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MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. ER-2006-0314

SURREBUTTAL TESTIMONY

OF

ROBERT J. CAMFIELD

ON BEHALF OF

KANSAS CITY POWER & LIGHT COMPANY

Jefferson City, Missouri
October 2006

KCP&L Exhibit No. 37
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SURREBUTTAL TESTIMONY

OF

ROBERT J. CAMFIELD

CASE NO. ER-2006-0314

1 **Q. Please state your name, title, and business address.**

2 A. My name is Robert J. Camfield. I am a Vice President with Christensen Associates
3 Energy Consulting LLC. My business address is Suite 700, 4610 University Avenue,
4 Madison, Wisconsin, 53705.

5 **Q. Are you the same Robert J. Camfield who has provided Direct Testimony on behalf**
6 **of Kansas City Power and Light Company in this proceeding?**

7 A. Yes. My Direct Testimony provides a detailed assessment of the performance of Kansas
8 City Power & Light Company ("KCPL"), from the perspective of retail consumers.

9 Using a battery of objective performance metrics including productivity and overall price
10 level, the assessment demonstrates that KCPL has, unequivocally, realized top-level
11 performance for its customers, with reference to that realized by the electric services
12 industry as a whole and by two peer groups. The testimony recommends that the
13 Missouri Public Service Commission ("MPSC" or "Commission") take full account of
14 KCPL's exceptionally high performance in its determination of key issues of the
15 immediate rate setting proceeding, including the allowed rate of return on common
16 equity. I recommend that the Commission consider the inclusion of a performance
17 allowance of 50 – 100 basis points within the authorized rate of return on equity for
18 KCPL in the immediate proceeding.

19 **Q. What prompts your surrebuttal testimony?**

1 A. My Surrebuttal Testimony responds to the Rebuttal Testimony of Ms. Deborah Ann
2 Bernsen regarding KCPL's performance. While I appreciate the concerns raised by
3 Ms. Bernsen regarding performance, I am concerned that she may have reached an
4 inappropriate position regarding KCPL's performance level, and the use of performance
5 in the determination of rates for retail electricity services. Accordingly, I wish to clarify
6 and elaborate on performance assessment, the value of KCPL's performance to retail
7 consumers, the proper application of performance metrics in rate setting, and the
8 consideration of the realized performance of KCPL by the MPSC in its deliberation of the
9 outstanding issues before it in this proceeding.

10 Q. Please summarize the views expressed by Ms. Bernsen.

11 A. Ms. Bernsen's position regarding performance is that the MPSC should not consider
12 performance in its determination of the overall rate of return and rate level for KCPL in
13 the immediate proceeding. Her position appears to be premised on two ideas. First,
14 Ms. Bernsen cites procedural case history and decisions by the MPSC regarding
15 performance and concludes that the Commission, as a matter of policy, does not view
16 performance as a basis to determine the authorized rate of return or overall rate level
17 (pages 4-6). Ms. Bernsen provides a brief review of decisions by the MPSC regarding
18 performance in support of this view and notes that in its deliberation of selected issues,
19 the MPSC has adjusted the authorized rates of return on rate base – and thus the realized
20 returns on common equity – in several rate proceedings including ER-82-39 and WR-82-
21 50 involving Missouri Public Service Company; ER-83-42 involving Empire District
22 Electric Company; and ER-83-49 involving Kansas City Power & Light Company. As
23 described by Ms. Bernsen at page 4, lines 4-5: "The Commission utilized both upward

1 and downward adjustments to the rate of return” As she noted, these adjustments
2 included modest upward adjustments of 40 basis points to the authorized rates of return
3 on common equity in ER-83-42 (Empire) and ER-83-49 (KCPL). In these two
4 proceedings, the Commission’s decision favoring higher authorized returns on equity
5 were based on performance including customer relations and management efficiency,
6 respectively. In her Rebuttal Testimony (page 5, lines 10-26), Ms. Bernsen goes on to
7 describe Missouri proceedings where the Commission declined to adopt adjustments to
8 the authorized rates of return because of the difficulty in determining the measurement of
9 performance in a case involving Southwestern Bell Telephone Company.

10 Second, Ms. Bernsen argues that the measurement of a utility’s effectiveness and
11 efficiency is difficult and that the overall performance cannot be readily discerned (page
12 3, lines 4-10). To this latter point, she raises issues regarding the linkage of performance
13 and authorized rates of return, and reaches the conclusion that such issues need to be
14 addressed beforehand (page 7, lines 12-22), although she acknowledges the principle that
15 I set forth originally (page 8, lines 4-15). Finally, Ms. Bernsen’s testimony discusses the
16 responsibility of regulated utilities to obtain what I interpret to be an acceptable level of
17 performance (page 6, line 27 to page 7, lines 10), regardless of the incentive properties
18 confronting them.

19 Taken together, she reaches the conclusion that the Commission should not utilize or take
20 account of KCPL’s exceptional performance in its deliberation of the issues before it in
21 this proceeding (page 9, line 13 to page 10, line 13).

22 **Q. What is your response to Ms. Bernsen’s Rebuttal Testimony?**

1 A. I respectfully disagree with her interpretation of the Commission's prior Orders as cited
2 and their applicability to this proceeding; her qualitative yet general analysis of
3 performance and performance measurement; the implied incentive properties of
4 regulatory governance; and the overall conclusions and policy advice expressed within
5 her Rebuttal Testimony.

6 Q. Why do you believe that Ms. Bernsen has not correctly interpreted the
7 Commission's decisions regarding performance, and application of such decisions
8 within the immediate proceeding?

9 A. She cites pages 70 – 72 of the Commission's Order in Case No. TC-89-14, where the
10 Commission stated that only rarely can the ROE adjustment be supported by evidence
11 and that Southwestern Bell had failed to provide any evidence to guide the Commission
12 in how to value a certain management decision. I generally concur with the
13 Commission's view that it is challenging and difficult to link a specific management
14 decision to the value that such decision provides to retail consumers and markets. For
15 these reasons, it is appropriate to define, beforehand, criteria for the consideration of a
16 performance allowance, as my Direct Testimony does. I recommended:

17 "...that the Commission apply a rational principle and criterion in
18 determining the appropriate level of a performance allowance
19 inclusion within the rate of return. In brief, the Commission
20 should ensure that the net benefits...are sufficient to cover the
21 allowance itself." (Camfield Direct Testimony, page 27, lines
22 18-21).

23 As the Commission stated and as Ms. Bernsen appreciates, the linkage between specific
24 actions and individual management decisions, which take place continually in the course
25 of operating a complex and highly integrated organization of resources like KCPL, and
26 specific gains in value are not easily observable. Furthermore, performance should be

1 defined broadly and aimed at tangible benefits to the retail markets served. For this
2 reason, it is necessary and appropriate for the Commission to assess the impacts of
3 corporate performance using pre-defined metrics that are measurable and objective. I
4 suggest that the metrics that I have applied in this case, which give rise to tangible and
5 measurable benefits to retail consumers and markets, satisfy the Commission's past
6 concerns, and the general principle that I cite in my Direct Testimony (noted above). To
7 this end, my testimony goes on to identify key dimensions of benefits, including
8 "Alignment of Long-term Performance with the Interests of Consumers" (Camfield
9 Direct Testimony, page 27, lines 12-14). These criteria, as I mention, are focused on
10 retail markets and the benefits realized by electricity consumers. By these standards,
11 which are definitive and measurable, KCPL's high levels of total factor productivity and
12 cost metrics translate directly into tangible and measurable benefits, stated in monetary
13 terms, to KCPL's customers and the region as a whole. These benefits are contemporary
14 insofar as they are observable in the price, cost, and productivity history of KCPL vis-à-
15 vis other companies. These benefits are also forward-looking, as the obtained levels of
16 high productivity and low costs give rise to flows of benefits to retail consumers over
17 future years. Later on, I quantify the value of these net benefits for the consideration of
18 the Commission.

19 In summary, I concur with Ms. Bernsen that for the Commission to seriously consider
20 utility performance as a basis for determination of the retail price level, performance must
21 be observable and directly linked to the value creation that such performance provides to
22 retail consumers. For this reason, as mentioned above, I apply and utilize observable
23 performance metrics including productivity and key cost diagnostics. These

1 performance metrics are measurable and definitive. Their net impacts translate directly
2 into value to retail consumers that is measurable in money terms.

3 **Q. What is the value and worth of KCPL's superior market performance to retail**
4 **consumers?**

5 **A.** As shown in my Direct Testimony, KCPL's overall performance resides at the very high
6 end of the experience of the electric utility industry. *See* Schedule RJC-3.

7 Productivity refers to the quantity of inputs used in the process of producing and
8 delivering retail electricity services, with reference to the quantity of services delivered.

9 Productivity growth refers to the rate of change in the quantity of inputs with reference to
10 the rate of change in output. If outputs increase faster than inputs, productivity is rising.

11 The productivity estimates account for changes in internal processes of the service
12 provider, as a result of changes in input prices, which are external to management
13 decisions.

14 I estimate that KCPL's relative performance advantage translates into net value gains to
15 retail consumers of \$116.9 - \$144.6 million, when compared to productivity for utilities
16 within the contiguous region and for the industry as a whole, respectively. For generation
17 service, the value obtained for retail electricity consumers by KCPL's superior
18 performance is equal to \$111.6 - \$132.8 million, also shown relative to the region and the
19 industry, while the net gains in distribution and customers services are equal to
20 \$11.6 -13.9 million, and \$2.3 - \$3.4 million, respectively.

21 The methodology used to determine net gains in value is a straight-forward analysis and
22 draws upon the performance assessment of KCPL with reference to the industry and the
23 two peer groups used in the study. Specifically, net gains to consumers are calculated as

1 the change in consumer surplus, which is the monetary value realized by consumers
2 through lower prices that are obtained as a direct result of KCPL's high level of
3 productivity. In short, KCPL's productivity gains translate into lower prices; lower
4 prices, in turn, create improved incremental value for consumers. The gains are sizable.
5 It is useful to mention that the industry-wide productivity analysis, referred to as total
6 factory productivity, is firmly rooted in economic analysis. These methods over the years
7 have been adopted by professional economists worldwide and are currently applied by
8 the Bureau of Labor Statistics of the U.S. Government. For the consideration of the
9 Commission and interested parties, I attach a discussion paper that provides a review of
10 the technical analysis used to determine productivity for the industry, peer groups, and
11 for KCPL. See Schedule RJC-6.

12 **Q. How do the value gains from KCPL's high performance level compare to the**
13 **revenue implications of the performance allowance that you recommend?**

14 **A.** The incremental revenues attending the suggested performance allowance,
15 \$5.6 - \$11.1 million, is small with reference to the value gains to retail electricity
16 consumers that result from KCPL's performance. In other words, the value gains to
17 consumers from KCPL's productivity advantage far outweigh the modest revenue
18 impacts of the allowance that I recommend for consideration by the Commission.

19 **Q. Is a performance allowance consistent with the principles that underlie just and**
20 **reasonable rates?**

21 **A.** Absolutely. The principles of just and reasonable rates reach back to the often referenced
22 decision by the U.S. Supreme Court in *Bluefield Water Works & Improvement Company*
23 *v. Public Service Commission of West Virginia*, 262 U.S. 679 (1923). The Bluefield

1 decision, as fortified by *Federal Power Commission v. Hope Natural Gas Company*,
2 320 U.S. 591 (1944), set the commonly recognized standard for fair rate of return and just
3 and reasonable rates. These legal principles state that the rate of return must be non-
4 confiscatory of the capital, and that utilities are entitled to a rate of return that is
5 equivalent to amounts that are realized on investments of comparable risk. Moreover,
6 regulatory agencies including the MPSC have for many years recognized that the
7 principle of just and reasonable rates and fair rate of return can, properly, recognize
8 efficiency. Indeed, Charles Phillips in the opening paragraph of the chapter on Rate of
9 Return of his classic work entitled *The Regulation of Public Utilities* (3d edition, 1993) at
10 page 375 states: "Furthermore, regulation may use the rate of return as an incentive by
11 awarding returns that are higher than the minimum to those utilities with relatively
12 greater efficiency." Phillips further states on page 401: "The cost of capital standard ...
13 has one serious limitation: it makes no specific allowance for efficiency." He observed,
14 also on page 401, that "Justice Brandeis argued that an efficient utility might properly be
15 allowed more than a rate of return barely above the level of confiscation." In summary,
16 the MPSC is on solid ground to consider and account for the effectiveness of utilities in
17 setting rate levels and determining authorized rates of return.

18 **Q. Has the general topic of the performance within the context of utility regulation**
19 **been taken into account by regulatory economists?**

20 **A.** Yes. Regulatory governance as it relates to performance has been a topic of keen interest
21 for regulatory law and economics for some time. In fact, alternative regulatory
22 governance structures including alternative forms of regulation was a popular topic
23 during the late-1970s – early-1980s. The essential concern was that, in the case of cost-

1 based regulation, utilities may not realize high performance levels and thus minimum
2 cost levels and maximum value to retail consumers may not occur.

3 While Ms. Bernsen may assert that utilities have a responsibility to minimize costs – an
4 idea with which I generally concur – most regulatory economists would contend that
5 substantial differences in performance among utilities do exist after accounting for other
6 factors – in particular, differences and similarities in input costs. Furthermore, it is also
7 the responsibility of the regulatory agency to put in place the appropriate regulatory
8 mechanisms that encourage the desired performance. The performance allowance that I
9 recommend in this case is a regulatory mechanism that achieves the desired result. The
10 cost of the recommended 50 to 100 basis points allowance – which can be viewed as a
11 sharing mechanism – is a fraction of the net benefits realized for retail consumers by
12 KCPL's high performance levels.

=13 The performance allowance communicates a valuable incentive to service providers.

14 Moreover, evidence suggests that the recognition of performance works where
15 performance metrics are defined in a manner that aligns the interests of retail consumers
16 with increased returns to capital. For this reason, I encourage the Commission to give
17 consideration to the principle that I have defined on page 27 of my Direct Testimony
18 which allows the Commission a substantial level of discretion about how to share the net
19 gains, in the form of the specific amount of the allowance that is permitted.

20 **Q. Is it necessary that the performance allowance be incorporated only within the**
21 **authorized rate of return on equity, or are other avenues available to the**
22 **Commission?**

1 A. No. While incorporation of the performance allowance within the rate of return is
2 consistent with just and reasonable rates, KCPL's performance can and should be
3 considered by the Commission on all outstanding issues regarding the case.

4 Q. Does that conclude your Surrebuttal Testimony?

5 A. Yes.

TECHNICAL DISCUSSION PAPER**TOTAL FACTOR PRODUCTIVITY
of the
U.S. ELECTRIC UTILITY INDUSTRY**

**Christensen Associates Energy Consulting LLC
Madison, Wisconsin
January, 2006**

This discussion reviews the methods used to construct total factor productivity (TFP) performance measures for Kansas City Power and Light and other investor-owned electric utilities. A comprehensive TFP measure, which evaluates all utility operations together, is developed for generation, transmission, distribution, and customer service categories of integrated services.¹ The estimation of TFP performance metrics requires the development of measures of output and inputs used in the process of providing electric services. Inputs include labor, quasi-materials, capital, and fuel.

Output Measures

The following measures were used to measure output. First, the comprehensive (company wide) measure of TFP for integrated services uses total MWH sales covering the various retail customer classes and sales in wholesale markets. The output measure used is a Fisher ideal quantity index of MWH sales to residential customers, commercial customers, industrial customers, and MWH sales for resale. The weights used for these measures are based on revenues realized from the sales to each customer class.²

For generation operations, the output measure used is net generation. For transmission operations, the study uses annual peak MW and total miles of transmission lines as the measure of output. We average the annual growth rates for these two output measures, and then compute an output index by obtaining an annual average growth rate. For distribution operations, the output measure is peak MW and the number of customers, using the same averaging procedure as employed to compute transmission output. The output measure for customer service is the number of customers.

¹ Customer service includes the functional accounting categories of customer accounts, customer service and informational, and sales.

² A Fisher ideal index was chosen in this analysis instead of a Tornqvist index because some utilities do not provide all outputs or use all inputs. A Tornqvist index cannot handle zero quantities.

Fuel and Purchased Power Inputs

The comprehensive TFP measure and the generation TFP measure incorporate fuel inputs, and the comprehensive TFP measure also incorporates purchased power.³ Four fuel inputs are separately recognized including coal, nuclear, natural gas, and oil. Fuel types are inputs into three of the four generation categories including fossil steam, nuclear power, and other power generation. The values of these fuel inputs are observed in the fuel expenses recorded in the electric operation and maintenance report contained in the FERC Form 1 reports.

The prices for these fuel inputs are as follows. A coal price index is assigned to steam generation fuel, a nuclear fuel price index is assigned to nuclear generation fuel, and a composite price index of gas and oil is assigned to other power generation fuel. The composite price index assigns a weight of .97 to the natural gas price index, and .03 to the oil price index. The quantities of fuel for these fuel inputs are obtained by dividing the expense values by the price indexes. A composite quantity index of fuel is derived from a Fisher ideal index of the fuel input quantities.

The value of purchased power is based on purchased power expenses, also as recorded in the FERC Form 1 reports. The price index for purchased power is based on revenue per MWH from sales for resale.

Labor Inputs

For the comprehensive TFP measure, the quantity of labor input is based on the number of employees. The value of labor input equals the total salaries and wages reported for each of the operation and maintenance expense categories, plus reported pension expenses. The price of labor input is obtained by dividing the labor value (expenses, or cost) by the quantity of labor.

To obtain labor input measures for the different operations, the study distributes total labor quantity and value. This is done by developing a distribution key based on the direct payroll, as reported for generation, transmission, distribution, and customer service. This distribution key effectively distributes administrative and general wages and salaries and payroll charged to clearing accounts in proportion to the direct wages and salaries for generation, transmission, distribution, and customer service.

Quasi-Material Inputs

For the comprehensive TFP measure, the value of quasi-materials inputs, which appear in the non-fuel operations and maintenance expenses, is obtained by taking total O&M expenses, subtracting the value of labor, the value of fuel, and the value of purchased power. The price of quasi-materials input is set equal to the Gross Domestic Product Price Index, and the quantity of quasi-materials input is obtained by dividing the value of inputs by the price index.

³ Purchased power must be included in the comprehensive TFP measure since the output measure is based on total sales. Since the generation TFP output measure is based on net generation instead of total sales, it would be inappropriate to include purchased power as an input.

To obtain the value of quasi-materials input for the different operations, we take the O&M expense booked to the operation, plus a share of administrative and general O&M expense, less the value of labor expense for the specific area and, in the case of generation, less the value of fuel and purchased power. The distribution of administrative and general O&M expense is based on the allocation key described in the section on labor input.

Capital Inputs

The value, price, and quantities of capital input are based on the methodology established by Christensen, Gollop, and Stevenson.⁴ Seven capital asset classes are distinguished: steam production, nuclear production, hydro production, other production, transmission plant, distribution plant, and general plant. The first step is to compute quantities of the capital stock using the perpetual inventory method. The perpetual inventory equation assumes the form:

$$K_{it} = I_{it} + (1 - \delta_i) \cdot K_{it-1},$$

where K represents the quantity of capital stock, I the quantity of investment, δ the rate of replacement, i the asset class, and t the year. The perpetual inventory equation requires a benchmark (or starting) year and value. 1965 is selected as the benchmark year.

To compute the quantity of investment in each year, the analyses begin by first determining the value of investment, measured in dollars, and the price of investment. The procedure then divides the investment value by the investment price index to obtain the quantity of investment. The value of investment is observed as the additions to plant in service for each asset class, as reported in the FERC Form 1 Report, Electric Plant in Service. The price indexes are based on various Handy-Whitman indexes. The following table shows the mapping of Handy-Whitman indexes to asset classes.

Steam Production Plant	Table E, Line 6 (Total Steam Production Plant)
Nuclear Production Plant	Table E, Line 17 (Total Nuclear Production Plant)
Hydro Production Plant	Table E, Line 22 (Total Hydraulic Production Plant)
Other Production Plant	Table E, Line 28 (Total Other Production Plant)
Transmission Plant	Table E, Line 33 (Total Transmission Plant)
Distribution Plant	Table E, Line 42 (Total Distribution Plant)
General Plant	Table B, Line 2 (Reinforced Concrete Building Construction)

The July price index values of Handy-Whitman are used to represent the capital price level for each year of the analysis. Each utility in the sample is mapped to a Handy-Whitman index

⁴ Laurits R. Christensen, Frank M. Gollop, and Rodney Stevenson, "Estimates of Capital Stocks and Capital Services Flows for Privately-Owned Electric Utilities in the U.S., 1950-1975," University of Wisconsin - Madison, May 1980.

region and assigned the set of indexes for that region. The Handy-Whitman indexes are all based to 100 in 1973. The analysis procedure rescales the price indexes to the relative price levels using the Christensen-Gollop-Stevenson scaling factors for 1966. These factors are shown in the following table.

Relative Scaling Factors for Investment Prices in 1966						
Region/Category	1	2	3	4	5	6
Steam (\$/kW)	122.81	119.35	126.26	121.54	126.61	130.08
Nuclear (\$/kW)	176.85	171.86	181.82	175.01	182.32	187.31
Hydro (\$/kW)	221.06	214.83	227.27	218.77	227.90	234.14
Other Production (\$/kW)	83.51	81.16	85.86	82.65	86.10	88.45
Transmission (\$ per circuit miles)	90792.82	88233.07	93343.34	89850.24	93602.09	96161.85
Distribution (\$/customer connection)	1670.25	1623.16	1717.17	1652.91	1721.93	1769.02
General Plant (\$/ft. ³)	1.0316	1.0025	1.0606	1.0209	1.0635	1.0926

The replacement rates are based on the 1.5 declining balance method. This means that the replacement rate $\delta_i = 1.5/T_i$, where T_i is the estimated service life of the asset. Following Christensen-Gollop-Stevenson, the study uses the following estimated service lives: steam production plant – 33 years, nuclear production plant – 33 years, hydro production plant – 56 years, other production plant – 24 years, transmission plant – 37 years, distribution plant – 37 years, and general plant – 25 years.⁵

The benchmark values for capital are based on the reported net book values of plant for 1965. The analysis procedure converts the net book values to quantities by using a deflation procedure that accounts for the different vintages of investment goods comprising book value. The net book value, B_i , is obtained by taking the balance at end of year, as reported in the electric plant in service report, and subtracting the end of year balance of accumulated depreciation, reported in the accumulated provision for depreciation of electric utility plant report. The net book value is then divided by a triangularized weighed average of scaled Handy-Whitman values:

⁵ These nominal values for the life of capital should perhaps be reviewed and, if needed, adjusted.

$$K_{i,1965} = \frac{B_{i,1965}}{\sum_{k=1}^{20} \left(\frac{k \cdot HW_{i,1945+k}}{\sum_{k=1}^{20} k} \right)}$$

where HW represents the scaled Handy-Whitman index. The triangularized weighted average approach gives more weight to price index values in more recent years, reflecting the fact that the net book value has more investments of recent vintage.

Once capital stocks are computed for the seven asset classes, the approach is to then compute quantities, prices, and values of capital input. The quantity of capital input (which represents a flow of services during the year) is set to equal the quantity of the capital stock at the end of the previous year:

$$K_{it}^S = K_{i,t-1}$$

The price of capital input is based on the Christensen-Jorgenson rental price equation:

$$p_{it}^S = \frac{(1 - u_t \cdot z_{it})}{(1 - u_t)} \cdot (r_t \cdot p_{i,t-1} + \delta_i \cdot p_{it} - (p_{it} - p_{i,t-1})) + \tau_t \cdot p_{i,t-1}$$

where p^S is the implicit rental price, p is the investment price, u is the rate of taxation on corporate income, z is the present value of tax depreciation allowances, r is the after-tax rate of return, δ is the replacement rate used in the perpetual inventory equation (which also equals the rate of economic depreciation), and τ is the rate of property taxation. The study approach simplifies the rental price equation using a method analyzed by Harper, Berndt, and Wood,⁶ which obtains the following conversion of the above equation to:

$$p_{it}^S = \frac{(1 - u_t \cdot z_{it})}{(1 - u_t)} \cdot (\bar{r}_t + \delta_i) \cdot p_{i,t-1} + \tau_t \cdot p_{i,t-1}$$

where \bar{r} is the real rate of return on capital. We use a 4% real rate of return, which is in line with the range proposed by Harper, Berndt, and Wood. The values of z are based on the MACRS depreciation allowance schedule, while the value of u is set to the marginal federal tax rate of 35%. The property tax rate is computed by dividing reported taxes other than income taxes (found in the statement of income for the year report) by the value of the total capital stock at the end of the year. The value of the capital stock for each asset class is obtained by multiplying the capital stock quantity by the scaled Handy-Whitman index. The total value of capital stock is obtained by adding the values for the seven asset classes.

The value of capital input for each asset class is obtained by multiplying the price by the quantity. The quantity of capital input for the comprehensive TFP measure is based on a Fisher ideal quantity index of capital input for the seven asset classes. To obtain capital input measures for each operation, the study approach is to assign the capital inputs to the different operations.

⁶ Michael J. Harper, Ernst R. Berndt, and David O. Wood, "Rates of Return and Capital Aggregation Using Alternative Rental Prices," in Dale W. Jorgenson and Ralph Landau, eds., *Technology and Capital Formation*, (MIT Press, 1989), pp. 331-372.

Steam production plant, nuclear production plant, hydro production plant, and other production plant are assigned to generation operations. Transmission plant is assigned to transmission operations, while distribution plant is assigned to distribution operation. General plant is distributed to the generation, transmission, distribution, and customer service operations according to the allocation factors described in the section above on labor inputs. Once the capital inputs are assigned to the different operations, they are aggregated using a Fisher ideal quantity index to obtain measures of total capital input.

Determining Total Input

The quantity of total input in the comprehensive TFP measure is computed as a Fisher ideal index of the fuel, purchased power, labor, materials, and capital input quantities. The value of total input is obtained by summing the values of fuel, purchased power, labor, materials, and capital input. The price of total input is obtained by dividing the value by the quantity. The total quantity input measures for the different operations are computed in a similar manner.

Constructing Data for the Electric Industry, and Data Issues

Data used in the immediate study covers those electric utilities that have generation, transmission, and distribution operations. The study begins with 122 utilities that submitted FERC Form 1 reports during the 1994-2004 period,⁷ although reaching back many years the data base consists of well over 200 utilities. Many of these utilities divested themselves of a substantial share of their generation (or transmission) assets during that period, making it difficult to develop comparable capital input measures for those firms. Thus, a number of utilities are excluded from the immediate analysis. Data anomalies are also present for some utilities. While the study work was often able to resolve these anomalies by drawing upon other data sources and estimation methods,⁸ some anomalies could not be resolved leading unfortunately to their exclusion from the immediate study. Finally, a few reporting entities had not reported results for 2004 at the time that the study was performed. The immediate study of U.S. electric utilities covers 55 service providers.

⁷ Some of these firms merged during the study period. In those instances we consolidated their data.

⁸ For example, a couple of firms reported MWh sales for 2004 that were clearly off by an order of magnitude. A close investigation showed that the data reported represented one quarter of sales reported in kWh instead of annual sale reported in MWh. We were able to make corrections for those firms.

My commission expires: June 22, 2008