Exhibit No.:
Issue(s): Production Cost Model
Witness: Tom Y. Lin
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Sponsoring Party: MoPSC Staff
Case No.: EO-2000-845

ON BEHALF OF THE

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

REBUTTAL TESTIMONY

OF

TOM Y. LIN

ST. JOSEPH LIGHT AND POWER

CASE NO. EO-2000-845

Exhibit No. 13 NP
Date 10-26-00 Case No. EO-2000-845
Reporter M

Jefferson City, Missouri

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REBUTTAL TESTIMONY

OF

TOM Y. LIN

ST. JOSEPH LIGHT & POWER COMPANY

CASE NO. EO-00-845

Q. Please state your name and business address.

A. My name is Tom Y. Lin and my business address is 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 (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, EM-2000-294 and EM-2000-369.

Q. What is the purpose of your rebuttal testimony?

A. On June 7, 2000 there was a fire and explosion that damaged St. Joseph Light and Power Company's (SJLP or Company) turbine at its Lake Road turbine 4 /boiler 6 power generation unit (Unit 4/6). Due to the damage to the turbine, Unit 4/6 was unavailable as a source of power generation until it was repaired and brought back into service on August 8, 2000. While Unit 4/6 was out of service from June 7, 2000 through August 8, 2000, SJLP used other sources to replace the power that it normally would have used Unit 4/6 to generate. The purpose of my rebuttal testimony is to explain how the Staff of the Missouri Public Service Commission ("Staff") evaluated the incremental replacement fuel and purchased power costs SJLP

asserts it incurred due to the unavailability of Unit 4/6 during the period of June 7, 2000 through August 8, 2000.

Q. What incremental replacement fuel and purchased power costs does SJLP assert it incurred due to the unavailability of Unit 4/6 during the period of June 7, 2000 through August 8, 2000?

A. Although in the prefiled testimony of SJLP witness Stephen L. Ferry at page 11 SJLP has set forth estimated amounts of $459,445 for incremental replacement fuel costs and $2,999,189 for purchased power costs, in a response to Staff Date Request (DR) #4112, SJLP has updated the estimated amounts to actual amounts of **_____** for incremental replacement fuel and **_____** for purchased power costs. Therefore, the total incremental replacement fuel and purchased power costs were **_____**.

Q. How did you determine the reasonableness of the Company's estimation of incremental costs?

A. I used a production cost model to estimate incremental replacement fuel and purchased power costs.

Q. What is a production cost model?

A. A production cost model is a computer program that performs an hour-by-hour 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. Why did you use the production cost model?

A. Traditionally, Staff uses the production cost model simulation to estimate fuel and purchased power costs.

Q. Did SJLP use production cost model simulation to calculate the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident of June 7, 2000 and the June 7, 2000 through August 8, 2000 incident outage for this case?

A. No.

Q. What method did the Company use?

A. The method used by the Company is described by the Company's witness, Stephen L. Ferry's direct testimony on page 10. Basically, the Company calculated the incremental replacement fuel and purchased power costs by calculating the difference of total fuel and purchased power costs to meet system load with and without Unit 4/6 in the economic dispatch order.

Q. What do you mean by economic dispatch?

A. Economic dispatch describes the process of "loading" generating units in order to meet system load at the lowest possible cost given the operational constraints on the system. Units with the lowest incremental cost or unit cost ($/MWH) are dispatched first to meet the system load. A simple

example regarding the economic dispatch for a 250 MW load on the SJLP system is shown in Schedule 1 to my testimony. In Schedule 1 the difference in total costs between Table 3, without Unit 4/6 in the dispatch order and Table 2, with Unit 4/6 in the dispatch order ($3,726 = $5,873 - $2,147) is an example of the method used to calculate the incremental replacement fuel and purchase power costs based on economic dispatch.

Q. What are your specific responsibilities in this case with regard to the determination of the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident of June 7, 2000 and the June 7, 2000 through August 8, 2000 incident outage?

A. I am responsible for: 1) evaluating the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident of June 7, 2000 and the June 7, 2000 through August 8, 2000 incident outage, which were calculated by SJLP by a spreadsheet analysis; 2) reviewing and assessing the reasonableness of the input data used in Staff's production cost model which includes each generating unit's heat rates, variable operation and maintenance (O&M) expenses, maintenance outage schedules, forced outage rates, purchases, and hourly system loads from June 7, 2000 to August 8, 2000; and 3) conducting the Staff's analysis of incremental replacement fuel and purchased power costs using the production cost model.

PARAMETERS OF ANALYSIS

Q. How did you calculate the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident of June 7, 2000 and the June 7, 2000 through August 8, 2000 incident outage?

A. First, I assumed that Unit 4/6 was online and ran the production cost model to obtain the fuel and purchased power costs using the actual load for that period. Second, I calculated the actual fuel and purchased power costs based on the data which were obtained from the Company either in response to Staff DR #4112 or as mandated by Commission Rule 4 CSR 240-20.080 (20.080 data). The difference in the two results with and without Unit 4/6 was considered as the incremental replacement fuel and purchased power costs for this case as showed in Schedule 2.

Q. What was the level of generation for Unit 4/6 obtained from the production cost model result?

A. **_____** MWH.

Q. What was the level of generation for Unit 4/6 obtained from the Company's spreadsheet analysis?

A. In response to Staff DR #4112, the Company calculated the expected level of Unit 4/6 generation as **_____** MWH.

Q. Why is the level of generation for Unit 4/6 from

the model result different from the Company's figure?

A. It is very complicated to estimate the operation and energy production for Unit 4/6 in the Company's system when the unit was actually unavailable.

The Company assumed that the difference between system load and the maximum hourly generation for the Iatan generating unit (Iatan), the actual hourly capacity purchased energy from Nebraska Public Power District (NPPD) and level of generation for other Lake Road units except Unit 4/6 was essentially the expected level of generation from Lake Road Unit 4/6.

On the other hand, Staff estimated the expected level of Unit 4/6 generation by just including Unit 4/6 online in the dispatch order of the production cost model simulation. In some hours, the model would dispatch more generation (MWH) from Unit 4/6 by shutting down or decreasing generation from other Lake Road units and/or decreasing the amount of purchased power energy to zero compared to the Company's method of calculating the expected level of Unit 4/6 generation. This coupled with the Staff's lower estimated fuel cost for Unit 4/6 of **_____**, compared to the Company's figure **_____**, which was obtained from the Company in response to Staff DR #4112, are the reasons that Staff got the higher expected level of generation for Unit 4/6 from the production cost model result compared to that from the Company.

Q. Did you use the actual hourly system load during June 7, 2000 to August 8, 2000 for this case?

A. Yes. The actual hourly load data were obtained from 20.080 data.

Q. What heat rates, maintenance outage hours and forced outage rates data and other input data did you use for this case?

A. The heat rates, maintenance outage hours and forced outage rates data for each generating unit and other input data were the same as those Staff used in SJLP's last electric rate case, Case No ER-99-247.

Q. Why did you use the actual hourly Iatan generation and amount of capacity purchased energy from NPPD for the model simulation?

A. Because the Iatan generating unit and the NPPD capacity purchase were the cheapest energy resources for the Company's system, SJLP always utilizes these energy resources to the maximum amount possible when they are available.

Q. How did you determine the appropriate purchased power prices to use as inputs in this case?

A. Purchased power prices were determined on the basis of historical capacity and spot market price data, which are obtained from 20.080 data. The purchased power prices were calculated in this case by the same method Staff has used in

previous cases.

Q. How many types of purchased power were considered in the expense calculation?

A. Three types of purchased power were considered: capacity purchases; spot market purchases and hypothetical peaking purchases.

Q. How many capacity purchase contracts did SJLP have during the Unit 4/6 incident outage?

A. SJLP had capacity purchase contracts with two suppliers during the Unit 4/6 incident outage; namely, Western Resources Inc. and NPPD.

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

A. I used the monthly weighted average price for each month's hourly energy prices for this case.

Q. What was the amount of energy (MWH) for each capacity contract?

A. SJLP provided the maximum amount of energy that can be used for each capacity contract in its 20.080 data.

Q. In computing the appropriate spot market energy prices, did you use the same procedure you used to arrive at capacity purchased prices?

A. No.

Q. What procedure did you use to determine spot

market energy prices?

A. Spot market energy prices were calculated based on SJLP's actual hourly spot market transaction prices, obtained from 20.080 data, by using a procedure developed and adopted by Staff's Electric-Engineering Section. The procedure is set forth in A Methodology to Calculate Representative Prices for Purchased Energy in the Spot Market (March 18, 1996). In particular, a statistical calculation based on a truncated normal distribution was used to represent the hourly purchased power prices in the spot market.

Q. Has Staff used this method in previous cases?

A. Yes, this method was used most recently in Case Nos. ER-95-279, ER-97-81, EO-97-144, EC-97-362, EC-98-573, ER-99-247 and EM-2000-292.

Q. How did you determine the amount of spot purchase energy available in each hour?

A. The amount of spot energy available in each hour used in this case was the same as that used by SJLP in the last SJLP electric rate case, Case No. ER-99-247.

Q. How did you determine the amount of hypothetical peaking purchased energy and the associated prices?

A. I used the figure provided by SJLP in its last electric rate case, Case No. ER-99-247 for the amount of energy and increased the prices to up limit **_____** for spot

prices since the actual spot purchased power prices were higher than $100/MWH in some hours.

RECOMMENDATION

Q. If the Commission grants an accounting authority order (AAO) to SJLP, is the level of the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident of June 7, 2000 and the June 7, 2000 through August 8, 2000 incident outage, developed by SJLP, reasonable?

A. Yes. The Company figure of **_____** excluding the incremental transmission service costs, which were obtained from the Company in response to Staff DR #4112 for the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident, is reasonable, if the Commission grants an AAO in this case to the Company.

Q. Why did you not recommend Staff's result for this case instead of the Company's figure?

A. It is the Staff's position the Company should not be granted an AAO in this case.

SUMMARY

Q. Would you summarize your rebuttal testimony?

A. My testimony presents my method to estimate and verify the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident of June 7, 2000 and the June 7, 2000 through August 8, 2000 incident outage, which

the Company claimed, for this case.

In addition to reviewing SJLP's spreadsheet calculation of incremental replacement fuel and purchased cost of **_____**, excluding the incremental transmission service costs, I reviewed and analyzed the following parameters associated with the generating units: heat rates, maintenance outage schedules, and forced outage rates. I used the actual hourly system load and calculated the appropriate purchased power prices for this case. The fuel prices were obtained from the Staff member (V. William Harris).

Q. If the Commission grants an AAO in this case to the Company, what is your recommendation for the incremental replacement fuel and purchased power costs associated with the Unit 4/6 incident of June 7, 2000 and the June 7, 2000 through August 8, 2000 incident outage?

A. Although the Staff believes that the Company should not be granted an AAO, if the Commission grants an AAO to SJLP, it should be no more than **_____**.

Q. Does this conclude your rebuttal testimony?

A. Yes, it does.

EO-00-845

Table 1 presents the generation resources and incremental costs of those resources to meet the load

Table 1

Resources	Avaliavle MW	Incremental cost $/MWH
NPPD	60	7
Iatan	121	8
Lake Road Unit 4/6	95	11
Other	Varies	65

If in a particular hour, the system load is 250 MW and the Lake Road Unit 4/6 is online, Table 2 shows the economic dispatch order.

Table 2

Resources	Avaliavle MW	MW loaded	Incremental cost $/MWH	Total cost ($)
NPPD	60	60	7	$420
Iatan	121	121	8	$968
Lake Road unit 4/6	95	69	11	$759
Other	Varies	0	65	$0
Total		250		$2,147

Now suppose the system load is 250 MW and the Lake Road Unit 4/6 is offline, Table 3 shows the economic dispatch order

Table 3

Resources	Avaliavle MW	MW loaded	Incremental cost $/MWH	Total cost ($)
NPPD	60	60	7	$420
Iatan	121	121	8	$968
Lake Road Unit 4/6	95	0	11	$0
Other	Varies	69	65	$4,485
Total		250		$5,873

Note: 1) Incremental costs $/MWH are hypothetical values used for the example.
2) NPPD means capacity purchased energy from Nebrska Public Power District (NPPD).
3) Iatan means Iatan generating unit
4) "Other" means Lake Road generating units, except Lake Road Unit 4/6 and spot and capacity purchased power.

Schedule 1

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Schedule 2 is Highly Confidential in its entirety.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

IN THE MATTER OF THE APPPLICATION OF ST. JOSEPH LIGHT & POWER COMPANY FOR THE ISSUANCE OF AN ACCOUNTING ORDER RELATING TO ITS ELECTRICAL OPERATIONS.	))))))	Case No. EO-2000-845

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 12 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 10th day of October, 2000.

Notary Public

My commission expires June 1, 2001