Exhibit No.:	
Issues:	Fuel Expense
Witness:	Michael L. Rahrer
Sponsoring Party:	MO PSC Staff
Type of Exhibit:	Direct Testimony
Case No.:	ER-2007-0002
Date Testimony Prepared:	December 15, 2006

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

DIRECT TESTIMONY

OF

MICHAEL L. RAHRER

UNION ELECTRIC COMPANY d/b/a AMERENUE

CASE NO. ER-2007-0002

Jefferson City, Missouri
December 2006

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-2007-0002

AFFIDAVIT OF MICHAEL L. RAHRER

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Michael L. Rahrer, of lawful age, on his oath states: that he has participated in the preparation of the following Direct Testimony in question and answer form, consisting of 14 pages of Direct Testimony to be presented in the above case, that the answers in the following Direct 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 L. Rahrer

Subscribed and sworn to before me this 14th day of December, 2006.

State of FL, County of Palm Bch.
Signed before me on this 14 day
of Dec, 06 by Michael L. Rahrer
DL# FL R660552513800
Notary Public

MASHALLAH C. ZADE
Notary Public - State of Florida
My Commission Expires Jan 2, 2008
Commission # DD247149
Bonded By National Notary Assn.

My commission expires

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DIRECT TESTIMONY

OF

MICHAEL L. RAHRER

UNION ELECTRIC COMPANY d/b/a AMERENUE

CASE NO. ER-2007-0002

Q. Please state your name and business address.

A. Michael L. Rahrer, 4415 Sherwood Forest Drive, Delray Beach, Florida 33445

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

A. I am employed by The Emelar Group, Inc. I am the owner of this company.

Q. Please describe your educational and work background.

A. I received a Bachelor of Science degree in Computer Science in June 1973 from Virginia Polytechnic Institute (Virginia Tech). After college, I was employed for several years by CACI (Arlington, Virginia) where I worked on various consulting assignments for the Federal Energy Administration (FEA), the predecessor agency to the Department of Energy. These assignments were my initiation into fuel and electric generation. In 1976, I was a cofounder of CEXEC, a company initially formed to consult in the energy sector. I left that company in 1980 to pursue a career as an independent consultant. In 1983, I teamed with another company to develop a set of models for the electric utility industry. The first model was the System Generation model, a production cost model, the second was the Revenue Requirements model and the final model was the Capacity Expansion model. The original models were designed for the Apple IIe personal computer. As personal computer power increased, the models were migrated to the IBM PC and enhanced. I remained involved in all phases of development of the System Generation model that was eventually renamed Real

Time ®. I acquired all rights to the model in 1997 and currently market and maintain the model.

Q. How are you involved in the Union Electric Company, d/b/a AmerenUE (AmerenUE), Case No. ER-2007-0002?

A. I have been hired as a consultant by the Missouri Public Service Commission Staff (Staff) to assist in the development of an electric RealTime production costing model database for the AmerenUE system, to benchmark the RealTime model's output to AmerenUE's model (PROSYM) output and to explain how Staff assumptions affect the model output.

Q. Have you filed testimony in previous cases before this Commission?

A. Yes, in The Empire District Electric Company rate case, Case No.ER-2002-0424

Q. What is the purpose of your testimony in Case No. ER-2007-0002?

A. The purpose of my testimony is to present the results of the Staff's electric production cost model simulations that were run in this case to establish the amount of normalized variable fuel and purchased power cost for AmerenUE for the test year ending June 30, 2006.

Executive Summary

Q. With reference to Case No. ER-2007-0002, what matters will this direct testimony address?

A. This direct testimony will provide information on the benchmark model run made by the RealTime model and information concerning the changes that were made to that model to accommodate the Staff's new data values and assumptions. RealTime's capabilities as they relate to the AmerenUE modeling requirements will be discussed. Output from both the benchmark run and the Staff model run will be discussed. Finally, conclusions will be offered regarding the calibration of the RealTime model to the AmerenUE model output.

Q. What is a production cost model?

A. A production cost model is a computer program used to simulate a utility's generation and power contracts. The model determines energy costs and fuel consumption necessary to economically meet a utility's load and contracts.

Method Used to Determine Fuel and Purchased Power Expense

Q. What model did you use?

A. The RealTime production cost model was used.

Q. Can you briefly describe RealTime?

A. RealTime is a model used to perform hour-by-hour chronological simulations of a utility's generating assets to determine energy costs, fuel consumption, purchase and sales amounts and emission output. As a true chronological, hour-by-hour model, RealTime has the ability to produce hourly reports showing exactly how it dispatches units and performs its other various functions.

Q. What is meant by an "hour-by-hour" chronological model?

A. An hour-by-hour model solves each hour's need, with serving load as the primary need, before moving to the next hour. A chronological model is one that handles each hour in sequence. For example, hour six (6) on January 19 is processed and then hour seven (7) for January 19 is processed. This process continues until every hour in the study period is processed sequentially, first hour to the last hour. In RealTime, a study can start on any day and proceed for a period as short as one day or as long as 30 years.

Q. Briefly summarize the results of the production cost model simulation.

A. The results of the production cost model simulations, as shown in Schedule 1 show that the estimated base amount of annual variable cost of fuel and net purchased power is $624,454,340. These amounts were supplied to Staff witness John Cassidy, who used this input in the annualization of fuel expense. The revenues resulting from interchange sales calculated by the RealTime model are $542,629,900. For further discussion of how Staff annualized the overall fuel expense and interchange revenues in this case, please see Staff witness John Cassidy's direct testimony. The revenue from sales calculated by the model is $542,629,900.

Q. What steps did you perform to create a RealTime production cost model simulation run?

A. I analyzed the AmerenUE data submitted in AmerenUE witness Tim Finnell's work papers to develop the input that the RealTime model requires. Next I ran the RealTime model to meet the hourly requirements. I then compared the model's output to the AmerenUE model results. This comparison is commonly referred as benchmarking.

Q. Please describe in general the input data required by the RealTime production cost model.

A. The RealTime production cost model, requires fuel prices, unit generating parameters, hourly load, and other energy generating resource information such as hydro units and pumped storage units. It also requires information on purchased power market prices and availability, and energy purchase and sales contract information.

Benchmarking

Q. Did you benchmark the RealTime production cost model against AmerenUE's production cost model?

A. Yes, I did.

Q. Why is benchmarking RealTime to the AmerenUE model important?

A. It is important in establishing the validity of the RealTime production cost model In this case benchmarking was done by first creating a RealTime production cost model using AmerenUE's assumptions and comparing the results from the model with the results obtained by the AmerenUE production cost model.

Q. What sources of information did you use in this production cost model simulation benchmark?

A. Information was obtained from AmerenUE data request responses and work papers.

Q. Can the RealTime production cost model handle all of the data inputs and processes defined for the AmerenUE production cost model?

A. Yes. RealTime's fuel module allows both a dispatch and an accounting cost for fuels. Fuel cost inputs can be constant or can vary over time, as frequently as hourly. Fuel blends and fuel contracts can also be modeled. RealTime's load module can handle hourly load data (and groups of hourly load called classes) and can create hourly load from monthly energy and peak values, given a historic hourly load curve. RealTime's contract power module can handle purchase and sale contracts.

The hydro module can handle run-of-river and pondage hydro units. Run-of-river hydro can be dispatched or base loaded. RealTime's pumped storage module can simulate pumped storage units and its load control module can determine the effects of load control programs.

RealTime also has a capacity expansion module that allows the user to study the impact of adding more generating units. RealTime can also simulate reserves and determine marginal costs by a variety of methods. In short, RealTime has the ability to model every defined aspect of the AmerenUE benchmark.

Q. How did the results of the RealTime production cost model benchmark run compare with the AmerenUE production cost model run?

A. A comparison of RealTime production cost model run and AmerenUE's production cost model benchmark run is provided in Schedule 2. Overall, the results of the RealTime production cost model run compared favorably with that of AmerenUE's production cost model.

Q. Please describe your comparison results.

A. I compared total generation output, total cost of production and heat input values.

Overall, RealTime reported a total of 39,872,736 megawatthours (MWh) compared to AmerenUE's value of 39,874,000 MWh. AmerenUE reported this value in gigawatthours (GWh), so the difference is most likely from rounding. The total net system input was 39,872,731 MWh. RealTime's production cost model output was only 5 MWhs higher than total net system input.

When comparing generation output on a coal plant by coal plant basis, the largest difference between the RealTime production cost model generation output and AmerenUE's production cost model generation output was 0.76%. Generation output by the four largest coal plants in AmerenUE's generation resources showed only a 0.32% difference between the two production cost models.

The RealTime model purchased approximately 24,000 more MWh, than did AmerenUE's model. This result is only 1.6% greater than AmerenUE's model. The RealTime model reported a total cost of $302,686,690 for the benchmark run. This compares favorably to AmerenUE's model which reported $307,470,000.

The two models were within 0.15% of each other when comparing cost of coal plant generation. The largest cost percentage difference among the coal units was 0.57%. The largest cost differences between the two models were in purchases and sales. The RealTime model purchased power cost was $5,398,141, (21% more than AmerenUE's model) and the RealTime model income from sales was $8,699,491 (2.7% higher than AmerenUE's model sales income.) RealTime's model overall heat input BTU consumption was within 0.074% of AmerenUE's heat input BTU consumption. The largest percentage difference between RealTime model heat input and AmerenUE's model heat input is 0.55%.

Q. What information did you use for unit forced outages?

A. I used forced outage information supplied in AmerenUE witness Tim Finnell's workpapers. This data contained six years of outage history for each unit. The RealTime model used this data to create forced outages for each of the coal units.

Q. Did you compare RealTime's production cost model unit outage results with AmerenUE's production cost model unit outage results?

A. Yes. See Schedule 3 for that comparison.

Q. What is your analysis of this comparison?

A. I compared the outage hours reported by AmerenUE production model results against those reported by the RealTime production model results. Because of the differences in outage hours the coal units were slightly more available in the RealTime production cost model than in AmerenUE's production cost model; consequently RealTime had 140,000 MWh's more generation.

Q. What other type of unit outages are simulated in the RealTime production model?

A. The RealTime production model simulated planned outages for each unit. A planned outage is an expected outage and may be either a full or a partial outage which is planned at a certain time and date by management. The planned outages in the simulation are all full outages. Planned outages begin and end dates were obtained from AmerenUE workpapers.

Q. Do you know of any other unit related factors, not accounted for, that might affect the benchmark comparisons?

A. No. The important elements which effect the simulations the most are unit availability (outages) and the heat rate curves.

Q. What fuel cost data was used in benchmarking RealTime?

A. All fuel cost data for the benchmarking was obtained from data submitted by AmerenUE. A fuel dispatch cost and a fuel accounting cost were provided for all coal units. The fuel dispatch cost is used in the decision to dispatch units; the fuel accounting cost is used to compute fuel cost in the final model output.

Q. How did the RealTime production cost model simulate purchase power contracts?

A. The RealTime production cost model simulates both fixed purchase contracts and economic purchase contracts.

Q. Please describe each type of purchase contract used in the simulation.

A. A fixed purchase contract is a purchase that must occur regardless of price. The AmerenUE simulation includes one semi-fixed purchase contract named, in RealTime, APL FIXED. AmerenUE purchases a fixed number of megawatt (MW) from this contract every hour of the year for a fixed price, unless purchasing the power would cause one of the major units to fall below its minimum capacity.

An economic purchase contract is one under which the model will purchase energy when it is cheaper to do so than to generate it internally. The simulation has one such purchase contract. The maximum amount that can be purchased by the model simulation is limited each hour to 1000MW. A threshold price is used to enable the model's decision as to when to purchase the energy in any particular hour. If the model can generate power internally at a price less than or equal to the threshold price, it will generate the power. If it cannot generate power at or below the threshold price, it will purchase the power. If it purchases the power, the model can then be charged the threshold price per MW. The hourly threshold price was provided by AmerenUE in and is called the forward price curve (FPC) market value.

Q. Please describe how the RealTime production cost model simulates sales contracts in this case.

A. The RealTime production cost model simulation in this case has two economic sale contracts. An economic sale will occur if the system has surplus power that can be produced at or below a specified hourly threshold price. As previously noted, the hourly threshold price was provided by AmerenUE and is called the FPC market value in this case. The maximum sale amount is set for each hour at 1500MW off-peak and 2000 MW on-peak. After the model meets the native requirement, the model looks for a sale contract opportunity. If the model can generate power at or below the threshold price, the sale will take place, up to the maximum allowed sale amount.

The model has several methods of charging for sales. Once the sale occurs, the sale can be billed at the cost of generation (i.e., at cost), it can be billed at the threshold price or it can be billed at a specified third-party cost. When the model is set to sell the power at cost, the exact cost of generating the sales power can be determined. I ran the model to charge sales at the threshold price. The results included in Schedule 4 reflect the model billing the sales at the threshold price, the FPC market value. The AmerenUE simulation also includes another economic sales contract identical to the first, with two exceptions. This contract has a maximum sale amount of 500MWper hour and has a 50% forced outage rate.

Q. Does the production cost model simulation include hydro units?

A. Yes. The production cost model simulation includes two hydro units. Keokuk is a run-of-river hydro unit that produces a fixed amount of generation every hour, based on the month of the year. Osage is a pondage (storage) hydro unit that can generate based on demand. The RealTime production cost model distributes this generation during higher load hours. The total hydro generation in the RealTime model simulation is only 313 MWH more

(0.02%) than the hydro output from AmerenUE's model simulation. The difference between the two simulations is most likely due to rounding.

Q. Please describe other sources of generation used in this production cost model simulation.

A. The production cost model simulation includes a pumped storage facility named Taum Sauk. Taum Sauk is a pumped storage system that stores energy during low load periods and releases it during high load periods. RealTime simulated the Taum Sauk facility with essentially the same settings used by AmerenUE and generated within 2,173 MWh (0.87% difference) of the AmerenUE production cost model output.

Q. Are you satisfied with the benchmark technique you have used to compare the RealTime production cost model with AmerenUE's production cost model?

A. Yes, I believe I have created an accurate RealTime production cost model with the supplied information. The results from that model are extremely close to the results provided by AmerenUE's model. However, if the goal is to get an accurate, realistic assessment of RealTime and AmerenUE's model, both should be benchmarked against reality. That is normally the way I benchmark RealTime for many clients. We provide the model with as much information as is available from a historical period, such as 2005, and then let the model simulate the historical period. The results are then compared with actual history to see whether the model has performed successfully. Historical information includes hourly load, fuel costs, unit planned outages, market price curves, etc. In the current case, test year data being used by RealTime has already been processed and synthesized by AmerenUE and can no longer be compared against an unbiased objective. For example, while Callaway had some real forced outages in 2005, they are not simulated in the model. The Taum Sauk facility stopped operating on December 14, 2005, yet it was simulated through the end of the year. The market price curve was created from data aggregated from the last three years. Further, usually items such as each unit's heat rate curve are created from periodic heat input tests, not a heat rate curve formula such as AmerenUE uses. These are just a few examples of reasons that neither model may be calibrated to actual conditions.

Q. What is your evaluation of the RealTime production cost model benchmark in comparison to the AmerenUE production cost model?

A. Based on the benchmark results discussed previously, I conclude the RealTime production cost model simulation used for this case is closely calibrated to the AmerenUE model.

Staff Production Cost Model

Q. Have you modified the RealTime production cost model since completing the benchmark?

A. Yes, I created a copy of the benchmark model to use as the Staff model before making changes for Staff. I then modified the copied model to accommodate the requested changes by Staff.

Q. Who provided you with the Staff assumptions and data?

A. I received new model input data from Staff witnesses Greg Meyer and John Cassidy

Q. Did you make changes to the model's fuel costs?

A. Yes, I used the accounting and dispatch fuel costs provided by Staff witnesses John Cassidy and Michael Proctor. I changed the dispatch and accounting costs for the coal and the nuclear fuels. Also, I changed the gas and fuel oil costs which have the same accounting and dispatch cost.

Q. Did you make changes to the hourly load?

A. Yes, I input the Staff's normalized hourly load provided by Staff witness Shawn E. Lange. The load's time period was July 1, 2005 through June 30, 2006.

Q. Did you make changes to the forward price curve used to dispatch purchases and sales?

A. Yes, I input a forward price curve provided to me by Staff witness Proctor. For a discussion of how the FPC was developed, please refer to his direct testimony.

Q. Did you make changes to the purchase power contracts?

A. Yes, I made changes to both the APL purchase contract and to the general purpose economic purchase contract. The purchase cost of the APL contract was changed. The economic purchase contract was changed to remove the limit on hourly purchases.

Q. Did you make changes to the sales contracts?

A. Yes, I changed the economy sales contract to remove the limit on hourly sales. I also removed the second economy sales contract that had a forced outage rate. That contract was no longer required because the first sales contract will sell as much generation as it can.

Q. Did you make changes to the Taum Sauk pumped storage station?

A. No, the pumped storage station is unchanged.

Q. Did you make changes to the two hydro units?

A. No, the hydro units at Keokuk and Osage are unchanged from the benchmark model.

Q. Did you make changes to the unit availabilities?

A. Yes. The Callaway unit was modified to use its actual monthly maximum capacities and several new planned outages were added to Callaway to simulate forced outages. The original Callaway planned outage was shortened and moved to another part of the year. All of the coal units were modified to use their actual monthly maximum capacities. In the benchmark run, the coal unit maximum capacities were set to an average value.

Q. Did you make any other changes to the generating units?

A. No, the other unit parameters were not changed from the benchmark run.

Q. Did you add anything else to the Staff model?

A. Yes, I added another source of generation named Joppa (EEI). I modeled Joppa as a fixed purchase contract. The model purchases 3,314,800 MWh from this contract during a calendar year.

Q. Have you made a simulation run with the Staff model?

A. Yes. The results are available in Schedule 1.

Q. Briefly summarize the results of the production cost model simulation.

A. The results of the production cost model simulations, as shown in Schedule 1 show that the estimated base amount of annual variable cost of fuel and net purchased power is $624,454,340. These amounts were supplied to Staff witness John Cassidy, who used this input in the annualization of fuel expense. For further discussion of how Staff annualized the overall fuel expense in this case, please see Staff witness John Cassidy's direct testimony. The revenue from sales calculated by the model is $542,629,900.

Q. Does this conclude your direct testimony in this case?

A. Yes it does.

Schedule 1

Summary of Results of Staffs Production Cost Model

Totals

Generation (energy (MWH))	54,151,187	Fuel expense (cost ($))	$584,997,500
Joppa (energy (MWH))	3,314,800	Purchases (cost ($))	$39,456,840
Purchases (energy (MWH))	1,573,471	Sales revenue (cost ($))	$-542,629,900
Sales (energy (MWH))	-13,203,210	Fuel & Purchased Power (cost($))	$624,434,340
Purchases (energy (MWH))	40,947,977		

Schedule 2

Comparison of RealTime Production Cost Model Run and AmerenUE

Production Cost Model Benchmark Run

Category	RealTime	AmerenUE
Generation (energy (MWH))	39,872,736	39,874,000
Total expense (cost ($))	$302,686,690	$307,470,000
Heat input (mmBTUs)	471,310,453	471,658,000

Schedule 3

Comparison of RealTime's Unit Outage Results and

AmerenUE Model Benchmark Outages

Unit	Capacity	Outage Hours Ameren	Outage Hours RealTime	Difference	Cap Loss Ameren	Cap Loss RealTime	Difference
Callaway 1	1220	1,056	1,056	0	1,288,320	1,288,320	0
Labadie 1	597	2,267	2,307	-40	1,353,399	1,377,279	-23,880
Labadie 2	595	599	717	-118	356,405	426,615	-70,210
Labadie 3	613	527	723	-196	323,051	443,199	-120,148
Labadie 4	611	976	614	362	596,336	375,154	221,182
Meramec 1	123	2,157	2,123	34	265,311	261,129	4,182
Meramec 2	125	395	428	-33	49,375	53,500	-4,125
Meramec 3	273	1,884	1,812	72	514,332	494,676	19,656
Meramec 4	356	1,324	1,491	-167	471,344	530,796	-59,452
Rush Island 1	593	2,112	1,923	189	1,252,416	1,140,339	112,077
Rush Island 2	592	922	720	202	545,824	426,240	119,584
Sioux 1	500	2,464	2,587	-123	1,232,000	1,293,500	-61,500
Sioux 2	503	484	480	4	243,452	241,440	2,012
				Lost mWhs	8,491,565	8,352,187	139,378

Schedule 4

Summary of RealTime Model Benchmark Results

Totals

Generation (energy (MWH))	48,892,431	Fuel expense (cost ($))	$596,868,000
Purchases (energy (MWH))	1,586,374	Purchases (cost ($))	$31,326,150
Sales (energy (MWH))	-9,019,701	Sales revenue (cost ($))	$-325,507,320
Total (energy (MWH))	39,872,730		