatures

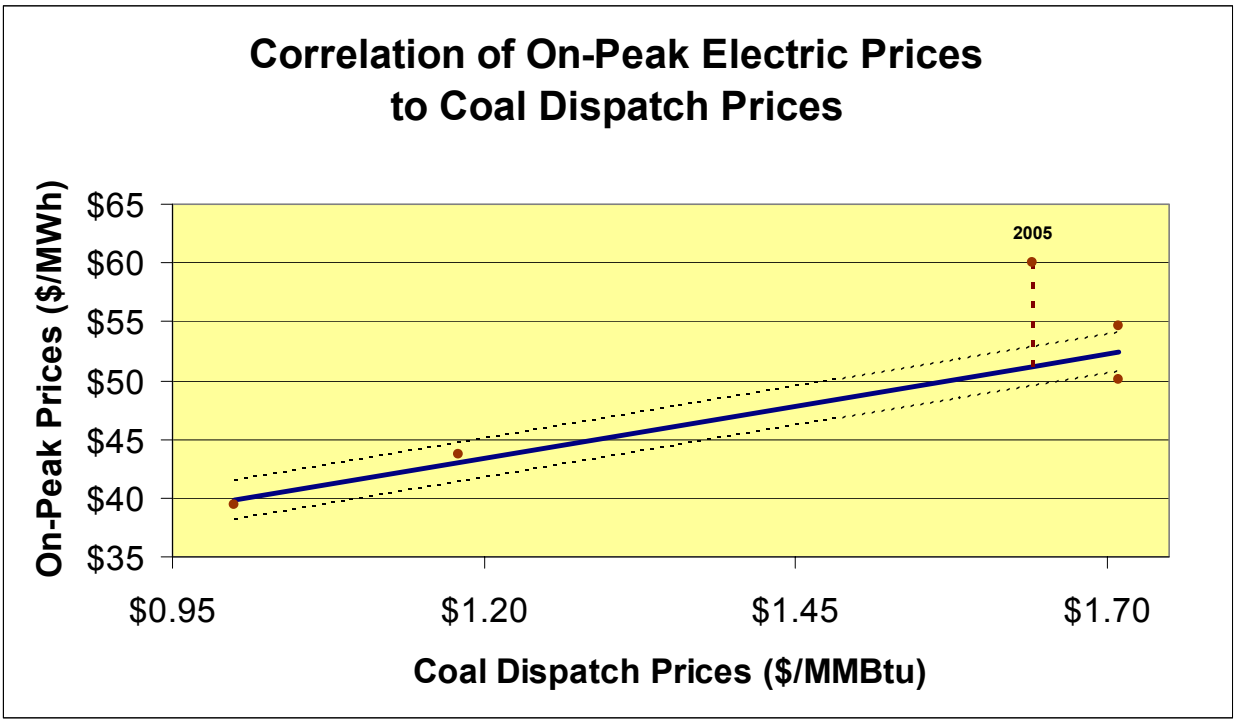
| Year | Annual Average | Profile Std Dev | Ratio |
|---|---|---|---|
| 1971 | 55.31 | 18.94 | 34.25% |
| 1972 | 53.67 | 19.43 | 36.21% |
| 1973 | 55.12 | 18.34 | 33.27% |
| 1974 | 53.98 | 18.00 | 33.35% |
| 1975 | 54.45 | 18.80 | 34.52% |
| 1976 | 53.14 | 18.91 | 35.58% |
| 1977 | 54.52 | 21.80 | 39.98% |
| 1978 | 52.15 | 21.69 | 41.58% |
| 1979 | 53.01 | 21.75 | 41.04% |
| 1980 | 55.24 | 21.01 | 38.03% |
| 1981 | 54.94 | 18.60 | 33.85% |
| 1982 | 53.74 | 19.95 | 37.12% |
| 1983 | 54.74 | 21.36 | 39.02% |
| 1984 | 55.13 | 19.20 | 34.82% |
| 1985 | 54.06 | 20.52 | 37.96% |
| 1986 | 56.46 | 18.92 | 33.51% |
| 1987 | 57.00 | 18.24 | 32.00% |
| 1988 | 55.38 | 20.22 | 36.52% |
| 1989 | 54.11 | 20.18 | 37.30% |
| 1990 | 57.39 | 17.23 | 30.02% |
| 1991 | 57.57 | 19.36 | 33.63% |
| 1992 | 55.48 | 16.27 | 29.32% |
| 1993 | 53.99 | 19.06 | 35.31% |
| 1994 | 56.11 | 18.58 | 33.11% |
| 1995 | 55.44 | 19.47 | 35.11% |
| 1996 | 54.34 | 19.72 | 36.29% |
| 1997 | 55.18 | 18.84 | 34.14% |
| 1998 | 58.75 | 18.04 | 30.71% |
| 1999 | 57.97 | 17.74 | 30.60% |
| 2000 | 56.19 | 19.60 | 34.88% |
| 2001 | 57.81 | 18.44 | 31.89% |
| 2002 | 57.90 | 18.48 | 31.91% |
| 2003 | 56.61 | 18.50 | 32.67% |
| 2004 | 57.57 | 17.78 | 30.89% |
| 2005 | 58.04 | 19.00 | 32.74% |
| 2006 | 58.59 | 17.40 | 29.70% |
| 2007 | 58.52 | 19.88 | 33.97% |
| **Average** | **55.67** | **19.17** | **34.51%** |
| **Std Dev** | **1.76** | | |
| **Ratio** | **3.17%** | | |
| **Max** | **58.75** | **21.80** | **41.58%** |
| **Min** | **52.15** | **16.27** | **29.32%** |

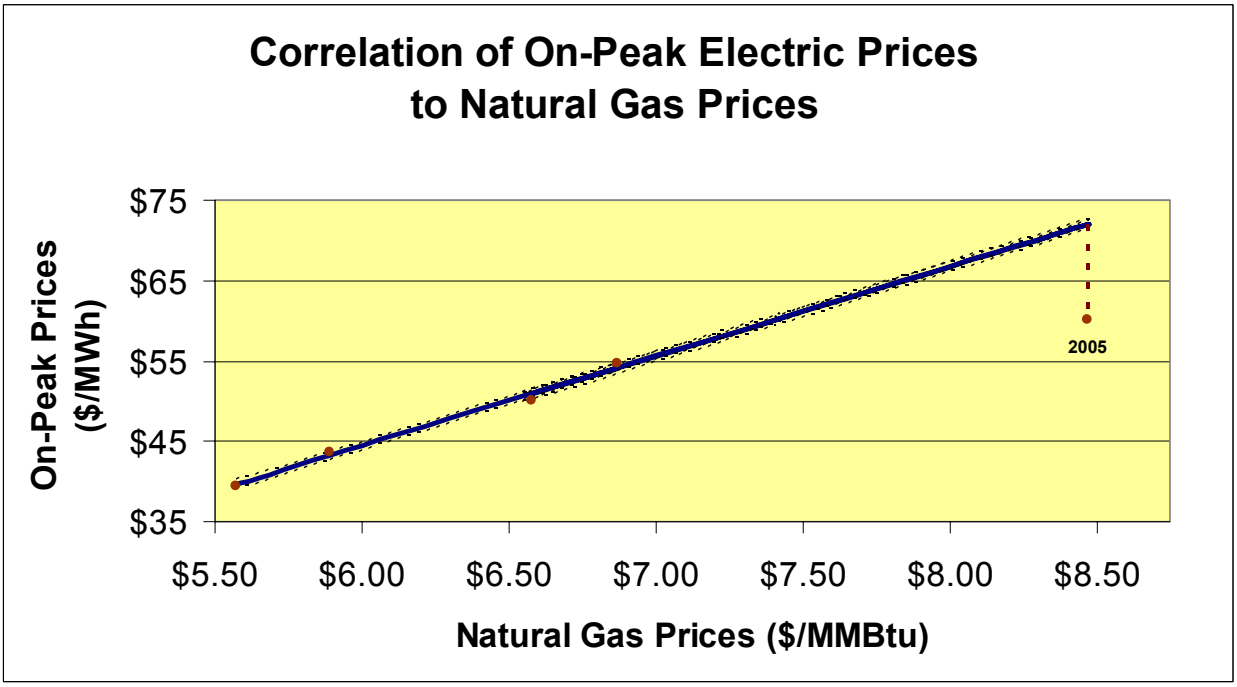


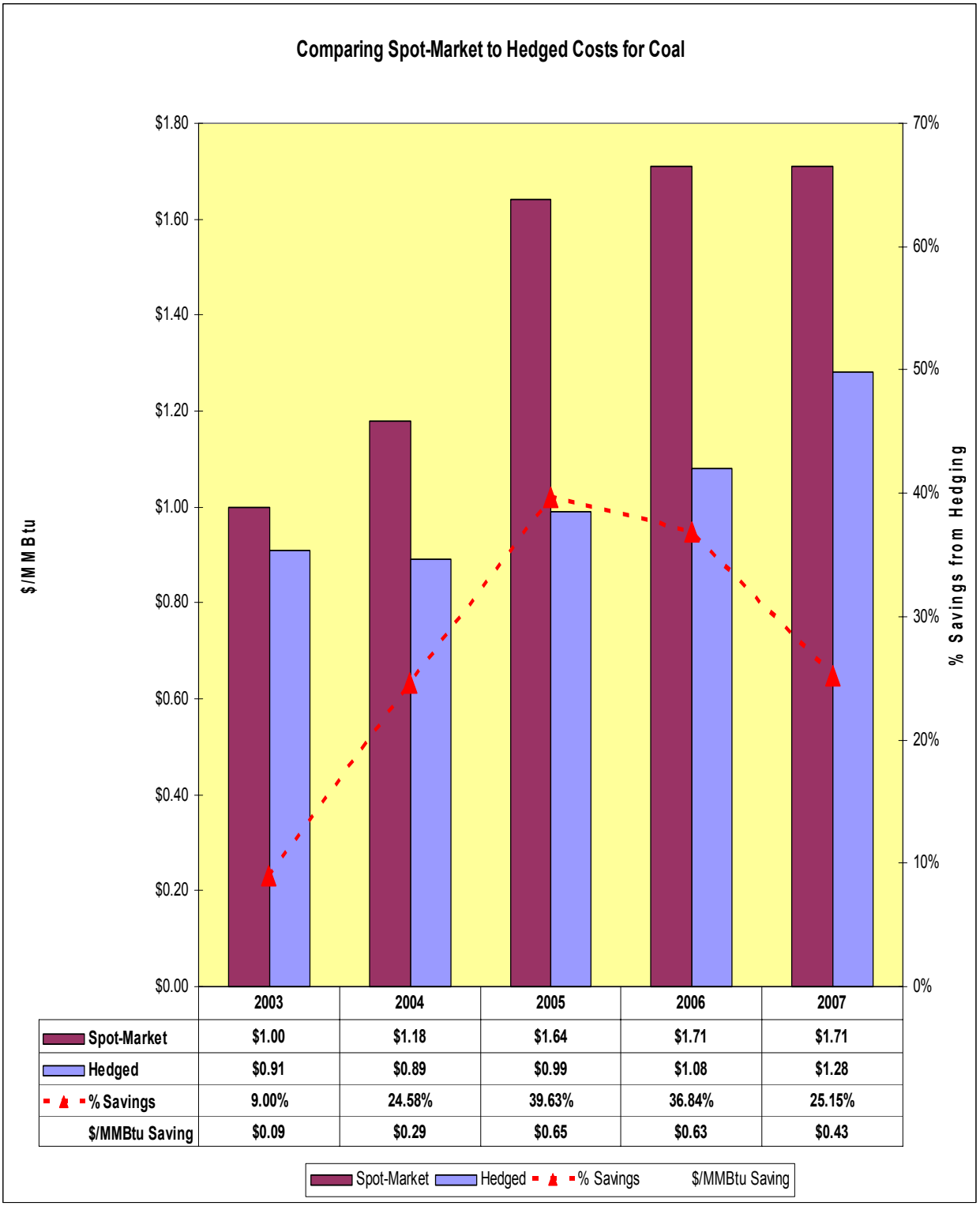

**Schedule 1**


Correlation of Off-Peak Electric Prices
to Coal Dispatch Prices
Off-Peak Prices ($/MWh)
$30
$25
$20
$15
2005
$0.95
$1.20
$1.45
$1.70
Coal Dispatch Prices ($/MMBtu)


Correlation of Off-Peak Electric Prices
to Natural Gas Prices
Off-Peak Prices
($/MWh)
$35
$30
$25
$20
$15
2005
$5.50
$6.00
$6.50
$7.00
$7.50
$8.00
$8.50
Natural Gas Prices ($/MMBtu)


Correlation of On-Peak Electric Prices
to Coal Dispatch Prices
On-Peak Prices ($/MWh)
$65
$60
$55
$50
$45
$40
$35
2005
$0.95
$1.20
$1.45
$1.70
Coal Dispatch Prices ($/MMBtu)


Correlation of On-Peak Electric Prices
to Natural Gas Prices
On-Peak Prices
($/MWh)
$75
$65
$55
$45
$35
2005
$5.50
$6.00
$6.50
$7.00
$7.50
$8.00
$8.50
Natural Gas Prices ($/MMBtu)




| | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|
| Spot-Market | $1.00 | $1.18 | $1.64 | $1.71 | $1.71 |
| Hedged | $0.91 | $0.89 | $0.99 | $1.08 | $1.28 |
| % Savings | 9.00% | 24.58% | 39.63% | 36.84% | 25.15% |
| $/MMBtu Saving | $0.09 | $0.29 | $0.65 | $0.63 | $0.43 |

**Schedule 3**

**Detrended On-Peak Monthly Average Prices**

| Month | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|
| Jan | $46.03 | $59.86 | $53.76 | $38.28 |
| Feb | $61.57 | $59.51 | $46.77 | $35.46 |
| Mar | $64.24 | $56.88 | $51.95 | $40.12 |
| Apr | $57.15 | $56.93 | $50.52 | $49.06 |
| May | $45.74 | $65.90 | $33.97 | $44.68 |
| Jun | $46.89 | $57.48 | $59.98 | $57.74 |
| Jul | $56.82 | $55.94 | $66.78 | $72.35 |
| Aug | $63.31 | $50.17 | $76.06 | $76.98 |
| Sep | $47.75 | $48.27 | $67.55 | $43.06 |
| Oct | $47.83 | $53.06 | $65.78 | $49.15 |
| Nov | $47.63 | $53.16 | $46.34 | $55.01 |
| Dec | $52.64 | $49.19 | $71.23 | $52.68 |
| Averages | $53.13 | $55.53 | $57.56 | $51.21 |
| St Dev | $7.13 | $5.08 | $12.36 | $12.89 |
| Ratio | 13.42% | 9.14% | 21.48% | 25.16% |

| Year | Averages |
|---|---|
| 2003 | $53.13 |
| 2004 | $55.53 |
| 2005 | $57.56 |
| 2006 | $51.21 |
| Average | $54.36 |
| St. Dev | $2.77 |
| Ratio | 5.09% |

**Observed On-Peak Monthly Average Prices**

| Month | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|
| Jan | $44.39 | $44.64 | $50.37 | $48.94 |
| Feb | $54.54 | $44.61 | $45.35 | $44.83 |
| Mar | $53.47 | $42.35 | $52.56 | $47.71 |
| Apr | $43.89 | $42.85 | $53.17 | $54.42 |
| May | $30.93 | $52.36 | $38.61 | $47.47 |
| Jun | $31.18 | $44.61 | $66.49 | $57.74 |
| Jul | $40.68 | $43.89 | $74.97 | $69.54 |
| Aug | $47.04 | $39.12 | $85.68 | $71.61 |
| Sep | $31.55 | $38.39 | $78.26 | $35.67 |
| Oct | $31.81 | $44.55 | $77.19 | $40.70 |
| Nov | $31.84 | $46.19 | $58.01 | $46.92 |
| Dec | $37.13 | $43.94 | $82.65 | $46.95 |
| Averages | $39.87 | $43.96 | $63.61 | $51.04 |
| St Dev | $8.79 | $3.51 | $15.90 | $10.72 |
| Ratio | 22.05% | 7.98% | 25.00% | 21.01% |

| Year | Averages |
|---|---|
| 2003 | $39.87 |
| 2004 | $43.96 |
| 2005 | $63.61 |
| 2006 | $51.04 |
| Average | $49.62 |
| St. Dev | $10.41 |
| Ratio | 20.97% |

**Schedule 4**