Exh WHH-S3 thru WHH-S

PECO STATEMENT NO. 15B

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PENNSYLVANIA PUBLIC UTILITY COMMISSION

V.

PHILADELPHIA ELECTRIC COMPANY.

DOCKET NO. R-850152

SUR-SURREBUTTAL TESTIMONY

OF

DR. WILLIAM H. HIERONYMUS

RATE TREATMENT PRINCIPLES APPLICABLE TO LIMERICK, ECONOMIC BENEFITS OF LIMERICK

MARCH 7, 1986

SUR-SURREBUTAL TESTIMONY OF DR. WILLIAM H. HIERONYMUS

Q. Please state your name and business address.

A. My name is William H. Hieronymus. My business address is Putnam, Hayes and Bartlett, Inc., 124 Mount Auburn St., Cambridge, Massachusetts.

Q. Have you testified previously in this proceeding?

A. Yes. My direct and rebuttal testimonies were PECO Statements 15 and 15A.

Q. What is the purpose of your sur-surrebuttal testimony?

A. I will respond to issues raised in the surrebuttal testimonies of Messrs. Falkenberg, Komanoff and Chernick, and comment briefly on those portions of Drs. Wilson and Wirtshafter's testimonies which address matters covered in my rebuttal testimony. In the interest of brevity, I shall not comment where I believe that my previous testimony deals adequately with the subject matter.

Surrebuttal Testimony of PAIEUG Witness Falkenberg

Q. The first area of your testimony addressed by Mr. Falkenberg is the discount rate for use in life cycle analyses. What is the substance of his testimony?

A. Setting aside his ad hominim and unprofessional attacks on the integrity of PECO's witnesses, Mr. Falkenberg makes four assertions: (1) that PECO's unwillingness to accept a much more substantial deferral of the return of capital from Limerick 1 proves that its discount rate exceeds 9.7 percent; (2) that the EEI survey in fact shows the discount rates of utilities in 1984; (3) that if PECO's response to the EEI survey were used, Limerick 1 with 100 percent of common plant would result in a negative net savings and Limerick 1 with 50 percent of common a relatively small net savings on a net-of-tax basis; and (4) that use of a net-of-tax discount rate leads to the counterintuitive result that Limerick is less valuable if federal taxes are lower.

Q. What is your response to his first point?

A. Mr. Falkenberg asserts that PECO and its investors should be indifferent to the timing of return since "PECO will collect the same amount of money [on a present value basis] under any of the depreciation plans I have discussed" or even under a "zero coupon" payment basis. PECO's unwillingness to do so Mr. Falkenberg asserts, is proof that its discount rate is higher. As I discuss later in connection with Mr. Chernick, the problem identified here has nothing to do with the discount rate but rather with the expected value of a promise that the utility would be made whole for its investment in the distant future. Such risks, including the risks associated with future fuel savings or operating costs of nuclear power plants or alternative investments, should be accounted for in an economic analysis by adjusting the estimates used for such specific items or by using a risk analysis methodology, not by adjusting the discount rate as proposed by Mr. Falkenberg. Mr. Falkenberg's proposal, which would both change the estimates and use a higher discount rate, constitutes nothing more than double-counting.

Q. Mr. Falkenberg discusses the EEI survey and contends that the position taken by both you and Mr. Hill that most utilities did not interpret the EEI survey as inquiring about discount rates is "absurd." Do you have any comments?

A. Mr. Falkenberg's testimony on this point is mostly rhetoric, quite unsubstantiated by the kind of factual support which would merit such language. He concedes, as he must, that the survey does not request a discount rate. It requests only the cost of capital. From this statement, Mr. Falkenberg "demonstrates" that Mr. Hill and my interpretation of the survey -- an interpretation upon which PECO's own response was based -- is "absurd," "silly," and "insincere". Mr. Falkenberg's argument is based on the statement that "[t]he reason is that any revenue

requirements analysis takes the cost of capital and adjusts it for the fact that debt interest is an expense while debt is deductible" (emphasis added). (As an aside, Mr. Falkenberg's statement is only partially correct in that revenue requirements analyses must also take into account Investment Tax Credits, deferred tax balances and the like). His statement, however, fatally exposes the fallacy of his argument since his adjustments acknowledge that the weighted cost of capital is an input to a revenue requirements analysis. Every revenue requirements model with which I am familiar, including the PECO model used in this proceeding and, indeed, Mr. Falkenberg's model, utilize the weighted cost of capital as an input. The input cost of capital is all that the EEI survey requested.

Mr. Falkenberg goes on to cite a Northeast Utilities brief as evidence that Northeast Utilities, an alleged "unbiased observer," also interpreted the survey as he did. While I am somewhat bemused at the characterization of a brief in a contested proceeding as the dispassionate statement of objective expert opinion, I will concede, as I stated in my rebuttal testimony, that it is conceivable, and indeed likely, that a minority of utility respondents probably did interpret the survey as asking for their discount rates. I should also note, however, that Mr. Falkenberg neglected to report that United Illuminating, the state's other major utility, supported a net of tax rate, and that the Commission in the referenced proceeding adopted a net of tax discount rate.

Q. Mr. Falkenberg goes on to compute the present value of savings which would be reached based on PECO's submission to the 1984 EEI survey. He concludes that the net savings based on your $2.0 billion dollar savings case are eliminated if the discount rate is equal to PECO's 1984 after tax incremental cost of capital. Please comment.

A. Mr. Falkenberg mischaracterizes his result twice, and in internally inconsistent ways. He first indicates that Mr. Paquette, in 1984, would have found that Limerick would not be cost-effective based on the assumptions in my lowest net benefit case when adjusted to include 100 percent of common and would show reduced savings based on 50 percent of common. However, he makes no pretense that PECO would have done the analysis in this manner, and indeed, PECO did not utilize the discount rate Falkenberg attributes to it when the Limerick 2 case was filed just one month later than PECO's EEI response; the reason being that the PECO case used the geometric mean of future costs of capital, not its 1984 cost of capital, as the discount rate. Second, and more importantly, what PECO would have concluded in 1984 is not relevant to the controversy concerning present forecasts of Limerick's net benefits. In particular, it is quite clear that PECO would not today respond to a similar survey with a cost of capital as high as was provided in 1984.

Q. What is your basis for that statement?

A. Exhibit WHH-53 shows the PECO response to the survey, its then-cost of capital as reflected in financial markets, and its current market cost of capital. As the Exhibit shows, PECO's then-estimate of its incremental cost of debt and preferred was closely related to its market return on such instruments. Since that time, its cost of debt has fallen by 300 basis points, preferred by 200 to 350 basis points, and equity by 110 basis points. Presumably, were PECO to respond to a similar survey today, its implied net of tax cost of capital would be 9.86 percent, essentially identical to the 9.7 percent used in my direct testimony.

Q. Lastly, Mr. Falkenberg performs analyses with 0 and 35 percent corporate tax rates to show that use of a net of tax rate produces counter-intuitive results. Can you explain his results?

A. Yes. Mr. Falkenberg's analysis shows quite properly that if corporate income tax rates are reduced, the relative net benefit from the capital intensive Limerick 1 investment is increased in each and every year. The cost reductions are front-loaded, mirroring the higher capital recovery in the earlier years. Thus, at any given discount rate, the economics of Limerick 1 become more favorable if taxes are lowered. However, since reducing the tax benefit of interest deductability increases the net of tax cost of capital, the discount rate rises and the apparent net benefit falls. This is his "counterintuitive" result. All he is really saying is that if the net of tax cost of capital goes up, the present value of future benefit streams goes down.

The fallacy of his analysis is that he assumes that the pre-tax weighted average cost of capital is unaffected by a reduction in corporate tax rates. Implicit in Mr. Falkenberg's assumption is that if corporate income taxes were eliminated, the effective (i.e. net-of-tax) cost of borrowed funds would double and the cost of equity would remain unchanged. While the response of the economy to an elimination of or major reduction in corporate income taxes is complicated, and would depend on factors not present in Mr. Falkenberg's hypothetical, it is quite probable that the qualitative effect would be to reduce the pre-tax cost of both debt and equity. Whether the ultimate net effect would be to raise or lower the present value of Limerick 1 net benefits is speculative and, in essence, depends on how much of a "supply-sider" one is.

Nevertheless, the financial concept of discounting was devised to deal with investment cash flows, not the gross receipts and expenses of regulated firms. However, the solution is not to evaluate utility investments based on a different theory and hence a higher discount rate than is used by the market in evaluating

the value of non-regulated entities. As I stated in my rebuttal testimony, to do so would result in systematic underinvestment in utility plant. How then do we handle the problem of discounting non-capital related flows? Dr. Perl's theory begins with the premise that expenses can be capitalized, as construction interest and pre-commercial plant fuel savings and expenses are capitalized. The promise to pay later implied by capitalization of expenses in a rate of return regulated firm creates debt capacity, and with it the tax shields occasioned by that debt. Hence, the cost of capital to be applied to all revenues requirements, not just capital-related requirements, is the net of tax rate.

Mr. Falkenberg appears to be willing to agree with this position but only if PECO is "accounting neutral" and expenses are in fact capitalized. On this point he parts company with current finance theory which instructs that the discount rate to be applied to these expenses is invariant with respect to whether they are in fact capitalized or not unless the fact of capitalization changes their risks. This is not as surprising as it might seem. The utility analog is that the appropriate discount rate for utility investments does not depend on whether CWIP is included in ratebase or not.

Q. Mr. Falkenberg also criticizes your testimony concerning the prudence standard. Does he properly characterize your rebuttal testimony?

A. His surrebuttal criticisms appear to have rather little to do with my rebuttal testimony but, in any event, he grossly mischaracterizes my position. He states his supposed understanding of my testimony on page 24, lines 2 through 13, where he asserts that I am saying that it is proper to allocate to shareholders the risk of prudent but allegedly unprofitable decisions only if PECO were allowed the freedom of an unregulated monopolist to charge what the market would bear.

That is, of course, not my position and I will not burden the record by repeating my earlier testimony.

Q. Mr. Falkenberg next contests your opinion that investors were unlikely to take seriously the risk of major excess capacity ratebase exclusions prior to the Susquehanna 1 decision in 1983, citing the exclusion of TMI Unit 1 from ratebase. Does this change your opinion?

A. No. The TMI exclusion obviously had to do with a plant which was not used. Hence, those circumstances were clearly distinguishable.

Q. Beginning on page 25 of his testimony, Mr. Falkenberg again returns to your prudence testimony. Do you have any comments on this testimony?

A. Yes. If I can take the liberty of lending some structure to his statement, he seems to be making two assertions. The first is his "speeding" analogy. This analogy is quite inapt. Speeding is a per se offense; speeders are the equivalent of imprudent, so his testimony about trying to demonstrate that many speeders avoid accidents is obviously irrelevant either in defending against the imprudence offense or against a tort claim if an accident in fact occurred. The analogy then wanders to something which may be addressing my quantification testimony on the 1976 and 1978 delays, though he does not say so directly. If so, he has missed the point. To put it in the context of his analogy, my point is that there is no tort claim against the speeder unless there was an accident.

His second, and unrelated point, beginning at the bottom of page 26, is the assertion that PECO has "cooked the books" in its past studies to justify continued construction of Limerick. He seems to be trying to imply that this was willful, an implication without any valid support in his testimony whatsoever. His two examples are simply wrong. He charges that in the Limerick Unit No. 2

proceeding the Company indicated a willingness to accept sinking fund accounting and that it testified that there would be no real escalation in O&M, positions it has supposedly repudiated now. No one in the Limerick 2 case said that PECO would accept sinking fund depreciation. Nor did PECO assert that there would be no escalation in O&M costs. In fact, its O&M escalation assumptions in the Limerick 2 case, to which I then testified, were identical to those in the present proceeding.

Q. Lastly, on page 28, Mr. Falkenberg attempts to summarize your prudence testimony. Is that summary accurate?

A. No. His first sentence imputes to me the belief that there is a presumption of prudence. Though this may be my belief, it is not merely my opinion but my understanding of the applicable legal standard, as is reflected in the NRRI report on the prudence standard which I discussed at length in my direct testimony. His second sentence ascribes to me statements with which I do not agree: that the Company's forecasts were "irresponsible", and that it has not lived up to its previous commitments to accept Mr. Falkenberg's accounting conventions. The third statement, "the reward for not being unreasonable is that we get all the money we want when we want it" (emphasis in original) is, of course, nonsense. My testimony supports no more, and the Company asks no more, than that it be allowed a return on its prudently incurred investment in a form which is not materially more risky than was contemplated during the period in which the investment was made.

Surrebuttal Testimony of OCA Witness Komanoff

Q. Mr. Komanoff makes two points concerning your capacity factor data. He first states that since adding the 1985 data to your regression made the "over-12" variable insignificant, you should have deleted it from your regression. He suggests that this would lead to a very different forecast than is reflected in your rebuttal testimony Exhibit WHH-45. Is this the case?

A. Let me first simply note that I left in the "over-12" variable since my purpose was simply to show how Mr. Komanoff's model would change with 1985 data added to his database. Since it is Mr. Komanoff's model, not mine, I felt it was appropriate not to change it despite the fact that both the "age" and "over-12" variables now failed the usual tests for statistical significance. However, as Exhibit WHH-54 (supplied in response to IR-OCA-27-1) shows, deleting the "over-12" variable has little effect on the regression. In fairness, I should point out that the age variable is now even less significant and hence the extrapolation past the twentieth year quite suspect. However, if I delete both the age and "over-12" variables based on their insignificance, not much is left of Mr. Komanoff's model.

While still on the subject of the 1985 data additions, I should also note that the 1985 data upon which I have relied contains a major error. The listed capacity factor for WPN-2 is 37 percent. The actual capacity factor is approximately 54 percent. This change would move the projected capacity factor from Mr. Komanoff's model still higher.

Q. Mr. Komanoff's second point is that you have erred in using average rather than levelized capacity factors. Is this correct?

A. No. Mr. Komanoff states that, in principle, capacity factors should be levelized to better reflect the higher present value of earlier savings. However, it is the

savings which should be levelized, not the capacity factor. Consider a case in which the discount rate is 9.7 percent and the value of savings per kWh goes up by 9.7 percent per year. Clearly, a percentage point of capacity factor has the same present value irrespective of the year in which it occurs. Choosing a simple average would give the right answer; levelizing based on a 9.7 percent discount rate would be equivalent to assuming that the nominal savings per kWh would not rise and the real savings would decline over time.

Q. Is your hypothetical case in which the value of Limerick 1 fuel savings per kWh goes up at 9.7 percent per year relevant to the forecasts used in this proceeding?

A. Yes. Using PECO's fuel savings assumptions, the fuel savings per kWh from Limerick 1 rise at slightly above the 9.7 percent discount rate. Even using Mr. Komanoff's fuel prices (as shown on Exhibit CK-3, p. 4), the savings rise at a 9.75 percent average rate, approximately equal to the discount rate. Therefore, I was not in error in using non-levelized averages. Rather, Mr. Komanoff was in error in levelizing.

Q. Turning now to the subject of capital additions, Mr. Komanoff contends that your Exhibit WHH-41 is misleading in that it compares his Limerick 1 capital additions forecast to the average over all reactors rather than only more recent reactors, a group which he contends is more representative. Please comment.

A. The primary difference between his Groups 1 and 2 (the older reactors) and his Group 3 has far less to do with when the reactors were placed in service, per se, than it has to do with the year in which reactors reached a given age. It is uncontested that capital additions costs were far lower in the 1970s than in the 1980s. What is contested is whether the experience of the 1980s--which is dominated by TMI retrofits, IGSCC repairs and steam generator retubing--is more

reflective of what can be expected for Limerick 1. Moreover, my primary dispute with Mr. Komanoff is not whether data for the 1980s should be the basis for the Limerick 1 forecast, it is whether one can validly draw a trend between the 1970s and 1980s and extrapolate growth in costs into the future.

However, even were I to accept the notion that his Group 3 reactors are the appropriate comparable group, his forecast appears high. Exhibit WHH-54 shows Mr. Komanoff's Group 3 forecast and his Limerick 1 forecast. His forecast is still nearly 60 percent higher than the history for plants completed since 1976. Even more striking is the absence of his age trend in the Group 3 data, a trend which is his sole basis for forecasting future growth in Limerick capital additions. This points up that perhaps the major factor responsible for the extreme results produced by his regression model is that it derives a high starting value based on plant vintage and then applies a high aging effect based on past trends for plants of older vintages which do not seem to be appropriate for more recent plants.

Q. Mr. Komanoff also rejects your use of median values to depict historic capital additions. Why did you discuss median values?

A. Mr. Komanoff's point is that least-squares regression analysis depends on means, not medians. I do not dispute this. My point was simply to illustrate that the high recent average values for capital additions do not mean that the typical plant has grown to have high capital additions. Rather, the high averages reflect an increased number (and cost) of major repairs. The difference between the mean and median demonstrates that the key to predicting the capital additions cost for a particular reactor is not measuring the trend in the averages but, rather, predicting the likelihood of an event requiring a major repair or retrofit. This Mr.

Komanoff has not done or attempted to do. The difference in approach between Mr. Komanoff (and Mr. Chernick) on the one hand and Mr. Helwig on the other lies principally in Mr. Helwig's emphasis on determining whether Limerick 1 is likely to require the costly repairs required at some reactors which have driven up the averages relied on by Messrs. Komanoff and Chernick.

Q. Mr. Komanoff states that the poor fit of his equation does not matter since he is not seeking to predict capital additions for a given year. Is this a valid response?

A. Only partially. Implicit in Mr. Komanoff's answer is that variations around his predicted values are random events and therefore that they should average out over the life of the reactor. This assumes that the poor performance of his equation is due to the lumpiness of capital additions rather than its failure to model important differences between reactors. I do not agree with this assumption. Therefore, while the poor fit of his equation somewhat overstates the range of likely error for a lifetime forecast, it also reflects the inability of his equation to discriminate between reactors whose design and/or operation has resulted in major backfits and other reactors.

Q. Turning now to the subject of coal prices, Mr. Komanoff criticizes your use of dollars per million BTU instead of the dollars per ton figure he used in deriving long term historic price trends as being selective in that you did not also adjust for sulfur content. He contends that your national data therefore overstate the price trend relevant to PECO's plants. Is this a valid comment?

A. No. The point of Exhibit WHH-46 was to show that by ignoring the marked shift from eastern to western coal, with the concomitant change in btu content per ton, Mr. Komanoff was misstating the historical escalation in the cost of coal energy. He does not contest that point, but argues instead that I should also have adjusted

for sulfur content. I should remind him that it is he, not I, who is sponsoring a price forecast based on historic trends and thus it is he who bears the burden of describing the trends properly. Moreover, the validity of his point is much reduced since Exhibit WHH-46, upon which I relied, shows prices on a district-by-district basis. Since sulfur content is more homogenous within than among districts, the sulfur issue is less important.

Q. Mr. Komanoff also makes reference to increased competition and deregulation in transportation as mitigating past increases in coal transportation costs and points to decreases in the charge out rates shown on Exhibit WHH-51 as a demonstration that cost reductions are already occurring. Is he correct?

A. If coal were carried in airplanes, or in over the road trucks, he would be. However, the trend in railroads is toward less, not more competition because mergers have reduced the number of potential transporters from the coal fields to the power plants. Moreover, his reliance on Exhibit WHH-51 would seem to be misplaced since it is clear on the face of the document that the major factors underlying the modest decline in real costs since the 1981-1982 peak have been a reduction in diesel fuel cost and a decline in materials and supplies cost which began in the 1982 recession.

Testimony of UCC/UP Witness Chernick

Q. Mr. Chernick's surrebuttal testimony responds to specific points concerning your rebuttal of intervenors' testimony regarding Limerick 1's net benefit. His first 3 points discuss your comments on his O&M forecast. Please comment.

A. The focal point of Mr. Chernick's O&M response is that my testimony dealt far more with his geometric forecast than his linearized forecast, whereas his net

benefit calculation used only the latter. The predicate of my testimony is quite simple and straight-forward. Mr. Chernick employs a geometric model, estimated over historic data. His sole basis for the O&M testimony is an extrapolation based on that model. It is that model to which my rebuttal testimony responds. The mere fact that Mr. Chernick did not directly utilize the results of his model, but instead chose to rely (arbitrarily) upon a future year's linearized growth rate as the basis for his forecast does not change the fact that the study upon which he relies is his geometric regression. The rebuttal testimony of which he complains simply explores the implications of his model. The theme of my rebuttal testimony is that his model is extraordinarily sensitive to minor changes in specification, and hence very suspect as a basis for forecasting. This is true irrespective of whether the forecast used is literally that produced by the model or one derived in some subjective fashion from the model. Since Mr. Chernick did not directly rely on his own model's forecast, he could have picked the 1983-1984 growth rate it produces, the 1989-1990 rate, or the 2009-2010 growth rate. This ad hoc procedure permitted his model to "predict" whatever result he desired with very broad latitude.

Thus, the only real basis for Mr. Chernick's O&M forecast is his judgment as to what is reasonable. My discussion of his geometric forecast was an exploration of his model, not his judgment for which he provides no basis and upon which he has no practical background. Thus, his first two points only serve to highlight the fact that his statistical analysis does not support the O&M forecasts which are critical to his conclusion that Limerick will not prove to be cost-effective.

Q. Do you have any comments to Mr. Chernick's third point concerning the specification changes you made to his model?

A. On technical grounds, this point may have somewhat more merit. However, my purpose in deriving a linear form of his model was simply to demonstrate that if the structure of his model were consistent with his judgment that future O&M growth would be trendwise linear rather than geometric, his forecast would have been lower. Some other linear specification indeed might have been better than the one which I derived rather mechanistically from his geometric model. However, it is likely that any plausible linear model estimated over actual historic data would produce a lower forecast than a geometric model which first projects a future growth rate and then linearizes into the future.

Q. Do you have any comments on the remaining points Mr. Chernick included in his surrebuttal testimony on the net benefit studies?

A. Yes. Mr. Chernick's fourth point asserts that by illustrating that recent capital additions are due substantially to major repair outages I am necessarily forecasting that Limerick 1 will be less prone to such outages. This mischaracterizes my testimony. The implications of Limerick's design and planned operation are not within my competence but rather are discussed in the rebuttal and sur-surrebuttal testimony of Mr. Helwig; I am merely pointing out the importance of Mr. Chernick's implicit assumption that Limerick 1 will perform no better than historic reactors. In connection with his fourth point, Mr. Chernick also takes a swipe at my testimony in a 1981 Seabrook case. That testimony on Seabrook construction cost is wholly irrelevant. Nevertheless, I feel compelled to point out that he has mischaracterized that testimony in asserting that I then believed that "the bad news is over."

His fifth point I have already discussed specifically in responding to Mr. Falkenberg. His sixth point is similar. I would note only that his computation explicitly assumes that forecast errors are random across units. In fact, units have persistently had higher -- or lower -- capacity factors than generic models predicted.

His seventh point disputes my rebuttal statement that recent units have performed better than his model would predict, at least in their early years. Exhibit WHH-56 summarizes capacity factor data on post-TMI reactors for all full years of operation. It is these data upon which the statement in my rebuttal testimony was based. These are compared to Mr. Chernick's Limerick 1 forecast. In comparison to his forecast of less than 50 percent for a 5-year average "start-up" capacity factor forecast for Limerick 1, the post-TMI group as a whole has averaged over 60 percent for this 5 year period. BWRs have done less well, but still better than his forecast for Limerick 1.

Q. Mr. Chernick also criticizes your rebuttal testimony on his excess capacity recommendations. Specifically, he accuses you of setting up a "straw man". Is this criticism valid?

A. If my characterization of his testimony is wrong, I am happy to hear it. My reading of his testimony was that PECO should be penalized for bringing on line the baseload capacity which replaced the peakers it had to add in the early 1970s to avoid capacity shortfalls. If that is not his testimony, my criticism is moot. If it is his testimony, then my criticism remains valid.

Q. Mr. Chernick next criticizes your rebuttal testimony on future PJM capacity charges in the hypothetical world in which Limerick was not built and PECO deliberately and knowingly chose to rely on PJM for the energy and capacity value of Limerick. Please comment.

A. I should first acknowledge, if it is not already clear, that I do not know specifically what of PJM would do under those circumstances. We will never know, since Limerick 1 does in fact, exist. It is for that reason that I did not make the increased capacity payments a part of my base case. With that statement as prologue, my direct and rebuttal testimonies discussing a higher capacity charge are fully consistent, contrary to Mr. Chernick's assertion. Second Mr. Chernick points to GPU as evidence that PJM will not impose additional capacity charges when a utility is long term deficit in baseload capacity. The circumstances are quite different. Indeed, if anything, the GPU experience tends to support my position. GPU was inadvertently short; it did not deliberately choose dependence upon PJM. GPU was given significantly preferential treatment by PJM, resulting in lower capacity payments than the formula warranted. If the reasons for the GPU shortages were taken into account, it seems logical that PJM would similarly take PECO's behavior into account if it consciously chose to live off the grid for an extended period.

Q. Is Mr. Chernick correct that your capacity charge is a penalty rate which would result in higher costs than a life cycle unit purchase of a coal unit?

A. He is correct. It is, and was intended to be a penalty rate. The reason for this is manifest in his Exhibit R-1. Even if the capital-related revenue requirements of a new baseload plant were levelized -- which they are not under current accounting practices -- these capacity charges would under-recover capacity costs in the early years of plant operation. Given the stated reluctance of many utilities to invest in expensive new baseload capacity, only penalty rates can create the inducement required to insure that each will build its fair share of the baseload capacity needed for the future.

Q. Mr. Chernick criticizes the inclusion of higher capacity charges in your analysis beginning in 1986. Is this criticism valid?

A. No. My reasoning goes to the construction of the hypothetical case used for valuing Limerick 1. The comparison is a pure "with versus without Limerick" analysis. The only circumstance under which such a comparison is valid is one in which PECO is assumed to have no Limerick sunk costs, implying that it never began Limerick construction. The predicate for beginning the higher charges in 1986 is simply that the other PJM members would have, some time ago, given notice that PECO had a limited time to rectify its economic capacity situation. Given that PECO forecasted economic (and total) capacity deficits absent Limerick completion well before 1986, the assumption that the penalty rate would have taken effect by 1986 does not seem to me to be at all unreasonable.

Q. The last topic addressed by Mr. Chernick is the discount rate for the analysis of Limerick's net benefit. Please comment.

A. Mr. Chernick makes a number of points, not all of which are pertinent to my testimony. Beginning with his third point, he acknowledges that an after-tax (net of tax) rate is correct for competitive industries. However, he goes on to contend that this is not true for rate-regulated companies since "paying $1 worth in interest generally creates $1 in revenues which neutralizes the tax benefit." This statement is simply not true. It implies, contrary to fact, that tax normalization does not equate to flow through accounting if the utility cost of capital is the discount rate. He goes on to state that a dollar of after tax equity return in a regulated industry creates a two dollar increase in revenue requirements, implying that this is not true in competitive industries. This is as true for competitive industries as it is for regulated industries; revenues which are adequate to return a

market-required after tax return must also be adequate to pay the associated taxes. Hence, Mr. Chernick's attempted differentiation between competitive and rate-regulated firms is unfounded.

Mr. Chernick's fourth point begins by quoting my testimony as arguing that the relevant issue is whether ratepayers would prefer to pay for Limerick 1 sooner or later. In fact, the quoted testimony (PECO Statement 15B, p. 47) says exactly the opposite. His fifth point is beneath comment, as is his sixth, as they are based on neither logic nor fact.

Finally, his seventh and tenth points take off from my statement that the (net of tax) market cost of capital for a project with Limerick's risk characteristics is the appropriate rate for evaluating it. He raises as possible rates the consumer rate for energy saving investments, or a 25 percent "hurdle rate" which he incorrectly characterizes me as having endorsed. I have discussed these points earlier. Neither of Mr. Chernick's "straw men" are relevant; the relevant issue is neither implicit psychological consumer discount rate nor the internal hurdle rates used in many companies as I explained in my rebuttal testimony.

Mr. Chernick points out that I have made no study of the relative riskiness of the Limerick 1 investment. That is true, though I can make an educated guess at how the market would view the project. Current finance theory states that the risk which is relevant in computing the cost of capital for a project is the project's systematic risk -- that which cannot be avoided by diversification of investments.

Non-systematic risks -- for example plant outages -- are regarded by the market as random noise, affecting the expected value of returns from the project but not the financial risk of a portfolio which contains it. Projects (or

companies) with low systematic risks yield returns which tend to reduce portfolio risks; they are "low-Beta" projects, a term familiar in the utility industry from CAP-M rate of return methods. Consider the elements of the project risk discussed in this proceeding. Capital additions, O&M escalation and capacity factor uncertainty are all non-systematic risks; they are project specific and uncorrelated with the value of market investments generally. The value of fuel savings is also relatively uncorrelated with the performance of a diversified investment in the U.S. economy. Therefore, Limerick is a "low Beta" investment; the risk premium the capital market would assign to Limerick net benefit streams would be low, contrary to Mr. Chernick's assertion.

Q. Is not your answer inconsistent with the belief that there is a "nuclear risk premium" assigned by the market to nuclear utilities?

A. No. First, I would note that the studies which show a nuclear risk premium relate to utilities with incomplete and non-ratebased nuclear plants, not to utilities operating nuclear plants. Second, the market risks under current regulation are not the project risks (which are borne primarily by customers) but are instead the risks of adverse regulatory treatment. Since these risks are also unsystematic, they do not affect the discount rate. However, they do affect the markets valuation of the company and hence the market value of its securities. It is this reduction of the worth of the company, not a higher discount rate which is reflected in the nuclear risk premium. I should note that these comments also apply to Mr. Falkenberg's discussion of the relationship between Mr. Farling's testimony and the discount rate.

Surrebuttal Testimony of GEC Witness Wilson

Q. Dr. Wilson responds to your testimony regarding the relatively few plants which fall within the 60 to 70 percent capacity factor deadband of his proposed incentive standard by saying that since PECO has a number of nuclear plants, if they are treated as a group, they should fall within the band. Please comment.

A. Dr. Wilson's direct testimony was not clear as to whether his proposal would apply to PECO's nuclear units jointly rather than individually. I agree that his standard is far less onerous if applied to the average capacity factor rather than to the individual capacity factors for PECO's nuclear units.

Nevertheless, the general point I make, that PECO could achieve the target capacity factor over extended periods of time yet not earn the Commission-mandated rate of return, still holds. Only if Dr. Wilson's incentive were irrelevant, meaning that the average was always within the deadband, would his non-symmetric reward and penalty structure produce the Commission-mandated return for on-target performance.

Q. Dr. Wilson responds to your symmetry testimony by stating that he regards a 65 percent capacity factor and performance within the 60 to 70 percent zone as a minimal level of satisfactory performance. He contends that his proposal to grant PECO 50 percent of the savings resulting from above-70 percent performance is a gift, since under traditional ratemaking, costs arising from below-60 percent performance would be disallowed with no offsetting potential for gain. Is this the case?

A. Only if the Commission were to deem performance of below 60 percent to be the result of imprudence, since Dr. Wilson's concept of "minimal acceptable performance" has no other interpretation consistent with his statement of

Commission action under traditional regulation. Dr. Wilson's opinion notwithstanding, it is quite unlikely, and would be unprecedented for this Commission to determine, that operation of nuclear plants at below 60 percent was imprudent on its face.

Surrebuttal Testimony of UUC/UP Witness Wirtshafter

Q. Why are you commenting on Dr. Wirtshafter's testimony?

A. I simply want to clarify a point which he makes at pages 4 and 5 of his testimony. He testifies with respect to a Limerick 1 versus peaker analysis and concludes that even if both ran at up to a 100 percent capacity factor, the peaker case is less expensive. My point of clarification is simply that his analysis is not a life cycle analysis. This is not a criticism; he does not argue that it is. However, the record should be clear that his analysis neither demonstrates, nor, I believe, seeks to demonstrate that a peaker strategy is more cost-effective than Limerick 1 on a life cycle basis. This is obvious from such considerations as, for example, the fact that a peaker is not designed to, and could not, run at 100% capacity factor for any significant period of time. More telling is his use of first year, rather than levelized life-cycle fuel savings.

Q. Does that complete your sur-surrebutal testimony?

A. Yes, it does.

Exhibit WHH-53

Computation of PECO Incremental Cost of Capital
for 1984 and 1986

	Capital Structure	Response	11/1/84 Market	2/4/86 Market
Debt	50	13	13	10
Preferred	12	13	14.5	11
Equity*	38	17	17	15.9
WACC		14.5	14.7	12.4
Net-of-Tax**		11.3	11.5	9.9

* Based on response to EEI survey for 1984, current claim for 1986.

** Assuming 50 percent tax rate.

Exhibit WHH-54
Komanoff Capacity Factor Regression
Without Over-12 Variable*

CF - 59.13 + .47 Age + 7.13 small - 8.52 salt
(1.19) (2.72) (-3.08)

-42.44 BFFIRE - 8.12 year 7475 - 9.59 Post TMI
-(4.14) -(2.03) -(3.17)

R^2 = .16
SE - 17.44

12 Year average = 52.59
20 Year average = 54.46
30 Year average = 56.80
39 Year average = 58.91

*Figures in parenthesis are t-statistics

Exhibit WHH-55

Comparison of Capital Additions History and Forecast
(1984$/KW)

Age	Komanoff Group 3	Komanoff LIM1 Forecast	Difference
1	29.93	40.09	+34
2	25.08	41.77	+67
3	23.59	43.47	+84
4	21.27	45.15	+112
5	33.76	46.84	+39
6	44.11	48.53	+10
7	29.29	50.21	+71
8	29.31	51.89	+77
Average	28.92	46.00	+59

Exhibit WHH-56

Comparison of Post-TMI Capacity
Factors to Chernick's Limerick 1 Forecast

	Age				
	1	2	3	4	5
PWRs					
Capacity Factor	62.3	58.2	62.6	61.6	77.9
Number	13	10	7	6	2
BWRs					
Capacity Factor	51.6	54.6	--	--	--
Number	4	2	--	--	--
Total					
Capacity Factor	59.8	57.6	62.6	61.6	77.9
Number	17	12	7	6	2
Limerick Forecast	49.1	41.1	44.6	59.6	51.5

WWH-1 thru 4

PECO STATEMENT NO. 37

3-12-86

R-850152

PENNSYLVANIA PUBLIC UTILITY COMMISSION
v.
PHILADELPHIA ELECTRIC COMPANY

Docket No. R-850152

REBUTTAL TESTIMONY
OF
WILLIAM W. HOGAN

REVIEW OF THE STARLOC MODEL UTILIZED BY DR. ARIE SCHINNAR AND DISCUSSION OF OIL PRICE PROJECTIONS

February 19, 1986

TESTIMONY OF WILLIAM W. HOGAN

Q. Please state your name and affiliation for the record.

A. I am William W. Hogan, Professor of Political Economy at the Kennedy School of Government, Harvard University, and Director of the Energy and Environmental Policy Center, Harvard University. I am also a Director of Putnam, Hayes and Bartlett, Inc., a management and economic consulting firm with offices in Cambridge, Massachusetts. A copy of my vitae and qualifications is attached as Appendix 1 to my testimony.

Q. Dr. Hogan, what is the purpose of your rebuttal testimony?

A. The purpose of my rebuttal testimony is to comment on the testimony of Dr. Arie P. Schinnar and the STARLOC model he used to estimate economic impacts in the Philadelphia MSA. I also have been asked to review and comment on the testimony of Mr. Komanoff, and on a comment made by Dr. Schinnar during his cross-examination, regarding future oil prices.

Q. Would you please summarize the conclusions reached in your rebuttal testimony?

A. Yes. My conclusions regarding Dr. Schinnar's testimony on the impacts of the proposed electric rate increase on the Philadelphia regional economy are as follows:

1. Dr. Schinnar has not allowed sufficient access to the STARLOC model, used as the basis for his regional economic impact testimony, to allow the testing which is necessary to determine the validity of the model and its results. Access to intermediate calculations, which are essential to assess the validity of the model, could not be supplied by Dr. Schinnar.

2. Based on a review and analysis of available model information, I have found four conceptual flaws or errors in the model that all lead to STARLOC'S overestimation of the negative impact of the proposed electric rate increase on regional development.

3. I suggest a possible approach to estimate the magnitude of the impact of the proposed rate increase on employment in the Philadelphia MSA. The approach indicates that Dr. Schinnar's estimate of a decrease in the growth of 19,000 new jobs by the end of 1989 in the area due to the proposed electric rate increase is implausibly high, while a range of plausible impacts would be from no effect on jobs to an upper estimate of our impact (relative to no change in real prices) of 2,000 to 3,000 fewer jobs created.

My conclusions regarding crude oil price forecasts proffered in this proceeding include:

1. Mr. Komanoff's oil price forecast is almost certainly too low over the period 1985 to 2000 given the evidence of the last decade.

2. While PECO's oil price forecast are higher than Mr. Komanoff's, they are also more probable than Mr. Komanoff's forecast, although still probably too low. This indicates that, especially for long-term planning purposes, the Company's oil price forecasts are probably low.

Q. How is your testimony organized?

A. My testimony is organized under five topical headings:

1. Review of the STARLOC Model Documentation
2. Calculations Assessing the STARLOC Model
3. Conceptual Errors in STARLOC Model
4. Approach to Estimate Magnitude of Economic Impact
5. Oil price Forecasts

REVIEW OF THE STARLOC MODEL DOCUMENTATION

Q. With respect to the testimony of Dr. Schinnar, have you reviewed the STARLOC model used in support of his testimony (City Statement No. 1)?

A. Yes. In preparing for this review of the STARLOC model, I examined the direct testimony of Dr. Schinnar; the draft Technical Report by Schinnar, et al, "A Model to Analyze Regional Economic Impact of Electric Rate Increases" (draft) dated January 24, 1986 (PECO Exhibit 22); the City's responses to interrogatories IR-PECO-City, Sets I-VI, dated January, 1986; PECO Exhibit 25, dated February, 1986; and the transcript of Dr. Schinnar's cross-examination in this proceeding (Transcript at 3268 to 3449). In addition to these documents, I spent one afternoon, February 10, 1986 with Dr. Schinnar discussing the model and the draft Technical Report. I have also consulted my colleagues who have spent additional time with Dr. Schinnar and his model. As indicated in these documents and conversations, the detailed description of the model and the supporting data will appear in other reports that are forthcoming. I have not seen any of these additional materials that have been described as components of the documentation.

Q. Have you built or reviewed complex models like STARLOC or models using similar methodologies?

A. Yes. The STARLOC model describes the level of regional economic growth and the pattern of interindustry interactions which comprise that growth, paying special attention to the role of energy and electricity in economic growth. I have over a dozen years of experience with such energy-economic models, which encompass a variety of responsibilities and projects in developing, applying and analyzing the underlying assumptions of energy-economic models. I have served in the past as Director of the Office of Quantitative Methods in the Department of Interior and Federal Energy Office; Deputy Assistant Administrator for Data and Analysis in the Federal Energy Administration; Director of the Energy Modeling Forum (EMF) at Stanford University; and most recently, as President of the International Association on Energy Economists (IAEE). The EMF, described further below, is the principal organization conducting regular comparisons of energy-economy models. The IAEE is the principal international professional organization for energy economists and organizes a regular sequence of national and international conferences. The most recent North American meeting, for example, was held in Philadelphia in December of 1985.

Q. What have you learned from the review of the documents related to STARLOC?

A. These documents provide only an introduction to the STARLOC model. They describe the theory of the regional growth model used to develop the baseline for the growth in employment and the input-output structure used to capture the indirect effects of the interindustry transactions. The model

reportedly includes over two hundred equations and one thousand parameters. Naturally, a model of this scope must rest upon an underlying data base of thousands of observations used to estimate the parameters. A review of every one of these equations and estimations, as implemented in the model, would present a formidable task. However, this would be an important step in a complete validation of the model and its results.

Q. Is the review of model documentation sufficient to assess a complex model?

A. Not by itself. Since its founding in 1976, the EMF has become the principal professional organization for the comparison and analysis of energy-economic models. Various EMF study groups have faced the task of model comparison and analysis for purposes to understand the basic structure and assumptions that drive model results. The EMF has found consistently that details of implementation can be of critical importance in assessing model results when dealing with models of similar theoretical designs, or even with the same model in the hands of different analysts. Therefore, the abstract discussion of equations and data sources allowed by the review of documentation has been supplemented by careful testing of the models.

Q. How has the EMF tested models to improve understanding of model results?

A. The EMF has adopted a standard operating procedure which makes scenario comparisons of the models the centerpiece of their studies. The scenarios represent alternative sets of assumptions that test the model in order to (i) reveal the critical constraints or preconceptions built into the model, or to (ii) shed light on the policy issue under study.

Due to the complexity of the models, the EMF testing process has been conducted with the assistance of the model developers. The EMF

working groups design the alternative scenarios and assumptions, and the model developers conduct the tests. The process usually takes several steps -- design the tests, review the final and intermediate results, and then design a new series of tests to explain the unexpected or unusual results in the first investigations. Typically this process leads to surprises, even for the model developers, and to improvements in the models.

Without the assistance of the model developers, the principal alternative for constructing these tests would be to transfer the model and train a new group of users who would understand the details of implementation and be able to conduct a variety of sensitivity tests. Without access to the model, the only alternative would be to collect the data anew and reconstruct the model starting with the theoretical outline. However, there is no guarantee that the details would be the same and differences in results might follow from differences in implementation.

Q. Would the tests you describe be limited to an examination of inputs and final outputs?

A. No. The tests should also include an examination of intermediate model outputs in order to evaluate the consistency and validity of the model. In a well-chosen test, the intermediate calculations can isolate the critical parts of the system.

Q. Have other complex models similar to STARLOC been subjected to such tests?

A. Yes. The STARLOC model system design is consistent with the typical large model considered by EMF. It should be reasonable for the developers of STARLOC to work with third parties to conduct such tests.

Q. Have you had the access to the STARLOC model which is required to conduct the tests necessary to determine the validity of the model?

A. No. I have not had access to the internal workings of the model and have not been able to conduct sufficient sensitivity tests. The only sensitivity tests that are available are those provided by Dr. Schinnar and those performed over one and a half days by one of my colleagues. These latter tests were restricted by Dr. Schinnar to computation of aggregate job changes under different growth, inflation and electric rate assumptions. This kind of sensitivity testing is elementary, and tells us little about the inner workings of the model.

CALCULATIONS ASSESSING THE STARLOC MODEL

Q. In the absence of these tests of the inner workings of the model, what can you do to comment on the validity of the model and the reliability of its conclusions?

A. My review has been limited to an evaluation of the conceptual foundations of the model, verification of the description of the mathematical model architecture described in the Technical Report, and a few calculations that I have been able to perform given the data provided in the Technical Report.

Q. What have you found in this review?

A. My calculations suggest that the loss of new job growth estimated by STARLOC is far too great for the proposed electric rate increase. Without access to the internal workings of the model, I cannot fully explain the cause of this large estimate of loss in job growth. However, I have found four principal conceptual flaws or errors in STARLOC that all lead to an overestimate of the impact on job growth. These errors lead me to dismiss

Dr. Schinnar's estimated reduction in the growth in jobs by 19,000 as far too high.

Q. Before you describe these four model flaws, can you explain your calculations and their implications?

A. Yes. A principal step in the STARLOC model computes the "indirect effect of electric price increases on relative prices in the economy" (PECO Exhibit 22 at § 4, p. 8). In the model, the proposed increase in electricity rates directly raises the costs of producing other goods and services. Under the usual input-output model assumptions applied in STARLOC, these direct price increases raise the price of all goods and services, creating secondary, or indirect, price increases, and so on. Dr. Schinnar calculates the resulting real indirect price increases in equation (4.16) of his Technical Report. These indirect price increases are the key drivers for the estimated economic effects of the rate increase in STARLOC. Unfortunately, this important mechanism is an intermediate calculation in the STARLOC model and, therefore, is not visible in model output. In addition, Dr. Schinnar denied us access to these calculations and data, claiming that they were not available.

However, since the overall multiplier matrix for 1981 is in Table 2.5 of the Technical Report, I was able to calculate a set of prices that should replicate the internal STARLOC estimate of the real indirect price increases felt in each of the 22 non-electric sectors of the regional economy.

Q. How did you calculate this set of prices from equation (4.16)?

A. The starting point is the proportion, or share, of industry expenditures spent on electricity in each sector of the economy. PECO Exhibit 25 presents the

value share data for the 1981 data base used in the STARLOC model. As we can see, the proportion of industry expenditures spent on electricity is small. For many sectors, direct electricity expenditures amount to less than 1% of gross output. Even for the hotel sector, which has the highest proportion of electric expenditures among the non-energy sectors, electricity amounts to only a little over 5% of total cost. It is apparent from PECO Exhibit 25 that any real electricity price increase will translate into a small impact on the final prices of goods and services.

Q. What else besides the share of expenditures determines the total price impact of an electric rate increase?

A. As Dr. Schinnar describes, a direct increase in electric price leads to indirect increases in the cost of other goods and services. The multipliers obtained from the input-output model calculate these indirect effects and compute the total changes in the prices of goods and services if there are no other adjustments in the prices of other primary factors. This is the purpose of equation (4.16) in the calculation of the indirect price increases for the 22 non-electric sectors of the STARLOC model.

Q. Have you calculated these indirect price increases?

A. Yes. I used the data in Table 2.5 of the Technical Report to recalculate the price multipliers in equation (4.16). In order to provide a consistent comparison with the STARLOC model, I utilized the sensitivity runs prepared by one of my colleagues which examine changes in total job creation given changes in electric rates. I plotted the results of these sensitivity cases in Exhibit WWH-1. This exhibit shows that the response of job creation to electric rate change in the model is linear. Furthermore, the

results show that at about a 16% nominal electric rate increase, there is no appreciable real price increase and no reduction in job growth. Hence, to calculate the real electric rate increase consistent with STARLOC, I used the difference between the nominal electric rate increase and the 16% inflation rate (which equals approximately 5% compounded over three years). Therefore, the 28.2% nominal electric rate increase proposed in this proceeding, and associated with the estimated 19,196 reduction in the growth of jobs, translates into a 12.2% real rate increase. I then multiplied this real electric rate increase by the multipliers defined in (4.16) to obtain the resulting real increases in prices for the non-electric sectors.

Q. Please describe these estimates of the resulting price increases.

A. The resulting estimates of real price changes in other goods and services due to a 28.2% nominal increase in the electricity rate appear in Exhibit WWH-2. Here, we see that the resulting real price increases range from a low of 3/100ths of a percent in construction to a high of 68/100ths of a percent in hotels. Evidently the low value share of electricity in the 22 sectors produces small multiplier effects in the model. Hence, the proposed electric rate increase produces only a small increase in the real costs of other goods and services. When weighted by 1981 employment in each sector, the average electric rate-induced price increase is only slightly more than two-tenths of a percent.

Under these small real price increases, Dr. Schinnar reports that the STARLOC model predicts a reduction in new job growth of approximately 19,000 jobs, out of a total of over two million jobs in the 1981 base year. In percentage terms, the loss of jobs is 0.93% or just under 1% of base employment.

In other words, the STARLOC model implies almost a 1% reduction in employment in the face of a little more than a 0.2% increase in the average price of goods and services, or more than a 4 to 1 ratio (my actual calculation is a ratio of 4.43). This result does not pass the test of common sense. I can think of no economic mechanism that would produce this surprising result.

Q. You mentioned the importance of obtaining intermediate calculations in validating the model. Would these calculations have been helpful in detecting errors in the model?

A. Yes. These intermediate data illustrate the importance of understanding the inner workings of the model. If these data had been available, and had also shown this surprising result, they would have raised an immediate flag signalling a serious problem somewhere in the model.

CONCEPTUAL ERRORS IN STARLOC MODEL

Q. You mentioned four errors that might explain Dr. Schinnar's surprising result. Can you explain these errors?

A. Yes. The first error in the model logic is that it assumes that expenditures on net export and investments, two important components of final demand, remain constant in the face of higher prices for goods and services. In essence, this assumes that the consumer groups purchasing the exports will not pay more in total, so any increase in price leads to a one-for-one decrease in the amounts consumed. In the examples cited by Dr. Schinnar, this would mean that any increase in tuition costs will be matched by a drop in enrollment of students from outside the area, while there will be no increase in total tuition income. In technical terms, this implies a short run

elasticity of 1.0. While I do not have an alternative estimate of this elasticity, I would expect that part of the burden of higher prices would fall on consumers who would be willing to pay more for education, for example, and suffer less reduction in their consumption. In the only elasticity estimates presented, which are for electricity (See Tables 5.1 and 6.1 of the Technical Report), all of the short-run elasticities are significantly less than 1.0. This would seem to be the pattern more than the exception, as implied by Dr. Schinnar's assumption. Hence, higher prices should lead in part to higher expenditures and less of a reduction in demand than estimated in the STARLOC model.

Q. How does Dr. Schinnar treat regional consumption and government expenditures?

A. From the documentation and from Dr. Schinnar's description, the STARLOC model appears to handle energy and non-energy purchases in a different way. For energy purchases, there is an explicit adjustment of demand, with respect to higher prices -- price goes up, and demand goes down. For this adjustment, Dr. Schinnar describes the use of the elasticity adjustments in Tables 5.1 and 6.1. Here, the short-run own-price elasticities are all less than unity (one). For the other sectors, each consuming household appears to maintain the same level of expenditures on the non-energy final demand categories. Hence, the final demand elasticity for consumption of non-energy products must be unity for each household. For a given household, a one percent increase in the price of a given good or service purchased leads to a one percent reduction in the amount of that good or service that the household can consume. Of course, the total expenditures estimated for the

entire economy will change because the number of households will change, a topic addressed later in my testimony. But the unreasonable unitary elasticity estimate, which over estimates losses in demand, appears to apply in the calculations of consumption for the non-energy sectors, which occur on a household-by-household basis.

Q. You say "appears to apply". Are you sure?

A. No. The documentation is cryptic on this point, and I could not get a clarification of this point from Dr. Schinnar. Hence, the only way to settle this issue would be to examine the intermediate calculations of the STARLOC model for the number of households and expenditures per household. Dr. Schinnar has told us that this is not possible.

Q. What is the second error you mentioned?

A. The second error appears in equations (4.18) and (4.19) of the Technical Report (PECO Exhibit 22). Here the notation is confusing, but in essence there is a double counting of the deflation of expenditures on final demand. The Technical Report says that "Let y denote the final demand and Ax the intermediate demand of the economy (expressed in dollar terms)." This refers to the translation of the final purchase of lumber, cars or electricity to account for the intermediate purchases of lumber, cars or electricity that are used in the production process. The "A" matrix summarizes the per unit use of each good or service used in the production process of providing goods and services for final consumption. A typical column in A, say for construction, is the quantity of every other good or service--from agricultural products to hotel services--needed to provide each unit of construction services.

During my meeting with Dr. Schinnar, he explained that for the static analysis of changes in job requirements, the only adjustment in the A matrix is for the demand response to change the quantities of energy used in intermediate production. But there was no adjustment to reflect the impact of higher prices in the determination of expenditures on intermediate output. Except for the quantity adjustments, therefore, the A matrix in (4.18) is the same as the A matrix in (2.1). Since expenditures on intermediate goods have not been inflated to reflect the higher prices in p_1, the deflation of the intermediate demand in (4.18) double counts the reduction caused by higher prices: once for the deflation of expenditures on final demand, and once to remove the higher prices that were not added to the intermediate expenditures. In other words, the quantity of intermediate consumption was divided by the higher price of output.

Q. Can you give an example which helps explain this double counting error in STARLOC?

A. Yes. This is like computing the board feet of lumber and then dividing by the price of lumber. While it would make sense to divide the expenditures by the price, in order to obtain the quantity, it is wrong to divide the quantities by the price to calculate demand. When prices are higher, this overstates the reduction in demand.

Q. How important is this double counting of the reductions in intermediate demand?

A. The magnitude of this error would depend on the relative size of intermediate transactions as a proportion of gross output. Since the principal purpose of the input-output calculations is to capture these indirect

intermediate effects, I assume the error is important. Again, this estimate would depend on intermediate calculations contained in the STARLOC model. Dr. Schinnar has not provided these data.

Q. What is the third conceptual error?

A. The third error builds in a strong relationship from employment to expenditures. Dr. Schinnar constructs a series of accounting steps to relate employment to the total number of households, and the expenditures per household to total expenditures and final demand. The details of these steps appear in equations (2.2) through (2.9) of the Technical Report. These results serve the principal purpose of accounting for expenditures after the fact. The data provide a series of ratios that relate the number of workers per household, and, in turn, to the expenditures per household to the expenditures per worker.

The difficulty enters when Dr. Schinnar assumes that these ratios will remain constant when he ventures away from after-the-fact accounting to describe the new conditions that will exist in the estimated scenarios. These assumptions appear in equations (2.12) to (2.21), which Dr. Schinnar describes as the principal structure of the STARLOC model. They entail a number of multipliers of labor and GIX (government purchases, investment, and exports), apparently to be discussed in STARLOC Report 3, which is "forthcoming" (PECO Exhibit 22, at §2, p. 7). Although I have not seen Report 3, the structure of these equations imply the following: when prices rise, final demand falls as consumers reduce demand in order to stay within the assumed expenditure limit (budget). The lower total demand in the economy eliminates some jobs. Without jobs, the associated households

leave the economy; hence, the expenditures from these households are totally eliminated. This drop in expenditures produces a further reduction in jobs, further reduction in the number of households, an attendant loss in expenditures, and so on. There is no dampening effect included, other than a decline in imports, to stop the downward spiral of reduced employment and reduced expenditures.

Q. What is the impact of this third error on STARLOC's model?

A. The impact of this error could be significant. Although we do not have the data on this internal STARLOC calculation, a reasonable estimate would be that 75-80% of final demand consists of regional consumption of goods and services. With the assumed unitary elasticity of demand for a given income, this job spiral would produce a 4 to 5 ratio of job loss to price increase. This might go a long way to explain the surprising result of an estimated 0.93% job loss given a 0.21% price increase.

Of course, in the real economy, many adjustments, which would strongly mitigate the job loss multiplier, would occur. We recognize the adjustment mechanism as one of the central problems of macroeconomic management: maintaining aggregate demand at a level sufficient to minimize unemployment without stimulating inflation. Consider, for instance, that a slight reduction in real wages and payments to capital would compensate for the 0.21% price increase and prevent the downward spiral altogether.

Q. What is the fourth error you mentioned?

A. The electric rate increase assumed in the base case applies the PECO percentage rate increase to the entire Philadelphia MSA. But as described in

the rebuttal testimony of Dr. George Schink (PECO Statement No. 38), PECO serves only a portion of this region. Hence, the average rate increase in the region will be smaller. As I understand Dr. Schink's estimates, the corrected average rate increase would be approximately 80% of the base case figure used by Dr. Schinnar. Hence, the nominal price increase would be 80% of the 28.2% assumed, or 22.6%. As I described above in constructing Exhibit WWH-2, this would yield a real price increase of 6.6% (22.6-16.0). When applied to the multipliers in equation (4.16) of Dr. Schinnar's Technical Report, this would reduce the final price increase in the non-electric sectors, as shown in Exhibit WWH-2, from 0.21% to only 0.11%.

Q. Are you confident that these four errors explain the surprisingly high job loss estimate?

A. No. As I stated before, these observations have been drawn only from my reading of the incomplete documentation and a few independent calculations. Despite my requests and those of my colleagues, I have not been able to examine the inner workings of the STARLOC model. However, based on these observations, I would assume that the STARLOC estimate of losses in job growth is a gross overestimate of the impact of a modest 0.21% increase in the average price of goods and services in the Philadelphia MSA.

APPROACH TO ESTIMATE MAGNITUDE OF ECONOMIC IMPACT

Q. What would be a more plausible estimate of the impact of the proposed electric rate increase?

A. While I have not studied the Philadelphia economy, I can suggest how to approach an order-of-magnitude estimate of the impact of the proposed increase in electric rates. At one end of the spectrum, we recognize that a

slight reduction in wages and the other primary factor inputs would eliminate the small 0.11% increase in the price of outputs. Since these primary factors account for as much as 80% of the cost of output, a 0.14% decrease in these payments would lead to no increase in total output price. In principle, the slightly lower prices of labor would protect all the jobs, although incomes would fall somewhat.

At the opposite extreme, we could accept the full price increase but recognize that the short run demand elasticities are less than unity. Furthermore, with a fall in demand, there will not be a proportional fall in the number of households. Consumption in the households of the unemployed will not disappear as people's actions dampen the income changes over time. Perhaps the net effect might be a percentage reduction in jobs of the same magnitude as the price increase. With the 0.11% price increase and over two million jobs, this would give us an upper estimate of approximately 2,000 to 3,000 fewer new jobs created in the regional economy, compared with the 19,000 calculated by the STARLOC model. In the real economy, something in between no job loss and the upper limit of 2,000 to 3,000 fewer new jobs created would be plausible. Part of the impact of higher costs in one area would be reduced wages in other areas, and part would be in lost output and job growth. The time path of rate changes would be important as well as the dynamics of income and saving. Government transfer programs would soften the blow of unemployment, and so on. The full adjustment would be complicated, and my sketch only suggests how to think about the magnitudes. However, it does suggest the implausibility of the large impacts produced by the STARLOC model.

OIL PRICE FORECASTS

Q. Have you read the testimony of Mr. Komanoff (OCA Statement No. 6)?

A. Yes, I have.

Q. What is your understanding of Mr. Komanoff's forecast of future oil prices?

A. Mr. Komanoff projects that, starting from PECO's 1985 oil price estimates, prices will decline at an annual rate of 1% in real terms through the year 1990, will then increase at an annual rate of 1% in real terms through the year 2000, and will then increase at an annual rate of 3% in real terms thereafter. Mr. Komanoff further states that he believes the 1% decline between now and 1990 to be conservative. Mr. Komanoff expects that "real oil prices will remain soft for the next half-dozen years", and attributes this to conservation, oil substitution, tapping of new sources of oil production, and deflationary expectations, all of which he expects to continue for at least the next several years. (OCA Statement No. 6 at 37). Eventually, however, and probably before the turn of the century, Mr. Komanoff expects real prices to begin rising as current producing areas are depleted.

Q. What is your understanding of PECO's projection of future oil prices?

A. In PECO Statement No. 32, PECO witness English supports the Company's oil price projection, in which the price rises at 3% in real terms between 1985 and the end of the century. Mr. English believes that the current softness in oil markets will prove to be temporary, and that prices will again become firm as demand rises.

Q. What is your evaluation of these views of future oil prices?

A. First, I would underscore the wide range of uncertainty associated with oil price forecasting. While this uncertainty is widely recognized, it is rarely

incorporated explicitly into a forecast. I believe it should be, and for this reason, I prefer to forecast in terms of probability distributions. I would accord some likelihood both to the Komanoff and to the English view of the future. Secondly, I agree with the view stated by Mr. Komanoff that prices are unlikely to follow a smooth path from year to year. Forecasters can at best attempt to predict the long-term trend line around which large seasonal and annual fluctuations will be seen.

Q. Do you agree with Mr. Komanoff's analysis of the forces that determine oil prices?

A. No. I believe that Mr. Komanoff fails to appreciate the strength of the forces which declining oil prices have set in motion. He therefore underestimates the speed with which the declining trend will be reversed. The reversal he sees "before the end of the century" will, in my view, more likely begin before the end of this decade (OCA Statement No. 6 at 39).

Q. What are the forces that will, in your view, lead to a reversal in the trend of falling oil prices?

A. First, there is an effect on non-OPEC sources of oil production, which have been rising steadily since the mid-1970's in response to the first and second oil price shocks. Most observers have felt, however, that this trend could not continue very much longer, even with constant real oil prices. The reason is that the large, mature producing regions in Texas, Louisiana, Oklahoma, Alaska, the North Sea, and the USSR are now beginning a steady decline which cannot be offset by increased production in such promising but relatively small new areas as Angola, the Sudan, Colombia, or even China, where the results have not so far been very impressive.

Q. Will falling prices affect this trend?

A. Yes. The rate at which the decline in mature areas occurs is very sensitive to the price of oil. The rate of decline can be slowed by investing in expensive tertiary recovery projects and by exploration in more hostile frontier areas in offshore Alaska and the North Sea. But with falling prices, the incentive to make these investments has been diminishing. The more the oil companies withdraw these investments, the more rapidly existing production will decline.

Q. What other effects result from falling oil prices?

A. The other important effect is on the demand for oil. It is important to recognize that, although oil prices have been falling in the U.S. since 1981, prices continued to rise in the rest of the world until the middle of 1985. The reason for the difference was that, from 1981 through 1985, the U.S. dollar was appreciating in value against other currencies faster than the dollar price of oil was falling. As a result, prices in local currencies for gasoline, jet fuel, heating oil, and residual fuel oil continued to rise throughout the world.

Q. Do you expect oil demand to begin rising in the U.S. and elsewhere?

A. I expect the trend in the U.S. will be moderately up, although sectors of demand growth — jet fuel, for example — will continue to be offset by efficiency improvements related to the turnover of capital stock. This may be true for Japan as well. In Europe and the developing countries, where prices in local currencies have only recently begun falling, I expect the stimulus of falling prices, combined with steadily increasing rates of economic activity, to produce some increase in oil consumption over the next five years.

Q. What are the implications of declining non-OPEC production and rising demand for future oil prices?

A. In my own view, despite recent events, OPEC remains the key in determining the medium and long-range oil price path. Rising demand and falling non-OPEC supply translate into increased demand for OPEC oil. And, despite the many plausible but conflicting theories of OPEC behavior, we have observed empirically since OPEC became a dominant market force in 1974 that oil price movements are directly related to the amount of idle OPEC production capacity.

Q. Please explain this empirical relationship between idle OPEC production capacity and oil price movements.

A. The relationship is depicted graphically in Exhibit WWH-3, which is taken from the U.S. Energy Information Administration's (EIA) "Annual Energy Outlook, 1984". The EIA uses this empirical relationship as the basis for their own oil price forecasting. This exhibit shows, for each year from 1975 through 1984, the percentage change in the world oil price relative to the previous year graphed against production capacity utilization for OPEC as a whole. In 1975, 1982, 1983 and 1984, when OPEC's capacity utilization was 70% or less, the real price of oil declined. In 1976, 1977, and 1981, when capacity utilization was in the 80-83% range, there was very little change in the real oil price. And in 1979 and 1980, when capacity utilization reached 90%, there were very substantial increases in real oil prices.

Q. Have you applied a model based on this rule to current and future oil price movement?

A. Yes. A model based on this rule was originally developed by the Energy Information Administration (EIA) in Washington. The EIA model is called the "Oil Market Simulation" (OMS) model. At Harvard we have taken the basic structure developed by the EIA, and adapted it to our requirements, the most important of which was to take uncertainty explicitly into account. The Harvard version of the model is called the "Harvard Oil Market Simulation" (HOMS) model.

Q. Has the HOMS model been documented and reviewed by energy economists or other knowledgable professionals outside of Harvard University?

A. Yes. Our work in developing HOMS is documented in a December, 1985 report entitled "Oil Market Risk Analysis" written by myself and Paul N. Leiby, and distributed by the Harvard University Energy and Environmental Policy Center. The report describes the structure of the model and illustrates intermediate calculations derived in the process of running the model. The report was formally submitted to the Department of Energy, which assisted in funding the project.

In addition, a draft version of the model was reviewed by many energy economists, especially at a Harvard conference in May of 1985 attended by over thirty energy experts from industry and academia. On several occasions, the economists of several major domestic and international oil companies have critiqued the model during its development. The Department of Energy also provided regular suggestions during the development stage.

The comments and suggestions on the draft model, where appropriate, were incorporated in the version reported in "Oil Market Risk Analysis."

The principal issue discussed was the applicability of Exhibit WWH-3 in describing future price responses from the OPEC producers. This relationship has been either accurate in the past or has tended to underestimate oil prices. But it is the best evidence we have on the relationship between price and capacity utilization. Therefore, we kept the DOE pricing function in our model.

Q. Please describe briefly the structure of HOMS.

A. HOMS forecasts the domestic refiners' average acquisition cost for crude. It incorporates a demand model, a non-OPEC supply model, and a price model. The demand model forecasts oil demand as a function of prices and economic activity. The non-OPEC supply model forecasts non-OPEC production as a function of price. The essential feature of these two sub-models is that responses to price and price changes are lagged. This, of course, reflects the lead-times associated with turnover of capital stock on the demand side and the fruition of exploration and development projects on the supply side. In other words, the changes in prices in one period have significant effects on the adjustment process in other periods. Hence, declines in prices carry the seeds of future increases in price, which in turn stimulate a market response that leads to later declines in price.

Q. Please describe the key uncertainties which the model takes explicitly into consideration.

A. The model incorporates probabilistic treatment of uncertainty for each of the following variables that can have an impact on the oil price path: the elasticity of oil demand with respect to economic activity (GNP) in various regions; the elasticity of oil demand with respect to oil price; the rate at

which these elasticities produce their effects on demand; OPEC's maximum capacity level; OPEC's target capacity utilization rate; currency exchange rates; and oil supply disruptions.

Q. What future oil price path does HOMS forecast?

A. As I have indicated, we use HOMS to generate probability distributions rather than point estimates. Given the important uncertainties that have major influences on the oil market, it is clear that for many critical decisions, the uncertainty is more important than any one forecast. Hence, we have been explicit about the role of uncertainty and produced forecast ranges expressed in terms of probability distributions.

In a recent set of HOMS runs, the model projected the following probability distribution for 1990 oil prices (expressed in 1984 dollars): a 10% chance of the price being $30/bbl or less; a 50% chance of the price falling between $30/bbl and $40/bbl; a 20% chance of the price falling between $40/bbl and $50/bbl; a 15% chance of the price falling between $50/bbl and $60/bbl; and a 5% chance of the price being above $60/bbl.

For the year 2000, the probability distribution in these HOMS runs is as follows: a 5% chance of the price being $50/bbl or less; a 30% chance of the price falling between $50/bbl and $60/bbl; a 35% chance of the price falling between $60/bbl and $70/bbl; a 20% chance of the price falling between $70/bbl and $80/bbl; and a 10% chance of the price being above $80/bbl.

Q. Do these runs represent your best view as of today regarding future oil price trends?

A. Generally, yes, but with one caveat. The 1985 and 1986 price probability distributions in these runs were not specified exogenously but were determined by the model as part of the forecast. The mean value of the price distribution so determined was in fact somewhat below the actual price in 1985. So far in 1986, the precipitous decline generated by Saudi Arabia in recent weeks has driven the average refiner acquisition cost close to $20 per bbl., a few dollars below the HOMS mean value for 1986. Should Saudi Arabia persist in its current production and pricing policies, despite the substantial revenue loss that these policies are producing, the 1986 average refiner acquisition cost may well be as low as, or even lower than, the current level. Of course, this lower price, if sustained for any period, would stimulate a faster recovery in demand and a sharper response in the price cycle.

Q. How do the HOMS forecasts you have described coincide with those of Messrs. Komanoff and English?

A. In Exhibit WWH-4, I have superimposed the forecasts of Mr. Komanoff (lower solid line) and PECO (upper solid line) on a graph showing the HOMS probability distributions. In order to do this, I took as my starting point for 1985 a price of $25.85 in 1984 dollars. This is the average U.S. refiners' crude oil acquisition cost for the first 10 months of 1985 as reported in EIA's Monthly Energy Review, converted to 1984 dollars using the GNP implicit price deflator published in the Monthly Energy Review. I assumed that these forecasts of residual oil prices in 1985 were consistent with this actual crude oil price value. I then used a 3% annual real growth rate from this base to generate the line representing the PECO forecast. The line representing Mr.

Komanoff's forecast was generated in the same manner, using the annual growth rates I described above in summarizing Mr. Komanoff's forecast.

Q. Please describe what Exhibit WWH-4 shows.

A. In 1987, the HOMS result says there is about a 22% chance that Mr. Komanoff's forecast is too high, and a 78% chance that his forecast is too low. For the PECO forecast, these percentages are about 35% and 65%, respectively. For the year 1990, the HOMS result accords a small probability (10%) to PECO's forecast being too high, and finds an even smaller probability (2%) that Mr. Komanoff's forecast is too high.

Q. Please summarize the important points of your review of oil price forecasts.

A. The first point is that the oil market is volatile, so that prices at any point in time are highly unpredictable. The second point is that the forces which link supply, demand, and price in the oil market are delayed in their operation, so that today's market conditions are a function of conditions months and even years earlier. Similarly, the effects of conditions today will be felt months and years into the future. The third point is that it is easy to concentrate on current market weakness and assume that it will continue indefinitely, whereas in fact pressures are now accumulating that will tighten the market sooner than most people realize. Lower prices will depress production, stimulate demand, and lead to a new cycle of rising prices. My best estimate is that in 1986-87 we are moving through the bottom of the current cycle. The deeper the bottom, the faster the rebound on the other side. This will of course be followed by another cycle of falling demand and falling prices. Given the concentration and instability of the sources of oil supply, I see no reason for these cyclical patterns, which we have observed in the oil market since 1973, not to continue indefinitely.

Q. Have you reviewed Dr. Schinnar's comments concerning future oil prices in his cross examination (Transcript at 3419-20)?

A. Yes. Dr. Schinnar mentioned during his cross examination that, while attending a conference in Honolulu, he heard "a number of individuals", who had attended yet another conference, comment on what they expected oil prices to be in the 1990's. Apart from the fact that the individuals are unnamed and the information is unsupported, the purpose of the conference Dr. Schinnar was attending was to discuss the development of the modernization of electric utilities in ASEAN and northeastern Asian countries from 1960 to 1985. The purpose of the conference clearly was not to discuss or evaluate oil price forecasts.

Q. Does this conclude your rebuttal testimony?

A. Yes.

APPENDIX 1

WILLIAM W. HOGAN — **Director**

PROFESSIONAL EXPERIENCE

1982-Present	Chairman, Public Policy Program, Kennedy School of Government.
1979-Present	Director and Principal, Putnam, Hayes & Bartlett, Inc.
1978-Present	Professor of Political Economy; Director, Energy and Environmental Policy Policy Center; John F. Kennedy School of Government, Harvard University, Cambridge, Massachusetts.
1976-1978	Adjunct Professor of Research and Scholarship, Department of Engineering-Economic Systems and Department of Operations Research, Stanford University, Stanford, California; taught in Energy Policy odeling and Techniques of Operations Research; founder and Executive Director of the Energy Modeling forum, conducting systematic comparisons and evaluations of energy models applied to policy problems.
1975-1976	Deputy Assistant Administrator for Data and Analysis, Federal Energy Administration. Responsible for statistical and analytical functions in support of energy policy and program development. Formulated and directed statistical programs designed to assemble and utilize energy data. Evaluated energy program and policy alternatives; directed the integration of statistical, modeling, forecasting, and analytical functions applied to the development of detailed analysis of energy policy and program issues. These activities included the development of the Project Independence Evaluations System (PIES) and the preparation of the National Energy Outlook.
1974-1975	Director, Officer of Quantitative Methods, Federal Energy Administration. Responsible for short-term energy supply-demand analysis and forecasting, long-term supply modeling, long-term energy system integration modeling, and analysis of international energy economy. Directed modeling and software implementation for Project Independence studies.
1973-1974	Acting Director, Modeling Division, Office of Energy Data and Analysis, Department of Interior. Responsible for organizing analytical and modeling activities dealing with energy policy. Directed forecasting and supply-demand analysis for the federal government during the 1973-1974 oil embargo.

1971-1973	Instructor, U.S. Air Force Academy, Department of Economics and Management. Developed and implemented large odels for optimizing the Defense Supply Agency's aviation fuel procurement process.
1969-197	Ph.D., Department of Quantitative Methods, Graduate School of Management, University of California, Los Angeles. Chairman: Dr. Arthur Gedffrion; Dissertation: "Optimization and Covergence of Extremal Value Functions Arising from Structured Nonlinear Programs."
1968-1969, 1975	Instructor, Associate Professor (part-time), George Washington University. Taught courses in Mathematical Programming and Introduction to Operations Research.
1967-1969	Operations Research Analyst, U.A. Air Force, Pentagon. Developed optimization and simulation models used in the personnel and manpower planning process.

CONSULTING EXPERIENCE

1985	Load Forecast Review, Gulf States Utilities.
July 1985	Natural Gas Transportation, FERC Proposed Rulemaking, Maryland People's Counsel.
1985	Load Forecast Review, Philadelphia Electric Co.
1984	Oil price Econometric Studies, State of Colorado *et al.*
1984	Mandatory Contract Carriage, National Association of State Utility Consumer Advocates.
1984	Fuel Forecast Review, EPRI.
1984	Competitive Effects of Payment of Oil Entitlements Exceptions Orders, Foley and Lardner.
1984	Competitive Impacts of Special Marketing Programs on Consumers, Pipelines, and Producers for the Maryland People's Counsel.
1984	Integrated Fuel and Investment Planning, Electric Power Research Institute.
1983	Alaskan Oil Export Policy, Alaska Pulp and Paper.
1983	Alternative Energy Demand and Load Forecasting, Department of Energy.
1983	Corporate Organization and Regulatory Policy, Public Service Commission of New Mexico and Gas Company of New Mexico.

1983	Domestic Natural Gas Markets and Policy, An Independent Gas Producer.
1983	Load and Rate Forecasting, General Public Utilities.
1983	Load Forecasting, Public Service of New Hampshire.
1983	Natural Energy policy a nd the Reagan Experiment, Urban Institute.
1982	Synthetic Fuels Policy, Synthetic Fuels Corporation.
1981	Integrated Corporate Planning, Pacific Gas and Electric.
1981	Energy Conservation and Energy Demand, Carnegie Mellon Foundation.
1980-1984	Corporate Strategy and Organization, Major Regulated Utilities.
1980	Corporate Strategy, General Public Utilities.
1979-1984	Energy Security and International Oil Policy, Department of Energy.
1977	Load Forecasting, Commonwealth Edison.

TESTIMONY

July 1985	U.S. Senate Committee on Energy and Natural Resources, Hearing on Future Electricity Needs, Washington, D.C.
July 15, 1985	Federal Energy Regulatory Commission, Regulation of Natural Gas Pipelines After Partial Wellnea Decontrol. Docket #RM 85-1-000.
February 26, 1985	Federal Energy Regulatory Commission, Columbia Gas Transmission Investigation, Docket #TA 82-1-21-000.
December 3, 1984	Pennsylvania Public Utilities Commission, Limerick Unit #2 Generating Station Investigation, Docket #1-840381.
1984	U.S. Department of Energy, office of Hearings and Appeals, Exception Orders and Market Disruption.
September 12, 1984	U.S. Department of Energy, Office of Hearings and Appeals, Stripper Well Exemption Litigation/Refiner Evidentiary Hearing, on behalf of The States of Colorado et al. Case No. HFH-0026.

August 29, 1984	FERC Inquiry on Impact of Special Marketing Programs on Natural Gas Companies and Consumers, Docket No. RM84-7-000.
February 1984	FERC Generic Hearings on Special Marketing Programs, Docket No. RM84-7-000.
May 1983	Senate Investigations of Alaska Oil Export.
May 1983	Supply-Demand Hearings, Public Service of New Hampshire.
January 1983	Interstate Commerce Commission, Delmarva Power and Light Company v. Consolidated Rail Corporation.
1981	Senate Finance Committee.
1977	House Subcommittee on Advanced Energy Technologies and Energy Conservation Research, Development and Demonstration.

HONORS

Distinguished Service Award (1975), Special Award for Exceptional service (1976), federal Energy Administration.

Alumni Award, Outstanding Doctoral Student, University of California, Los Angeles (1971).

Outstanding Cadet Award, Engineering Management, U.S. Air Force Academy (1966).

BOOKS AND ARTICLES

Dr. Hogan is the author and editor of numerous professional papers and books on modeling, mathematical programming, economics, and energy policy.

ACTIVITIES AND ORGANIZATIONS

1967-Present	Operations Research Society
1967-Present	The Institute of Management Sciences
1971-Present	The Mathematical Programming Society
1977-1978	Chairman, ORSA Special Interest Group on Energy Applications
1974-1976	Supply and Demand Advisory Task Force, Electric Power Research Institute

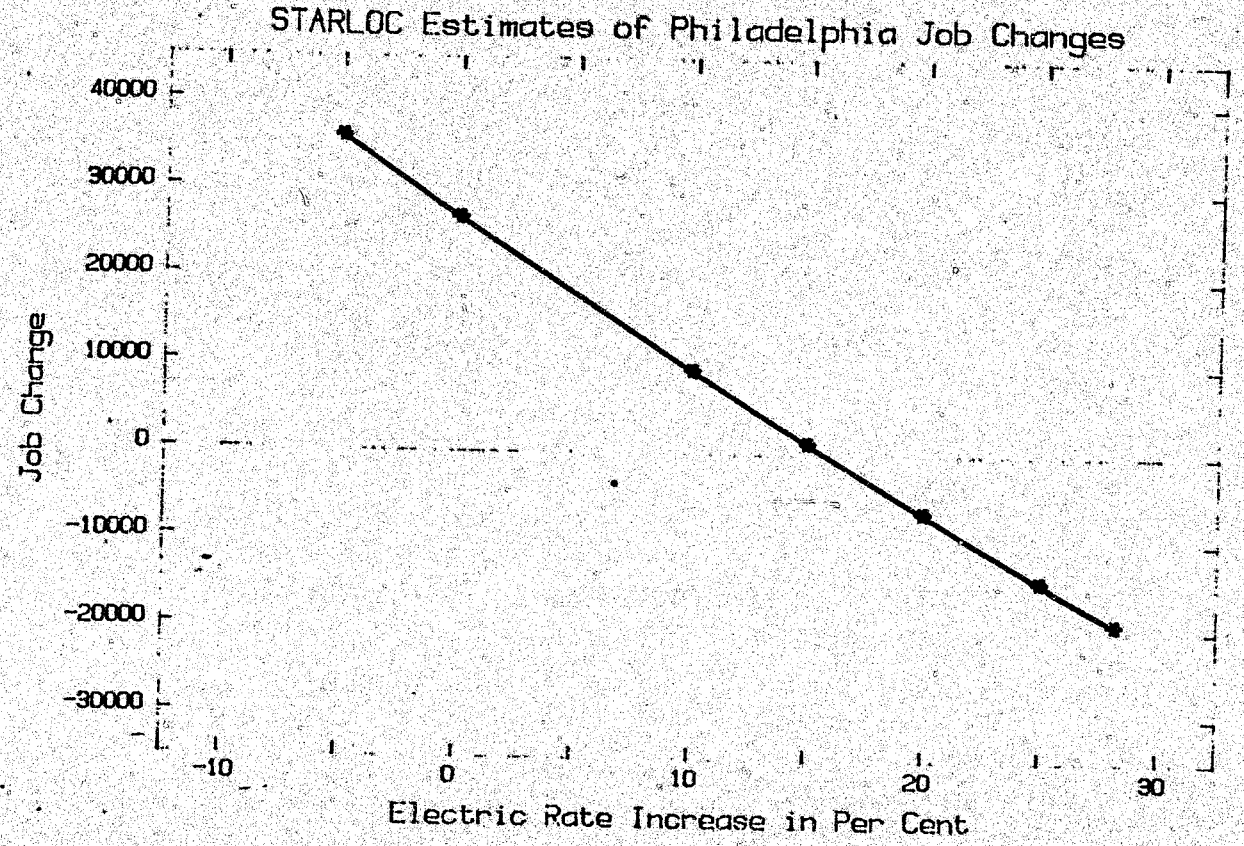
1977-Present	Advisory Panel, Center for Energy Studies, University of Texas
1978-Present	International Association of Energy Economists
1978-1980	National Advisory Board, Texas National Energy modeling Project
1978-1983	Editor, Energy and Environment, Operations Research
1978-Present	Chairman, Steering Committee, Energy Modeling Forum
1979-1981	Steering Committee, Undergraduate Mathematics Applications Project
1979-Present	Editorial Board, Public Policy and Public Management Case Project
1979-Present	Advisory Editor, Resources and Energy
1979-1980	Advisory Board, National Center for Energy Systems Analysis
1980-1983	Advisory Board, Energy and Environment Systems Division, Argonne National Laboratories
1981-Present	Editorial Board, International Association of Energy Economists (IAEE), The Energy Journal
1983-Present	Advisory Council, Gas Research Institute
1982-Present	Director, Harvard Real Estate Corporation
1985	President, IAEE.

EDUCATION

1971	Ph.D. University of California, Los Angeles
1967	M.B.A. University of California, Los Angeles
1966	B.S. United States Air Force Academy

EXHIBIT WWH-1

STARLOC MODEL YIELDS A STRAIGHT LINE RESPONSE TO RATE INCREASES



Note: Data taken from sensitivity tests with STARLOC model performed by Kirby Owen of PHB, 2-11-86. Uses case with assumed inflation at 5% per year.

2-17-86

EXHIBIT WWH-2

Real Indirect Price Increase

1	AG & MINING	0.15%
2	CONST	0.03%
3	FDTEXAPP	0.11%
4	LUMBFURN	0.08%
5	PAPPRT	0.18%
6	CHRUBPIL	0.21%
7	PETRO COAL	0.09%
8	STCY MISC	0.29%
9	METALS	0.32%
10	ELECEQMA	0.16%
11	INSTREQ	0.15%
12	TC	0.22%
13	WT	0.08%
14	RT	0.35%
15	FIR	0.22%
16	ADVBUSV	0.10%
17	HEALTHSV	0.33%
18	EDUCSV	0.22%
19	OTHSVGOV	0.16%
20	R & R	0.66%
22	GASUTILS	0.05%
23	HOTELS	0.68%

Employment Weighted Average: 0.21%

Note: Real price increase calculated use data from Table 2.5 and equation (4.16) of the technical report by Schinnar et al, assuming a 28.2% nominal increase in electricity rates with approximately 16% inflation. The real electricity price increase is multiplied by the price multiplier for each sector calculated form the vector $A_{21}(I-A_{11})^{-1}$. The components for the multiplier vector were calculated from Table 2.5. The employment figures for calculating the wieghted average are taken from Table 2.2 in the technical report.

EXHIBIT WWH-3

OPEC Pricing Behavior; 1975-1984

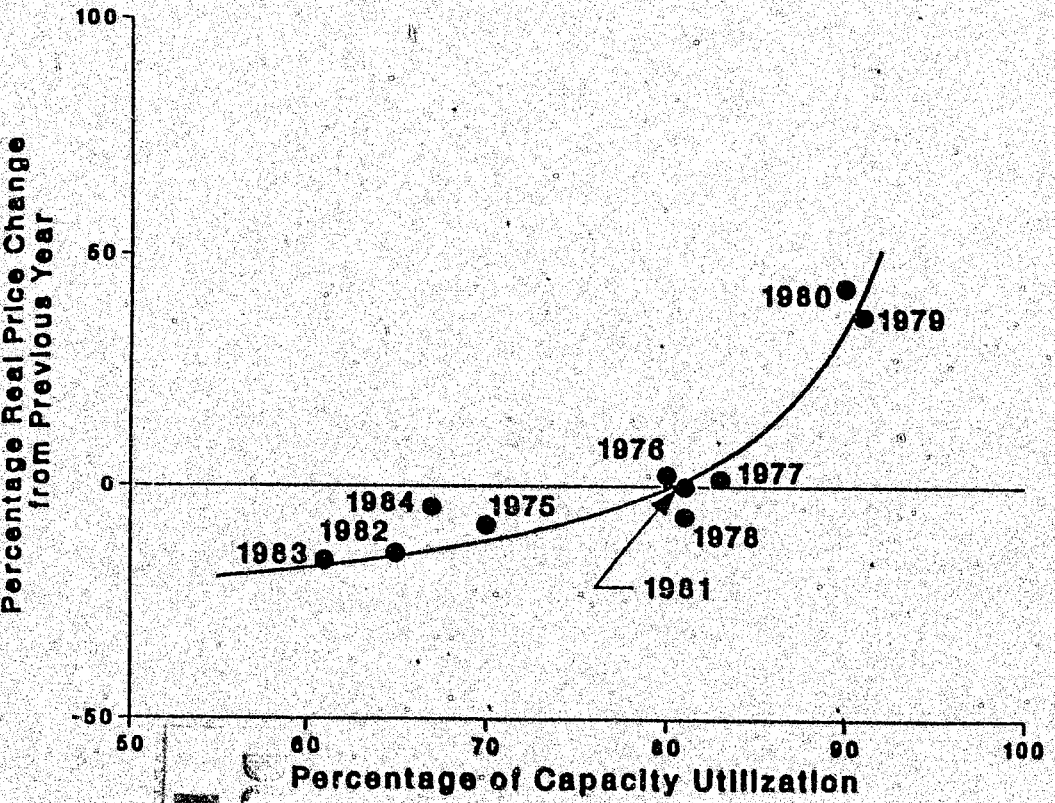
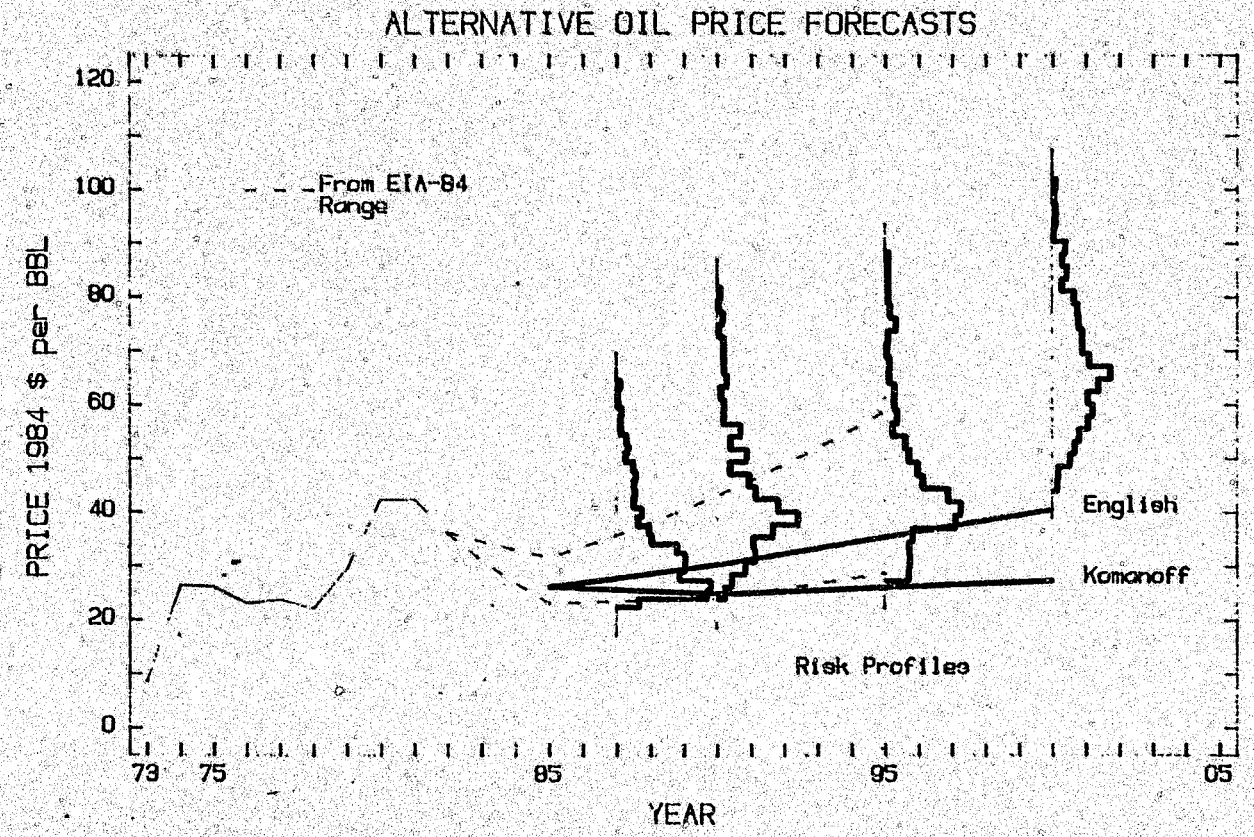


EXHIBIT WWH-4

THE WIDE RANGE OF OIL PRICES REFLECTS THE MARKET UNCERTAINTY



Note: The Energy Information Administration (EIA) forecasts taken from the 1984 Annual Energy Outlook, DOE, January 1985. Aggregate Model forecasts and probability distributions taken from Harvard two product version of the DOE Oil Market Simulation (OMS) Model. The Komanoff and English forecasts taken from testimony in the PECO rate case.

2-17-86

WWH-5 thru 7

PECO STATEMENT NO. 37A

3-12-86

R-850152

PENNSYLVANIA PUBLIC UTILITY COMMISSION
v.
PHILADELPHIA ELECTRIC COMPANY

Docket NO. R-850152

SUR-SURREBUTTAL TESTIMONY
OF
WILLIAM W. HOGAN

RESPONSE TO THE SURREBUTTAL TESTIMONIES OF ARIE SCHINNAR, CHARLES KOMANOFF AND PAUL CHERNICK

March 7, 1986

PECO STATEMENT NO. 37A

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SUR-SURREBUTTAL TESTIMONY
OF
WILLIAM W. HOGAN

Q. Please state your name and affiliation for the record.

A. I am William W. Hogan, Professor of Political Economy at the Kennedy School of Government, Harvard University, and Director of the Energy and Environmental Policy Center, Harvard University. I am also a Director of Putnam, Hayes and Bartlett, Inc., a management and economic consulting firm with offices in Cambridge, Massachusetts.

Q. Have you previously filed testimony in this proceeding?

A. Yes. My rebuttal testimony has been marked as PECO Statement No. 37.

Q. What is the purpose of your sur-surrebuttal testimony?

A. The purpose of my sur-surrebuttal testimony is to respond to the surrebuttal testimonies of City witness Arie P. Schinnar (City Statement No. 1A), OCA witness Charles Komanoff (OCA Statement No. 6A), and Paul Chernick (UUC/UP Statement No. 1A).

Q. Would you please summarize your sur-surrebuttal testimony?

A. Yes. My rebuttal testimony raised four serious flaws in Dr. Schinnar's STARLOC model, all of which contributed to his overestimation of the impact of PECO's proposed rate increase on new employment in the Philadelphia MSA. In his surrebuttal testimony (City Statement No. 1A) Dr. Schinnar has presented additional model information in an attempt to refute my criticisms. Instead, this

information confirms my conclusion that Dr. Schinnar's estimated impact is implausibly high, as I discuss here in my sur-surrebuttal testimony.

Next, my sur-surrebuttal testimony responds to the criticisms of my oil price forecast offered by Mr. Chernick (UUC/UP Statement No. 1A) and by Mr. Komanoff (OCA Statement No. 6A). Mr. Komanoff asserts that the HOMS model, used as a basis for my oil price forecast, is subject to error because it assumes symmetric response of world oil demand to world oil prices. As I discuss herein, Mr. Komanoff's criticism is erroneous and based on a misunderstanding of the operation of the HOMS model. Finally, Mr. Chernick questions my credentials as an expert in oil price forecasting and contends that my forecast is out of line with other forecasts. I demonstrate herein that I have extensive experience in energy modeling and my oil price analysis is in line with other reputable forecasts.

SUR-REBUTTAL TO DR. SCHINNAR

Q. Notwithstanding significant criticism of his initial testimony, Dr. Schinnar persisted in defending conclusions he reached, based on his STARLOC model, in his surrebuttal testimony. Dr. Schinnar's testimony remains based on the general claim that electric rate increases produce adverse economic impacts. Would you comment on this assertion?

A. Yes. Dr. Schinnar's analysis says that, all other things being equal, PECO's proposed real increase in the price of electricity would reduce expected growth in new jobs in the Philadelphia MSA as compared to the level of new job creation expected in the area's economy given no real increase in the price of electricity. Dr. Schinnar, therefore, suggests that PECO's proposed rate increase be phased-in over a longer period of time than proposed by PECO, reducing PECO's near-term

proposed increase in electric rates to teach the currently expected rate of inflation. Dr. Schinnar asserts that his proposal would result in no real electric price increase in PECO's service territory and would avert the possible adverse impacts on all employment that he postulates. Not only is Dr. Schinnar's analysis of employment impacts greatly flawed, but his analysis of the macro-economic impacts of electric rate increases is also incomplete. Dr. Schinnar's analysis considers only the impact of real rate increases; he ignores the potential adverse economic impacts that may result from arbitrary disallowances of required rates or rate increases. Artificially low rates would injure the service provider and would impact both the local economy and future electric rates. It is improper for Dr. Schinnar to assume that there are no adverse macro economic consequences resulting from arbitrary reductions in rates. A full determination of the economic impacts of various rate proposal would also include other effects on the cost of capital, the business climate, and so on. Therefore, a balanced investigation of the impacts of electric rate changes would consider rate increases and reductions below required rate increases, as well as other types of economic impacts, in addition to employment impacts.

Q. Dr. Schinnar claims that your reestimation of the impact of PECO's proposed rate increase on growth in new jobs in the area, which appeared in your rebuttal testimony, is incomplete. Would you comment on your methodology?

A. Yes. My calculations were done without the benefit of a model like STARLOC. My estimate of the impact of PECO's proposed rate increase on new job creation, which ranged from no impact to a reduction in growth of 2,000-3,000 new jobs, was based on a rough approximation that considered the net effect of all of the

reasonable changes in the economy that could be anticipated. This approximation was based, in part, on my estimates of the intermediate calculations that occur in the STARLOC model. Of necessity, my estimates of these complex intermediate calculations were only approximations because no intermediate calculations were provided by Dr. Schinnar despite our requests for them.

Q. Did you receive the information necessary to evaluate the validity of the STARLOC model's intermediate calculations?

A. No. During discussions with Dr. Schinnar and in response to our interrogatories, we were informed by Dr. Schinnar that the detailed intermediate calculations in STARLOC could not be made available to us. In particular, Dr. Schinnar said that untangling the complex multi-step intermediate calculations in the STARLOC model would impose an undue burden. The limited access we were provided to the STARLOC model allowed only partial analysis of the sensitivity of the model output and did not allow insight into the complex, multi-step intermediate calculations. It was, therefore, not possible to separate the effects of different parts of the model in determining the overall job impacts, if any, of increases in electric rates.

Q. Dr. Schinnar does not believe that you took full advantage of the access provided to him and the STARLOC model. Please comment on this assertion.

A. First, although I was present for only half of one day, my colleague, Kirby Owen, was present during the entire time. Mr. Owen asked questions and made computer runs at my direction, and briefed me fully as to the information received. In addition, Dr. George Schink was present for two of the days, and I consulted with him.

Second, Dr. Schinnar concedes that he made himself and his model available only for two and one half days (see City Statement No. 1A, p. 14). Dr. Schinnar has indicated that it has taken over a year and a half of painstaking work on the part of him and his assistants just to bring the model to its present preliminary state. In view of this fact, and the hundreds of equations and thousands of parameters in the STARLOC model, two and one half days, even with full documentation, which was not provided, would hardly be sufficient.

Third, even during the time the PECO experts were present at Dr. Schinnar's workshop, complete access was not provided to the model. For at least three hours on one of the days they were there, Dr. Schinnar was unable to log onto the computer. In addition, when the runs requested by PECO experts produced results that Dr. Schinnar could not explain, he excluded the PECO experts from the computer while he presumably performed further analyses with his model.

Fourth, the final day was spent reviewing the results of computer runs produced as a result of Dr. Schinnar having modified his computer program after the PECO experts had left on the second day.

Q. Has Dr. Schinnar subsequently provided some of the intermediate calculations you thought would be essential to assess the STARLOC model?

A. Yes. In Table 1 of his surrebuttal testimony (City Statement No. 1A, p.5), Dr. Schinnar provided for the first time selected intermediate calculations that decompose the total estimated employment impact calculated by the STARLOC model into four calculated subparts. These limited calculations, and other

information provided in Dr. Schinnar's surrebuttal testimony, would have been extremely helpful in our own evaluation of the STARLOC model initially.

Q. What do the intermediate calculations provided in Dr. Schinnar's surrebuttal testimony reveal?

A. As discussed in my rebuttal testimony, my approximations of STARLOC's intermediate calculations led me to conclude that STARLOC was seriously flawed in at least four ways that caused it to overestimate the impacts on new job creation. The intermediate calculations provided by Dr. Schinnar in his surrebuttal testimony reveal implausible intermediate results in the model that reinforce the criticism provided in my rebuttal testimony. In particular, the impacts on new job creation in the individual categories, as set forth in Table 1 to Dr. Schinnar's surrebuttal testimony, which appear as intermediate calculations, are implausibly high. Furthermore, the accounting system used by Dr. Schinnar double counts the impacts of price changes and, thereby, overestimates the impact resulting from higher electric rates. Based on Table 1 in Dr. Schinnar's surrebuttal testimony, I conclude that the STARLOC model is flawed in at least the four ways identified in my earlier testimony. The model's resulting estimate of employment impacts does not withstand scrutiny when decomposed into even the categories of intermediate outputs offered by Dr. Schinnar.

Q. You refer to intermediate estimates of job employment impacts by categories that were implausibly high. Could you be more specific?

A. Yes. In Table 1, Dr. Schinnar identifies the first category as "Conservation and Interfuel Substitution" and estimates a loss in new job growth of 3,142 new jobs in

this category. As disclosed in Dr. Schinnar's workpapers filed with his surrebuttal testimony, this calculation captures only the impact of changes in the demand for energy, not including any inflationary effects of higher prices. This amounts to modeling the result of a hypothetical mandatory energy conservation and interfuel substitution program that achieved the same energy savings as would accrue from PECO's proposed electricity prices increase. Electricity consumption would be reduced, and the consumption of electricity substitutes, principally oil and gas, would be increased. In addition, labor and materials would substitute for electricity as a result of the increased attractiveness of electricity conservation. I emphasize that Dr. Schinnar offers these as the separate effects of energy conservation and interfuel substitution, independent of the impact of higher prices on incomes and the demand for other products. This conservation program could be thought of, I suppose, as the same type of government sponsored energy conservation activities that have been described often as promoting economic growth and increasing employment.

Because the use of substitutes for electricity would reduce the use of electricity, and increase the use of other factor inputs per unit of output, the net loser in job growth would be the sector initiating the price increase, namely the electric sector. This implies that the loss in new employment in the electric sector must be greater than the total employment impact shown; we must net out the increases in jobs in other sectors that are substituting for electricity from the loss in the electricity sector. Hence Table 1, Category 1, should underestimate the number of new jobs lost in this sector. However, the surprising and remarkable result is that the real increase of 12.44% in electric rates produces a loss of 3,142 new jobs in this sector! This supposed underestimate of the loss in

jobs in electric utilities comes in a sector where total employment is only 11,800. In other words, the 12.44% real increase proposed by PECO in the price of electricity produces, according to the STARLOC model, more than a 26% reduction in the number of workers employed in the production of electric service! According to Dr. Schinnar's testimony, this is before adding in the employment impact of the multiplier effects shown as Category 4 of Table 1. Hence, the STARLOC estimate of the final loss of jobs in the electric utility sector must be even greater than shown in the Category 1 results. These estimates of losses in new job creation are so large relative to the total electric sector that they cannot be the result of conservation and fuel substitution alone. nonsensical. If the category description presented by Dr. Schinnar in Table 1 correctly state what the STARLOC model calculates, then they strongly suggest the presence of serious flaws in the model.

Q. You mentioned that Dr. Schinnar's model double counts new employment impacts. Could you identify an example of this double counting?

A. Yes. Again referring to Table 1 in Dr. Schinnar's surrebuttal testimony, Dr. Schinnar claims that the estimates of employment impacts prepared by Dr. Schink, which were developed by analyzing the impacts of increased cost to business on employment, and by myself, which were developed by analyzing the impacts of secondary inflation on employment throughout the local economy, are separate impacts that can be added together. He further asserts that the detailed category estimates produced in the STARLOC model, which Dr. Schinnar adds together to get his total impact estimate, are comparable to the impacts assessed by Dr. Schink and myself, and that, therefore, our estimates should be added together to provide a total impact assessment.

In fact, the estimates produced by Dr. Schink and myself are not additive. They represent two different approaches to estimating the total effect of the proposed electric rate increase. In one approach, we can assume that higher costs are not transferred to other industries or to consumers, but are absorbed entirely as part of the cost of doing business, and result in a corresponding reduction in activity and employment. This is the approach used by Dr. Schink which resulted in an estimate of an upper limit of 3,550 new jobs being affected. An alternative approach is to assume that all of the increases in business costs are passed through to consumers in the form of higher prices, and are not absorbed by businesses as a business cost. I used this latter approach to prepare my estimate of a maximum potential impact of 2,000 to 3,000 fewer jobs created considering other economic adjustments, which Dr. Schinnar erroneously recalculated as a reduction of 3954 or 4,442 new jobs. Dr. Schink's and my estimates are not estimates of mutually exclusive impacts, but are alternative estimates of the same impact, and thus, certainly should not be added together.

Q. Can you provide any additional examples of Dr. Schinnar's overestimation of new employment impacts?

A. Yes. In Table 1, Category 4, Dr. Schinnar's estimate grows erroneously yet again. As discussed above, Dr. Schinnar's analysis starts with an implausibly high estimate of new employment impacts in Category 1, the electric sector, and then double-counts through Categories 2 and 3, the new employment effects of higher prices for other goods and services. Then, Category 4 applies a large employment multiplier that increases the estimated impact, while assuming that there are no responses in any other aspects of the economy that might reduce or lessen new

employment impacts. Dr. Schinnar assumes no lower wages, no higher transfer payments, no borrowing from savings, or other such mitigating factors.

In summary, the intermediate calculations shown in Table 1 demonstrate the implausible foundation for Dr. Schinnar's analysis, which is his overestimate of the adverse impact on demand for electricity and employment in that sector; the double counting of impacts due to direct price increases; and the use of large employment impact multipliers that assume away any mitigating response in the economy. Therefore, the new employment growth impacts of 19,196 estimated by Dr. Schinnar do not stand up under reasonable interpretation of the operation of the economy. In my rebuttal testimony, I demonstrated that a much smaller estimated new employment impact ranging from nothing up to an estimate of 2,000 to 3,000 fewer new jobs created, would be a much better estimate of the potential total impact of PECO's rate increase.

Q. Would you comment on Dr. Schinnar's response to your identification of his error in using an incorrect rate increase in the STARLOC model?

A. Yes. In his STARLOC model, Dr. Schinnar used the nominal percentage electric rate increase proposed by PECO; however, he assumed that it applied to all of the customers in the entire Philadelphia region, instead of just the portion actually served by PECO. PECO services about 80% of the entire region. Therefore, Dr. Schinnar's estimate overstates the price increase for the region by approximately 25%.

In responding to this observation, Dr. Schinnar implicitly agreed that the estimate he used was too high. However, he argued that other changes could take

place in the economy that could increase electric rates in the region. For example, on page 29 of his surrebuttal testimony Dr. Schinnar refers to increases in the rates of PSE&G, which bring the average area electric rates closer to the figure he used in his analysis. Of course, the PSE&G rates are not related to the PECO rates. For the calculation of impacts on new employment growth, we are interested only in the incremental impact of the proposed PECO rate increase.

To assess the incremental impact of the proposed PECO rates, the nominal rate increase in the area should be 22.6%, and the real rate increase should be 6.6% using the STARLOC approach, as I explained in my rebuttal testimony. Using the multipliers from the draft technical report (PECO Exhibit 22) to estimate intermediate calculations, I calculated a net effect of PECO's proposed rate increase on the costs faced by other industries. This indirect cost effect drives the inter-industry substitution, which is so important in Dr. Schinnar's calculations. Yet I have calculated that this price impact is only 0.2%. According to the STARLOC model, this small stimulus precipitates almost a 1% reduction in employment! As I showed in my rebuttal testimony, this implies a multiplier effect greater than 4 to 1: for every 1% change in prices, STARLOC implies a greater than 4% reduction in new employment. This result is implausible. This error coupled with the review of Table 1 mentioned above, demonstrates that there are serious flaws in the STARLOC model and significant overestimations in its results.

Q. Dr. Schinnar states that you have ignored the effect of multipliers in your estimate of the new employment impact of PECO's proposed rates. Would you comment on the importance of these multipliers?

A. Yes. I have not ignored the effect of multipliers. Instead, I have merely recognized that the multiplier effects apply to all adjustments that take place in the economy. The multipliers tell us how an employment change in one industry, such as electric, affects employment in other industries, other things being equal. Hence, if the demand for services in one industry suddenly drops enough to eliminate a job, and if there are no changes in the prices of labor or capital, and if there are no increases in transfer payments to the unemployed worker, and there is no consumption of savings in order to maintain the unemployed worker's family, then, as Dr. Schinnar assumes in STARLOC, the worker and his entire household are eliminated from the economy. If the worker and his entire household are eliminated from the economy, then all of the goods and services they would purchase are eliminated from the economy. If the other workers who would have produced those goods and services are also eliminated from the economy, because they too do not change their wages, and they lose their jobs, and if they do not get increased transfer payments, or reallocate their savings or spending over time, then the multiplier effects apply and the total employment impact resulting from the first employment change will be correspondingly increased. This is the meaning of the labor multipliers referred to by Dr. Schinnar.

But suppose that some of those "other things being equal" assumptions relied upon by Dr. Schinnar do not apply as is surely the case in the real world. Thus suppose that the effect of reduced demand for services of workers is a slight reduction in the increase in wages. Or suppose that the workers collect unemployment compensation, use savings, or borrow for a period of time. Suppose that the economy enjoys a slightly more fiscally stimulative expansion. Any of these and other countervailing actions will tend to mitigate the proposed rate

increase's impact on the local economy, thereby supporting higher employment growth. That higher level of employment growth will also be subjected to multiplier effects, creating more jobs which will create other jobs. Hence, the net effect on total employment growth depends more on full evaluation of all of the responses of the economy to the proposed price increase rather than on a simple application of the multiplier to only one portion of the possible response.

Q. Dr. Schinnar states that he knows of no literature that claims that these other mitigating adjustments will occur; therefore, he assumes that the full impact of the multipliers will apply. Would you comment on this observation?

A. Yes. Essentially, the issue that Dr. Schinnar dismisses as ignored in the literature is precisely the full problem of estimating macro-economic adjustments in an economy. The response of wages to unemployment, the opportunities of government intervention through transfer payments or fiscal stimulus, the response of monetary authorities in affecting the price of capital, etc., are subjects that have been written on so extensively that they dominate the daily discussions taking place in financial markets around the world. Although it is well known that the full extent of an economy adjustment to a factor or event is difficult to estimate, there is also a consensus that these adjustments do occur. By contrast, Dr. Schinnar has assumed that the local economy will respond to electric price increases by simply unwinding and unraveling, and that allegedly resulting unemployed workers and their families will disappear from the economy. I know of no justification for this extreme assumption.

Q. Would you please comment on Dr. Schinnar's assertion that you have had adequate access to the STARLOC model and its supporting data to validate the model and its results?

A. Dr. Schinnar asserted that we had a "complete and final mathematical documentation of the model." This is incorrect. The best documentation we have is a draft technical report (PECO Exhibit 22) which states that a final report will not be available until March, 1986 and refers for various details to several other proposed reports which themselves will not be available until well after the record closes in this case. As I have demonstrated in my rebuttal testimony, this draft report is ambiguous and confusing; there are many possible errors that could occur in the translation from this general document to the final model. Because the intermediate calculations provided for the first time by Dr. Schinnar in his surrebuttal testimony produce highly implausible results, the possibility of error in the model is very high. It is impossible to conclude from the draft technical report that the STARLOC model can provide a reasonable estimate of the new employment impacts of PECO's proposed rate increase. In both the written responses to interrogatories and in our discussion, Dr. Schinnar asserted that it was impossible to obtain intermediate results from the model to test its sensitivity to changes in key assumptions or parameters. Although Dr. Schinnar later produced some partial intermediate results in his surrebuttal testimony, I was informed during our discussions that this information could not be made available. These four intermediate calculations by no means validate the model, and if anything, demonstrate that STARLOC has serious flaws. The little additional information these calculations provide only make it more apparent that we need further documentation, including the intermediate calculations, in order to validate and test the model.

Q. Can you summarize your comments on Dr. Schinnar's surrebuttal testimony?

A. Yes. Dr. Schinnar's STARLOC model remains unexamined and invalidated in its detail. It has not been possible to get sufficient intermediate calculations or documentation to evaluate the model's structure and to test its implementation. The intermediate calculations that are available suggest that the model's results are implausibly high, include double counting of employment impacts, and follow from a misapplication of the basic concept of labor multipliers. My rebuttal testimony suggested that a correction of these errors would result in a total impact on new employment growth ranging from no impact to an upper limit of a 2,000 to 3,000 reduction in job growth. In addition, my estimate captured only part of the economic impact; it does not account for the impact on future ratepayers that would result from an arbitrary reduction in PECO rates.

SUR-SURREBUTTAL TO TESTIMONY OF UUC/UP WITNESS CHERNICK AND OCA WITNESS KOMANOFF

Q. Mr. Chernick dismissed your oil price projection, asserting that you were a "part time forecaster" and the only person available to support PECO's oil price estimates. Would you comment on your relevant experience and knowledge of oil markets?

A. As shown in the summary of my qualifications, which was appended to my rebuttal testimony, I have been involved in energy modeling and analysis for more than a decade. My earliest involvement in the analysis of likely trends in oil prices and the impacts on energy markets was in the work I directed at the Department of the Interior, the Federal Energy Office, and the Federal Energy Administration from 1973 - 1976. Most notably, the Project Independence Report and the

National Energy Outlook, completed under my direction, included detailed models of a wide variety of issues related to energy markets. In subsequent years, I analyzed a range of issues related to energy demand and energy security. Throughout this period, I have studied oil market models and have been involved in many analyses. In the last two years, I have been heavily involved in reviews of oil market forecasts and my own analysis of oil markets because of the great controversy involving, and the reduction of the number of, international organizations that have been publishing oil market forecasts. My recent paper entitled "Oil Market Risk Analysis," the executive summary of which is attached hereto as Exhibit WHH-5, summarizes the results of those studies which were done under the auspices of the U.S. Department of Energy. The details of my published studies on energy markets, including oil prices, are included in my publications bibliography.

Q. You mentioned that you directed the studies for the Project Independence Report and in the National Energy Outlook. What was the focus of those studies?

A. Those studies described the level and sensitivity of oil imports and oil prices for the United States. The purpose of these analyses was to understand the options available to the United States regarding the level of national dependence on imported oil and the sensitivity of that dependence level to changes in import prices. These studies were not designed to produce single point forecasts, but to provide a range of assumptions for purposes of sensitivity analysis.

Q. What was the base case assumption on oil prices in the Project Independence Report and in National Energy Outlook, and how did those assumptions compare with prices actually experienced in 1985?

A. The base case assumption for the Project Independence Report was for a real price in 1985 of $11 per barrel. This is measured in 1973 dollars; when converted to 1985 dollars, using the GNP deflator, this equals $24.80 per barrel. The base case assumption for the National Energy Outlook was a real price of $13.00 per barrel. Again, when adjusted to 1985 dollars, this equals $24.50 per barrel. The actual price in 1985, for the same "Refiners' Average Acquisition Cost of Imported Oil," was about $27 per barrel. Of course, real prices have been above and below this level in the intervening years, but the analysis was always intended to be a mid-range outlook rather than a cyclical price study. Both the Project Independence Report and the National Energy Outlook recognized the importance of variations in prices as a result of oil supply interruptions. The focus of my paper on "Oil Market Risk Analysis" was to capture more of this range of variation, and to show how declines in prices, such as we have enjoyed recently, carry the seeds for future increases in prices (see Exhibit WHH-5).

Q. Have you seen any other studies which support your projection of future oil prices?

A. Yes. For instance, the Synthetic Fuels Corporation commissioned Sobotka and Co. to prepare a survey of a wide range of oil price forecasts. A copy of this survey, completed in January 1986, is attached as Exhibit WWH-6. It lists 72 organizations and individuals contacted in the process of this survey. These organizations and individuals represent major forecasters in the world. I should note that I was one of the individuals contacted, while neither Messrs. Chernick or Komanoff are mentioned. The Sobotka Report also provided an exhibit which includes estimates of the median and range of the price forecasts. As can be seen

from this exhibit, the forecasts are consistent with the range included in my own analysis.

A second graph, attached to this testimony as Exhibit WWH-7, summarizes the oil price surveys conducted by the International Energy Workshop at Stanford University. This survey includes 25 different oil price estimates made by a variety of groups around the world. The graph plots the median value of the oil price forecasts. Again, this median value is consistent with the range in my own risk analysis.

It is evident from these surveys that the majority of the widely known oil market analysts and oil price forecasting groups who have been analyzing international data through the end of 1985, have a view of the oil market that is more consistent with my Forecast, and that of PECO, than with the low price forecasts -- assumed to extend for more than ten years — used in the analyses of Mr. Komanoff and Mr. Chernick.

Q. Mr. Komanoff criticizes the HOMS model, used to generate your oil price forecast, for incorporating symmetric, rather than asymmetric, oil price elasticities. Please comment on this criticism.

A. Mr. Komanoff endorses the framework of the HOMS model, which forecasts oil prices based on the utilization of OPEC production capacity. However, he asserts that the model may be subject to forecast error because it incorporates symmetric elasticities, which imply that world oil demand is equally sensitive to increases in world oil prices and to decrease in world oil prices.

Mr. Komanoff has incorrectly interpreted the HOMS model, which does not use elasticities which imply that world oil demand reacts symmetrically to price. Rather, the HOMS model separately assesses the demand for oil consumption generated by existing capital stock as contrasted to demand generated by future, new investment in oil-consuming capital stock. In the model, existing capital either consumes oil at its original level of intensity per unit of output or that capital is retired. New capital investment and resulting marginal oil consumption is modeled as responsive to price through elasticities. The model's results, however, are driven by the slow adjustment of the inventory of oil-consuming capital stock to market conditions. Hence, the theory of the HOMS model is consistent with Mr. Komanoff's description of the slow adjustment to changes in prices that shall drive future movements in the oil market. The HOMS model was specifically designed to capture this process and reflect it in long-term demand patterns, rather than project future oil prices based on near-term variations in oil prices.

Q. Does that conclude your sur-surrebuttal testimony?

A. Yes.

Exhibit WWH-5

OIL MARKET RISK ANALYSIS

William W. Hogan and Paul N. Leiby

Report of the Harvard Energy Security Project

Energy and Environmental Policy Center
John F. Kennedy School of Government
Harvard University
Cambridge MA.

December, 1985

Oil Market Risk Analysis

Executive Summary

There is a consensus that the oil market will be soft during the second half of the 1980's, and that disruptions are unlikely. Hence, in the most likely case, the Strategic Petroleum Reserve (SPR) will not be used, and oil purchased for the SPR may lose value. However, we should not revise SPR policies on this basis alone. The SPR was designed as insurance against the less likely but expensive case of a major market disruption. Any analysis of SPR policy must explicitly examine a range of events, not just consider the most likely scenario. This study presents a risk analysis of oil market behavior as a prelude to further study of the SPR and related energy security policies.

The lessons of the oil decade emphasize the importance of uncertainty, the surprising resilience of OPEC, the consistent long run pattern of demand adjustments, the dangers of forecasting myopia, and the continuing challenge of energy vulnerability:

> A major feature of the world oil market is the high degree of uncertainty.
>
> OPEC pricing behavior during the "oil glut" of the early 1980's is more indicative of the cartel's resilience than its weakness. Faced with a dramatic reduction in their market, oil producers have moderated the price drops that would have been expected based on their previous behavior.
>
> Oil demand data are consistent with a stable, dynamic demand structure with large long-run elasticities and slow short-run adjustment. Hence oil demand behavior in 1985 can be partially explained as a response to the high oil prices of a few years earlier.
>
> Instances of mistaken consensus by energy analysts are well known. Projections tend to extrapolate future oil market developments from recent price movements.
>
> The major energy security concern is our vulnerability to market disruptions; that vulnerability may not diminish directly with oil prices or import levels.

The Harvard Oil Market Simulation (HOMS) model's Most Likely case price projection differs sharply from the forecasting consensus in the 1980's. The HOMS forecasts start from actual 1983 data. There is strong pressure for a downward price cycle in the first few years of the HOMS projections, consistent with 1983-1985 slack markets and falling prices. However, in the HOMS Most Likely scenario, after the oil price falls to a 1986 low, it rises as demand recovers in the face of low prices and steady economic growth. A substantial price rise in the late 1980's is followed by an oscillatory price path caused by future responses to higher prices.

The HOMS Most Likely case results are primarily useful as an exercise in understanding the model of the oil market. Further policy analysis integrates the model and the uncertainty of projections in a risk analysis of the oil market.

The risk analysis simulates the HOMS model over a sample of possible futures. The price paths explored here assume that the SPR is not used. The major uncertainties were identified as:

> Demand curve parameters, including price and income elasticities, and the demand adjustment rate;

OPEC's trend capacity path;

Disruption in a given year;

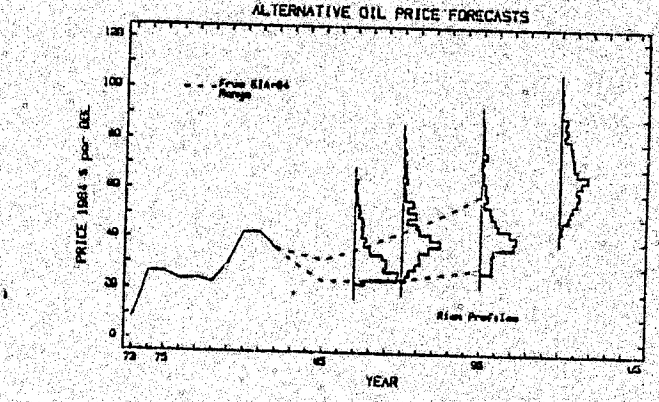
OPEC's capacity utilization target level;

Exchange rate changes.

When exercised with these uncertainties, the HOMS Model generated asymmetric risk profiles for oil price, with long tails indicating the occurence of high prices due to disruptions. The figure superimposes the probability density functions for price generated by the risk analysis on the Energy Information Administration's Annual Energy Outlook 1984 range of projections. The band formed by the high and low EIA projections captures the bulk of the outcomes, but not the tails of the distributions.

The long tails indicate a significant probability that price will be substantially above even the EIA High case. Since economic costs to society increase rapidly with increasing oil price, one would expect the distribution of economic benefits and costs to be even more unbalanced. Energy security policy, which is targeted toward unlikely but potentially costly events, should be evaluated with a special attention to risks and the effects of policy on the range of probable outcomes. These objectives govern the next phase of our research. Risk analysis will serve as a tool for highlighting the ability of energy security policies to mitigate the high-cost tails of the economic benefits distribution.

THE WIDE RANGE OF OIL PRICES ILLUSTRATES THE ENERGY SECURITY EXPOSURE



Notes: The Energy Information Administration (EIA) forecasts taken from the 1984 Annual Energy Outlook, DOE, January 1985. Aggregate Model forecasts and probability distributions taken from Harvard Business School version of the DOE Oil Market Simulation (OMS) Model.

11-2-85

Exhibit WWH-6

Final Report

SURVEY OF WORLD CRUDE OIL PRICE FORECASTS

Prepared for

THE UNITED STATES SYNTHETIC FUELS CORPORATION

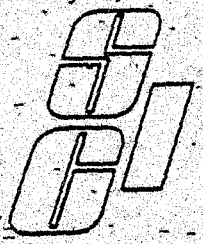
by

SOBOTKA & COMPANY, INC.

under

CONTRACT No. SFC-84-001-C

January 2, 1986



SOBOTKA & COMPANY, INC.
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EXHIBIT I

SURVEY OF CRUDE OIL PRICE FORECASTS - FORECAST CODES AND SOURCES

Code*	Organization†	Forecast Date	Source
	Major Oil Companies		
OASHLO OASHML OASHHI	Ashland Oil	Jul '85	"World Energy Outlook," H. Tahmessebi, Chief Economist
OCONLO	Conoco Oil	Apr '85	"World Energy Outlook Through 2000" and letter from James E. McNabb
OCHVLO OCHVML OCHVHI	Chevron Oil	Jun '85	"World Energy Outlook" and price forecast table date July 29, 1985
O##ALO O##AML	Major Oil Co. A	Nov '85	Oil and Gas Price Forecast Table from Corporate Planning Director
O##BHI	Major Oil Co. B	Nov '85	Internal forecast; phone conversation with Chief Economist
O##CML	Major Oil Co. C	Nov '85	Internal forecast; phone conversation with Chief Economist
O##DLO O##DML L##DHI	Major Oil Co. D	1985	Internal forecast; phone conversation with Director Economic Staff, data from 1985 Environmental Forecast
O##ELO O##EML L##EHI	Major Oil Co. E	1985	Internal forecast; phone conversations with members of Economics Group, data from recent forecast studies
O##FML	Major Oil Co. F	1985	Internal forecast; phone conversation with Corporate Planning Staff
O##GML	Major Oil Co. G	8/19/85	Data from company's annual Energy and Economic Outlook studies

NOTES: *Last two characters in forecast code indicate forecast range: (LO = Low; ML = Most Likely; HI = High).
†Organizations denoted by letter have requested that their identify not be disclosed.

EXHIBIT 1 (Continued)

Code*	Organization†	Forecast Date	Source
	Energy and Economics Consulting Firms		
CDRILO CDRIMO CDRIHI	Data Resources, Inc.	Summer 1985	"The Data Resources Energy Review," Summer 1985
C##AML	Energy/Economic Consulting Co. A	Jun '85	Forecasts of energy/economics consulting firms obtained from major oil company contact
C##BML	Energy/Economic Consulting Co. B	Jun '85	
C##CML	Energy/Economic Consulting Co. C	Mar '85	
C##DML	Energy/Economic Consulting Co. D	Sum '85	
CPACLO CPACMD	Pace Consultants, Inc.	1985	Energy Prices section of recent energy forecasting service document, Joseph Loftus letter dated 11/18/85
C##FML	Energy Consulting Firm F	1985	World Energy Study
CPFAML	Planning and Forecasting Assoc.	1985	Phone conversation with Dale Steffes
CLISLO CLISML CLISHI	Liston International Energy Forecasts	Autumn 1985	"The Price and Availability of Oil to 2000"
CDFILO CDFIML CDFIHI	Decision Focus, Inc.	Fall 1985	"Precursors for High and Low Future Oil Prices"
CTBSLO CTBSML CTBSHI	Temple, Barker, and Sloane, Inc.	1985	Phone conversation with Bijan Mossavar Rahmani
CP&GML	Purvin & Gertz, Inc.	1985	Phone conversation with Robert Hermes

NOTES: *Last two characters in forecast code indicate forecast range: (LO = Low; ML = Most Likely; HI = High).
†Organizations denoted by letter have requested that their identity not be disclosed.

EXHIBIT 1 (Continued)

Code*	Organization†	Forecast Date	Source Document
	Banks and Financial Institutions		
FBTCLO FBTCML	Bankers Trust Co.	8/7/85	Internal memorandum from Herb Krupp/Frank Spadine
FCTYLO FCTYML	Citibank	Fall '85	Phone conversation with John Mugno
FTXCML	Texas Commerce Bank	Fall '85	Phone conversation with Anna Faye Williams (Energy/Economics Group)
F##AML	Bank A (Texas)	Nov '85	Phone conversation with bank's energy economics personnel
F##BML	Bank B (Texas)	Nov '85	Phone conversation with bank's energy economics personnel
FFBOML	First Boston Co.	Nov '85	Phone conversation with William Randol
	Agencies and Associations		
AGRIML	Gas Research Institute	10/31/85	Letter from Paul Holtbug, GRI
AAGAML	American Gas Association	3/22/85	A.G.A. Tera Base Case 1985-I
AEPRLO AEPRHI	Electric Power Research, Inc.	11/15/85	Letter from Oliver Yu, Manager, Planning Analysis, EP[illegible]
ADOCML	U.S. Department of Commerce	7/2/85	"U.S. Energy for the Rest of the Century - 1985 Edition," by J.F. Gustaferro
ADOELO ADOEML ADOEHK	U.S. Department of Energy	Jun '85	"American Energy Outlook - 1984"

NOTES: *Last two characters in forecast code indicate forecast range: (LO = Low; ML = Most Likely; HI = High)
†Organizations denoted by letter have requested that their identify not be disclosed.

EXHIBIT 1 (Continued)

Code*	Organization†	Forecast Date	Source Document
	International Government Agencies		
ICECML	Commission of the European Communities	Apr '85	"Energy In Europe," No. 1, April 1985
INORLO INORHI	Norwegian Ministry of Petroleum and Energy		"Report No. 32 to the Storting (1984-85)," concerning the future of petroleum activity
I##AML	National Energy Department Country A	11/13/85	Recent forecast by national energy department of non-OPEC crude exporting country

NOTES: *Last two characters in forecast code indicate forecast range: (LO = Low; ML = Most Likely; HI = High).

†Organizations denoted by letter have requested that their identify not be disclosed.

EXHIBIT 2

SURVEY OF CRUDE PRICE FORECASTS

-- Groups Contacted --

Oil & Gas Companies

Arco
Amoco
Ashland
B.P.
Chevron
Conoco
Consolidated Gas
Exxon
Gulf Canada
Marathon
Mobil
Panhandle Eastern
Pennzoil
Phillips
Shell
Scallop (Shell Int'l)
Sohio
Sun
Tenneco
Union

Bank and Financial Int'l.

Bank of America
Bankers Trust Co.
Chase Manhattan
Citibank
First Boston
Cyrus J. Lawrence
Mellon
Merrill Lynch
Morgan Guaranty Trust
Solomon Bros.
TX Commerce
TX Bank A
TX Bank B
World Bank

Consulting Co. & Energy Economists

Arthur D. Little
Cambridge Energy Assoc.
Chase Econometrics
Decision Focus
DRI
Liston International
Plan'g & Forecasting Assoc.
Pace
PIRA
Purvin & Gertz
Sherman Clark Assoc.
Temple Barker & Sloane
Wharton
Ed. Erickson (NC State)
D. Gately (NYC)
J. Griffin (TX A&M)
Wm. Hogan (Harvard)
H. Jacoby (MIT)
J. Plummer
F. Singer (Geo. Mason U.)
Arlon Tussig
J. Weyant (Stanford)

Agencies and Associations

Am. Gas Assoc.
Am. Petroleum Inst.
Brookhaven Nat. Labs
Dept. of Commerce
Dept. of Energy
Edison Elec. Inst.
Elec. Power Res. Inst.

International

Canada
  Nat'l. Energy Board
  Dept. Energy, Mines & Res.
Europe
  Comm. Eur. Communities
Japan
  Economic Institute
  Nat'l. Oil Co.
Kuwait
  National Oil Co.
Norway
  Embassy Energy Off.
UK
  Dept. of Energy
  Dept. of Treasury
Venezuela
  Petroleos de Venz.

EXHIBIT 3

CONSENSUS CRUDE PRICE FORECAST

(Averages of All Forecasters Most Likely Forecasts)

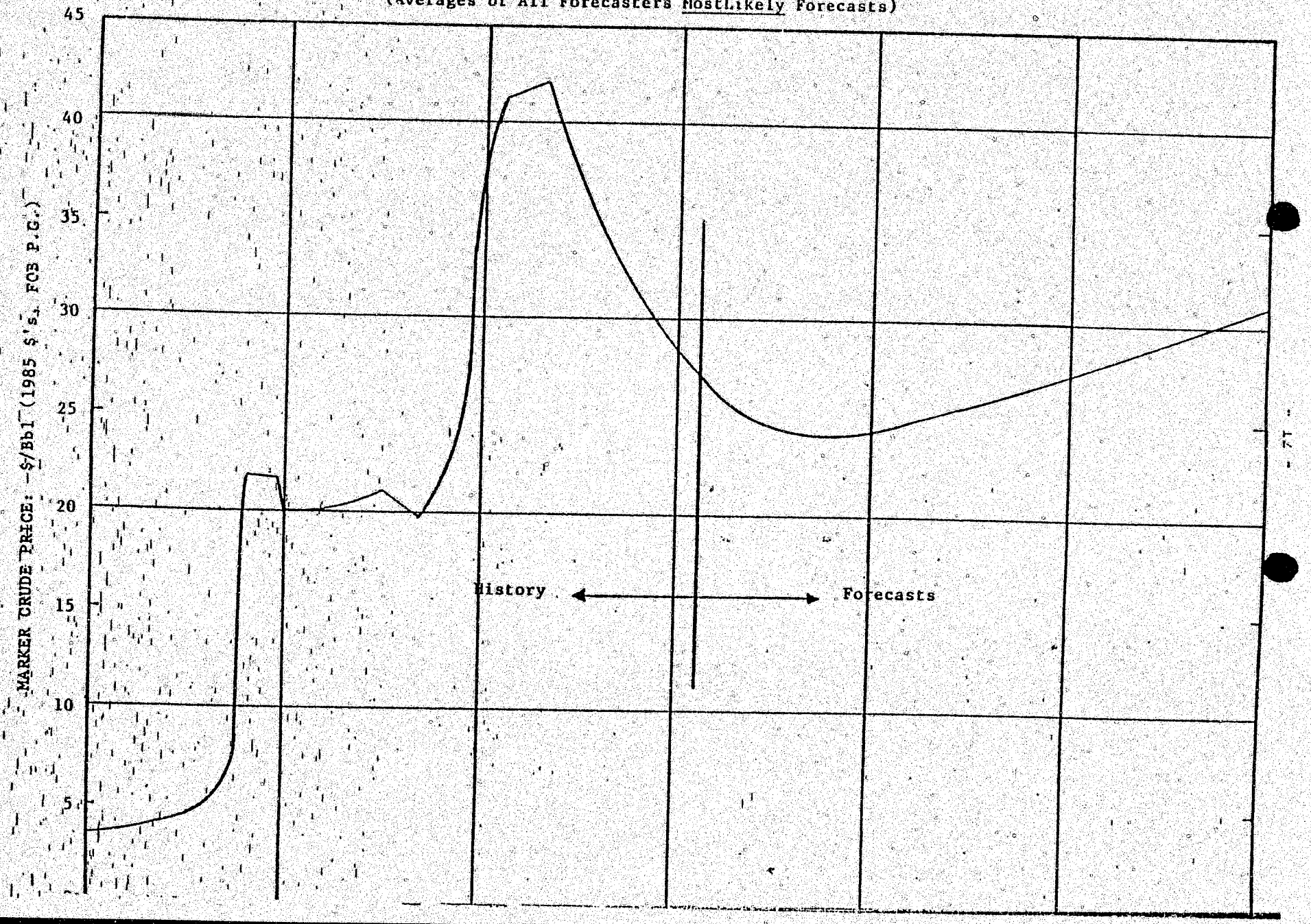


EXHIBIT 4

PROFILES OF CRUDE PRICE FORECASTS BY SOURCE ORGANIZATION TYPE

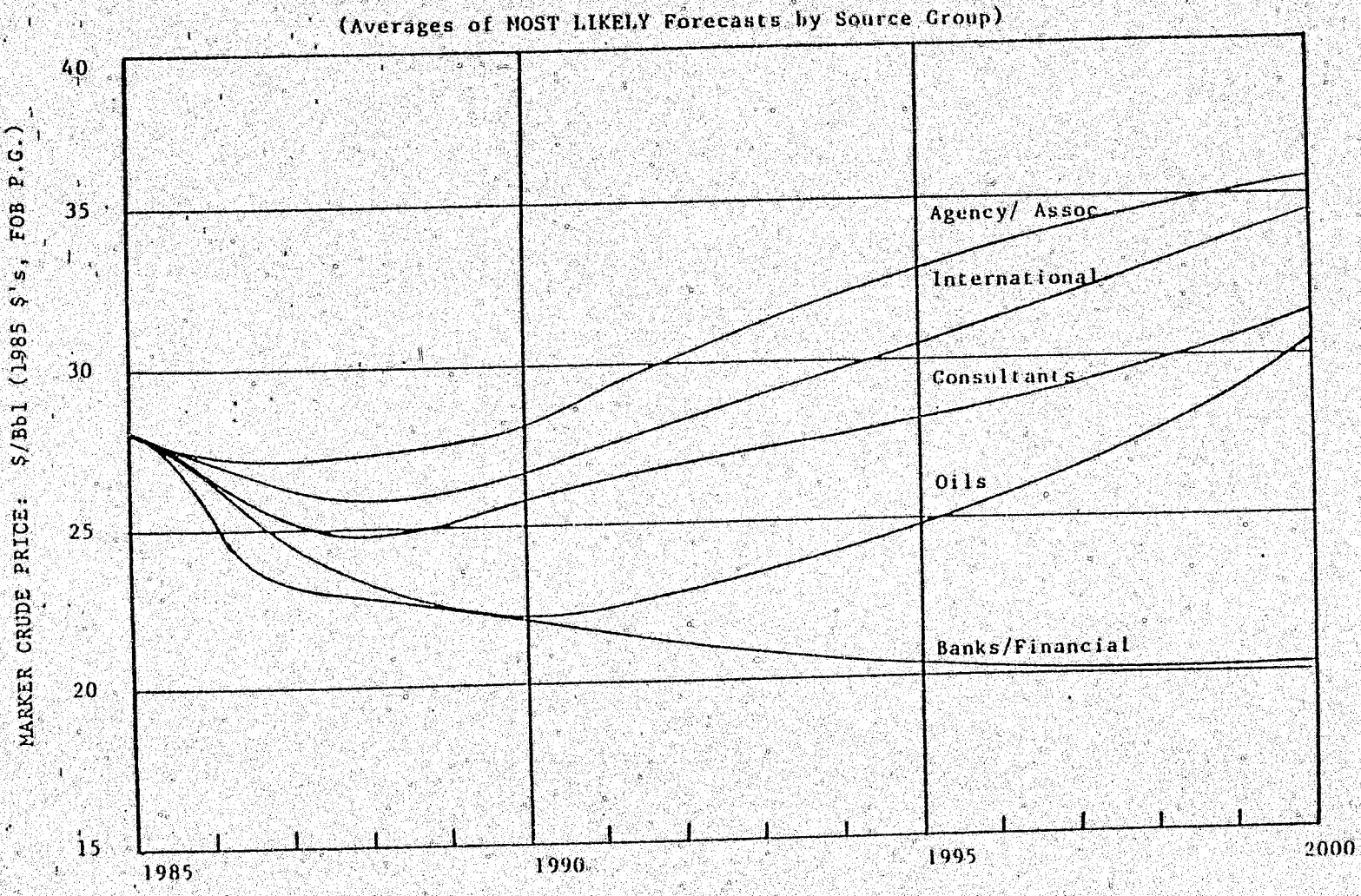
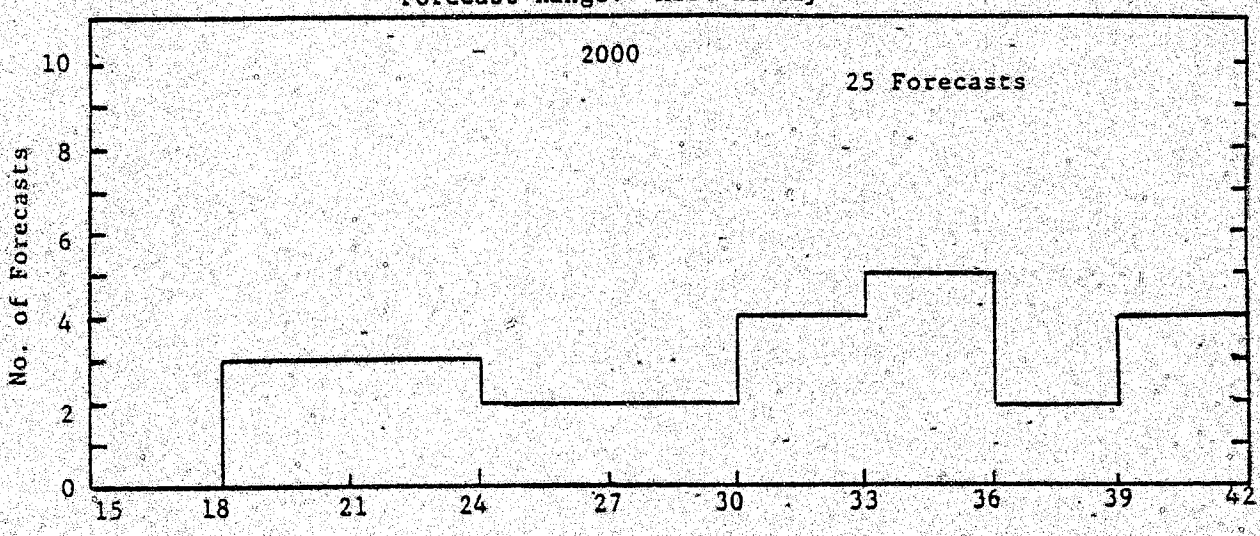
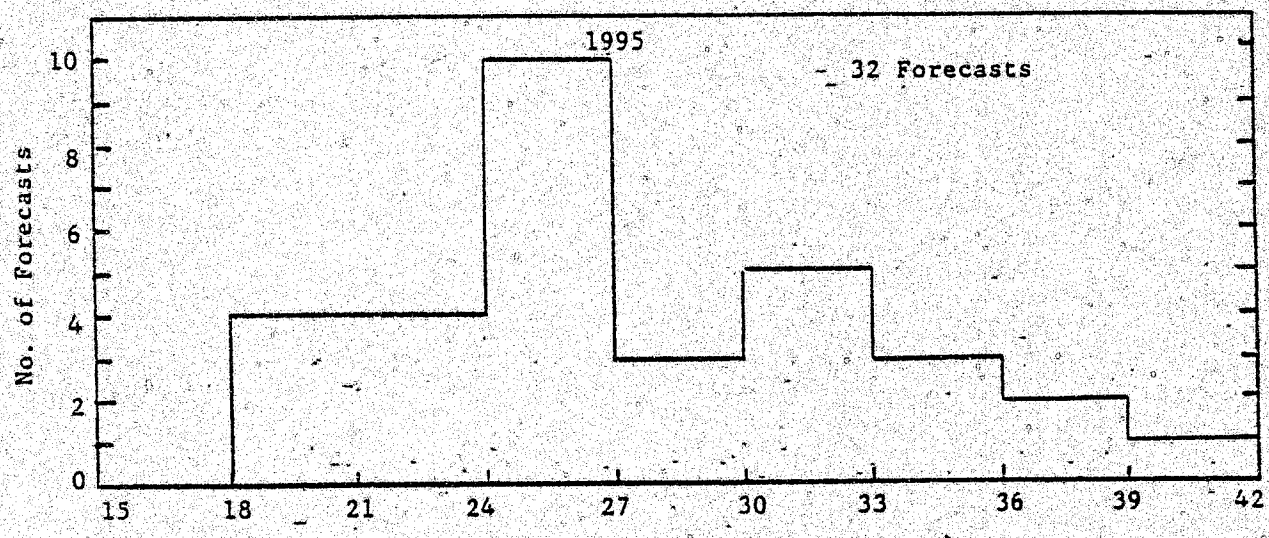


EXHIBIT 5

DISTRIBUTION OF CRUDE PRICE FORECASTS

Forecast Range: Most Likely





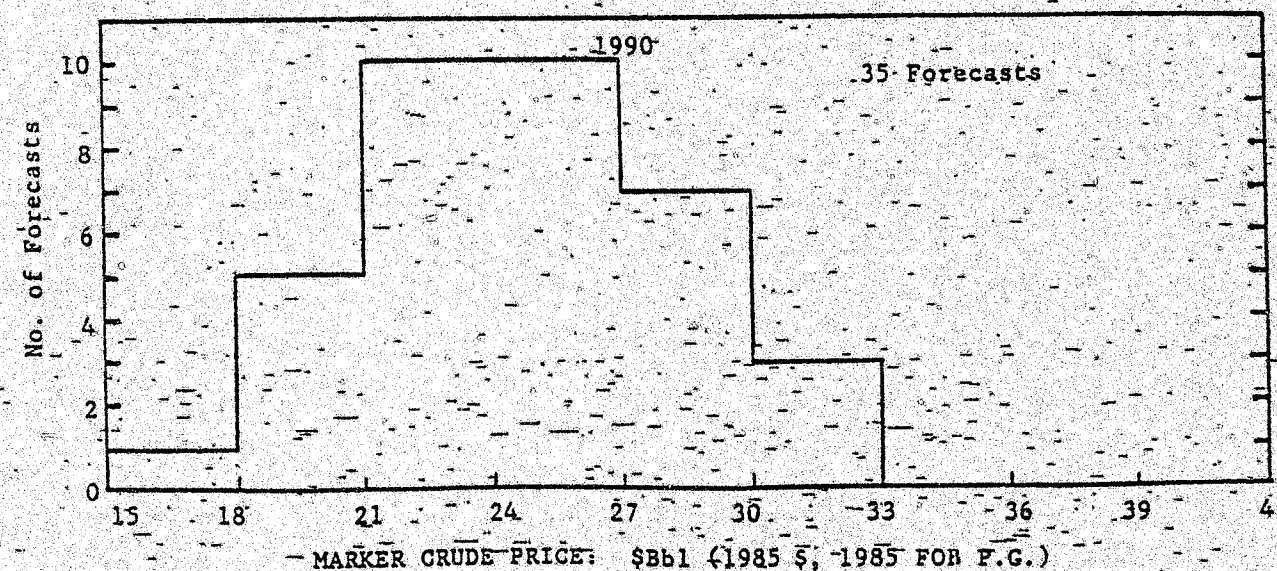


EXHIBIT 6

FORECASTS OF CRUDE PRICE PROFILES

(Averages of All Forecasters Estimates by Range: High, Most Likely, Low)

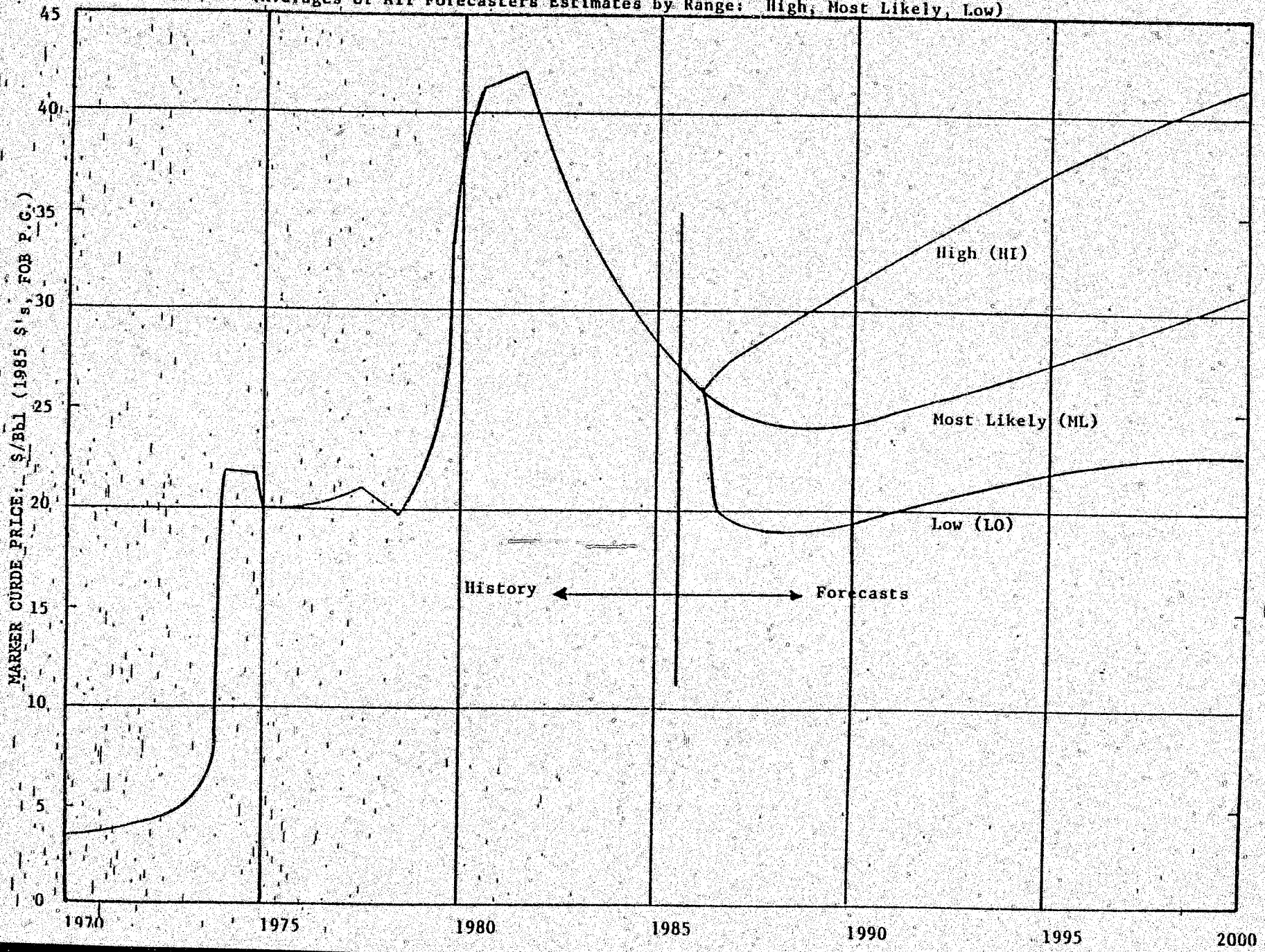


TABLE 1

CRUDE OIL PRICE FORECASTS DEVELOPED
BY
MAJOR OIL COMPANIES

(Marker Crude, FOB P.G.)

		1985	1986	1987	1990	1995	2000	2005	2010
OASHLO	Cur. $	28.0		15.0	20.0	26.0			
	1985 $	28.0		14.3	16.7	16.7			
OASHML	Cur. $	28.0		23.0	23.0	30.8			
	1985 $	28.0		21.5	18.6	18.6			
OASHHI	Cur. $	28.0		26.0	26.0	36.5			
	1985 $	28.0		24.7	20.5	20.5			
OCONLO	Cur. $		19.0		21.3	29.8	42.8		
	1985 $		18.1		17.3	19.9	23.5		
OCONHI	Cur. $		29.0		32.6	48.0	72.0		
	1985 $		27.7		26.4	32.0	39.5		
OCHVLO	Cur. $	27.0	15.0	15.0	17.0	23.0	31.0	42.0	56.0
	1985 $	27.0	14.0	13.0	14.0	17.0	19.0	23.0	26.0
OCHVMD	Cur. $	27.0	26 .0	25.0	26.0	36.0	56.0	88.0	138.0
	1985 $	27.0	25.0	23.0	21.0	25.0	34.0	46.0	63.0
OCHVHI	Cur. $	28.0	28.0	30.0	38.0	53.0	75.0	105.0	147.0
	1985 $	28.0	27.0	28.0	31.0	38.0	46.0	55.0	67.0
O##ALO	Cur. $		20.0		24.0	36.0	53.0		
	1985 $		19.0		18.5	22.4	25.6		
O##AML	Cur. $		25.0		26.0	37.0	54.0		
	1985 $		23.8		20.3	22.7	25.9		
O##BHI	Cur. $	27.0				50.5*	67.8*		
	1985 $	27.0				30.0	30.0		
O##CML	Cur. $	27.0	24.0*		25.0*	42.0*	73.1*		
	1985 $	27.0	23.0		20.0	25.0	35.0		

*DRI inflation rate estimates incorporated in these forecasts, because original forecasts were stated only in current or constant dollars.

TABLE 1 (Continued)

MAJOR OIL COMPANIES

(Marker Crude, FOB P.G.)

		1985	1986	1987	1990	1995	2000	2005	2010
O##DLO	Cur. $	26.0			26.0	35.0	47.0		92.0
	1985 $	26.0			20.0	20.0	20.0		22.0
O##DML	Cur. $	26.0			32.0	47.0	72.0		170.0
	1985 $	26.0			24.0	26.0	30.0		38.0
O##DHI	Cur. $	26.0			37.0	59.0	95.0		246.0
	1985 $	26.0			28.0	33.0	40.0		58.0
O##ELO	Cur. $	27.3	22.8		25.2	35.3	50.0		
	1985 $	27.3	21.7		20.9	24.0	26.3		
O##EML	Cur. $	27.3	26.2		31.7	54.6	83.0		
	1985 $	27.3	24.7		26.1	31.6	33.8		
O##EHI	Cur. $	27.3	28.4		37.6	64.7	110.1		
	1985 $	27.3	27.7		31.5	37.0	44.3		
O##FML	Cur. $	27.3	27.3*		27.3*	36.7*	49.3*	73.3*	108.7*
	1985 $	27.3	26.1		21.8	21.8	21.8	24.1	26.6
O##GML	Cur. $	28.0	26.0	25.0	30.0	45.5			
	1985 $	28.0	26.0*	23.9*	24.0*	27.0*			

*DRI inflation rate estimates incorporated in these forecasts, because original forecasts were stated only in current or constant dollars.

TABLE 2

CRUDE OIL PRICE FORECASTS DEVELOPED
BY
ENERGY AND ECONOMIC CONSULTING FIRMS

(Marker Crude, FOB P.G.)

		1985	1986	1987	1990	1995	2000	2005	2010
CDRILO	Cur. $	28.0	22.5	22.0	24.5		58.5		129.0
	1985 $	28.0	21.5	20.1	19.6		25.9		31.6
CDRIML	Cur. $	28.0	27.0	26.5	30.0	45.0	80.0		185.0
	1985 $	28.0	25.8	24.2	24.0	26.8	35.4		45.3
CDRIHI	Cur. $	28.0	29.8	31.0	38.5		115.0		215.0
	1985 $	28.0	28.5	28.4	30.8		50.9		52.6
C##AML	Cur. $	26.4	26.0	26.0	29.2	42.9			
	1985 $	26.4	24.9*	23.8*	23.3*	25.5*			
C##BML	Cur. $	26.7	26.6	26.7	31.2	42.7			
	1985 $	26.7	25.5*	25.2*	24.9*	25.4*			
C##CML	Cur. $	29.0	26.0	25.0	31.0				
	1985 $	29.0	24.9*	22.9*	24.8*				
C##DML	Cur. $	27.0	25.0	24.0	30.0	45.0			
	1985 $	27.0	23.9*	22.0*	24.0*	26.8*			
C##EML	Cur. $	27.3	28.5*		36.3*	56.7*	93.8*		
	1985 $	27.3	27.3		29.0	33.7	41.5		
CPACLO	Cur. $	27.1	27.0	25.6	24.7	35.8			
	1985 $	27.1	25.7	23.4	21.2	26.1			
CPACMD	Cur. $	27.1	28.7	92.6	36.6	53.1			
	1985 $	27.1	26.7	27.2	28.5	30.9			
C##FLO	Cur. $	27.2			12.5*	25.2*	45.2*		
	1985 $	27.2			10.0	15.0	20.0		
C##FML	Cur. $	27.2			32.5*	48.5*	80.0*		
	1985 $	27.2			26.1	29.5	32.9		

*DRI inflation-rate estimates incorporated in these forecasts, because original forecasts were stated only in current or constant dollars.

TABLE 2 (Continued)

ENERGY AND ECONOMIC CONSULTING FIRMS

(Marker Crude, FOB P.G.)

		1985	1986	1987	1990	1995	2000	2005	2010
CPFAML	Cur. $	27.3	23.0*		27.5*	37.0*	49.7*		89.9*
	1985 $	27.3	22.0		22.0	22.0	22.0		22.0
CLISLO	Cur. $	27.0			35.0*	53.8*	79.1*		
	1985 $	27.0			28.0	32.0	35.0		
CLISML	Cur. $	27.0			40.0*	60.5*	90.4*		
	1985 $	27.0			32.0	36.0	40.0		
CLISHI	Cur. $	27.0			42.5*	63.9*	101.8*		
	1985 $	27.0			34.0	38.0	45.0		
CDFILO	Cur. $	27.0			18.9*	27.2*	37.8*	55.9*	
	1985 $	27.0			15.1	16.2	16.7	18.4	
CDFIML	Cur. $	27.0			36.0*	51.5*	72.8*	104.3*	
	1985 $	27.0			28.8	30.6	32.2	34.3	
CDFIHI	Cur. $	27.0			58.3*	70.0*	112.6*	158.8*	
	1985 $	27.0			46.6	48.6	49.8	50.6	
CTBSLO	Cur. $	27.0			30.0	40.0	50.0		
	1985 $	27.0			24.0*	23.8*	22.1*		
CTBSML	Cur. $	27.0			35.0	50.0	60.0		
	1985 $	27.0			28.0*	29.7*	26.5*		
CTBSHI	Cur. $	27.0			40.0	60.0	70.0		
	1985 $	27.0			32.0*	35.7*	31.0*		
CP&GML	Cur. $	27.0	27.0		26.3	34.1	45.7		
	1985 $	27.0	25.8*		21.0*	20.2*	19.7*		

*DRI inflation rate estimates incorporated in these forecasts, because original forecasts were stated only in current or constant dollars.

TABLE 3

CRUDE OIL PRICE FORECASTS DEVELOPED
BY
BANKS AND FINANCIAL INSTITUTIONS

(Marker Crude, FOB P.G.)

		1985	1986	1987	1990	1995	2000	2005	2010
FBTCLO	Cur. $	27.0	19.0	19.0	23.0	30.8	41.2		
	1985 $	27.0	18.2	17.4	18.4	18.4	18.4		
FBTCML	Cur. $	27.0	24.0	24.0	28.8	38.5	51.8		
	1985 $	27.0	23.0	22.0	23.1	23.1	23.1		
FCTYLO	Cur. $	26.0	16.7		16.7	21.3	27.2		
	1985 $	26.0	16.1		13.4	13.4	13.4		
FTCYML	Cur. $	26.0	23.7		23.7	30.2	36.6		
	1985 $	26.0	22.9		18.9	18.9	18.9		
FTXCML	Cur. $	27.0	24.0		37.5				
	1985 $	27.0	23.0*		30.0*				
F##AML	Cur. $	28.0	28.0		24.0*	32.3*	43.4*		
	1985 $	28.0	26.8		19.2	19.2	19.2		
F##BML	Cur. $	27.3	23.5		23.5				
	1985 $	27.3	22.5*		18.8*				
FFBOML	Cur. $	27.3			21.8				
	1985 $	27.3			17.4				

*DRI inflation rate estimates incorporated in these forecasts, because original forecasts were stated only in current or constant dollars.

TABLE 4

CRUDE OIL-PRICE FORECASTS DEVELOPED
BY
AGENCIES AND ASSOCIATIONS

(Marker Crude, FOB P.G.)

		1985	1986	1987	1990	1995	2000	2005	2010
AGRIML	Cur. $	27.5			34.0	56.4	91.2	152.4	244.1
	1985 $	27.5			26.9	33.4	39.8	49.4	59.0
AEPRLO	Cur. $	26.3			27.0*	38.8*	61.1*	93.9*	126.3*
	1985 $	26.3			21.6	23.1	27.0	30.9	30.9
AEPRHI	Cur. $	26.3			28.9*	45.4*	71.5*	114.9*	182.7*
	1985 $	26.3			23.1	27.0	31.6	37.8	44.7
AAGAML	Cur. $	27.3	28.9	30.0	35.0	48.3	67.8		
	1985 $	27.3	27.3	27.3	27.3	30.1	33.2		
ADOCML	Cur. $	27.3	28.5*	32.4*	40.8*	60.5*	90.0*		
	1985 $	27.3	27.3	29.6	32.6	36.0	39.8		
ADOELO	Cur. $	27.6	24.6	25.4	32.2	51.6			
	1985 $	27.6	23.7	22.9	24.4	28.9			
ADOEML	Cur. $	27.6	27.6	29.5	39.2	71.6			
	1985 $	27.6	26.6	26.6	29.7	40.1			
ADOEHI	Cur. $	27.6	33.6	37.5	54.2	102.6			
	1985 $	27.6	32.4	33.8	41.1	57.4			

*DRI inflation rate estimates incorporated in these forecasts, because original forecasts were stated only in current or constant dollars.

TABLE 5

CRUDE OIL PRICE FORECASTS DEVELOPED
BY
INTERNATIONAL GOVERNMENT AGENCIES

(Marker Crude, FOB P.G.)

		1985	1986	1987	1990	1995	2000	2005	2010
ICECML	Cur. $	27.3			36.6*		85.0*		
	1985 $	27.3			29.3		37.6		
INORLO	Cur. $	27.3			28.9*		57.7*		115.3*
	1985 $	27.3			23.1		25.5		28.2
INORHI	Cur. $	27.3			41.3*		113.1*		204.4*
	1985 $	27.3			33.0		50.0		50.0
I##AML	Cur. $	27.8	26.0	26.0	26.8	35.5	49.5	71.1	
	1985 $	27.8	25.0	24.3	23.1	25.5	28.1	31.1	

*DRI inflation rate estimates incorporated in these forecasts, because original forecasts were stated only in current or constant dollars.

TABLE 6

CRUDE OIL PRICE FORECASTS: 1990/MOST LIKELY

(Marker Crude, FOB P.G., '85$/Bbl)

Price Range ('85$/Bbl)	Oils Code	Oils Price	Consultants Code	Consultants Price	Banks/Fin. Code	Banks/Fin. Price	Agency/Assoc. Code	Agency/Assoc. Price	International Code	International Price
15-18					FFBO	17.4				
18-21	OASH	18.6			FCTY	18.9				
					F##A	19.2				
	O##C	20.0								
	O##A	20.3								
21-24	OCHV	21.0	CP&G	21.0	FBTC	23.1				
	O##F	21.8			F##B	23.5	AEPR	22.4		
	OCON	21.9	CPPA	22.0						
			C##A	23.3					I##A	23.1
24-27	O##D	24.0	CDRI	24.0						
	O##G	24.0	C##D	24.0						
			C##C	24.8						
			C##B	24.9						
	O##E	26.1	C##F	26.1			AGRI	26.9		
			CTBS	28.0						
27-30			CPAC	28.5			AAGA	27.3		
			CDFI	28.8					INOR	28.1
			C##E	29.0			ADOE	29.7	ICEC	29.3
30-33					FTXC	30.0				
			CLIS	32.0			ADOC	32.6		
33-36										
Number in Group	9		13		6		5		3	
Group Average	$22.0		$25.9		$22.0		$27.8		$26.8	
Overall Average					$24.6/Bbl					

NOTE: All codes are as defined in Exhibit 1.

TABLE 7

CRUDE OIL PRICE FORECASTS: 1995/MOST LIKELY

(Marker Crude, FOB P.G., '85$/bbl)

Price Range ('85$/Bbl)	Oils		Consultants		Banks/Fin.		Agency/Assoc.		International	
	Code	Price	Code	Price	Code	Price	Code	Price	Code	Price
18-21	OASH	18.6	CP&G	20.2	FCTY	18.9				
					F##A	19.2				
21-24	O##F	21.8	CPFA	22.0	FBTC	23.1				
	O##A	22.7								
24-27	OCHV	25.0	C##B	25.4			AEPR	25.1		
	O##C	25.0	C##A	25.5					I##A	25.5
	OCON	25.9	GDRI	26.8						
	O##D	26.0	C##D	26.8						
27-30	O##G	27.0	C##F	29.5						
			CIBS	29.7						
30-33	O##E	31.6	CDFI	30.6			AAGA	30.1		
			CPAC	30.9					INOR	32.9
33-36			C##E	33.7			AGRI	33.4	ICEC	33.5
36-39			CLIS	36.0			ADOC	36.0		
39-42							ADOE	40.1		
Number in Group	9		12		3		5		3	
Group Average	$24.8		$28.1		$20.4		$32.9		$30.6	
Overall Average					$27.5/Bbl					

NOTE: All codes are as defined in Exhibit 1.

TABLE 8

CRUDE OIL PRICE FORECASTS: 2000/MOST LIKELY

(Marker Crude, FOB P.G., '85$/Bbl)

Price Range ('85$/Bbl)	Oils Code	Oils Price	Consultants Code	Consultants Price	Banks/Fin. Code	Banks/Fin. Price	Agency/Assoc. Code	Agency/Assoc. Price	International Code	International Price
18-21			CP&G	19.7	FCTY	18.9				
					F##A	19.2				
21-24	O##F	21.8	CPFA	22.0	FBTC	23.1				
24-27	O##A	25.9	CTBS	26.5						
27-30							AEPR	29.3	I##A	28.1
30-33	O##D	30.0	CDFI	32.2						
	OCON	31.5	C##F	32.9						
33-36	O##E	33.8	CDRI	35.4			AAGA	33.2		
	OCHV	34.0								
	O##C	35.0								
36-39									ICEC	37.6
									INOR	37.7
39-42			CLIS	40.0			AGRI	39.8		
			C##E	41.5			ADOC	39.8		
Number in Group	7		8		3		4		3	
Group Average	$30.3		$31.3		$20.4		$35.5		$34.5	

Overall Average $30.8/Bbl

NOTE: All codes are as defined in Exhibit 1.

TABLE 9

CRUDE OIL PRICE FORECASTS: LOW RANGE ESTIMATES

(Marker Crude, FOB P.G.)

Price Range (1985 $/Bbl)	1990 Code	1990 Price	1995 Code	1995 Price	2000 Code	2000 Price
12-15	FCTY	13.4	FCTY	13.4	FCTY	13.4
	OCHV	14.0				
15-18	CDFI	15.1	CDFI	16.2		
		16.7	OASH	16.7	CDFI	16.7
	OASH		OCHV	17.0		
	OCON	17.3				
18-21	FBTC	18.4			FBTC	18.2
	O##A	18.5				
	CDRI	19.6	OCON	19.9	OCHV	19.0
	O##D	20.0	O##D	20.0	O##D	20.0
	O##E	20.9				
21-24	CPAC	21.2				
	AEPR	21.6				
			O##A	22.4	CTBS	22.1
			CDRI	22.8		
	INOR	23.1	AEPR	23.1	OCON	23.5
			CTBS	23.8		
24-27	CTBS	24.0	O##E	24.0		
	ADOE	24.4	INOR	24.3		
			FBTC	24.3		
					INOR	25.5
					O##A	25.6
					CDRI	25.9
			CPAC	26.1	O##E	26.3
					AEPR	27.0
27-30	CLIS	28.0	ADOE	28.9		
30-33			CLIS	32.0		
33-36					CLIS	35.0
Number in Group		16		16		13
Overall Average		19.8		22.2		22.9

NOTE: All codes are as defined in Exhibit 1.

TABLE 10

CRUDE OIL PRICE FORECASTS: HIGH RANGE ESTIMATES

(Marker Crude, FOB P.G., 85$/Bbl)

Price Range (1985 $/Bbl)	1990 Code	1990 Price	1995 Code	1995 Price	2000 Code	2000 Price
18-21	OASH	20.5	OASH	20.5		
21-24	AEPR	23.1				
24-27	OCON	26.4				
27-30	O##D	28.0	AEPR	27.0		
30-33	CDRI	30.8	O##B	30.0	O##B	30.0
	OCHV	31.0			CTBS	31.0
	O##E	31.5	OCON	32.0	AEPR	31.6
	CTBS	32.0				
33-36	INOR	33.0				
	CLIS	34.0	O##D	28.9		
			CTBS	35.7		
36-39			O##E	37.0		
			OCHV	38.0		
			CLIS	38.0		
39-42					OCON	39.5
	ADOE	41.1	INOR	41.5	O##D	40.0
42-45					O##E	44.3
45-48			CDRI	45.0	CLIS	45.0
	CDFI	46.6			OCHV	46.0
48-51			CDFI	48.6	CDFI	49.8
					INOR	50.0
					CDRI	50.9
51-54						
54-57						
57-60			ADOE	57.4		
Number in Group		12		13		11
Overall Average		31.5		37.2		41.6

NOTE: All codes are as defined in Exhibit 1.

TABLE 11

SURVEY OF CRUDE OIL PRICE FORECASTS: DISTRIBUTION OF FORECAST RESPONSES

(Marker Crude, FOB P.G.)

Price Range (1985 $/Bbl)	1990			1995			2000	
	Low	Most Likely	High	Low	Most Likely	High	Low	Most Likely
12-15	2			1			1	
15-18	3	1		3			1	
18-21	5	5	1	2	4		3	3
21-24	3	10	1	4	4		2	3
24-27	2	10	1	4	10		4	2
27-30	1	7	1	1	3	1	1	2
30-33		3	4	1	5	2		4
33-36			2		3	2	1	5
36-39					2	3		2
39-42			1		1	1		4
42-45								
45-48			1			1		
48-51						1		
51-54								
54-57								
57-60						1		
TOTAL RESPONSES	16	36	12	16	32	13	13	25

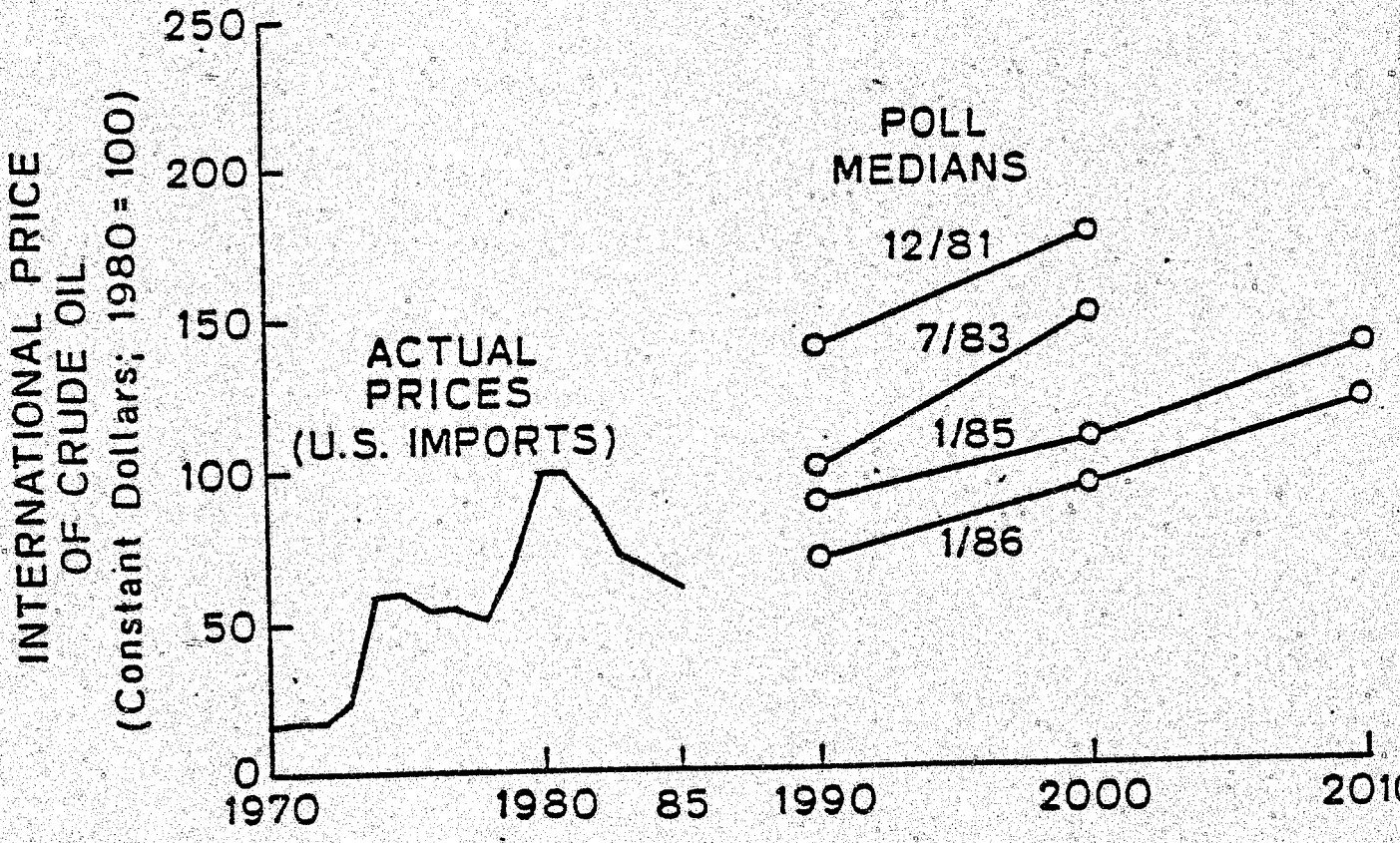
Sunday NY Times / early Feb.

Comparing the Costs of Oil Production

Estimated direct costs of production (before depletion, depreciation, amortization and interest charges) for various regions in the non-Communist world

Production Costs ($/barrel)	Production Capacity (million barrels/day)	Current Production (million barrels/day)	Locations
Under $2	15	8	Middle East
$2 – $4	16	12	Middle East, Africa, Indonesia, Mexico, and small amounts from the North Sea
$4 – $12	22	22	Most United States, North Sea, and Canada
$12 – $24	4	3	U.S. stripper-well oil; Canadian oil sands, offshore and arctic areas

Source: Texas Eastern Corporation



COMPARISON OF FOUR SUCCESSIVE IEW POLLS
AND ACTUAL PRICES

Ex FC-1

PECO STATEMENT NO. 36

SGR
3-12-86
HBG
R-850152

PENNSYLVANIA PUBLIC UTILITY COMMISSION
v. PHILADELPHIA ELECTRIC COMPANY,
DOCKET NO. R-850152

REBUTTAL TESTIMONY OF
FRANK CLEMENTE

EMPIRICAL STUDY OF SOCIOECONOMIC ASPECTS OF ELECTRIC RATE CHANGES IN RESPONSE TO THE STARLOC MODEL AND THE TESTIMONY OF DR. ARIE SCHINNAR

February 19, 1986

REBUTTAL TESTIMONY OF FRANK CLEMENTE

Q. Please state your name and address.

A. My name is Frank Clemente and I reside at 322 Arbor Way, State College, Pennsylvania 16803.

Q. What is your present employment?

A. I am Chairman of the Department of Sociology and Social Work at The Pennsylvania State University. I am also a Senior Member of the Graduate Faculty of the University, an elected member of the Faculty Senate, and a Senior Research Associate in the Institute for Research on Land and Water. At Penn State I have taught a variety of courses including urban sociology, research methodology, and sociology of energy. I also regularly direct doctoral dissertations and masters theses.

Q. Please describe your professional education and employment experience.

A. I received a Ph.D. in sociology from the University of Tennessee. I have served on the Faculty of both the University of Kentucky and the University of Wisconsin, where I was a National Institute of Mental Health Post-doctoral Fellow. Since 1973, I have been on the Graduate Faculty at Penn State, and from 1978-1980 I served as Acting Director of the Environmental Policy Center at the University. In 1981 I was promoted to Professor by the President of the University.

The testimony and exhibit presented here are my responsibility as a professional research scholar and are presented independently from The Pennsylvania State University.

Q. In what areas have you concentrated your research activity?

A. I have concentrated my research in the areas of the sociology of energy,

socioeconomic impact analysis, and research on socioeconomic change in both cities and rural areas.

Q. Please briefly describe some of your work on the socioeconomic aspects of electric power?

A. Over the past 15 years I have been involved in a number of socioeconomic studies--largely related to electric power issues. For example, from 1975-1977, I was a principal investigator on a National Science Foundation project to study electric energy facilities. I also served as a principal investigator on a Rockfeller Foundation project to assess the socioeconomic impacts of electric energy facility siting. During 1978-1980 I served as director of a Ford Foundation research project assessing the socioeconomic aspects of low-level radioactive waste. From 1981-84 I was co-director of a project funded by the U.S. Department of Energy on the socioeconomic aspects of waste facilities. Also, during 1978 I was invited to organize the "Socioeconomic Aspects of Energy" section for the meetings of the American Association for the Advancement of Science - a major scientific association in the United States. I have also been elected by my peers to the Council of the Environmental Section of the American Sociological Association.

Q. Have you published any of your research findings?

A. Yes, I have published several books with colleagues and a range of articles. I have approximately 50 articles and book chapters published on different socioeconomic issues. Theses articles appear in such major refereed journals as Rural Sociology, Social Forces, Growth and Change, and Urban Studies.

Q. Have you testified previously in this proceeding?

A. No. However, I have testified before regulatory commissions in Ohio, Florida and Kansas. I have also testified on socioeconomic impact assessment before the Pennsylvania Senate.

Q. Have you done research on behalf of government agencies?

A. Yes. I have worked with the staff of the Pennsylvania Public Utilities Commission on a preliminary study of the socioeconomic issues relating to electric power outages. I have also worked closely with the Department of Environmental Resources in Pennsylvania and with the National Science Foundation.

Q. What is the purpose of your testimony?

A. I have been asked by the Philadelphia Electric Company (PECO) to review the testimony and exhibits of Dr. Arie Schinnar from a social science perspective. In particular, PECO has asked me to examine the quality of the socioeconomic materials and conclusions Dr. Schinnar submitted in this proceeding.

As part of my rebuttal testimony, I was also asked to present some of my own research on the socioeconomic aspects of electric rate changes. These findings are presented in Exhibit FC-1.

Q. Please briefly summarize the findings of your research.

A. My study of metropolitan areas throughout the United States reveals no empirical support for the conclusion that electric rate increases, lead to economic stagnation, trigger economic decline or have similarly severe economic consequences. Over the past two years I have developed a major data set on a wide range of socioeconomic variables for a variety of electric utility service areas. The socioeconomic variables include employment,

income, the manufacturing sector, retail trade, property values and projections of the future. This mass of data provides empirical evidence that electric rate increases play a relatively minor role in determining the socioeconomic health of the local community.

Q. What is your general reaction to Dr. Schinnar's testimony and exhibits?

A. Basically, I would point to two limitations in Dr. Schinnar's approach to the problem he addresses.

First, he ignores history and fails to incorporate known events into his analysis and discussion. Although other service areas have experienced rate increases, Dr. Schinnar has made no effort to test his model in these areas. Dr. Schinnar's statement that "... we do not have precedents for a price increase of the magnitude we are considering here" (City Statement No. 1, p. 36) is historically incorrect and shows his somewhat constrained view of a very complex phenomenon. I have examined the history of rate changes of various magnitudes in a significant number of metropolitan areas and my study demonstrates that Dr. Schinnar's spectre of severe economic consequences is not substantiated.

Second, Dr. Schinnar vastly overestimates the role of electric rates in determining an SMSA economy. He contends that his calculations are "... illustrative of the severe economic consequences of any further electric rate increases" (City Statement No. 1, p. 17). This statement represents an undue emphasis on electric rates that reflects the analytical narrowness of his perspective. Electric rates are not the primum mobile of a metropolitan economy but are merely a small part of a large complex puzzle including local, regional, national and international variables. My study, discussed in

this rebuttal testimony, clearly shows that Dr. Schinnar has ignored the complexity of the Philadelphia SMSA and the relatively small impact of electric rate increases on this economy.

Q. Please describe your research in the area of electric rate changes and socioeconomic change in metropolitan communities.

A. When I began looking into the subject of electric rate changes and socioeconomic change in metropolitan communities, I quickly came to the realization that: (a) little empirical research had been done, and (b) many people already have their minds made up one way or another. The debate over rate increases has been largely emotional rather than rational. Few systematic research data exist to guide regulatory commissions on this complex matter. Given the void of empirical information, I decided to collect a series of data which might serve as a basis for understanding what actual socioeconomic changes have occurred in areas with elecric rate changes.

Q. Please describe the study you have submitted in this proceeding.

A. I have presented findings dealing with the socioeconomic impact of rate increases in metropolitan areas. The primary focus of my analysis is on Standard Metropolitan Statistical Areas. I will refer to my study as the SMSA study. Exhibit FC-1 presents the methodology and findings of the SMSA study.

Q. Was this study done under your direction and supervision?

A. Yes, I designed the research and directed and supervised all phases of data collection and analysis.

Q. What is the purpose of your study?

A. My purpose is to shed light upon the issue of how electric rate changes may affect the economy of a metropolitan area in contrast to the modeling approach taken by Dr. Schinnar. I firmly believe that systematic background data from the real world must be presented beyond the abstract level of "models" and simulations. My goal is to document how the economies of metropolitan areas with varying electric rate increases change over time. The collection and analysis of real data is the most appropriate way to begin examination of the question at hand.

Q. Please describe the methodology of your SMSA study.

A. I looked at both industrial and commercial rates over the period 1972-83, and examined rate changes in three ways: (1) percentage change over the period 1972-83, (2) absolute change over the period 1972-83, and (3) actual rates in 1983. The samples were derived from three groups of 13 utilities: (1) those SMSAs where the major city was served by a utility ranking in the lowest eighth with respect to the various rate changes, (2) those SMSAs where the major city was served by a utility ranking in a middle group with respect to the various changes and (3) those SMSAs where the major city was served by a utility ranking in the top eighth with respect to the various changes. Data on rates were taken from the 1985 NARUC study of 112 utilities. Socioeconomic data for the SMSAs were obtained from such independent sources as the U.S. Department of Commerce and the U.S. Department of Labor.

Q. What were the findings of your SMSA study?

A. There were a number of findings and they are presented in Tables 1 to 15 of Exhibit FC-1. I can summarize the major points, however by discussing four

key Tables - 2, 8, 11 and 15:

(a) Manufacturing - It is widely recognized that manufacturing jobs have higher employment multipliers than jobs in many other sectors of the economy. Changes in manufacturing as a percentage of employment, therefore, can provide some insights into how an economy is faring in regard to job creation. Table 2, for example, presents data on how SMSAs with varying absolute increases in industrial rates have been changing in terms of manufacturing as a percentage of employment. Table 2 demonstrates several important points:

(1) Manufacturing as a percentage of employment is declining in most SMSAs but actually is doing so at a slower rate in areas that have experienced the greatest rate increases.

(2) Of the 7 SMSAs with an increase in manufacturing as a percentage of employment, 6 were served by the utilities with the greatest absolute rate increases over 1972-83.

Tables 1 through 6 provide an array of data on manufacturing via-a-vis various rate situations.

(b) Unemployment - I obtained comparable unemployment data for October, 1976 and October, 1984 (see Tables 6-8). These data do not support the position that rate increases are associated with a rise in unemployment. Consider, for example, the following facts for the absolute rate increase variable in Table 8:

(1) Of 25 SMSAs served by utilities with the greatest industrial rate increases, 6 (24%) experienced a decrease in unemployment of 3.1 or more. None of the SMSAs served by the middle rate or lowest rate

increase companies had such a decline.

(2) Of the 25 SMSAs in Table 8 that experienced either no change or a decline in unemployment, 18 were served by companies with the greatest absolute increase in industrial rates over 1972-83.

Tables 6 and 7 also report findings on changes in unemployment and display a pattern similar to Table 8.

(c) Retail Sales - I examined the 1983 rank of SMSAs on Retail Sales per household by commerical rate increase (Tables 10 to 12). Table 11 provides an illustration typical of the findings. As Table 11 shows, absolute increases in commercial rates are not related to rank in retail sales by 1983. For example, more SMSA areas with the lowest increase in commercial rates ranked in the top 60 than did those with greater increases. On the other hand, areas with the middle increase in rates had the lowest rankings of all in household retail sales.

(d) The Future - Policy makers in all areas are concerned about the future socioeconomic health of their constitutent communities. In an effort to assess how the future of various communities might be viewed I evaluated the SMSAs on the 1984 Rand-McNally rating of Metropolitan Areas on "Economic Promise" (see Tables 13 to 15). As Table 15 reveals, relatively high industrial electric rates in 1983 have not depressed the economic promise ranking of SMSAs in 1985. Several points should be noted with respect ot Table 15:

(1) Of the 8 SMSAs in the Table ranked in the top 60 on economic promise in 1985, seven had the highest industrial rates in 1983.

(2) Only four SMSAs with the highest industrial rates in 1983 were

ranked in the lowest 149 on economic promise in 1985. In marked contrast, 16 SMSAs with the lowest rates and 12 with the middle rates were ranked in the least promising group.

Tables 13 and 14 present results consistent with Table 15.

As I mentioned earlier, I will not discuss the remaining tables because they all follow a similar general trend. All Tables, however, are included in Exhibit FC-1.

Q. Is your study replicable?

A. It is. There is enough information in the testimony and Exhibit FC-1 that a scholar, working independently from me, could replicate the analysis making her or his own research decisions.

Q. Have any other studies been done by professional researchers that corroborate the findings of your study?

A. The entire issue of the socioeconomic impact of rates is laden with shrill charges and countercharges. One objective study, however, was published in 1984 by Burnet D. Brown of the California Energy Commission. Mr. Brown studied "Industrial Electricity Prices and Industrial Growth" and came to the following conclusions:

> "This study shows that there is no one-for-one relationship between electricity prices and industrial growth. Some states with low electricity prices have low growth rates. Some with high electricity prices have high growth rates. Others with low electricity prices have high growth rates and vice versa." (Page iv)

The results of the California Energy Commission study closely parallel my findings for SMSAs. That each study yielded similar results allows one to place increased confidence in the conclusions.

Q. What are the specific conclusions of your study?

A. My conclusions are threefold:

1. The relationship between electric rates and the socioeconomic structure of a community is very complex. Understanding the nature of that relationship may be enhanced by examining actual experience in areas that have experienced rate increases. A review of real events is a logical precursor to the assessment of the validity of the computer model used by Dr. Schinnar, which attempts to project "what might be."

2. Electric rates are only part of a much larger puzzle at the local level, and the role of such rates in determining economic activity must be kept in perspective. Many social forces - local, regional, national and even international - are important in shaping the future of a service area. Policy makers must not lose sight of the complex nature of the service area economy or its close linkages with the rest of the world.

3. As a final point, I want to stress that I am not proposing that electric rate increases lead to economic growth or present similar benefits to the community. Certain increases may have inhibited economic growth and even led to some loss in potential new job growth. I believe, however, that the data in Exhibit FC-1 show it would be very difficult, if not impossible, to detect such impacts in the real world because of their minor nature. In any event, it is clear that Dr. Schinnar's assumptions of large multiplicative adverse effects from an electric rate increase do not represent real world experience. Although a given model may make certain predictions,

and these predictions may be stated with great confidence, one must always remember that the validity of computerized models rests largely on the subjective assumptions of the modeler, such as Dr. Schinnar's projected electric rate impacts. For my own research on this issue, I prefer to begin my understanding with an assessment of objective data from independent sources and juxtapose these data with actual events. Based upon such data, and upon similar information from the California Energy Commission study, I can find no evidence that electric rate increases have been associated with economic stagnation.

Q. Does this conclude your rebuttal testimony?

A. Yes, at this time.

SMSA STUDY

STUDY DESCRIPTION

1. Unit of Analysis: SMSAs (Standard Metropolitan Statistical Areas)

2. Time Frame: 1972-1983 for industrial and commercial rates
   1972-82, 83, 84 for socioeconomic variables

3. Rates Studies: industrial and commercial

4. Types of rate increases studied:

   (a) Percentage increase 1972-1983
   (b) Absolute (actual) rate increase in cents per kwh, 1972-1983
   (c) Extant rate in 1983

5. Sample studied:

   (a) All SMSAs in which the major city was served by a utility in the lowest eighth (n=13) of all ranked utilities in terms of a respective rate or rate increase.

   (b) All SMSAs in which the major city was served by a utility in a middle group (n=13) of all ranked utilities in terms of a respective rate or rate increase.

   (c) All SMSAs in which the major city was served by a utility in the highest eighth (n=13) of all ranked utilities in terms of a respective rate or rate increase.

DATA SOURCES

1. Electric Rates - Ranking of 111 utilities in the contiguous United States by the National Association of Regulatory Utility Commissioners (NARUC), Electric Utility Performance Study, 1972-83. (1985)

2. Socioeconomic Data - Independent governmental agencies and firms; e.g., U.S. Department of Commerce (sources reported on tables).

CHANGE IN MANUFACTURING

TABLE 3.1

Change in Manufacturing as Percentage of Employment in Metro Areas, 1972-1984

% Change in Manufacturing as Percentage of Total Employment October, 1972-October, 1984	Metro areas served by the 13 utilities with the least % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest % increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
0.01 or more	0	0.0	1	5.3	6	23.0
0.0 to -5.0	3	33.3	7	36.8	15	57.7
-5.1 to -10.0	6	66.7	9	47.4	4	15.4
-10.0 or more	0	0.0	2	10.5	1	3.8
TOTAL	9	100.0	19	100.0	26	99.9*

(*Does not total 100% due to rounding)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.

CHANGE IN MANUFACTURING

TABLE 2

Change in Manufacturing as Percentage of Employment in Metro Areas, 1972-1984

% Change in Manufacturing as Percentage of Total Employment October, 1972-October, 1984	Metro areas served by the 13 utilities with the least actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest actual increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
0.01 or more	1	16.7	0	0.0	6	25.0
0.0 to -5.0	2	33.3	6	46.2	11	45.8
-5.1 to -10.0	3	50.0	4	30.7	6	25.0
-10.0 or more	0	0.0	3	23.1	1	4.2
TOTAL	6	100.0	13	100.0	24	100.0

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.

CHANGE IN MANUFACTURING

TABLE 3

Change in Manufacturing as Percentage of Employment in Metro Areas, 1972-1984

% Change in Manufacturing as Percentage of Total Employment October, 1972-October, 1984	Metro areas served by the 13 utilities with the lowest industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle industrial rates, 1972-1983		Metro areas served by the 13 utilities with the highest industrial rates, 1972-1983	
	N	%	N	%	N	%
0.01 or more	1	16.7	0	0.0	3	15.8
0.0 to -5.0	2	33.3	9	52.9	7	36.8
-5.1 to -10.0	2	33.3	7	41.2	7	36.8
-10.0 or more	1	16.7	1	5.9	2	10.5
TOTAL	6	100.0	17	100.0	19	99.9*

(* Does not total 100% due to rounding)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.

MANUFACTURING

TABLE 4

Manufacturing as a Percentage of Total Employment, 1984

Manufacturing as a % of Total Employment October, 1984	Metro areas served by the 13 utilities with the least % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest % increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
30.0 or more	0	0.0	5	20.0	3	10.3
25.1 - 30.0	4	33.3	3	12.0	0	0.0
20.1 - 25.0	4	33.3	3	12.0	3	10.3
15.1 - 20.0	1	8.3	7	28.0	7	24.1
10.1 - 15.0	2	16.7	4	16.0	11	37.9
10.0 or less	1	8.3	3	12.0	5	17.2
TOTAL	12	99.9*	25	100.0	29	99.8*

(* Does not total 100% due to rounding)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.

MANUFACTURING

TABLE 5

Manufacturing as a Percentage of Total Employment, 1984

Manufacturing as a % of Total Employment, October, 1984	Metro areas served by the 13 utilities with the least actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest actual increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
30.0 or more	0	0.0	1	5.6	5	18.5
25.1 - 30.0	2	25.0	3	16.7	0	0.0
20.1 - 25.0	2	25.0	3	16.7	3	11.1
15.1 - 20.0	1	12.5	6	33.3	8	29.6
10.1 - 15.0	2	25.0	4	22.2	9	33.3
10.0 or less	1	12.5	1	5.6	2	7.4
TOTAL	8	100.0	18	100.1	27	99.9*

(* Does not total 100% due to rounding)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.

MANUFACTURING

TABLE 6

Manufacturing as Percentage of Total Employment, 1984

Manufacturing as a % of Total Employment, 1984	Metro areas served by the 13 utilities with the lowest industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle industrial rates, 1972-1983		Metro areas served by the 13 utilities with the highest industrial rates, 1972-1983	
	N	%	N	%	N	%
30.0 or more	1	11.1	7	36.8	5	21.7
25.1 - 30.0	2	22.2	3	15.8	2	8.7
20.1 - 25.0	2	22.2	2	10.5	4	17.4
15.1 - 20.0	3	33.3	2	10.5	8	34.8
10.1 - 15.0	1	11.1	4	21.0	4	17.4
10.0 or less	0	0.0	1	5.3	0	0.0
TOTAL	9	99.9*	19	100.0	23	100.0

(* Does not total 100% due to rounding)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.

CHANGE IN UNEMPLOYMENT

TABLE 7

Change in Percentage of Labor Force Unemployed, 1976-1984

Change in % Unemployment, October, 1976-October, 1984	Metro areas served by the 13 utilities with the least % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest % increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
1 to 6.0	1	10.0	0	0.0	2	7.7
0.1 to 3.0	5	50.0	8	38.0	10	38.5
0.0 to -3.0	4	40.0	12	57.1	11	42.3
-3.1 to -6.0	0	0.0	1	4.8	3	11.5
TOTAL	10	100.0	21	99.9*	26	100.0

(* Does not total 100% due to rounding)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1977 and 1985 volumes.

CHANGE IN UNEMPLOYMENT

TABLE 8

Change in Percentage of Labor Force Unemployed, 1976-1984

Change in % Unemployment, October, 1976-October, 1984	Metro areas served by the 13 utilities with the least actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest actual increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
to 6.0	1	12.5	4	26.7	2	8.0
0.1 to 3.0	4	50.0	7	46.7	5	20.0
0.0 to -3.0	3	37.5	4	26.7	12	48.0
-3.1 to -6.0	0	0.0	0	0.0	6	24.0
TOTAL	8	100.0	15	100.1*	25	100.0

(* Does not total 100% due to rounding)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1977 and 1985 volumes.

CHANGE IN UNEMPLOYMENT

TABLE 9

Change in Percentage of Labor Force Unemployed, 1976-1984

Change in % Unemployment, October, 1976 October, 1984	Metro areas served by the 13 utilities with the lowest industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle industrial rates, 1972-1983		Metro areas served by the 13 utilities with the highest industrial rates, 1972-1983	
	N	%	N	%	N	%
6.1 to 6.0	1	12.5	0	0.0	0	0.0
0.1 to 3.0	6	75.0	16	88.9	2	10.0
0.0 to -3.0	1	12.5	2	11.1	14	70.0
-3.1 to -6.0	0	0.0	0	0.0	4	20.0
TOTAL	8	100.0	18	100.0*	20	100.0

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1977 and 1985 volumes.

RETAIL SALES PER HOUSEHOLD

TABLE 10

Rank of Metro Areas by Retail Sales Per Household, 1983

Rank of 315 Metro Areas on Per Household Retail Sales - 1983	Metro areas served by the 13 utilities with the least percent increase in commercial rates, 1972-1983		Metro areas served by the 13 utilities with the middle percent increase in commercial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest percent increase in commercial rates, 1972-1983	
	N	%	N	%	N	%
Top 60	7	43.8	8	33.3	9	29.0
Second 60	5	31.3	3	12.5	8	25.8
Third 60	0	0.0	4	16.7	5	16.1
Fourth 60	2	12.5	4	16.7	5	16.1
Bottom 75	2	12.5	5	20.8	4	12.9
TOTAL	16	100.1*	24	100.0	31	99.9*

(* Does not total 100% due to rounding.)

Sources: Foley, Michael and Terrence Manuel. 1985 "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

Sales & Marketing Management 1984. Survey of Buying Power, July 23, 1984, Bill Publication, A-05; C-1; C-16; C-18.

RETAIL SALES PER HOUSEHOLD

TABLE 11

Rank of Metro Areas by Retail Sales Per Household, 1983

Rank of 315 Metro Areas on Per Household Retail Sales - 1983	Metro areas served by the 13 utilities with the least actual increase in commercial rates, 1972-1983		Metro areas served by the 13 utilities with the middle actual increase in commercial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest actual increase in commercial rates, 1972-1983	
	N	%	N	%	N	%
Top 60	8	47.1	3	8.8	4	23.5
Second 60	4	23.5	10	29.4	3	17.6
Third 60	1	5.9	5	14.7	5	29.4
Fourth 60	3	17.6	4	11.8	3	17.6
Bottom 75	1	5.9	12	35.3	2	11.8
TOTAL	17	100.0	34	100.0	17	99.9*

(* Does not total 100 due to rounding.)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

Sales & Marketing Management 1984. Survey of Buying Power, July 23, 1984, Bill Publication, A-05; C-1; C-16; C-18.

RETAIL SALES PER HOUSEHOLD

TABLE 12

Rank of Metro Areas by Retail Sales Per Household, 1983

Rank of 315 Metro Areas on Per Household Retail Sales - 1983	Metro areas served by the 13 utilities with the lowest commercial rates, 1983		Metro areas served by the 13 utilities with the middle commercial rates, 1983		Metro areas served by the 13 utilities with the highest commercial rates, 1983	
	N	%	N	%	N	%
Top 60	4	17.4	7	36.8	4	33.3
Second 60	7	30.4	2	10.5	1	8.3
Third 60	5	21.7	3	15.8	4	33.3
Fourth 60	3	13.0	2	10.5	1	8.3
Bottom 75	4	17.4	5	26.3	2	16.7
TOTAL	23	99.9*	19	99.9*	12	99.9*

(* Does not total 100 due to rounding.)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

Sales & Marketing Management 1984. Survey of Buying Power, July 23, 1984, Bill Publication, A-05; C-1; C-16; C-18.

1985 PERSONAL ECONOMIC OUTLOOK

TABLE 13

Rank of Metro Areas on Rand-McNally Rating of "Economic Promise"

Rank of 329 Metro Areas on Personal Economic Outlook - 1985	Metro areas served by the 13 utilities with the least % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle % increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest % increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
Top 60	0	0.0	4	16.0	5	14.7
Second 60	3	17.6	7	28.0	7	20.6
Third 60	5	29.4	5	20.0	14	41.2
Fourth 60	4	23.5	3	12.0	4	11.8
Bottom 89	5	29.4	6	24.0	4	11.8
TOTAL	17	99.9*	25	100.0	34	100.1*

(* Does not total 100 due to rounding.)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

Boyer, Richard and David Savageau, 1985. "Places Rated Almanac". (2nd Ed.) Rand McNally & Co.

1985 PERSONAL ECONOMIC OUTLOOK

TABLE 14

Rank of Metro Areas by Retail Sales Per Household, 1983

Rank of 329 Metro Areas of Personal Economic Outlook - 1985	Metro areas served by the 13 utilities with the least actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest actual increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
[illegible] 60	0	0.0	3	11.5	8	25.8
Second 60	3	16.7	8	30.8	5	16.1
Third 60	3	16.7	3	11.5	13	41.9
Fourth 60	5	27.8	4	15.4	3	9.7
Bottom 89	7	38.9	8	30.8	2	6.5
TOTAL	18	100.1*	26	100.0	31	100.0

(* Does not total 100 due to rounding.)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

Boyer, Richard and David Savageau, 1985. "Places Rated Almanac". (2nd Ed.) Rand McNally & Co.

1985 PERSONAL ECONOMIC OUTLOOK

TABLE 15

Rank of Metro Areas on Rand-McNally Rating of "Economic Promise"

Rank of 329 Metro Areas on Personal Economic Outlook - 1985	Metro areas served by the 13 utilities with the lowest industrial rates, 1983		Metro areas served by the 13 utilities with the middle industrial rates, 1983		Metro areas served by the 13 utilities with the highest industrial rates, 1983	
	N	%	N	%	N	%
Top 60	0	0.0	1	4.5	7	35.0
Second 60	2	11.1	5	22.7	2	10.0
Third 60	0	0.0	4	18.2	7	35.0
Fourth 60	4	22.2	7	31.8	3	15.0
Bottom 89	12	66.7	5	22.7	1	5.0
TOTAL	18	100.0	22	99.9*	20	100.0

(* Does not total 100 due to rounding.)

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

Boyer, Richard and David Savageau, 1985. "Places Rated Almanac". (2nd Ed.) Rand McNally & Co.

FC-2

PECO STATEMENT NO. 36A

SD
R-850152
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1269

PENNSYLVANIA PUBLIC UTILITY COMMISSION
v. PHILADELPHIA ELECTRIC COMPANY,
DOCKET NO. R-850152

REBUTTAL TESTIMONY OF
FRANK CLEMENTE

EMPIRICAL STUDY OF SOCIOECONOMIC ASPECTS OF COMMERCIAL ELECTRIC RATE CHANGES IN RESPONSE TO THE TESTIMONY OF DR. STEPHEN L. FELDMAN

February 26, 1986

REBUTTAL TESTIMONY OF FRANK CLEMENTE

Q. Please state your name and address.

A. My name is Frank Clemente and I reside at 322 Arbor Way, State College, Pennsylvania 16803.

Q. Have you filed testimony previously in these proceedings?

A. Yes. I have filed previous rebuttal testimony in response to the testimony of Dr. Arie Schinnar and the computer model he utilized as the basis for his testimony. My professional qualifications and background are set forth in my previous rebuttal testimony. My previous rebuttal testimony is marked PECO Statement No. 36.

Q. What is the purpose of your present rebuttal testimony?

A. I have been asked by the Philadelphia Electric Company (PECO) to review the testimony and exhibits of Dr. Stephen L. Feldman. Dr. Feldman has asserted that the proposed PECO rate increase will lead to large potential job losses in the non-manufacturing sector of the Philadelphia economy and will have a severe impact on the future location of service industries in the Philadelphia area. I will demonstrate that Dr. Feldman's unsupported assertions lack empirical foundation, by presenting the findings of my own empirical research on the actual socioeconomic changes in areas of the Northeast that have experienced varying increases in commercial electric rates. These findings are presented in Exhibit FC-2.

Q. Please briefly summarize the findings of your research.

A. In my previous rebuttal testimony, I presented a study of metropolitan areas throughout the United States. This study, which I identified as the SMSA study and marked as Exhibit FC-1, revealed no empirical support for the conclusion that electric rate increases lead to economic stagnation, trigger economic decline or

have similarly severe economic consequences.

In my current analysis, I have focused my research specifically on commercial rate increases in the Northeastern region of the United States. If Dr. Feldman's dire predictions were accurate, one would expect to find that severe socioeconomic disruptions in the commercial sector of the economy have historically taken place in areas with high commercial electric rate increases, particularly in areas of the Northeastern snowbelt. The data from my current analysis, however, provide no historical support for Dr. Feldman's position. Rather, the data provide strong support for the conclusion that changes in commercial electric rates are not significant detriments to a metropolitan economy.

Q. What is your general reaction to Dr. Feldman's testimony?

A. I have two fundamental problems with Dr. Feldman's analysis. First, he tends to overstate the significance of utility costs to commercial and service sector firms. Second, he accepts Dr. Schinnar's conclusions regarding massive job impacts from PECO's proposed rate increase with little or no critical analysis of Dr. Schinnar's model and no assessment of historical experience.

Q. In what ways does Dr. Feldman overstate the significance of utility costs to commercial and service sector firms?

A. Dr. Feldman focuses on only one narrow element of the costs of running a commercial enterprise, i.e., commercial office building costs. Dr. Feldman relies almost totally on the BOMA survey (see UP/UUC Statement No. 2, p. 8) to suggest that utility costs are a significant part of total operating costs. The BOMA survey, however, deals with office building operating costs only, and does not speak to the operating costs of commercial firms in general. While utility costs (of which electric costs are only a part) may be relatively large when compared with other

office building costs, such as maintenance, cleaning, groundskeeping and security, utility costs are a relatively small fraction of the operating costs of a commercial enterprise. Costs of utilities per square foot would be dwarfed, for example, by rental costs. Office building operating costs would be reflected only indirectly, in the tenant's operating costs, and only to the extent that such building costs are passed through to the tenant.

In addition, Dr. Feldman's narrow focus fails to appreciate the role of broader regional factors in influencing a commercial enterprise's locational and expansion decisions. Such factors as access to transportation, educational facilities, relative wage rates, and overall living conditions play a much more significant role in a firm's decision to locate or expand in a particular area.

Q. Do you agree with Dr. Feldman's reliance on the results of Dr. Schinnar's study?

A. No. Dr. Feldman admits in his testimony (UP/UUC Statement No. 2, p. 7) that he has done no independent study of Dr. Schinnar's conclusions. As I have demonstrated in my studies, such an independent analysis using objective data rather than subjectively constructed models would reveal no basis for relying on Dr. Schinnar's results. Moreover, the rebuttal testimonies of Dr. George R. Schink (PECO Statement No. 38) and Dr. William W. Hogan (PECO Statement No. 37) demonstrate that Dr. Schinnar's STARLOC model is still only in its preliminary or draft stage at best (with no way to validate or confirm its results) and that the results it produces are clearly wrong.

Q. Please describe your current study.

A. My current study presents findings dealing with the socioeconomic aspects of commercial electric rate changes in all of the metropolitan areas in the Northeast. To distinguish it from the study presented in my earlier testimony, I

will refer to my current study as the Northeast SMSA study. Exhibit FC-2 presents the methodology and findings of the Northeast SMSA study.

Q. Was this study done under your direction and supervision?

A. Yes, I designed the research and directed and supervised all phases of data collection and analysis.

Q. What is the purpose of your study?

A. My purpose is to shed light upon the issue of how commercial electric rate changes may be associated with changes in the economy of a metropolitan area, in contrast to the unsupported assertions and opinions of Dr. Feldman. I have designed the Northeast SMSA study specifically to examine the history of electric rate changes in the Northeast region's non-manufacturing sector, the sector which Dr. Feldman seems to think will bear the brunt of the alleged economic consequences of PECO's rate proposal in this case.

Q. Please describe the methodology of your Northeast SMSA study.

A. I looked at absolute commercial rate changes over the period 1972-83. The sample consisted of the universe of all Standard Metropolitan Statistical Areas (SMSAs) in the Mideastern and New England Regions designated by the U.S. Bureau of Economic Analysis. Although SMSAs are the primary unit of analysis, data on the host county were used in cases where total SMSA data were unavailable. Data on rates were taken from the 1985 NARUC study of 112 utilities. Socioeconomic data for the SMSAs were obtained from such independent sources as the U.S. Department of Commerce and the U.S. Department of Labor.

Q. What were the findings of your Northeast SMSA study?

A. There were a number of findings and they are presented in Tables 1 to 10 of Exhibit FC-2.

In examining each table, it is crucial to keep in mind that the data are not projections into a nebulous future; nor are they the results of an unspecified computer model; nor are they narrowly constrained to one or two socioeconomic variables. Rather, these data constitute objective information on many characteristics of the Northeastern section of the United States. Examination of these real-world data is essential to evaluating the validity of Dr. Feldman's depiction of the future.

Q. Do the actual events that you have examined support Dr. Feldman's conclusions?

A. No.

Q. Please explain.

A. Let us begin with Dr. Feldman's projection of the impact of the proposed rate request upon the non-manufacturing services sector. Dr. Feldman states in his testimony that:

> "... the service sectors most affected will be hotels and lodging; health services; advertising and business services; finance, insurance and real estate; and retail trade." (UP/UUC Statement No. 2, p. 7).

Now, let us examine what has actually happened in these service sectors in Northeastern metropolitan areas that have experienced rate increases:

1. Retail trade - Table 2.1 reports data on changes in retail sales per household over the 1973-84 period. These data show no support for Dr. Feldman's position. For example, of the 25 Northeast Metropolitan areas with the greatest increase in commercial rates over this period, 11 (45.8%) had an over 300 percent increase in retail sales. None of the 25 metropolitan areas with the lowest commercial rate increases had increases of this magnitude.

2. Service - Service employment is another area in which Dr. Feldman predicts a decline. The data in Table 2.2 demonstrate that the SMSAs with the

lowest commercial rate increase actually had substantially less growth in service employment than those SMSAs with the greatest rate increase. For example, only one (3.4%) of the 29 SMSAs with the lowest commercial rate increases had a growth of over 75% in service employment. On the other hand, 6 (21.4%) of the 28 SMSAs with the highest commercial rate increases had over 75% growth in service employment.

3. Business Services - Business services are also projected to decline in Dr. Feldman's scenario. Table 2.3 shows what has happened in the Northeast over the last decade in this regard. Once again, we find that Dr. Feldman's hypotheses run counter to experience. For example, Table 2.3 presents 14 SMSAs that experienced over 100% growth in business services. Of these 14 SMSAs, 11 were areas that experienced the highest commercial rate increases. Further, only three of the 57 SMSAs in the Northeast group experienced a decline in business services, and all three were areas that experienced the lowest absolute increase in commercial rates.

4. Health services - Dr. Feldman expects a decline in health service employment due to an increase in commercial electric rates. Table 2.4 examines actual changes in health service employment. As these data show, contrary to Feldman's assumptions, health service employment did not decline in areas of higher rate increases, nor did it grow more slowly in such areas. The distribution of growth in employment between the lower and higher-rate areas is virtually identical.

5. Finance, Insurance and Real Estate - Table 2.5 demonstrates that the finance, insurance and real estate sector has clearly grown more rapidly in SMSAs with the highest commercial rate increases than in SMSAs with the lowest

increases. Once again, we find Dr. Feldman's projection runs counter to the experience of all Northeastern SMSAs.

6. Hotels - Dr. Feldman also predicts reductions in hotel employment as a result of commercial electric rate increases. The data in Table 2.6, however, demonstrate that actual hotel employment in the Northeast has not followed the pattern hypothesized by Dr. Feldman. There is virtually no difference in the distribution of hotel employment change in Northeastern SMSAs on the basis of the magnitude of commercial electric rate increases.

Q. Are there any other matters in which Dr. Feldman's prognostications are contradicted by actual events?

A. Yes. I have collected data on several additional variables:

1. Unemployment - Dr. Feldman contends that commercial electric rate increases generate job losses through a reduction of the work force (UP/UUC Statement No. 2, p. 7). In order to examine this contention, I collected unemployment data for the Northeastern SMSAs. As the data in Table 2.7 reveal, Dr. Feldman's forecasts receive no support. Two facts in particular stand out in Table 2.7:

(a) Of 42 Northeastern SMSAs, 17 experienced unemployment reductions of greater than 2%. Of these 17, a total of 13 were in the areas of the greatest increase in commercial rates.

(b) Of 12 Northeastern SMSAs that experienced no change or increases in unemployment, 11 were in areas of the least growth in electric rates.

The data in Table 2.7 emphatically underscore the untenable nature of Dr. Feldman's position.

2. Income - The concept of depressed income permeates Dr. Feldman's

assumptions regarding the impact of commercial electric rate increases. In order to examine empirically this issue, I collected two types of data on income changes in Northeastern metropolitan areas (see Tables 2.8 and 2.9). None of these data supports Dr. Feldman's position.

Table 2.8, for example, presents data on per capita income increases. As these data show, there are striking differences in per capita income growth between SMSAs with the highest rate increases vis-a-vis those SMSAs with the lowest rate increases. For example, 13 SMSAs in the Northeast had increases in per capita income of 151% or more. Of these 13 SMSAs, 12 were in areas with the highest commercial electric rate increases. Further, of the 18 SMSAs with a per capita income growth rate of 130% or less, 14 were in areas of the lowest commercial electric rate increases.

Table 2.9 presents data on changes in "Effective Buying Income" in Northeast SMSAs over the 1972-84 period. These income data strongly corroborate the findings presented in Table 2.8. For example, in terms of effective buying income, 12 Northeastern SMSAs had increases of more than 200%. Of these twelve, 11 were in the areas of the highest commercial rate increases.

3. Job opportunity - Job opportunity is another variable that Dr. Feldman anticipates will diminish due to electric rate increases. In order to examine this issue, I collected data on projected job growth for Northeastern SMSAs through 1990. Table 2.10 reports projected change in employment through 1990. As these data reveal, areas with the greatest commercial electric rate increases clearly have the most promising projected job opportunities through 1990. Of 17 SMSAs with projected job growth of 15% or more, 14 are in areas of the greatest commercial rate increases.

Q. Dr. Clemente, have you conducted any other analyses that corraborate the findings of your Northeast SMSA study?

A. Yes. I have conducted a similar analysis of the SMSAs across the United States that had the highest commercial electric rate increases over the same period (1972-83). These national findings indicated that the metropolitan areas with the greatest commercial electric rate increases did not experience the severe socio-economic problems projected by Dr. Feldman (and Dr. Schinnar). In fact, on a number of significant variables, the SMSAs with the greatest commercial electric rate increases had economic growth rates above the national mean. These national data corraborate both my SMSA study (Exhibit FC-1) and my Northeast SMSA study (Exhibit FC-2), as well as other descriptive, empirical analyses (as opposed to projected analyses) of which I am aware.

Q. What are the conclusions of your Northeast SMSA study?

A. I have concluded that the actual data demonstrate that commercial electric rate changes play a very minor role, if any, in determining the economic vitality of the non-manufacturing sector of a particular metropolitan area. My research has yielded no empirical support for the proposition that increasing commercial electric rates will stifle the growth of a regional economy. Whatever the factors are that affect the location and expansion decisions and the growth of non-manufacturing sector enterprises, commercial electric rates are not a factor of significant magnitude to warrant the conclusions proffered by Dr. Feldman. Policy makers should be mindful of the many complex social forces that affect the commercial and service sectors of every metropolitan economy, and should keep the minimal role of electric rates in proper perspective.

Q. Does this conclude your rebuttal testimony?

A. Yes.

NORTHEAST SMSA STUDY

STUDY DESCRIPTION

1. Unit of Analysis: NORTHEAST SMSAs (Standard Metropolitan Statistical Areas); Host County data when entire SMSA data unavailable.

2. Time Frame: 1972-1983 for commercial rates
   1972-1982, 1983, 1984, 1985 for socioeconomic variables

3. Rates Studied: Commercial

4. Type of rate increases studied:

   (a) Absolute (actual) rate increase in cents per kwh, 1972-1983

5. Sample Studied:

   (a) All SMSAs in the U.S. Bureau of Economic Analysis Mideast and New England Regions which were served by a utility for which NARUC data were available.

DATA SOURCES

1. Electric Rates - Ranking of 111 utilities in the contiguous United States by the National Association of Regulatory Utility Commissioners (NARUC), Electric Utility Performance Study, 1972-83. (1985)

2. Socioeconomic Data - Independent governmental agencies and firms; e.g., U.S. Department of Commerce (sources reported on tables).

TABLE 2.1

INCREASE IN PER HOUSEHOLD RETAIL SALES, 1973 - 1984, NORTHEAST SMSAs

% Increase in Retail Sales Per Household, 1973-84	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
less than 100%	12	48.0	3	12.5
100 to 200%	11	44.0	7	29.2
201 to 300%	2	8.0	3	12.5
301% or more	0	0.0	11	45.8
TOTAL	25	100.0%	24	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

"Survey of Buying Power." Sales Management, July, 1974 and 1985. Bill Publication.

TABLE 2.2

CHANGE IN SERVICE EMPLOYMENT, 1973 - 1983, NORTHEAST SMSA HOST COUNTY

% Change in Service Employment 1973-1983	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
less than 25%	3	10.3	2	7.1
25 - 50%	9	31.0	8	28.6
51 - 75%	16	55.2	12	42.9
more than 75%	1	3.4	6	21.4
TOTAL	29	100.0%	28	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Commerce, Bureau of Census, "County Business Patterns," 1973 and 1983 volumes.

TABLE 2.3

CHANGE IN BUSINESS SERVICES EMPLOYMENT, 1973 - 1983, NORTHEAST SMSA HOST COUNTIES

% Change in Business Service Employment 1973-1983	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
Negative	3	10.3	0	0.0
Positive:				
0 to 50%	10	34.5	9	32.1
51 to 100%	13	44.8	8	28.6
more than 100%	3	10.3	11	39.3
TOTAL	29	100.0%	28	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Commerce, Bureau of Census, "County Business Patterns," 1973 and 1983 volumes.

TABLE 2.4

CHANGE IN HEALTH SERVICES EMPLOYMENT, 1973-1983, NORTHEAST SMSA HOST COUNTY

% Increase in Health Service Employment, 1973-83	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
Less than 40%	2	6.9	4	14.8
40 - 59.9%	8	27.6	4	14.8
60 - or more	19	65.5	19	70.4
TOTAL	29	100.0%	27	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Commerce, Bureau of Census, "County Business Patterns," 1973 and 1983 volumes for each state.

TABLE 2.5

CHANGE IN FINANCIAL, INSURANCE, REAL ESTATE EMPLOYMENT, 1973 - 1983, NORTHEAST SMSA HOST COUNTIES

% Change in Financial, Insurance, Real Estate Employment, 1973-83	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
Decrease	5	17.2	3	11.1
Increase:				
0.0 - 19.9%	10	34.5	3	11.1
20 - 39.9%	8	27.6	8	29.6
40% or more	6	20.7	13	48.2
TOTAL	29	100.0%	27	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Commerce, Bureau of Census, "County Business Patterns," 1973 and 1983 volumes.

TABLE 2.6

CHANGE IN HOTEL AND LODGING EMPLOYMENT, 1973 - 1983, NORTHEAST SMSA HOST COUNTIES

% Change in Hotel and Lodging Employment 1973-83	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
Decrease	14	50.0	10	40.0
Increase:				
0.0 to 49.9%	9	32.1	10	40.0
50 and above	5	17.9	5	20.0
TOTAL	28	100.0%	25	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983.". National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Commerce, Bureau of Census, "County Business Patterns," 1973 and 1983 volumes.

TABLE 2.7

CHANGE IN UNEMPLOYMENT, 1976 - 1984, NORTHEAST SMSAs

Change in Percentage of Labor Force Unemployed, 1976-1984

Change in % Unemployment October, 1976 - October, 1984	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
more than 2.0%	3	13.6	0	0.0
0.0 to 2.0%	8	36.4	1	5.0
-.1 to -2.0%	7	31.8	6	30.0
-2.1 to -4.0%	4	18.2	9	45.0
more than -4.% reduction	0	0.0	4	20.0
TOTAL	22	100.0%	20	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, 1977 and 1985 volumes.

TABLE 2.8

INCREASE IN PER CAPITA INCOME, 1973-1983, NORTHEAST SMSAs

% Increase in Per Capita Income, 1973 - 1983	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
130% or less	14	58.3	4	17.4
131% to 140%	6	25.0	2	8.7
141% to 150%	3	12.5	5	21.7
151% or more	1	4.2	12	52.2
TOTAL	24	100.0%	23	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Commerce "Survey of Current Business," 1975 and 1985 volumes.

TABLE 2.9

EFFECTIVE BUYING INCOME PER HOUSEHOLD, 1973-1984, NORTHEAST SMSAs

% Increase in Effective Buying Income Per Household 1973 - 1984	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
Less than 160%	7	28.0	2	8.3
160 to 180%	13	52.0	4	16.7
181 to 200%	4	16.0	7	29.2
More than 200%	1	4.0	11	45.8
TOTAL	25	100.0%	24	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985, "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

"Survey of Buying Power." Sales Management, July, 1974 and 1985. Bill Publications.

TABLE 2.10

PROJECTED 1990 CHANGE IN EMPLOYMENT, NORTHEAST SMSAs

Projected % Change in Employment by 1990	Northeast Metro areas served by utilities in the lowest half of absolute commercial rate increases, 1972-1983		Northeast Metro areas served by utilities in the highest half of absolute commercial rate increases, 1972-1983	
	N	%	N	%
less than 4.9	1	3.4	1	4.0
5 - 9.9	11	38.0	3	12.0
10 - 14.9	14	48.3	7	28.0
15 - 15.9	2	6.9	6	24.0
20% or more	1	3.4	8	32.0
TOTAL	29	100.0%	25	100.0%

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Commerce, "Survey of Current Business", 1984 and 1985 volumes.

Ex FC-3

PECO STATEMENT NO. 36B

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PENNSYLVANIA PUBLIC UTILITY COMMISSION
v. PHILADELPHIA ELECTRIC COMPANY,
DOCKET NO. R-850152

SUR-SURREBUTTAL TESTIMONY OF FRANK CLEMENTE

RESPONSE TO THE SURREBUTTAL TESTIMONY OF ARIE P. SCHINNAR AND OF STEPHEN L. FELDMAN

MARCH 7, 1986

SUR-SURREBUTTAL TESTIMONY OF FRANK CLEMENTE

Q. Please state your name, profession and address.

A. My name is Frank Clemente. I am Professor of Sociology and Chairman of the Department of Sociology and Social Work, The Pennsylvania State University. My address is 322 Arbor Way, State College, Pennsylvania 16803.

The testimony presented here is my responsibility as a professional research scholar and is presented independently from The Pennsylvania State University.

Q. Have you previously filed rebuttal testimony in this proceeding?

A. Yes. I have previously submitted rebuttal testimony and an exhibit relating to the direct testimony of Dr. Arie P. Schinnar. This previous rebuttal testimony and exhibit are marked as PECO Statement No. 36 and Exhibit FC-1, respectively.

I have also submitted rebuttal testimony and an exhibit relating to the direct testimony of Dr. Stephen L. Feldman. This previous rebuttal testimony and exhibit are marked as PECO Statement No. 36A and Exhibit FC-2, respectively.

Q. What is the purpose of your sur-surrebuttal testimony?

A. The purpose of my sur-surrebuttal testimony is to comment on the surrebuttal testimony of Dr. Schinnar (City Statement No. 1A) and the surrebuttal testimony of Dr. Feldman (UUC/UP Statement No. 3A).

Q. Please summarize your comments as to the surrebuttal testimony of Dr. Schinnar and of Dr. Feldman.

A. I have four major comments:

1. Dr. Schinnar and Dr. Feldman have largely misinterpreted or chosen to ignore the purpose and conclusions of my empirical study.

2. Dr. Schinnar and Dr. Feldman place an inordinate and unjustified amount of faith in the unsubstantiated predictions of computer models and blindly ignore the objective reality of what has actually happened in metropolitan areas that have experienced electric rate changes of various magnitudes.

3. Dr. Schinnar's attempt to criticize my professional research decisions by selectively manipulating the sample size leads to no change in the results.

4. In their haste to rebut my methodology, Dr. Schinnar and Dr. Feldman actually reaffirm my conclusion that electric rates play a relatively minor role in determining the socioeconomic health of a metropolitan area by suggesting that the true driving forces of socioeconomic change are such "variables as wage rates, inflation rates, interest rates and population growth rates."

Q. How have Dr. Schinnar and Dr. Feldman misinterpreted the purpose and conclusions of your study?

A. Dr. Schinnar and Dr. Feldman assume that my work is an attempt to "project" into the future in a manner similar to Dr. Schinnar's computer model. This misunderstanding leads Dr. Schinnar to "dismiss" my study due to the methodology employed. Dr. Schinnar and Dr. Feldman look to my study for causality, independent variables and dependent variables when, in fact, my objective is not to predict "what will happen" but rather to report "what has happened". As I stated in my rebuttal testimony: "[m]y goal is to document how the economies of metropolitan areas with varying rate increases change over time". The examination of <u>real</u> data is the most appropriate way to begin an assessment of

the question at hand. The real data reveal that changes in the economies of metropolitan areas have had little to do with changes in electric rates.

My study, then, is descriptive rather than predictive. In order to understand a complex socioeconomic issue it is frequently useful to examine what has previously happened in similar situations. I present my data as basic socioeconomic facts that have occurred in other metropolitan areas--nothing more, nothing less. The data have been verified and are now available for review, interpretation and judgment by this Commission.

In criticizing my study, Dr. Schinnar and Dr. Feldman seem to be captivated by a desire to predict before fully understanding the nature of the problem and the support available for their predictions. One must ask, therefore, why they so cavalierly dismiss the actual data from over 180 metropolitan areas? The answer seems apparent: because Dr. Schinnar's STARLOC model makes predictions that are not supported by actual data, the only tact that he can take is to question my "methodology" of presenting the facts.

Q. Are the conclusions of Dr. Schinnar and Dr. Feldman based upon actual historical observations?

A. No. Dr. Schinnar does not distinguish between actual historical events and his artificial projeetions of future events, i.e., between "fact" and what "might be". If anything, he presumes computer predictions are more valid indicators of socioeconomic change than are real events. He presents his projections as data--they are not data. Rather, they are unsubstantiated predictions of what may or may not occur. One must have great faith in computer models, for example, to describe real events as a "flip of a coin," as Dr. Schinnar does (City Statement No. 14, p.24), merely because such events do not mesh with one's computerized view

of the world. One must have great faith to argue a sample size of one is somehow superior to a sample of 6 or 18 or 43. And one must surely have faith in computer models to suggest that data on actual events be "dismissed" in favor of hypotheses about a nebulous future.

Dr. Feldman goes even further than Dr. Schinnar. He places blind faith in the projections of Dr. Schinnar's computer model without having read the draft technical report (PECO Exhibit 22) in detail (Transcript p. 3859, l. 22-24) and without having any idea of the procedures employed to update the data (Transcript p. 3860, l. 21-24).

Q. Dr. Schinnar has stated that there is no comparison between his data base and yours. Do you agree?

A. Absolutely. Dr. Schinnar employs a sample size of only one metropolitan area. To the best of my knowledge, he has never tested his model projections against actual data from a metropolitan area that has experienced a rate increase. Further, he has submitted no work papers, and all of his calculations are inaccessible in a "computer memory". Overall, his work is ad hoc and provides no verifiable basis from which reasonable conclusions can be drawn.

In contrast, my analysis included at least 180 metropolitan areas across the United States with an estimated total population of over 100 million people. I examined electric rate increases in three different ways over more than a decade. I studied such major variables as manufacturing, retail sales and unemployment. I submitted all of my workpapers and my study can be readily replicated by anyone interested in doing so.

Q. Do you agree with Dr. Schinnar's assertion that your sample size is too small for reliable conclusions?

A. No. This is indeed a peculiar criticism coming from someone whose sample size is one. I would only need to look at two metropolitan areas to have a sample twice as large as Dr. Schinnar's. Moreover, the smallest number of metropolitan areas in any of my tables is 42. Some of the cells in my tables may look sparse because I deliberately used a finely graded measure of my variables in order to permit an interested reader to combine categories for descriptive purposes by adding the numbers and percentages, if they wish. I would hope, however, such readers would use a method more objective than that employed by Dr. Schinnar.

Q. Dr. Schinnar questions why you collected data on SMSA's as to only 39 of the 112 utilities. Do you have a response?

A. Yes. In order to obtain variances on electric rates for descriptive purposes, I collected socioeconomic data on the SMSA's that are served by utilities ranked in the highest and lowest eighth of electric rate increases. A similar size middle group was chosen as an additional point of comparison. This procedure is fully delineated on Page 1 of my Exhibit FC-1. Although data as to only 39 utilities were presented in any one table, data from a total of seventy utilities were presented in one table or another throughout Exhibit FC-1. I received data for all 112 utilities, but selected a range of utilities reflecting various levels of electric rate increases, because this was the most straightforward way to present the data for comparative purposes.

Q. Dr. Schinnar and Dr. Feldman criticize you for not using statistical tests. Is this a valid criticism?

A. No. This criticism derives from their misunderstanding of my purpose. Because I am not necessarily generalizing from a sample to a population, there is no need for inferential statistics at this point. Although one might use other measures of

association for describing the relationships presented in my tables, I feel that the use of percentages is quite sufficient to describe those relationships in a meaningful way. Unlike Dr. Schinnar, I do not believe a movement toward the esoteric improves the quality of the data. I believe an educated lay-person can read my tables, make sense of the patterns of the data and come to his or her own conclusions.

Q. Do you agree with Dr. Schinnar's statements concerning your Table 2 (Exhibit FC-1, p.3)?

A. No. His statements are misleading. Dr. Schinnar suggests that his Table 3 is an exact copy of my Table 2. His Table 3, however, has omitted the entire column of figures on cities with utilities that experienced middle-range industrial electric rate increases. Proceeding with this erroneous table, Dr. Schinnar then argues that by re-defining certain categories one can shift metropolitan areas from one category to another. This latter point is true. But let us look at the meaning of this table one final time. Table 2 of Exhibit FC-3 shows my original Table 2. Following Table 2 is Table 2A. Table 2A presents the same data as Table 2, but reduces the number of categories indicating percentage change in manufacturing from four to two. The substantive meaning of the table is unaltered by this change. Cities with the greatest increases in industrial utility rates have been more likely (70%) to have had smaller declines in manufacturing (or actual increases) than cities with moderate rate increases (46.2%) or the smallest rate increases (50%). These findings, of course, do not mean electric rate increases spur manufacturing employment, but merely that even the greatest industrial rate increases have not led to a disproportionate decline in manufacturing employment.

Q. Dr. Schinnar and Dr. Feldman have criticized your study for not controlling for important variables. Please comment on this criticism.

A. By emphasizing the magnitude of the variables other than electric rates, Dr. Schinnar and Dr. Feldman actually support my ultimate conclusion. I concluded in my rebuttal testimony (PECO Statement No. 36, p. 10) that:

> Electric rates are only part of a much larger puzzle at the local level, and the role of such rates in determining economic activity must be kept in perspective. Many social forces--local, regional, national and even international--are important in shaping the future of a service area. Policy makers must not lose sight of the complex nature of the service area economy or its close linkages with the rest of the world.

Dr. Schinnar himself suggests that there are obvious "major variables" other than electric rates that affect the economy of a region, including "wage rates, inflation rates, interest rates, and population growth rates." (City Statement No. 1A, p. 15). I agree. Indeed, Dr. Schinnar provides a partial context for understanding the effect of electric rates when he states that "[w]ages constitute about 20% of the cost-of-doing-business (CDB) in manufacturing and more than 30% of the CDB in services" (City Statement No. 1A, p. 16), while at the same time stating that electric rates account for "only 1% to 3% of consumer and industry expenditures." (City Statement No. 1A, p. 15). The question is how many major variables must be controlled before such secondary variables as electric rate increases can be shown as Dr. Schinnar suggests, to play a significant role in socioeconomic change? And, if the impact of electric rates is so small that it can be detected only after meticulously controlling for many other variables, is the result meaningful from a policy viewpoint? I do not think so.

Dr. Schinnar portrays social scientific research on a large aggregated basis as being far more precise than is actually the case. Although social scientists are continually striving to refine data and measurement, I think few would agree with Dr. Schinnar's presumption that the socioeconomic impact of such secondary variables as electric rates can be isolated and measured in any meaningful way using real data.

Q. Is there any independent support for your conclusions?

A. Yes. In addition to the California Energy Commission study, referenced in PECO Statement No. 36, I find support in the testimony of Dr. Anita Summers in the Limerick Unit No. 2 Investigation. You may recall that Dr. Feldman stated in his surrebuttal testimony that "[t]he empirical foundations" of his testimony were "based upon the work of" Dr. Summers in the Limerick Unit No. 2 proceeding. In that proceeding, Dr. Summers presented the following testimony:

> "During my cross-examination I stated that I did not specifically consider the impact of prospective electricity price increases on employment in preparing my testimony. I stated, however, that' most of the studies that have been done on the relationship between energy costs and employment suggest that it is a small influence.' As Dr. Rodberg pointed out in his cross-examination:
>
> > "It is very difficult to extract from the overall employment change in a region the effect of a factor such as change in electric rates, and to my knowledge, no one any where succeeded in doing that kind of disaggregation" .... I don't think anybody could claim, that you could look at the actual employment change in a region and see the effect .... "the change in energy prices because there are so many other things going on in an economy that affects the level of employment, movement of industry, people, et cetera."

(PECO Statement No. 3A, Limerick Unit No. 2 Generating Station Investigation, Docket No. I-840381).

This testimony is fully supportive of my conclusions, and is directly contrary to the assertions of Dr. Schinnar and Dr. Feldman.

Q. Do you have any concluding comments concerning the surrebuttal testimony of Dr. Schinnar and of Dr. Feldman?

A. Yes. As I stated in my rebuttal testimony, when I first began studying this issue I quickly earned that virtually everyone had made up his or her mind already, before carefully examining the available data. People generally have simple answers to this complex question. My goal in documenting actual events is not to solve the problem but rather to provide some empirical information which may be useful as part of an answer to the question.

My point is not that electric rate changes have no socioeconomic effects, but that in a complex economy electric rate changes are dwarfed by far more significant variables and thus have had no measurable socioeconomic effects that are relevant for policymaking purposes.

Before giving any credence to Dr. Schinnar's predictions, I would strongly encourage policy makers to examine: (a) the socioeconomic changes which have actually occurred in metropolitan areas experiencing rate increases, and (b) the track record of the real world reliability of the STARLOC model upon which Dr. Schinnar's entire predictive scheme depends.

Q. Does this conclude your sur-surrebuttal testimony?

A. Yes.

TABLE 2

CHANGE IN MANUFACTURING

Change in Manufacturing as Percentage of Employment in Metro Areas, 1972-1984

% Change in Manufacturing as Percentage of Total Employement October, 1972-October, 1984	Metro areas served by the 13 utilities with the least actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest actual increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
0.01 or more	1	16.7	0	0.0	6	25.0
0.0 to -5.0	2	33.3	6	46.2	11	45.8
-5.1 to -10.0	3	50.0	4	30.7	6	25.0
-10.0 or more	0	0.0	3	23.1	1	4.2
TOTAL	6	100.0	13	100.0	24	100.0

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.

TABLE 2-A

CHANGE IN MANUFACTURING

Change in Manufacturing as Percentage of Employment in Metro Areas, 1972-1984

% Change in Manufacturing as Percentage of Total Employement October, 1972-October, 1984	Metro areas served by the 13 utilities with the least actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the middle actual increase in industrial rates, 1972-1983		Metro areas served by the 13 utilities with the greatest actual increase in industrial rates, 1972-1983	
	N	%	N	%	N	%
Increase or a decline of -5.0% or less	3	50.0	6	46.2	17	70.8
Decline of -5.1% or more	3	50.0	7	53.8	7	29.2
TOTAL	6	100.0	13	100.0	24	100.0

Sources: Foley, Michael and Terrence Manuel. 1985. "Electric Utility Performance Study 1972-1983." National Association of Regulatory Utility Commissioners, Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics, "Employment and Earnings," 1973 and 1985 volumes.