Exhibit No.:	
Issues:	Fuel Run Production Cost Model
Witness:	Leon C. Bender
Sponsoring Party:	MO PSC Staff
Type of Exhibit:	Direct Testimony
Case No.:	EC-2002-1
Date Testimony Prepared:	March 1, 2002

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

DIRECT TESTIMONY

OF

LEON C. BENDER

UNION ELECTRIC d/b/a

AMERENUE

CASE NO. EC-2002-1

Jefferson City, Missouri
March 1, 2002

Exhibit No. 17
Date 7/10/02 Case No. EC-2002-1
Reporter KEM

DIRECT TESTIMONY

OF

LEON C. BENDER

UNION ELECTRIC COMPANY

D/B/A AMERENUE

CASE NO. EC-2002-1

Q. Please state your name and business address.

A. Leon C. Bender, P.O. Box 360, Jefferson City, Missouri, 65102.

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

A. I am employed by the Missouri Public Service Commission Staff (Staff) as a Regulatory Engineer in the Energy Department of the Utility Operations Division.

Q. Please describe your educational and work background.

A. I received a Bachelor of Science degree in Mechanical Engineering in August 1978 from Texas Tech University. I became employed by Southwestern Public Service (SPS) Company as a power generation plant design engineer in September 1978. While employed by SPS, I was lead engineer on many projects involving design and construction of new power generating stations and upgrading of their older plants. In 1983, I became a registered Professional Engineer in the state of Texas. In 1986, I transferred to SPS's newly formed subsidiary company, Utility Engineering Corporation, and was responsible for various projects at various other clients' power generation plants. In June 1990, I accepted employment as a systems engineer with Entergy Operations, Inc. at the nuclear powered generating station, Arkansas Nuclear One. In December 1995, I joined the Missouri Public Service Commission (Commission).

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

A. Yes, I filed testimony in Case Nos. ER-2001-299, ER-97-394, and EM-97-515.

Q. Have you submitted testimony in this case before?

A. Yes. On July 2, 2001, I submitted direct testimony in this case on the same issue, but based upon an earlier test year.

Q. What is the purpose of your testimony in this case, the Staff's complaint case against the Union Electric Company d/b/a AmerenUE (UE), Case No. EC-2002-1?

A. The purpose of my testimony is to recommend that the Commission adopt the results of the Staff's electric production cost model simulation that is used to establish a normalized fuel and purchased power cost for UE.

Q. What is the result of the production cost model simulation?

A. The production cost model simulation shows that the allocated normalized cost of fuel and net purchase power for the test year is $345,765,029.

Q. What test year did Staff use to annualize fuel?

A. The twelve months ending June 30, 2001, updated to September 30, 2001.

Q. What is a production cost model?

A. A production cost model is a computer program used to perform an hour-by-hour chronological simulation of a utility's generation and power purchases. The model determines energy costs and fuel consumption necessary to economically meet a utility's load.

Q. What is meant by an "hour-by-hour" chronological simulation of a utility's generation and power purchases?

A. The production cost model operates in a chronological fashion, meeting each hour's energy demand before moving to the next hour. It will schedule generating units to dispatch in a least cost manner based upon fuel cost, the cost of purchased power, and resource availability. This model simulates the way the company should dispatch its generating units and purchased power to meet its net system load in a least cost manner.

Q. What production cost model did the Staff use in this case?

A. The RealTime production cost model was used.

Q. What were the sources of data used in the model?

A. The sources of data used in the model are listed in Schedule 1 of this testimony.

Q. What is purchased power?

A. Purchased power is the hourly energy which is purchased in the market place from another electric supplier and which is used to meet the load of the electric utility company.

Q. Does UE use purchased power to serve native load?

A. Yes. UE purchases power from other sources during times of plant forced or planned outages and during times when it is more economical to purchase power rather than generate power.

Q. What were the sources of data used to calculate purchased power prices and to determine amount of energy available?

A. The data used to calculate purchased power prices and to determine the amount of energy available was submitted to Staff by UE, as required by Commission Rule 4 CSR 240-20.080 (20.080 data).

Q. What different kinds of purchased power were used in the production cost model?

A. Three kinds of purchased power were used in the production cost model: capacity purchases, spot purchased energy, and emergency energy.

Q. Please explain what is meant by capacity purchases.

A. Capacity purchases are made through firm capacity contracts for the purchase of power. Under these contracts, the purchaser pays a fixed cost for the ability to receive a maximum number of megawatts per hour and also pays a variable cost for the amount of megawatt-hours that is being purchased. The purchasing company can obtain a quantity of hourly energy up to the maximum amount shown in the capacity contract.

Q. What capacity purchase contracts were used in the model?

A. The existing purchase contracts used in the production cost model are listed on the bottom of the table in Schedule 1.

Q. How did you calculate the hourly energy prices for each capacity contract?

A. I used historical prices for energy obtained from 20.080 data. The prices were fixed for each hour of every month regardless of amount of energy purchased up to the contract maximum.

Q. What is spot purchased energy?

A. Spot energy is energy purchased on an hourly basis rather than through a longer-term contract. The purchasing company decides to buy spot energy from one or more suppliers based on the economics and availability of its generating units and capacity purchases. Purchases of spot energy are made to lower costs when the spot market price is

below the marginal cost of providing that energy from the company's generating units or from capacity purchases. Since the spot market depends on energy supply and demand, the prices tend to be much more volatile than capacity purchases.

Q. What methodology did you use to determine the spot purchased energy prices?

A. I used a procedure developed by the Commission's Energy Department-Engineering Section described in the document entitled A Methodology to Calculate Representative Prices for Purchased Energy in the Spot Market (March 18, 1996). The method uses a statistical calculation based on the truncated normal distribution curve to represent the hourly purchased power prices in the spot market. UE's actual hourly non-contract transaction prices, obtained from UE's 20.080 data, are used as price inputs in the calculation. The calculation yield a spot energy price for each hour of the year.

Q. How did you determine spot purchased energy available?

A. I limited the hourly spot purchased energy available based on the amount of spot energy that was actually purchased in the same hours of days that had a similar price range. The higher the price paid, the more energy I made available, up to the maximum actually purchased in that hour of the month as shown by the 20.080 data. This was done for each hour of each month. After the amount of spot purchased energy available is determined, the Staff's production cost model calculates the amount of spot energy purchased based on the least cost to meet load.

Q. What is emergency purchased energy?

A. Emergency energy is energy purchased on a short-term hourly basis rather than through a longer-term contract. For example, a sudden loss of generation source or

transmission ability could require the purchase of energy at a substantially higher price when other sources become unavailable.

Q. How did you determine the amount of emergency purchased energy available?

A. I estimated the hourly emergency purchased energy available to be approximately ten percent of total generation capacity in the non-summer months. For the summer months (June through August), the amount of emergency purchased energy is approximately 15% of total generation capacity. This was done on an hourly basis for each month.

Q. How did you determine the price of emergency purchased energy available?

A. I used the highest price actually paid for spot purchase power in a given month plus 10%. This monthly emergency energy price was then assigned to every hour in the month.

Q. Were any generation plants included in the production cost model that are not presently operating?

A. Yes. I included thirteen combustion turbine generating units, that supply a total of 500 megawatts, that do not presently exist. For a discussion of why these units were included in the model see the testimony of Staff witness Dr. Michael Proctor.

Q. What number of hours did you use for the planned maintenance and forced outage hours?

A. I used a five-year average of planned maintenance hours from 1997 to 2001 for all generating plants except Callaway. For the Callaway nuclear plant, I used a six-year average because the nuclear plant undergoes refueling outages every 18 months.

Q. Is an average of outage hours for a period of several years more appropriate than using the actual scheduled outage hours for the test year?

A. Yes. In any one specific year a unit's outage may be atypical, depending upon events that year. For example, a unit's outage may be prolonged by an event such as converting the unit to burn a different fuel, or the outage may be shortened for scheduling reasons. Therefore, using that particular year's data may be an unreasonable outage length for a normal year. Also, for example, lengthy turbine overhaul outages occur approximately every five years (six years for a nuclear unit). Using an average for a five-year period helps to ensure that the hours for the outage are accounted for without skewing the test year results toward a more expensive or a less expensive unit, and thus permits the determination of a reasonable expense for the test year.

Q. Please explain spinning reserve in an electric system.

A. Spinning reserve is generating capacity in operation and synchronized to the electrical grid but not yet loaded (spinning) which can be loaded automatically when the control area frequency drops to 59.5 HZ or below.

Q. What is the requirement for a generating unit to contribute to the spinning reserve?

A. The Mid-America Interconnected Network Reliability Council (MAIN), of which UE is a member, requires that the spinning reserve of a unit be obtainable from the unit within 10 minutes; otherwise it cannot be counted as spinning reserve. Ramp rates and other restrictions may limit the amount of capacity obtainable from a unit in 10 minutes.

Q. What values for spinning reserve did you use?

A. I used the values given by UE in the response to Staff data request 2917. I assumed that the combustion turbines that can ramp up to full load in 10 minutes can supply their full capacity to spinning reserve. In the model, the amount of spinning reserves is set at 12% of the daily peak.

Q. What are sulfur dioxide emission allowances (SO2 Allowances)?

A. SO2 Allowances were created by the 1990 Amendments to the Federal Clean Air Act. An allowance is an authorization to emit one ton of sulfur dioxide. The amendments established a program under which the U.S. Environmental Protection Agency determined which generating units must conform to the Act. It also established a program under which SO2 allowances are traded on the open market. A fixed number of allowances are issued for each generating unit and the utility must buy allowances for any additional SO2 release above its authorized amount as set by the program.

Q. Did you use SO2 Allowances in the production cost model?

A. Yes. Replacement costs of emissions allowances are included as a cost to dispatch a generation unit that emits SO2.

Q. What was the allowance price you used in running the production cost model?

A. The prices were based on the Cantor Fitzgerald Environment Brokerage Services, and were supplied by UE on a monthly basis in response to Staff data request 2917.

Q. How does the cost of emissions affect the dispatch of the generating units?

A. The cost of emissions was added to the units' dispatch cost by the production cost model. Only units that emit SO2 have these costs and their dispatch is affected by the

increase in cost. However, emissions cost are not reported in the total number reported by the production cost model used to annualize fuel and purchase power.

Q. Does UE have hydro generating plants?

A. Yes, they have the Keokuk and Osage hydro generating plants.

Q. How were these hydro generating plants simulated in the production cost model?

A. Keokuk, a "run of the river" hydro plant, was simulated as one unit whose maximum capacity varies with the flow of the Mississippi River. The capacity I used was the same as that used by UE in its production cost model supplied in response to Staff data request 4149 in Case No. EM-96-149. Osage, a "pondage" hydro plant, also was simulated as one unit with the capacity of 212 megawatts (MW) and a monthly energy available equal to that made available in the UE production cost model. No dispatch costs were associated with the hydro units in the model.

Q. What is a pumped storage unit?

A. A pumped storage unit is a type of hydro plant where water is pumped to storage during times of low energy demand and cheap energy supply and then used to run a hydro generating unit during times of high energy demand.

Q. Does UE have any pumped storage units?

A. Yes. They have two units at its Tom Sauk plant.

Q. How were these simulated in the production cost model?

A. The Tom Sauk pumped storage plant was simulated as having a maximum capacity of 430 MW. The reservoir level and pumping efficiency used are the same as used in

the UE production cost model. The Staff's production cost model schedules these units to generate electricity during peak hours and to pump water during hours of low demand.

Q. Did you determine UE's production costs on a stand-alone basis only?

A. No. UE's production costs are determined through a Joint Dispatch Agreement (JDA) with Ameren Energy Generating Company (AEG).

Q. What is the JDA between UE and AEG?

A. On December 18, 1995, UE and Central Illinois Public Service Company (CIPS) entered into a JDA by which the generation, purchased power and power sales would be committed and dispatched as a combined system. The JDA is fundamentally a description of how the energy and costs from generation and purchased power and the profit from power sales are to be distributed between the two companies. On May 1, 2000, this JDA was amended to recognize AEG as the subsidiary to which CIPS has transferred the ownership of its generating assets. For a further discussion of the JDA and how the JDA affects energy and cost allocated to UE, please refer to the testimony of Staff witness Dr. Michael Proctor.

Q. How were the Staff's production cost model results used to determine JDA assignments of cost for energy?

A. I made three production cost model runs. The first run determined the normalized costs for the joint dispatch of the combined UE and AEG supply resources and spot purchased energy to meet the combined loads. The additional two runs determined the stand-alone dispatch for UE and AEG to meet their stand alone load requirements. The stand-alone dispatches are compared to the joint dispatch to determine the JDA assignment of costs to UE and AEG.

Q. How did you determine spot purchased energy available in the stand-alone dispatches?

A. In the stand-alone production cost model runs, the spot purchased energy available is assigned to each company based on its percentage share of load in each hour.

Q. How were Staff's production cost model results used to determine the JDA assignment of joint fuel and purchased power cost between the two companies?

A. Excluding spot purchased energy, the supply resources from the stand-alone fuel runs are compared to those for the joint dispatch run for each hour. For a particular company, in a given hour, if the energy from the supply resources for the stand-alone dispatch is less than or equal to the energy for the supply resources for that same company in the joint dispatch, then the energy and costs from the stand-alone dispatch (including spot purchased energy) are assigned to that company and subtracted from the energy and costs of the joint dispatch. The remaining costs from the joint dispatch are then assigned to the other company. For further discussion of the JDA and how the JDA affects energy and cost allocated to UE, please refer to Dr. Proctor's testimony.

Q. Did you use the results of the JDA assignment as the final number for allocated cost for fuel and net purchased power.

A. No. I discovered before filing time that the Mid American Energy (MEC) purchase contract expired during the test year and was not renewed. Since this contract was included in the initial stand alone and joint production cost model runs, I re-ran the model without including the MEC purchase contract. The result was that other resources' total costs increased because of the absence of the MEC contract. Since time did not permit me to

recalculate the effect of the absence of the MEC contract upon the JDA allocations, I took the difference between total cost of the stand alone with the MEC purchase and the total cost without the MEC contract and added that difference to the JDA allocated cost to calculate a final number.

Q. What is the test year allocated cost of fuel and net purchased power?

A. The test year allocated cost for fuel and net purchased power in the test year (twelve months ending June 30, 2001, updated to September 30, 2001) is $345,765,029. This amount was supplied to Staff witness John Cassidy to use 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.

Q. Does this conclude your direct testimony?

A. Yes, it does.

Schedule 1

Inputs to the production cost model	Source of information for inputs
Fuel Prices	Staff witness John Cassidy
Unit Maintenance History	UE Response to Staff Data Requests
Generation Unit Data	UE Response to Staff Data Requests
Weather Normalized Hourly Load	Staff witness Lena Mantle
Purchase Power Capacities and Prices	Data sent to Staff monthly to comply with 4 CSR 240-20.080
Capacity purchase contracts reflected in the model	Electric Energy Inc. Entergy Inc.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

The Staff of the Missouri Public Service Commission, Complainant,	)	
vs.	)	Case No. EC-2002-1
Union Electric Company, d/b/a AmerenUE, Respondent.	)	

AFFIDAVIT OF LEON C. BENDER

STATE OF MISSOURI)
) **ss**
COUNTY OF COLE)

Leon C. Bender, of lawful age, on his oath states: that he has participated in the preparation of the foregoing written Direct Testimony in question and answer form, consisting of 12 pages of testimony to be presented in the above case, that the answers in the attached written 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.

Leon C. Bender

Subscribed and sworn to before me this 28th day of February, 2002.

DAWN L. HAKE
Notary Public – State of Missouri
County of Cole
My Commission Expires Jan 9, 2005

Notary Public

My commission expires