Exhibit No.:
Issue(s): Production Cost Model
Witness: Tom Y. Lin
Type of Exhibit: Rebuttal
Sponsoring Party: MoPSC Staff
Case No.: EM-2000-369

ON BEHALF OF THE

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

REBUTTAL TESTIMONY

OF

TOM Y. LIN

UTILICORP UNITED INC. AND
THE EMPIRE DISTRICT ELECTRIC COMPANY

CASE NO. EM-2000-369

Exhibit No. 709
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REBUTTAL TESTIMONY

OF

TOM Y. LIN

UTILICORP UNITED INC. AND THE EMPIRE DISTRICT ELECTRIC COMPANY

CASE NO. EM-2000-369

Q. Please state your name and business address.

A. My name is Tom Y. Lin and my business address is 301 West High Street, Jefferson City, Missouri 65101.

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

A. I am employed by the Missouri Public Service Commission (Commission) as a Staff Engineer in the Engineering Section of the Utility Operations Division's Electric Department.

Q. Please describe your educational and professional background.

A. I received a Bachelor of Engineering degree in Mechanical Engineering from Nanjing Institute of Technology (now Southeast University), China, in July 1983. After graduation in 1983, I worked for seven years as a mechanical engineer at the Fujian Testing and Research Institute for Electric Power, a division of Fujian Provincial Electric Power Industry Bureau. During that time, I was responsible for developing, designing, modifying, testing, and performing computer simulation programs,

boiler efficiency and heat rate tests, and various projects in Fujian power plants. In January 1991, I pursued an advanced degree in the United States and graduated from the University of Oklahoma with a Master of Science degree in Mechanical Engineering in 1993. I began my employment with the Commission in 1994. I am a professional engineer (PE) under the laws of the State of Missouri and a member of both the National and the Missouri Society of Professional Engineers.

Q. Have you filed testimony previously before this Commission?

A. Yes, I have filed testimony in Case Nos. ER-95-279, EM-96-149, ER-97-81, EO-97-144, EC-97-362, ER-97-394, EC-98-573, HR-99-245, ER-99-247 and EM-2000-292.

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my rebuttal testimony is to respond to the direct testimony of UtiliCorp United Inc. (UCU) witness Frank A. DeBacker, who has adopted the direct testimony of Robert W. Holzwarth, regarding joint dispatch savings associated with coordination of generation dispatch between Missouri Public Service (MPS), a division of UCU, and The Empire District Electric Company (EDE). The savings were calculated by a production cost model simulation and the calculation is discussed in this testimony.

Q. How does your testimony filed in this merger application compare to the testimony you filed earlier concerning the same issues in the UCU/St. Joseph Light & Power Company (SJLP) merger application, Case No. EM-2000-292?

A. This testimony is very similar to that which I filed in Case No. EM-2000-292 concerning the same issues, and in some sections is identical.

Q. What is a production cost model?

A. A production cost model is a computer program that performs an hour-by-hour chronological economic dispatch simulation of a utility's generation and net power purchases, as a means of determining energy costs, fuel consumption, and/or emissions outputs required to serve the company's net system load.

Q. What production cost model did UCU use to calculate the merger savings for this case?

A. UCU used REAL TIME, a model developed by the EMELAR Group.

Q. What production cost model did you use?

A. REAL TIME, the same model as UCU used.

JOINT DISPATCH SAVINGS AFTER THE MERGER

Q. What is your responsibility in the Staff's analysis of estimated joint dispatch savings resulting from the merger in this case?

A. I am responsible for calculating joint dispatch savings resulting from the merger, through economic dispatch simulation.

Q. What are the joint dispatch savings associated with the merger?

A. The joint dispatch savings are those savings in electric production costs attributable to jointly dispatching MPS's and EDE's generation on a single or combined system basis after the merger, compared to the total electric production costs of MPS and EDE on a stand-alone basis as if there were no merger. Total electric production costs include fuel costs, costs associated with net purchases and sales, and variable operation and maintenance (O&M) costs for this case.

Q. What level of joint dispatch savings did UCU estimate for this case?

A. UCU estimated that the joint dispatch savings based on a combined cycle expansion plan over the ten-year period from 2001 to 2010 would be approximately $161 million associated with the UCU and EDE merger. The savings, as shown in Schedule 1, were calculated by UCU's updated production cost model simulation that was sent to Staff on February 2, 2000.

Q. What is your responsibility in this case with regard to the determination of the joint dispatch savings?

A. I am responsible for: 1) evaluating the joint

dispatch savings, which were calculated by UCU, using a computerized production cost model simulation; and 2) reviewing and assessing the reasonableness of the input data used in Staff's model. The input data include each generating unit's fuel prices, heat rates, variable O&M, maintenance outage schedules, forced outage rates, energy sales and purchases, with their associated prices and system loads projected for a ten-year period from 2001 through 2010. In addition, I also calculated the joint dispatch savings for the UCU and SJLP merger (Case No. EM-2000-292) as well as a UCU/SJLP/EDE three-way merger combined system, respectively, because the proposed UCU/SJLP and UCU/EDE mergers will affect each other in the joint dispatch area.

Q. How did you calculate the joint dispatch savings?

A. I ran the production cost model for three different scenarios. The first two scenarios assumed that the UCU and EDE generating systems would be operated as stand-alone systems. The third scenario assumed that the combined generation resources of the two systems would be operated as a single or combined system. The total electric production costs for the three simulations were collected. The MPS and EDE stand-alone system simulation results were added together and compared to the results for the MPS and EDE combined system simulation. The difference in the two results was identified as joint dispatch

savings. The same method was used to calculate the savings for the UCU/SJLP merger and a UCU/SJLP/EDE combined system.

Q. Did you consider the same scenario for limited sales opportunities for off-system sales in the model UCU used for this case in estimating joint dispatch saving?

A. Yes.

Q. What is the method and basis UCU used to adjust the amount of energy for off-system sales?

A. UCU adjusted the amount of energy sales using forced outage rates and upper bound limits on off-system energy sales in the model to approximate the level of historical off-system sales for the MPS, SJLP and EDE stand-alone systems as shown in Table 1.

Table 1. Upper Bound for Off-system Sales: MW/hour and Forced Outage Rates (FOR)

Model input	Upper Bound for Off-system Sales: MW/hour	FOR (%)
MPS stand-alone	3,000	25%
SJLP stand-alone	25	35%
EDE stand-alone	3 before 6/1/01 – 60 after 6/1/01	18%
MPS and SJLP joint dispatch	3,000	15%
MPS and EDE joint dispatch	3,000	0%
MPS, SJLP and EDE joint dispatch	3,000	0%

UCU eliminated limits on off-system energy sales and decreased forced outage rates for off-system energy sales in the MPS/SJLP and MPS/EDE joint dispatch models because UCU is

projecting an increase in the opportunity for off-system energy sales after the UCU/SJLP and/or UCU/EDE mergers.

Q. Do the data given above indicate that UCU considered the opportunities for off-system sales to be limited in the energy market for the stand-alone cases, but that the merger would result in expanded opportunities in the off-system energy market?

A. Yes. Table 1 shows that UCU assumes that SJLP and EDE cases have limited opportunities to make off-system sales as stand-alone companies. Staff witness Dr. Michael S. Proctor of the Commission's Electric Department has a detailed discussion in his rebuttal testimony regarding the relationship between the merger and expanded sales opportunities in the off-system energy markets.

Q. Did you consider additional scenarios for off-system sales opportunities beyond the UCU scenarios provided?

A. Yes, I considered not only the UCU assumptions/ scenarios, but also others, which Dr. Proctor requested that I run.

The differences among these scenarios take into account not only the combinations of utilities jointly dispatching generation resources (MPS/SJLP, MPS/EDE, MPS/SJLP/EDE) but also assumptions about the ability of the utilities either as stand-alone (MPS, SJLP, EDE) or jointly

dispatched to make off-system sales (no off-system sales, limited off-system sales, and "unlimited" off-system sales). Dr. Proctor has a detailed discussion of the reasons for considering these additional scenarios in his testimony.

Q. Please describe the scenarios that you have run and the joint dispatch savings calculation.

A. The detailed results for all scenarios for a ten-year period from 2001 to 2010 are shown at Schedule 1, and summarized below:

1) The joint dispatch savings with UCU's assumption that there would be limited off-system sales opportunities with the stand-alone model would be approximately $164.0 million for the MPS and EDE combined system.

2) The joint dispatch savings without any off-system sales opportunities would be approximately $43.6 million for the MPS and EDE combined system.

3) The joint dispatch savings with the same off-system sales opportunities ("unlimited" off-system sales) for the stand-alone and joint dispatch models would be approximately $6.95 million for the MPS and EDE combined system.

4) The joint dispatch savings with UCU's assumption that there would be limited off-system sales

opportunities with the stand-alone model would be approximately $99.5 million for the MPS and SJLP combined system.

5) The joint dispatch savings without any off-system sales opportunities would be approximately $47.9 million for the MPS and SJLP combined system.

6) The joint dispatch savings with UCU's assumption that there would be limited off-system sales opportunities with the stand-alone model would be approximately $246.1 million for an MPS, SJLP and EDE combined system.

7) The joint dispatch savings without any off-system sales opportunities would be approximately $89.0 million for an MPS, SJLP and EDE combined system.

8) The joint dispatch savings with the same off-system sales opportunities ("unlimited" off-system sales) for the stand-alone and joint dispatch models would be approximately $12.1 million for an MPS, SJLP and EDE combined system.

Q. What caused the differences in joint dispatch savings between the Staff and UCU model results?

A. Several changes that I made to the input data in the model and/or model version differences caused the different results. These differences are discussed in the next section of

my analysis.

PARAMETERS OF ANALYSIS

Q. What inputs did you change and adjust for the Staff's EDE stand-alone model compared to UCU's model?

A. I increased the capacities for the EDE units Asbury #2, Energy Center #1 and #2, and Riverton #7 and #8 to their peak capacities as stated in response to Staff Data Request (DR) No. 4105. In addition, Riverton #7 and #8 were modeled using natural gas as the fuel for the last block of capacity; that is, I considered Riverton #7 and #8 would burn natural gas when the level of generation for these units exceeded the capacities indicated in response to Staff DR No. 4105 (In DR No. 4105, maximum capacities were underreported by EDE because the last block of capacity was omitted).

Q. Were the above modifications that you made used in both the Staff and the EDE models in the previous EDE rate cases, Case Nos. ER-95-279 and ER-97-81?

A. Yes.

Q. What input changes and adjustments did you make for the Staff's SJLP stand-alone model compared to UCU's model?

A. I changed the SJLP Lake Road (LR) units #1, #2, and #3 fuel inputs to blends of coal and gas, based on their actual operating experience, instead of using the UCU assumption of LR #1 using only coal, and LR #2 and #3 using only gas. In

addition, I adjusted the heat rate factors for LR #1, #2, and #3 because the heat rate inputs for those units by UCU did not consider the boilers' efficiency.

Q. Did you review projected system load data for MPS, SJLP and EDE over a ten-year period?

A. Yes, for the period 2001 through 2010.

Q. Did you modify MPS, SJLP and EDE projected system load data?

A. No, the projected system load data over a ten-year period from 2001 through 2010 which I used in this analysis are the same data as that furnished by UCU in response to Staff DR Nos. 4104 and 4105.

Q. What else did you review?

A. I reviewed the projected fuel prices, heat rates, variable O&M, maintenance outage schedules, and forced outage rates of each generating unit as well as energy purchases and sales data.

Q. Did you change any projected fuel prices, heat rates, variable O&M, maintenance outage schedules, or forced outage rates of any generating units or energy purchases and sales data provided by UCU, SJLP, or EDE in response to Staff DRs?

A. No. In response to Staff DR Nos. 4104 and 4105, UCU, SJLP and EDE provided the projected fuel prices, heat

rates, variable O&M, maintenance outage schedules, and forced outage rates of each generating unit as well as purchase power and energy sales projected over the ten-year period 2001 through 2010 used in this analysis.

Q. Do you think UCU can accomplish the Asbury Operating Enhancements as indicated in Mr. DeBacker's Schedule RWH-7?

A. I am not aware that either UCU or EDE has made specific decisions on what heat rate improvement projects for Asbury to implement, as indicated in their response to Staff DR No. 4123. However, in order to compare the results between the Staff and UCU models used in this case, I am assuming that UCU can achieve its goals for Asbury operating enhancements after the merger.

STAFF RECOMMENDED CONDITIONS FOR APPROVAL OF THE MERGER

Q. Are there merger conditions, in your opinion, that the Commission should require of UCU/EDE so that the Electric Engineering Section can continue to perform appropriate fuel and energy cost simulations after the merger?

A. Yes. The following conditions should be ordered:

1. MPS and EDE must continue to provide the historical actual hourly generation, energy purchases and sales data, and other information for the MPS and EDE divisions of UCU

presently required under Commission Rule 4 CSR 240-20.080 in electronic format accessible by a spreadsheet program.

2. In order for the Staff to be able to analyze fuel and energy costs, acknowledgment and agreement that the Commission may access and require without the necessity of subpoena the production of all accounts, books, contracts, records, documents, memoranda, papers, and employees of UtiliCorp United Inc. and any affiliate, division or subsidiary.

It would be detrimental to Missouri ratepayers if the Commission did not receive or have access to the above information because the Commission's ability to set just and reasonable rates would be impaired.

SUMMARY

Q. Would you summarize your rebuttal testimony?

A. Yes. Projected fuel prices, heat rates, variable O&M costs, maintenance outage schedules, and forced outage rates for all MPS, SJLP and EDE generating units, system loads and all purchases and sales data were included in the production cost model run to estimate joint dispatch savings scenarios by the Staff. The joint dispatch savings of the MPS and EDE generating units resulting from the mergers and for other scenarios (no off-system sales, limited off-system sales, and "unlimited" off-system sales) are calculated by the production cost model simulation and are shown in Schedule 1.

Q. Does this conclude your rebuttal testimony?

A. Yes, it does.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of the Joint Application of	)	
UtiliCorp United Inc. and The Empire	)	
District Electric Company for Authority to	)	
Merge The Empire District Electric Company	)	CASE NO. EM-2000-369
with and into UtiliCorp United Inc., and,	)	
in Connection Therewith, Certain Other	)	
Related Transactions.	)	

AFFIDAVIT OF TOM Y. LIN

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Tom Y. Lin, of lawful age, on his oath states: that he has participated in the preparation of the foregoing written testimony in question and answer form, consisting of 14 pages of testimony to be presented in the above case, that the answers in the attached written 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.

Tom Y. Lin

Subscribed and sworn to before me this 19th day of June, 2000.

Notary Public

My commission expires_____

SHARON S WILES
NOTARY PUBLIC STATE OF MISSOURI
COLE COUNTY
MY COMMISSION EXP. AUG. 23,2002

Total electric production costs from production cost model simulation from 2001 to 2010

1. UCU assumption of limited sales opportunities for the MPS and EDE combined system

	UCU	Staff
MPS Stand-Alone	$1,072,131,398	$1,069,983,615
EDE Stand-Alone	$969,809,358	$967,496,569
MPS + EDE Joint Dispatch	$1,880,941,459	$1,873,460,495
Savings (Joint Dispatch - Stand-Alone)	($160,999,297)	($164,019,689)

2. No sales opportunities for the MPS and EDE combined system

	UCU	Staff
MPS Stand-Alone	$1,227,261,779	$1,229,832,957
EDE Stand-Alone	$983,606,279	$982,286,854
MPS + EDE Joint Dispatch	$2,170,981,903	$2,168,529,215
Savings (Joint Dispatch - Stand-Alone)	($39,886,155)	($43,590,596)

3. The same sales opportunities (FOR=0%) for Stand-Alone and joint dispatch for the MPS and EDE combined system

	Staff
MPS Stand-Alone	$993,095,564
EDE Stand-Alone	$887,314,061
MPS + EDE Joint Dispatch	$1,873,460,495
Savings (Joint Dispatch - Stand-Alone)	($6,949,130)

4. UCU assumption of limited sales opportunities for the MPS and SJLP combined system

	UCU	Staff
MPS Stand-Alone	$1,072,131,398	$1,069,983,615
SJLP Stand-Alone	$252,047,078	$256,291,685
MPS + SJLP Joint Dispatch	$1,219,834,417	$1,226,732,322
Savings (Joint Dispatch - Stand-Alone)	($104,344,059)	($99,542,978)

5. No sales opportunities for the MPS and SJLP combined system

	UCU	Staff
MPS Stand-Alone	$1,227,261,779	$1,229,832,957
SJLP Stand-Alone	$255,964,724	$260,476,572
MPS + SJLP Joint Dispatch	$1,433,570,333	$1,442,401,101
Savings (Joint Dispatch - Stand-Alone)	($49,656,170)	($47,908,428)

6. UCU assumption of limited sales opportunities for an MPS, SJLP and EDE combined system

	UCU	Staff
MPS Stand-Alone	$1,072,131,398	$1,069,983,615
SJLP Stand-Alone	$252,047,078	$256,291,685
EDE Stand-Alone	$969,809,358	$967,496,569
MPS + SJLP + EDE Joint Dispatch	$2,052,933,483	$2,047,656,909
Savings (Joint Dispatch - Stand-Alone)	($241,054,351)	($246,114,960)

7. No sales opportunities for an MPS, SJLP and EDE combined system

	UCU	Staff
MPS Stand-Alone	$1,227,261,779	$1,229,832,957
SJLP Stand-Alone	$255,964,724	$260,476,572
EDE Stand-Alone	$983,606,280	$982,286,854
MPS + SJLP + EDE Joint Dispatch	$2,388,309,709	$2,383,643,901
Savings (Joint Dispatch - Stand-Alone)	($78,523,074)	($88,952,482)

8. The same sales opportunities (FOR=0%) for Stand-Alone and joint dispatch for an MPS, SJLP and EDE combined system

	Staff
MPS Stand-Alone	$993,095,564
SJLP Stand-Alone	$179,394,561
EDE Stand-Alone	$887,314,061
MPS + SJLP + EDE Joint Dispatch	$2,047,656,909
Savings (Joint Dispatch - Stand-Alone)	($12,147,277)

Schedule 1