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April 25, 1997

BY HAND DELIVERY

Ms. Blanca S. Bayo, Director
Division of Records and Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: Determination of appropriate cost allocation and regulatory treatment of total revenues associated with wholesale sales to Florida Municipal Agency and City of Lakeland by Tampa Electric Company; Docket No. 970171-EU

Dear Ms. Bayo:

Enclosed for filing in the above docket on behalf of Tampa Electric Company are the original and fifteen (15) copies of the following:

1. Direct Testimony of John B. Ramil; — 04234-97
2. Direct Testimony and Exhibit of Karen A. Branick; and 04314-97
3. Direct Testimony and Appendix of Douglas R. bohi. 04315-97

Please acknowledge receipt and filing of the above by stamping the duplicate copy of this letter and returning the same to this writer.

Thank you for your assistance in this matter.

Sincerely,

Lee L. Willis

LLW/bjm
Enclosures
cc: All Parties of Record

RECEIVED & FILED
FPSC-BUREAU OF RECORDS

CERTIFICATE OF SERVICE
DOCKET NO. 970171-EU

I HEREBY CERTIFY that true and correct copies of Testimonies of John B. Ramil, Karen A. Branick and Douglas R. Bohi on behalf of Tampa Electric Company have been furnished by hand delivery(*) or U. S. Mail this 25th day of April, 1997 to the following:

Ms. Leslie Paugh*
Staff Counsel
Division of Legal Services
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Mr. Gary Lawrence
City of Lakeland
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Vicki Gordon Kaufman*
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Tallahassee, FL 32399-1400

ATTORNEY

BEFORE THE PUBLIC SERVICE COMMISSION

DIRECT TESTIMONY

OF

DOUGLAS R. BOHI

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name and business address.

A. My name is Douglas R. Bohi. My business address is Charles River Associates Incorporated, 1001 Pennsylvania Avenue, N.W., Suite 750 North, Washington, D.C. 20004.

Q. By whom are you employed?

A. I am a Vice President of Charles River Associates Incorporated, an economics consulting firm with offices in Washington, Boston, and Palo Alto.

Q. Please describe your educational background and prior work experience.

A. I have been awarded a bachelor of science degree in economics from Idaho State University (1962) and a Ph.D. in economics from Washington State University (1967). Prior

positions I have held since receiving my Ph.D. include: Economist in the Office of the Assistant Secretary of Defense for Systems Analysis; Economist for Caterpillar Tractor Company; Professor of Economics and Chairman of the Economics Department at Southern Illinois University; Senior Fellow and Director of the Energy and Natural Resources Division at Resources for the Future, Incorporated; and Chief Economist and Director of the Office of Economic Policy at the Federal Energy Regulatory Commission.

While at Resources for the Future, I concentrated on research that would help explain how energy markets, including electricity markets, behave and how various kinds of government regulation affect market efficiency. I have authored or co-authored eight books and numerous articles on various aspects of energy market behavior and energy policy issues. [My résumé is attached as Appendix 1.]

Q. Have you testified before the Florida Public Service Commission before?

A. No, I have not.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of Tampa Electric.

II. PURPOSE AND SUMMARY OF TESTIMONY.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the basic economic principles that should be used in determining how the revenues and costs associated with the wholesale sales of power to Florida Municipal Power Agency (FMPA) and to the City of Lakeland (Lakeland) should be reflected in the retail jurisdiction. Based on these principles, both transactions are profitable in the sense that the additional revenues received will exceed the additional costs incurred to serve each of the two transactions. Thus, both sales yield net benefits. The Commission should encourage these types of sales and would, in fact, discourage them if the cost of these transactions were imputed at their average cost rather than their incremental cost.

Q. Please summarize your testimony.

A. My testimony uses traditional economic analysis to show that, to maximize economic efficiency for the firm and for

society, firms should produce and offer for sale any increment of output where price (or, equivalently, average revenue) at least covers the incremental costs of production, even if the price is less than the average cost of production. Put another way, incremental wholesale sales are profitable as long as they make a contribution to fixed costs. This condition is satisfied by the sale of power to FMPA and Lakeland.

The wholesale market for power in Florida is highly competitive, implying that individual sellers such as Tampa Electric are unable to determine the market price and must be willing to sell at a price that the market will bear. In their assessment of whether each individual transaction is profitable, sellers will determine whether the price covers the incremental cost of production. Market efficiency is achieved if the seller with the lowest incremental cost is the one that makes the sale.

If the Commission requires the imputed cost of wholesale sales to be set at average cost rather than incremental cost, the correct efficiency condition will not be achieved. The firm with the lowest incremental cost for the same service may not be the one making the sale. Moreover, if the Commission applies an inappropriate

standard for evaluating the benefits of wholesale sales to firms under its jurisdiction, a distortion will be created favoring firms outside the Commission's jurisdiction. In particular, independent power producers and power marketers who do not have retail customers will be able to sell according to their incremental costs of production. To the extent that their incremental costs are larger than those of jurisdictional firms, the wrong firms will be supplying the market.

When the market is operating less efficiently than it should, electricity prices are higher than they need to be. As a consequence, consumers will ultimately bear the cost of market inefficiency. Importantly, the retail customers of firms that are unable to make wholesale sales because of the imputation of average costs may be harmed as will the ultimate consumers of wholesale sales.

III. ECONOMIC PRINCIPLES.

Q. What types of costs will you be discussing in your testimony?

A. I will be discussing average costs, average variable costs, marginal costs, and incremental costs. Moreover, I will be

discussing these costs within the context of a competitive wholesale market.

Q. Why in the context of a competitive wholesale market?

A. Because the transactions at issue are sales in the wholesale power market and, as demonstrated in the Prepared Direct Testimony of Tampa Electric Witness John B. Ramil, the wholesale power market in Florida is very competitive. In particular, this means that Tampa Electric is a pricetaker in the wholesale market, not a price setter. Tampa Electric must be willing to sell in the wholesale market at whatever price the market will bear.

Q. Define what you mean by average costs, average variable costs, marginal costs, and incremental costs.

A. Average cost refers to the cost per unit of producing a particular level of output. It is simply total costs of production divided by the quantity of output. Total costs include fixed costs, which are costs of production that do not vary with the level of output within the time frame under consideration, and variable costs are costs of production that vary with the level of output.

Average variable cost refers to the per unit variable costs of producing a particular level of output. It is simply total variable costs divided by the quantity of output.

Marginal cost refers to the change in total cost that results from an increase of one unit of production. It is equal to the change in total cost divided by the change in output. Since the change in output is one unit, it is simply the change in total cost. Note further that total cost will change only because of a change in variable costs (since fixed costs are fixed). Thus, marginal cost is also equal to the change in total variable costs.

Incremental cost is a term that is used in place of marginal cost when one wants to refer to a change in output larger than one unit. This occurs because the transactions under consideration usually involve more than a single unit of electricity. Incremental cost is calculated by the increase in total cost (or, equivalently, the increase in total variable cost) divided by the increase in quantity of output. Since the increase in total cost is divided by the change in output, the increase is averaged to obtain a per unit measure.

Q. The distinction between fixed costs and variable costs is

important in defining these terms. Are some costs always fixed costs and others always variable costs?

A. No. What is a fixed cost or a variable cost depends on the time frame under consideration, and the variability of cost within that time frame. For example, capital costs are commonly called fixed costs, but within a very long time frame where expansion plans are being considered, these costs are variable. Similarly, fuel costs are commonly thought of as variable costs, since more fuel must be burned to increase output, but certain types of long-term contracts for fuel purchases may actually make some fuel costs fixed within the time frame set by the fuel contract.

Q. What time frame are you using for your testimony?

A. The time period of relevance for my testimony is determined by the length of time needed to complete the wholesale power transactions with FMPA and Lakeland. The FMPA transaction is for baseload capacity that grows from 35 MW starting December 16, 1996 to 150 MW by March 15, 2001. The Lakeland transaction is for 10 MW of peaking capacity that extends from November 4, 1996 through September, 30, 2006.

As indicated in the Prepared Direct Testimony of Tampa Electric Witness Karen Branick, the FMPA transaction does not require an increase in Tampa Electric's system capacity to satisfy the transaction, nor does the transaction force an expansion in Tampa Electric's system capacity to satisfy retail customers or any of Tampa Electric's other contractual obligations. In short, Tampa Electric's capacity requirements are the same whether the sale to FMPA is consummated or not. Thus, all capacity costs are fixed for the purpose of evaluating this transaction. Incremental costs are therefore measured by changes in fuel costs and variable O&M costs.

The Lakeland transaction involves 10 MW of peaking capacity that extends beyond Tampa Electric's next planned expansion. The testimony of Tampa Electric Witness Karen Branick indicates that there is uncertainty about whether additional peaking capacity is required to meet the Lakeland obligation. Consequently, incremental costs are calculated with and without a capacity charge, plus additional fuel costs and O&M costs.

Q. Based on these definitions, at what level of output should a firm produce?

A. The firm should continue to increase production as long as the price received for each increment of output covers the increase in cost required to produce that level of output, as long as price covers average variable costs of production.

Q. Please explain.

A. The firm should produce each increment of output that increases its profits or reduces its losses. Since the firm will incur its fixed costs of production no matter how much it decides to produce, the production decision is based on variable costs. The correct level of output can be determined by applying a simple rule to each increment of production under consideration. Each increment should be produced as long as the price received for that increment more than covers its incremental costs of production. As long as this rule holds, each additional sale contributes some amount to fixed costs and the firm is better off. In other words, if the firm is making profits before the sale, the sale will add to total profits; if the firm is making losses before the sale, the sale will reduce total losses.

Q. Do you mean that different transactions may be charged

different prices because incremental costs charge with the number of transactions?

A. Not necessarily. In a competitive market, all transactions of a similar nature and entered into at the same time would be charged the same price. This is best illustrated in the case of a wholesale spot market for electricity, where there may be several buyers of the same commodity at the same time. If incremental costs rise with the number of such transactions, the price charged for all of the transactions should cover the highest incremental cost incurred. Indeed, in a competitive spot market it is not possible to charge different prices for the same commodity because of "arbitrage." The customer receiving a lower price could resell to a customer that is charged a higher price, thus earning a profit, and reducing the market share of the original seller. Such arbitrage activities in competitive markets ensure that price discrepancies cannot persist for very long.

The same argument does not apply as easily in the case of contract sales, because contracts tend to specify unique commodities and because contracts tend to be negotiated at different points in time.

Q. Why would prices vary for different services or for the same services arranged at different times?

A. Different services may involve different costs, in which case they warrant different prices. One example is the spot sale of energy versus a contract sale of capacity. Another example is the difference between a contract sale of 10 MW of baseload power and a contract for 10 MW of peaking power. The latter example indicates why the pricing of baseload power for FMPA differs from the pricing of peaking load for Lakeland.

In the case where the same services are arranged at different times, prices may vary because costs of production change. For example, fuel prices can change over time so that the incremental cost of different transactions will change. Even if fuel prices do not change, the fuel costs of plants in the dispatch order required to serve peak loads will typically be higher than the fuel costs at off-peak times of day.

Q. What is the significance of average costs in this analysis?

A. The relationship between price and average cost is important for determining whether to produce at all, but it

does not determine how much to produce. If the average revenue earned from all sales is below average cost, the firm is incurring losses and may eventually be forced to shut down. However, as long as the firm must pay its fixed costs and if its price is above the variable costs of production, it pays the firm to continue operating in order to pay for some of its fixed costs.

Thus, the relationship between price and average cost determines whether to produce, while the relationship between price and incremental cost determines how much to produce.

In a regulated context, the firm's average costs are covered by revenues from retail sales and the issue is whether to produce an additional amount for sale into the wholesale market. If incremental costs of wholesale sales are covered by incremental revenues, retail customers will not be subsidizing wholesale sales.

Q. Would a requirement that all utilities price their wholesale sales at average costs, rather than incremental costs, have negative implications for the efficiency of the electric industry in the state of Florida?

A. Yes. As I have explained, firms should determine how much they produce according to their incremental costs, not their average costs. If decisions about which firm supplies the wholesale market are determined by average costs rather than incremental costs, it is possible that the firm with higher costs would be supplying the market, and that the wholesale price of electricity would be higher than necessary. Excessive prices in the wholesale market ultimately mean that retail prices will be excessive as well. The negative effects of excessive electricity prices go beyond the reduction in welfare of consumers to include more general adverse implications for employment and productivity in the state of Florida.

For example, suppose that Firm A has lower average costs than Firm B, but higher incremental costs. If wholesale transactions are to be evaluated on the basis of relative average costs, Firm A would supply the market; if, however, incremental costs were compared, Firm B would supply the market. Such a comparison would be possible if Firm B's average costs include larger fixed costs than Firm A's average costs. But differences in fixed costs are irrelevant for determining which firm should supply the market since fixed costs will be incurred whether the sale is made or not. The comparison should be made on the basis

of the incremental costs incurred and, on this basis, Firm B should supply the market. The profit (or contribution to fixed costs) resulting from the sale made by Firm B would be larger than the corresponding amount resulting from the sale made by Firm A.

If Firm A supplies the market rather than Firm B, the price of wholesale electricity in the state of Florida would be higher than necessary. The price of electricity paid by retail customers would also be higher than necessary. By choosing an inappropriate criterion for determining who can make the sale, therefore, the electric industry is forced to operate less efficiently than it otherwise could and consumers are forced to pay higher prices than are necessary.

Q. If some firms must impute their costs for wholesale sales at average costs, while other firms may use incremental costs, is there likely to be an uneconomic bias against those using average costs?

A. Yes. Suppose I.O.U.s in the state of Florida must evaluate decisions to sell in the wholesale market on the basis of average costs, while independent power producers and marketers are allowed to make the evaluation on the basis

of incremental costs. As indicated in the example above, the incremental costs of the I.O.U.s may be relatively lower, while the average costs may be relatively higher, than the independent power producers and marketers. This can happen because the I.O.U.s have higher fixed costs, but fixed costs are irrelevant to the decision to make the wholesale sale. Thus, the I.O.U.s may be unable to compete in the wholesale market even though the I.O.U.'s incremental costs for the same service may be lower than competing incremental costs. Not only is market efficiency harmed, but the I.O.U.s are unfairly treated relative to other wholesale competitors.

IV. APPLICATION OF THE ECONOMIC PRINCIPLES TO TAMPA ELECTRIC'S SALES TO FMPA AND LAKELAND.

Q. What are the incremental costs that are incurred by the FMPA transaction?

A. The incremental costs of supplying the FMPA transaction are given in the Prepared Direct Testimony of Tampa Electric witness Karen Branick. Document 4 in Exhibit KAB-1 of Ms. Branick's testimony gives the cumulative present value of incremental costs and revenues over the five-year period in which the transaction would last. The incremental cost to

Tampa Electric's system for producing and transmitting the amount of power called for by the contract with FMPA are separated into fuel costs and non-fuel costs. There are no capacity charges included with non-fuel costs. This is appropriate, as noted earlier, because the FMPA sale does not require Tampa Electric to increase capacity to accommodate the sale. The only non-fuel costs are SO2 allowance costs and variable O&M costs.

As noted in Ms. Branick's testimony, these incremental costs are calculated at the margin for Tampa Electric's system. In other words, the dispatch order for the quantity required to serve the FMPA sale comes after the retail load is served. This means that the incremental costs of serving FMPA are higher than the incremental costs of serving retail customers. For this reason, it may be concluded that incremental costs of serving FMPA are larger than Tampa Electric's average variable costs.

Q. What are the revenues to be earned from the FMPA transaction?

A. Document # in Exhibit KAB-1 also gives the incremental revenues to be earned from the FMPA transaction. If these revenues are divided by the quantity to be sold, one

derives the average revenue, or price, of the transaction.

Q. What may be concluded about the profitability of the transaction?

A. Since the incremental revenues from the transaction exceed the incremental cost of the transaction, the transaction is profitable. Since the sale is beneficial, the Commission should follow a policy that encourages rather than discourages such a sale.

Q. Does Tampa Electric's wholesale power sale to FMPA benefit FMPA's retail customers?

A. Yes. Tampa Electric was awarded the contract by FMPA because it was the cheapest source of the additional power required by FMPA. If Tampa Electric does not supply the power, FMPA will be forced to purchase from a higher-priced alternative supplier. FMPA's customers would have to pay higher prices as a result.

Q. What are the incremental costs and revenues of Tampa Electric's proposed sale to Lakeland?

A. The incremental costs and revenues of Tampa Electric's proposed sale to Lakeland are given in Document 5 in Exhibit KAB-1 in Ms. Branick's testimony.

In this case, incremental costs may include a charge for new peaking load capacity to service the Lakeland transaction. Whether capacity charges are included or not, the incremental costs are evaluated at the margin for Tampa Electric's system, so that the incremental costs for new peaking capacity exceed the average costs of peaking capacity.

Q. What may be concluded about the profitability of the transaction?

A. Since incremental revenues are larger than incremental costs, the transaction is profitable. The same arguments given above in connection with the sale to FMPA apply equally to the sale to Lakeland.

Q. Should the Commission encourage the FMPA and Lakeland sales?

A. Yes. These sales have been evaluated according to established economic principles and have been found to be

profitable. Thus, these sales should be encouraged by the Commission. To provide the proper encouragement for such sales, the Commission should ensure that incentives are in place that will cause firms to seek out this business.

Q. Does this conclude your testimony?

A. Yes, it does.

STATE OF FLORIDA

BEFORE THE

FLORIDA PUBLIC SERVICE COMMISSION

In Re: Determination of Appropriate Cost Allocation and Regulatory Treatment of Total Revenues Associated with Wholesale Sales to FMPA and City of Lakeland by Tampa Electric Co.	)	**Docket No. 970171-EU**

AFFIDAVIT OF WITNESS

I, the undersigned, being duly sworn, depose and say that the Prepared Direct Testimony of Douglas R. Bohi served on behalf of Tampa Electric Company in this proceeding is the testimony of the undersigned, and that such Prepared Direct Testimony is sponsored by me to the best of my knowledge, information and belief, is true, correct, accurate and complete, and I hereby adopt said testimony as if given by me in formal hearing, under oath.

Douglas R. Bohi

Subscribed and sworn before me this 24th day of April, 1997.

Notary Public for District of Columbia

My Commission Expires November 14, 2001

Charles
River
Associates

DOUGLAS R. BOHI — Vice President

Ph.D. Economics, Idaho State University
B.S. Economics, Washington State University

EXPERIENCE

Current	*Vice President*, Charles River Associates Incorporated, Boston, MA.
1988–1996	*Director*, Energy and Natural Resources Division, Resources for the Future, Washington, DC.
1987–1988	*Chief Economist* and *Director*, Office of Economic Policy, Federal Energy Regulatory Commission, Washington, DC.
1978–1987	*Senior Fellow*, Energy and Materials Division, Resources for the Future, Washington, DC.
1974–1977	*Chairman*, Department of Economics, Southern Illinois University, Carbondale, IL.
1970–1978	*Assistant Professor*, *Associate Professor*, and *Professor of Economics*, Southern Illinois University, Carbondale, IL.
1969–1970	*Economist*, Caterpillar Tractor Company, Peoria, IL.
1967–1969	*Economist*, Office of the Assistant Secretary of Defense for Systems Analysis, Washington, DC.

SELECTED HONORS AND ACTIVITIES

Senior Research Scientist for Economic Policy, Energy Division. Oak Ridge National Laboratory, 1995–present.

Member, Energy Division Advisory Committee, Oak Ridge National Laboratory, 1993–1995.

Editorial Board, *Resource and Energy Economics*.

Member, National Research Council Committee on the National Energy Modeling System, 1990-1991.

Member, National Petroleum Council Study on *Natural Gas*, 1991–1992.

Member, Scientific Committee, *Energia: Revista Trimestrale Siu Problemi Dell 'Energia,* Bologna, Italy.

Distinguished Alumnus, Idaho State University, 1988.

Visiting Professor, Centre of Policy Studies, Monash University, Melbourne, Australia, Summer 1982.

Adjunct Professor of Economics, George Washington University, 1980.

Fulbright Scholar, Netherlands School of Economics, Rotterdam, The Netherlands, 1977.

RECENT CONSULTING ARRANGEMENTS

Tampa Electric Company: Expert witness on transmission pricing and access issues before the Federal Energy Regulatory Commission, 1994–1995.

Western States Petroleum Association: Expert witness on Low Emission Vehicle Programs before the California Public Utilities Commission, 1994.

California Energy Commission: Expert witness and testimony on Transportation and Avoidable Energy Security Costs, November 1993.

Tucson Electric Power Company: Expert witness on Federal Energy Regulatory Commission merger policy in a case before the Superior Court of the State of California, 1992.

PUBLICATIONS

Books

The Economics of Energy Security. With M. Toman. Boston: Kluwer Academic Publishers, 1996.

Energy Price Shocks and Macroeconomic Performance. Washington, DC: Resources for the Future, 1989.

Analyzing Nonrenewable Resource Supply. With M. Toman. Washington, DC: Resources for the Future and Johns Hopkins University Press, 1984.

Energy Security in the 1980s: Economic and Political Perspectives. With W. Quandt. Washington, DC: The Brookings Institution, 1984.

Oil Prices, Energy Security, and Import Policy. With W. D. Montgomery. Washington, DC: Resources for the Future and Johns Hopkins University Press, 1982.

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Limiting Oil Imports: An Economic History and Analysis. With M. Russell. Baltimore, MD: Johns Hopkins University Press for Resources for the Future, 1978.

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