COMMONWEALTH OF PENNSYLVANIA

PUBLIC UTILITY COMMISSION

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Pennsylvania Public Utility Commission, et al. : :
versus Philadelphia Electric Company. : Docket No.
Investigation into a requested $660 million : R-850152
annual rate increase. :

Further Hearing :

- x

Pages 2833 through 2986

Hearing Room No. 1
North Office Building
Harrisburg, Pennsylvania

Monday, February 10, 1986

Met, pursuant to notice, at 10:03 a.m.

BEFORE:

JOSEPH MATUSCHAK, Administrative Law Judge

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C O N T E N T S

E X H I B I T S

E X H I B I T S (Continued)

NUMBER	FOR IDENTIFICATION	IN EVIDENCE
UUC/UP Statement No.		
1 (Chernick)	2895	2895
Staff Exhibit No.		
22 (Form 1, Projected and Levelized Energy Costs 1984-1994 Mills/Kilowatt-Hour)	2963	2966

P R O C E E D I N G S

ADMINISTRATIVE LAW JUDGE JOSEPH MATUSCHAK: This is the time and place set for the further hearing in the matter of Pennsylvania Public Utility Commission against Philadelphia Electric Company, Docket No. R-850152.

Are there any preliminary matters before we proceed?

(No audible response.)

JUDGE MATUSCHAK: If not, are we starting today with a witness for the Consumer Advocate?

MR. RUBIN: Yes, we are, Your Honor.

The Consumer Advocate's Office would like to call as its next witness Mr. Charles Komanoff.

Whereupon,

CHARLES KOMANOFF

having been duly sworn, testified as follows:

JUDGE MATUSCHAK: You may proceed.

MR. RUBIN: Your Honor, the Office of Consumer Advocate would like to have marked as OCA Statement No. 6 the prepared direct testimony of Charles Komanoff.

JUDGE MATUSCHAK: So marked.

MR. RUBIN: Thank you.

(Whereupon, the document was marked as Office of Consumer Advocate Statement No. 6 for identification.)

DIRECT EXAMINATION

BY MR. RUBIN:

Q. Mr. Komanoff, could you please state your name and business address?

A. Charles Komanoff, K-o-m-a-n-o-f-f, 270 Lafayette Street, Suite 902, New York, New York, 10012.

Q. Do you have before you a copy of what has just been marked as OCA Statement No. 6?

A. Yes.

Q. And is this your prepared direct testimony in this proceeding?

A. Yes.

Q. And was this testimony prepared by you or under your direction and supervision?

A. Yes.

Q. If I were to ask you the same questions which appear in OCA Statement No. 6 would your answers today be the same as those that are contained therein?

A. Yes.

Q. And are those answers true and correct to the best of your knowledge, information and belief?

A. Yes.

MR. RUBIN: Your Honor, Mr. Komanoff is available for cross-examination. At this time I would like to move into evidence, subject to any motions to strike made in

a timely fashion, OCA Statement No. 6.

JUDGE MATUSCHAK: Under those conditions the motion is granted.

MR. RUBIN: Thank you, Your Honor.

(Whereupon, the document marked as Office of Consumer Advocate Statement No. 6 was received in evidence.)

JUDGE MATUSCHAK: PECo?

MR. LODER: Good morning, Your Honor.

CROSS-EXAMINATION

BY MR. LODER:

Q. Mr. Komanoff, good morning.

A. Good morning.

Q. Mr. Komanoff, on page nine and ten of your direct testimony you discuss two-party purchases and there is a brief section there discussing energy availability from west of PJM, specifically from ECAR?

A. Yes.

Q. I would like to begin by asking do you have experience in load forecasting? Is this something that you have done work on in the past?

A. I have examined load forecasts and I think I have a good understanding of how it's done. I have not ever done a full-blown load forecast to the extent that utilities such as PECo, for example, perform it.

Q. Have you done any independent analysis as to the availability of power from the ECAR system in the next 10 to 15 year time period?

A. The analysis that I've done on that is essentially what I have described on pages nine and ten and my response to, I believe, the one interrogatory that was proffered to me on this question.

Q. In other words, you're basically relying on the NERC appraisal that there will be, quote, an adequate supply, unquote, from ECAR through 1994?

A. I am relying on that, and that appraisal doesn't come as a surprise to me. I'm not intimately familiar with every capacity and load variable for each member of ECAR but I have a general familiarity with capacity availability and load growth in the upper Midwest and it certainly didn't surprise that ECAR concluded that there should be adequate supplies -- I'm sorry -- that NERC concluded that ECAR should have adequate supplies at least through 1994, which is the end of NERC's forecasting horizon.

Q. Right. But you haven't conducted any independent analysis as to that availability?

A. You're correct.

Q. Did you consult any other sources other than the NERC to support your conclusion as to power availability

beyond the year 1994?

A. No.

Q. In the NERC appraisal is there an analysis of the reserve margins that the ECAR system has for any year other than 1986, which you discuss in your testimony? I'm sorry, it's 1984 that you discuss in your testimony.

A. I don't recall.

Q. So your analysis of the available capacity was limited to what the reserve margin for the ECAR system was in 1984?

A. Well, I cited the 1984 summer reserve of 37 percent. That's the start of the period. I cited the 1994 expectation by NERC of adequate supplies. That's the end of the period.

Q. But what do we mean by "adequate supplies" though? That's a very broad term. The ECAR system will have adequate supplies for its own customers but what does that speak to as far as what reserve capacity will be available to customers outside that service area?

A. Well, remember, we don't have to be concerned with whether reserve capacity is available because I'm not assuming that PECo will purchase firm capacity or even emergency capacity from ECAR. The question here is whether economy energy will be available from ECAR past 1993.

Q. Right. And we know that there is going to be adequate supplies within ECAR in 1994, generally speaking, from the NERC report?

A. Right.

Q. Did you supply PECo with a copy of that NERC report that you relied on?

A. I don't recall if I was asked. Of course, PECo being a contributor to NERC, I'm sure they have dozens of copies of the report.

Q. On page ten of your testimony, at the bottom, you refer to your rough but reasonable way to estimate the effect of continued two-party purchases; am I correct?

A. Yes.

Q. How much confidence do you have in your approximation that the continuing two-party purchases would increase Limerick's net cost by $1.2 billion?

(Pause.)

Q. You know, we are dealing in estimates here. How confident are you in that precise figure?

A. Should my answer, perhaps, indicate a 90 percent confidence band?

Q. What kind of range would you expect that figure actually to fall in? Would it be accurate, in your opinion, to $100 million or $200 million?

A. Oh, no.

Q. Or $300 million or $400 million? What range can we expect to have the actual figure fall?

A. I would expect it to be accurate to half a billion or $600 million either way. But I would like to remind you that I have to make an approximation if I'm going to talk about this issue at all, and I think it's important enough to talk about. I need to make an approximation because I was limited to requesting only the one SOBIG run that the company performed for me. So some approximation is necessary and I would -- I came down on a $1.2 billion figure and I would think the true figure is probably somewhere between $600 or $700 million on the low side and $1.7, $1.8 billion on the high side.

Q. If you had multiplied by the 70 percent figure in your range of OCA-to-PECo fuel assumptions that you reference in your testimony, would that lower your estimate if you multiplied by the 75 percent that you referenced there?

A. Okay. Had I used the 70 percent it would be just marginally less.

Q. Tha figure, I think, would be $560 million?

A. For a 50 percent reduction in two-party purchases and then it would be 1.12 billion for a maintenance of two-party purchases at the current level. So I would be losing less than $100 million on the whole calculation.

Q. At lines 16 and 17, also on page ten, you cite PECo's results of a $3.8 billion figure for the net benefits of Limerick 1, assuming that the post-1993 reductions of two-party purchases are 50 and 100 percent respectively. Do you see where I am?

A. I do.

Q. And you obtained these figures by reference to pages one and two of Item 1 of what has become Exhibit GEC-3, I assume?

A. Oh, that's the former IR-OCA-2-25-B?

Q. Yes, IR-OCA-2-25-B.

A. I would be happy to call it GEC-3.

Q. Okay. It comes out a little easier, doesn't it?

A. Yes. I'm going to have to reprogram my computer to change the name.

Q. I'm going to show you an excerpt from that exhibit, three pages, Item 1.

A. Actually --

Q. Do you have it there?

A. Yes, I have it.

Q. Now, if you could look at Item 1, page one, the last column on the right, which is designated "Benefits less Costs"?

A. Got you.

Q. The figure that you took to begin your

calculation was the $3.023 billion figure there?

A. Yes.

Q. So you selected a figure that did not include gross receipts tax; am I correct?

A. Yes, you are right.

Q. Okay. And on Item 1, page two, in the same column, the last column on the right, the benefits less costs column, you also selected the $3.8 billion figure that was also before the adjustment for gross receipts tax; am I right?

A. Yes.

Q. Can you tell me what the difference is in the number you used and the number after gross receipts tax in then imposed there?

A. I assume that that's 4.50 percent, as shown on the same pages.

Q. Okay. And to quantify that, on Item 1, page one, that difference would be how much in millions of dollars?

A. About $142 or $143 million.

Q. And on Item 1, page two, that same figure would be...?

A. About $179 or $180 million.

Q. Also on page ten at line 14 you give a figure of 2.2 billion and refer to it as PECo's calculated net

benefit for Limerick 1 assuming continuation of the present level of two-party purchases after 1993?

A. Yes.

Q. Was this $2.2 billion amount calculated by PECo?

A. I don't believe so. I think that was my figure extrapolating from the effect of the two-party purchase assumption for a 50 percent reduction and a 100 percent reduction.

Q. And you did not attempt to analyze why that figure would do anything other than repeat the $800 million spread between the 3.8 and 3 billion?

A. I think that's correct.

Q. That's a simple extrapolation?

A. That's right.

Q. Is there any basis that you can think of for why that simple extrapolation would not be fully accurate?

A. Yes. Because each purchase from outside PJM, or each purchase from within PJM for that matter, doesn't displace PECo generation of equal cost and the more that one displaces the less are the per unit savings because one is displacing more expensive generation first.

I would point out that page three of GEC-3 -- or page three of the excerpt that you just presented to us -- appears to indicate that PECo's witness, Dr. Hieronymous,

also either assumed or ended up with a pretty linear relationship between the first 50 percent and the second 50 percent reduction in the two-party purchases.

Q. How accurate would you assume that your $2.2 billion net benefit figure is given the possible range of outcomes on the displaced energy and the result of your choice of figures, pre-gross revenue tax? What would the band be around your $2.2 billion figure?

A. Just on the question of Limerick 1 fuel savings here -- is that right? You're not asking me to evaluate the accuracy of the figure as a function of my and the company's estimates of everything else: O&M costs, capital additions?

Q. That's right. Just simply as a function of that limited analysis on the two-party purchases.

A. Oh, and just on the two-party purchases? I'm sorry.

Q. Your figure is $2.2 billion. Do you think that figure could -- for the benefit of Limerick -- could range as high as $2.7 billion?

A. Okay. Just to clarify, what we are talking about is what I calculate the net benefit for Limerick will be using all of PECo's assumptions except assuming continuation of the present level of two-party purchases?

Q. Correct.

A. I would think that that's accurate to within several hundred million dollars.

Q. What is that, the $2.7 billion figure that I posited?

A. Okay. I must have gotten lost because I thought you were asking me about the $2.2 billion.

Q. Your own figure, you're saying, is correct within several hundred million dollars? Your own figure of $2.2 billion is correct within several hundred million dollars?

A. Again, we are talking about the $2.2 billion that appears on page ten, line 14, and this is my calculation of what PECo would estimate the net benefit to be with all PECo assumptions except continuation of the present level of two-party purchases.

MR. LODER: Perhaps this would be a good time to introduce PECo Exhibit No. 11, if I could mark it for identification?

JUDGE MATUSCHAK: Very well. It will be so marked.

(Whereupon, the document was marked as PECo Exhibit No. 11 for identification.)

MR. LODER: Your Honor, I would also like to mark PECo Exhibit No. 12 at this time. This is a summary of Mr. Komanoff's figures in this area. It will probably simplify our discussion here.

(Whereupon, the document was marked as PECo Exhibit No. 12 for identification.)

JUDGE MATUSCHAK: Are you offering it into evidence?

MR. LODER: Yes.

JUDGE MATUSCHAK: Any objections?

MR. RUBIN: We have no objections to PECo Exhibit 11. We haven't seen 12 yet.

JUDGE MATUSCHAK: PECo Exhibit 11 is admitted into evidence.

(Whereupon, the document marked as PECo Exhibit No. 11 was received in evidence.)

BY MR. LODER:

Q. Have you familiarized yourself with the document?

A. Yes.

Q. Exhibit 12?

A. Yes.

Q. Is this an accurate summary of the numbers that you have associated with an elimination of 50 percent and 100 percent of the two-party purchases?

A. I think so.

Q. Now, line four of the exhibit shows that your estimation of the value is a $2 billion net cost assuming a 100 percent reduction in post-1993 two-party purchases?

A. Yes.

Q. And this figure also appears in your Exhibit CK-3 on pages one and four?

(Witness perusing documents.)

A. Yes.

Q. Now, this $2 billion figure was calculated based on the results of the SOBIG run performed by the company at your direction?

A. That was one of the components.

Q. With the OCA fuel assumptions?

A. Yes.

(Pause.)

A. Just to clarify that answer, if I could, the SOBIG runs enter into one of the columns in Exhibit CK-3, page four. It's certainly a very important column. It's the fuel savings column under Limerick benefits.

Q. I understand.

A. Okay.

Q. The two values shown on line five of Exhibit No. 12, those were not based on the SOBIG runs; am I right? Those are your extrapolated figures?

A. Let me answer this way: as you said, line four rests on SOBIG runs. The difference between line four and the results in line five was calculated entirely by myself.

Q. Right. Resting on your assumption that your fuel prices were 75 percent of the difference between the

3.8 and the 3.0 billion that appears at line two?

(Pause.)

Q. Explain the calculation on line five there.

A. Okay.

Q. The 2.6 billion.

MR. RUBIN: Your Honor, just for clarification, PECo Exhibit 12 is not Mr. Komanoff's calculations. It's the company's summary of Mr. Komanoff's testimony. I just want to be sure we are clear on that.

MR. LODER: He has reviewed the document and acknowledged that these figures are an accurate summary of his own testimony.

BY MR. LODER:

Q. Is that correct?

A. Yes.

Here is how I got to the numbers shown in line five of PECo Exhibit 12. I began with GEC-3, page three, and each of the columns on that page shows that under PECo assumptions of fuel costs and Limerick capacity factor that there is an $800 million effect for eliminating two-party purchases after 1993 versus only halving those purchases.

Now, I endeavored to estimate the same effect for my assumptions for fuel cost and capacity factor, and since as you know I have lower fuel cost projections than PECo,

which offset my assumption of a lower Limerick capacity factor, my estimates of Limerick costs and benefits are going to be less sensitive to the changes in two-party purchases than will PECo's estimates. And I estimated that the sensitivity was about 70 to 75 percent as great as PECo's

My basis for that was an extrapolation from...

(Witness perusing documents.)

A. ...was an extrapolation from the difference in costs -- the difference in the fuel savings calculations themselves between my assumptions and PECo's assumptions.

Q. And the figure you come up with for the net cost of Limerick is 2.6 assuming a 50 percent reduction in the current level of two-party purchases?

A. Right. In other words, whereas PECo calculates that there is an $800 million effect of the difference between a halving and a total elimination of two-party purchases, I estimated with my lower fuel cost sensitivity that the effect would be three-quarters as much: $600 million.

Q. Right, following the same simple linear extrapolation that we discussed earlier?

A. Yes.

Q. So the $2.2 billion figure that you come up with -- the $2.6 billion figure that you come up with as a

net cost, is it possible that that figure could be as low as $2.2 billion?

A. Yes, that's possible.

Q. Mr. Komanoff, do you have any knowledge of the construction or engineering design at Limerick Unit No. 1?

A. I have some.

Q. Have you examined any design specifications or engineering blueprints of Limerick 1?

A. Only a mere handful.

Q. Have you inspected the plant?

A. Only common facilities, which I toured a year ago as part of the Limerick 2 investigation.

Q. But your knowledge and your testimony basically assumes Limerick as a generic nuclear plant much like other plants in your data base with whatever modifications you made for its characteristics?

A. I think that's a fair statement.

Q. But you have not studied any of the design specifications for the plant per se?

A. Again, beyond my general familiarity with BWR design and Mark II containments, and I think a reasonable understanding of the general design principles and practices in --

Q. In the industry?

A. In the nuclear industry. I have not specifically

studied how that has all been carried out at Limerick 1.

Q. Right. You're not an engineer?

A. That's true. I'm not sure that that's quite the same. I think that's a -- well, I will just leave it with that's true.

Q. Are you familiar with design modifications that have been made at Limerick to prevent IGSCC problems?

A. To some extent, yes.

Q. And are you familiar with design changes that have been made to account for past problems with LPRM?

A. No.

Q. Are you aware that steam generator and tubing replacement problems that affected some nuclear plants will not affect Limerick because Limerick is not a PWR?

A. If I didn't know that I shouldn't be in this room.

Q. And you are somewhat familiar with the kinds of design modifications that have been made to allow for Mark I and Mark II containments?

A. Yes.

Q. And ATWS?

A. Yes.

Q. Or Radway solidification?

A. Yes.

Q. Fire protection systems?

A. Yes.

Q. TMI-inspired modifications?

A. Yes.

Q. Then you will agree that many design changes have been made at Limerick to comply with NRC requirements or to correct problems that have appeared generally in the nuclear industry at various plants?

A. I would amend that slightly to say that many efforts have been made in an effort to correct problems at other plants and in an effort to comply with TMI and other safety-related issues.

Q. How specific is your knowledge as to what those efforts have been?

A. It would depend on which sector of the plant we are talking about. In some areas I think I have a good knowledge and in others less adequate.

Q. Would you say that the measures that you're aware of have effectively addressed the problems that have occurred in the past with respect to IGSCC or LPRM, for example?

A. Well, certainly none of us can say that until the plant has accumulated a good deal of operating history. You know, there are two countervailing forces. On the one hand a great deal of money has been spent and effort has been taken to try to correct problems. On the other hand, that also could characterize differences between

late 1970s plants versus early 1970s plants where the later plants cost a good deal more than the earlier plants even adjusted for inflation and yet the later plants seem to have suffered as many, if not more, operating problems than the earlier ones. So it's something that we will have to see.

Q. But you believe there has been some leveling of the regulatory pressures in recent years?

A. There has been some leveling of regulatory pressures on the design requirements of new or newly completed plants.

Q. And these are the kinds of design changes and what not that have been incorporated at Limerick 1?

A. Well, to clarify, this partial leveling off occurred for the most part too late to result in substantial savings or effect on Limerick 1.

Q. We are not talking about construction costs now. We are talking about whether or not they have corrected a lot of problems that have plagued the industry in the past with respect to the specific items that I mentioned.

A. Right. Okay. If you could lead me back into a question because I've dropped the thread.

Q. Well, let me ask you this: your halving of the TMI effect in the capital additions regression

acknowledges your judgement that regulatory requirements will not grow at the same rate as they have in the recent past; is that correct?

A. That's correct. As you know, I halved the effect in all three of the statistical-based projections I made, on capital additions, O&M and capacity factor.

Q. And each of those regressions showed the reduced significance of the post-TMI factors or just the capital additions regression?

A. Again, if you don't mind my clarifying, I think you're asking me to compare the regressions I did for this case with the regressions I did a year ago that had a year's less worth of data; is that right?

Q. That's right. And adding in the most recent year's data caused a lessening of the post-TMI factors; is that correct?

A. That is correct for capital additions. On capacity factor I can't say because I didn't do a new statistical analysis. And in a moment I can uncover whether that was true on operating and maintenance costs.

(Witness perusing documents.)

A. To tell you where I am, I'm looking at one of the files that was provided on the second Komanoff work-paper diskette. This is OMKA 1227.LST. That's the name of the file.

As I see it, or as the numbers have it, the strength of the post-TMI effect in the operating and maintenance cost statistics fell by about ten percent from the year-ago regressions to the current regressions.

Q. In the O&M?

A. In the O&M.

Q. And what percentage did it fall in the capital additions regression?

(Witness perusing documents.)

A. This I have to calculate.

(Witness performing calculations on electronic calculator.)

A. By about 30 percent.

Q. Does your model or capital additions account for or include any adjustment for the low probability of occurrence of one-time events such as IGSCC and the others we have discussed?

A. It doesn't, and I have addressed this question -- I probably have been asked this question at least a dozen times in similar proceedings. I was asked it in '77 after I had done regressions with the Browns Ferry fire.

Q. And it's your feeling about these events that they are not one-time events but they are events that either might recur or they are events that will be substituted for by equally costly events in the future?

Is that a fair summary?

A. If I could answer every question you ask as clearly as that I would be delighted. Yes.

Q. Do you assume that the same events that we discussed -- let's take the IGSCC problem, for example -- that these problems will recur despite substantial design changes that have been incorporated into Limerick's design? Or are you saying that -- well, I will let you answer.

A. I'm not making a specific prediction, obviously, with respect to IGSCC or any other problem that has contributed to O&M capital additions costs. I'm saying there is now a tremendous body of experience on these costs and in the past judiciously applied statistical analysis has at least in the way that I have practiced and some of my peers have practiced, has a pretty good track record. And I think it's still the best predictor of future costs or performance for the industry as a whole as well as for any individual plant such as Limerick 1.

Q. I understand that. But you're not specifically trying to say that IGSCC might -- that an IGSCC problem specifically is going to recur? You wouldn't expect that particular problem necessarily in light of the fact that substantial money and design changes have been incorporated into Limerick 1's design?

A. I'm not assuming that it would happen but I'm

not assuming that it won't happen either.

Q. If that doesn't then there will be something else of a like magnitude?

A. Well, I don't think it's as cut and dried as that either. I'm saying that there is a substantial probability either that this problem will continue or, as you said, others will come up to replace it.

Q. If I could read back to you something from your Limerick 2 testimony and ask you whether you remember making that statement, or ask you whether you remember making this statement, that you are habitually wary about adjusting for so-called one-time events because one-time events have a history in the nuclear industry of either being repeated or being replaced by equivalent one-time events.

Does that sound like something you might have said and is that consistent with your position?

A. I think so.

MR. LODER: Your Honor, I would like to introduce and have marked for identification at this time Exhibits 13 through 17, PECo Exhibits 13 through 17.

JUDGE MATUSCHAK: Very well. They will be so marked.

(Whereupon, the documents were marked as PECo Exhibits Nos. 13 through 17 for identification.)

BY MR. LOPER:

Q. Let's turn first to Exhibit 13. Is that your response to IR-PECO-OCA-VIII-14?

A. Yes.

Q. And Exhibit 14 is your response to IR-PECO-OCA-IX-16?

A. Yes.

Q. And Exhibit 15 is your response to IR-PECO-OCA-IX-14?

A. Yes.

Q. And Exhibit 16 is your response to IR-PECO-OCA-IX-15?

A. Yes.

Q. And lastly, Exhibit 17 is your response to IR-PECO-OCA-IX-17?

A. Yes.

Q. Is it true generally speaking that the expenditures for problems such as IGSCC and the others we have gone over today were a driving force behind your O&M and capital additions data in your data base?

A. I really want you to be more specific in the question. IGSCC, you know, I'm familiar with. Do you also mean fire protection, ATWS?

Q. That's right, that all these different kinds of design changes that were imposed by NRC requirement and

are the result of various problems that appeared at nuclear power plants, that these were driving forces driving the cost of capital additions for the plants that are included in your data base?

A. Well, there are two types of problems here subsumed in your question. One is responding to NRC requirements and another is repairs or replacements to correct or alleviate design flaws, construction problems and so forth. And yes, both categories have been driving forces in causing real capital additions costs to increase.

There have been other driving forces as well. The fact that nuclear plants with each new year are more complex than they had been previously means they will tend to require more replacement, more spare parts, more upkeep simply because they are more complex machines. And so that is yet another driving force.

Q. There has been some leveling of that increased regulatory concern. We have built up to a plateau of regulatory presence at the various nuclear power plant facilities that won't be expected to grow at the same rate as it had in the past. We are reaching the point where we do have some leveling and that is what I assume you have accounted for in having the TMI effect in your capital additions regression.

A. Not quite. First of all, this leveling of the

regulatory presence, again, it's something that I observed or a tendency towards leveling. I mean, I don't see that the refinements have stopped coming.

But it's something that I observed primarily in the design and construction of new plants.

I agree that at some point there could be some spill-over from that to the capital additions sector because there is a regulatory presence in capital additions. But we haven't been able to observe that yet.

It's my own feeling, and I've said this for some time, that the leveling in regulatory requirements, to the extent it has happened, for new plants began around '82 or '83. Yet the 1984 increase in capital additions was tremendous, an increase of between 40 and 50 percent in real terms compared to capital additions costs in 1983.

So if there is a leveling we haven't yet observed it.

Now, the last part of the answer. The TMI effect is a special, you know, post-1979 factor and the industry is finally getting to a point where there is probably less TMI-related changes in front of it than there are behind it. And to account for that I have the TMI effect.

Q. Can we look at your Exhibit CK-5 for a moment?

Now, your first figure in that first column is that capital additions will cost $41.61 per kilowatt in 1986 in 1985 constant dollars?

A. Yes.

Q. And your linear projection escalates by about $1.70 per kilowatt per year in real terms?

A. Yes.

Q. So that by the year 2010 you would predict that capital additions costs per kilowatt will have doubled?

A. Yes.

Q. Now, if I could reference your statement again in the Limerick 2 proceeding, you said that these past problems with respect to IGSCC and these other cost items, you expect them to either recur or be replaced by equivalent one-time events.

Now, would you say that your figures in the year 2010 reflect equivalent one-time expenses for capital additions or would you say that that in effect assumes costs with new one-time events that are twice as expensive?

A. What I am anticipating in this year 2010 number is that by the time Limerick is 25 years old considerable investments are going to have to be made to keep it in good enough shape to keep it running from a sheer performance standpoint and from a safety and regulatory standing.

I would suggest that the issue of IGSCC and whether new design problems will come along to replace IGSCC, assuming it's solved, that issue goes more, to my way of thinking, to the starting level of capital additions costs.

Q. Well, let's just look at --

MR. RUBIN: Wait a minute.

A. I'm trying to finish my answer. I may be going to the same place as you in your next question.

The increase or the doubling over this period is something that I expect because of aging problems and the increased cost to keep this plant running as it gets older and faces more wear and tear.

BY MR. LODER:

Q. But not necessarily with respect to, as you just said, a problem such as IGSCC?

A. That's correct.

Q. So it would be some sort of new event or new kind of retrofitting or other kind of problem that would develop in the industry that we haven't seen yet that would cost in the year 2010 twice as much as what we have seen capital additions costs to be on the average up to the present date?

A. I don't think it requires that. I think, again, investments are going to need to be made to keep aging

plants on line.

Q. With respect to items that are unclear as of today as to what they are going to be?

A. I can't pinpoint the equipment that will need to be replaced. It's easy to imagine that 25 years after the start of life that perhaps a great percentage of electrical cables will have to be replaced because experience at other plants or tests on the aging of electrical cables or their ability to perform in accident environments will indicate that 25 year old cables can't cut the mustard.

Q. That's one possibility and there's another range of possibilities of things that could occur?

A. We could imagine the same thing for pumps, seals, valves, motors, connectors, for any of the equipment that's inside the plant.

The way that I prefer to look at this is -- or to put it in context -- is that in 1985 dollars per kilowatt Limerick 1 plus half of common is about a $3,000 per kilowatt plant. And I am asserting in these numbers that in 1986 about one and a half percent of the plant will have to be replaced, made over or added to. By the time we get to the year 2010 and age 25, it's going to take about three percent of the initial cost that will have to be made over in that year. And that seems to me to be entirely

reasonable.

Q. Mr. Komanoff, do you know what your capital additions cost estimate at Peach Bottom was for the year 1984?

A. I imagine what you're asking me is what projection for 1984 does my cap. ads. equation translate into.

Q. For Peach Bottom.

A. No.

Q. You accepted, subject to check in the Limerick 2 proceeding that the actual figure at Peach Bottom was $86.3 million in 1984. Would you accept that figure again today subject to check?

A. Yes. Let me just get it down. This was for Peach Bottom 3?

Q. The Peach Bottom plant.

A. For Peach Bottom 2 and 3, the whole plant.

Q. Yes.

A. And this was for 1984?

Q. 1984, $86.3 million.

A. And this was based on my year-ago cap. ads. equation?

Q. The data base as it existed at the time of the Limerick 2 proceeding.

A. Thanks.

MR. RUBIN: Your Honor, could I ask for a clarification? Is Mr. Loder asking Mr. Komanoff to accept a result based on an earlier equation of his or is he asking him to accept the actual amount of capital additions at the Peach Bottom plant in 1984?

JUDGE MATUSCHAK: He is asking him what his estimate was.

MR. LODER: I began by asking what the actual figure was, and I asssume that that figure has not changed from the last year's Limerick 2 proceeding. That figure would have remained at $86.3 million.

BY MR. LODER:

Q. Is that correct?

A. I thought I wasn't confused but now I might be. This is, again, my estimate from my year-ago equation? Or is this the actual cost?

Q. That's actual.

A. Okay. Thanks.

Q. Now, your equation would have estimated that that cost be $108.2 million. Will you accept that subject to check?

A. I think I even recall that, yes.

MR. RUBIN: Your Honor, again, for clarification are we talking about Mr. Komanoff's current equation or his equation that was done more than a year ago?

MR. LODER: We are talking about the equation in the Limerick 2 proceeding.

MR. RUBIN: Thank you.

BY MR. LODER:

Q. So your equation for capital additions would have overpredicted the costs of capital additions at Peach Bottom by approximately $20 million?

A. $22 million, yes.

Q. And has there been any change in your regression since that '84 Limerick proceeding?

A. Yes.

Q. Would you reach a different prediction today?

A. I'm sure I would.

Q. But you don't know what that would be?

A. No.

Q. Would you expect applying the regression that you formed from your new data base -- from your updated data base, I should say -- that your predicted costs for Peach Bottom's capital additions expenses would rise or would fall?

A. For 1984?

Q. Yes.

A. I don't know.

Q. On page 18 of your testimony you make certain comparisons between the Limerick and Peach Bottom O&M and

capital addition costs, and you cite the anticipated differences of $30 per kilowatt for O&M and $20 per kilowatt for capital additions owing to the ten year difference in the plant completion dates of Peach Bottom and Limerick?

A. Yes.

Q. And that is based on your regression analysis?

A. Yes.

Q. Did you adjust for any other differences between Limerick and Peach Bottom other than the year of plant completion in making that comparison?

A. The figures you just cited relate only to the effects of the later vintage of Limerick. There are a few other differences as well. Limerick's wage scales for its vicinity are different from those of Peach Bottom, and so that affects the estimate that I would make of Limerick vis-a-vis Peach Bottom.

Q. But your difference of $30 per kilowatt in O&M and $20 per kilowatt in capital additions is based on what the variable for plant year completion would suggest the differences were?

A. Exactly.

Q. Is it possible that other differences and characteristics between the plants could reduce the differences below the $30 per kilowatt and $20 per kilowatt

figure?

A. Yes, it is.

Q. Now, you have testified in the past on a number of occasions in projecting capacity factors, again, that you expect a modest easing of regulatory stringency; is that correct?

A. Yes.

Q. And this is one of your reasons for your halving of the post-TMI effect in your capital additions regression?

A. Yes.

Q. And you state on page 24 of your testimony that the nuclear industry could plausibly expect the benefit from a learning effect in terms of increasing capacity factors?

A. Yes.

Q. And you state as one of the reasons for modifying your capacity factor projection is that containment backfitting and pipe repairs that affected capacity factors in the past would probably not recur to the same extent; is that correct?

(Pause.)

Q. That's at page 25 of your testimony.

A. Yes.

Q. And that is based on your informed judgement as to what the likely future results would look like.

That would involve some modification of your regression analysis results?

A. Yes.

Q. When you halved the post-TMI effect in accounting for that possible future learning curve that the industry has gone through, that only affects one variable in your capital additions and O&M regressions; is that correct?

A. Yes; the post-TMI variable.

Q. Just that one variable?

A. Yes.

Q. And the other variables in your regressions, say, for recently completed plants and all plants as they age, they will remain fully affected by the full expectation of what regulatory costs would result that were driving your earlier data base; is that correct? In other words, those variables have not been adjusted for the expectation of the slight ease in regulatory presence or the level of regulatory requirements?

A. That's correct. And that is because of my belief that the other two factors, the aging factor where you just have to work harder to fight wear and tear, and this completion date factor whereby later plants like Limerick are more complex and have more equipment that needs to be maintained, that those effects more or less

transcend the level of regulatory involvement.

Now, again, there is that slight conversatism in my analysis of freezing the completion date of Limerick at the start of 1984 rather than the start or 1986, and that -- well, maybe it's more than slight. It's a modest conservatism.

Q. But with respect to the other variables in the regression that expectation that there would be a slight easing of regulatory pressure does not appear?

A. That's correct.

MR. LODER: Your Honor, if I could I would like to mark for identification PECo Exhibits 18 through 21.

JUDGE MATUSCHAK: Very well.

(Whereupon, the documents were marked as PECo Exhibits Nos. 18 through 21 for identification.)

MR. LODER: Your Honor, perhaps I should explain the last one. Exhibit 21 is recreated. It's an answer to an interrogatory that has a little garbled language if you look at the last page. That would ordinarily be selfsufficient but instead we put in the first two pages, the question as it was presented to Mr. Komanoff. His answer was printed out correctly and that's all we are really interested in but we have reprinted the whole page as it came back. Computers will print out that way

sometimes, I guess.

BY MR. LODER:

Q. Mr. Komanoff, have you had a chance to review these exhibits?

A. Yes.

Q. And Exhibit 18 is a true and correct copy of your answer to IR-PECO-OCA-VIII-18?

A. Yes.

Q. And Exhibit 19 is a true and correct copy of your answer to IR-PECO-OCA-VIII-19?

A. Yes.

Q. And Exhibit 20 is a true and correct copy of your response to IR-PECO-OCA-VIII-22?

A. Yes.

Q. And Exhibit 21 is a true and correct copy of your response to IR-PECO-OCA-IX-18?

A. Yes.

Q. Mr. Komanoff, you state in your answer to Exhibit 20, IR-PECO-OCA-VIII-22 -- and there I have a typo problem -- in your answer you indicate that the 1985 data for older BWRs will fall somewhere between the pre-1985 and the 1985 figures?

A. Yes.

Q. And the historical average for BWRs was exceeded by 37 percent in 1985, the 1985 data?

A. No. It was simply that 37 percentage points was the increase from 1984 to 1985.

(Pause.)

A. Well, let's see. I should check that.

(Witness perusing documents.)

A. You were correct. The increase is from the historical average.

Q. And your estimate that the actual BWR performance will fall somewhere between the historical average and the 1985 average is based on your judgement that the pre-1985 figure for older BWRs was low and the 73 percent 1985 figure was high?

A. Yes.

Q. To the extent that you believe the actual BWR capacity factor will fall somewhere between those two figures, wouldn't the use of the historical figures in your data base result in a lower average capacity factor than you would reasonably expect using your own judgement?

A. That's true if we only examine the small number of older BWRs. For 1985 BWRs as a whole had, although higher capacity factors than they had in 1984, they still had lower than the entire BWR historical average. So some of the individual trends would get moved around when we added 1985 data, but given that the '85 average was less than the prior average I would be surprised if the

trends ended up being more favorable with the '85 data added in.

Q. Well, do the 1985 figures for older BWRs lessen your confidence in the projections of lifetime capacity factors for plants that are older than age 12?

A. I'd say they temper slightly the certainty with which I view -- the certainty in speed with which I expect a downfall in capacity factors for BWRs after age 12.

On the other hand, there was nothing magic about the previous fall-off after age 12 and as if to compensate for the very fine performance of units older than 12 last year those that were 9, 10 and 11 had disasterous years in 1985 including, as it happens, Peach Bottom 2 and 3.

So I think the ingredients and the statistics for a decline at some point starting in the teenage years are still there. I'm a little bit less certain as to just when that dropoff actually begins to take place.

Q. Your adjustment of the capacity factor assumption upwards to 60 percent and perhaps your answer to the question as to the certainty of the age factor, past 12, and that you would expect older BWRs to perform somewhat better than the historical average reflects your judgement that the regression averages should be subject to informed judgement as well as to where the trends are likely to go?

A. That's true. A year ago when I first presented

this regression equation I deliberately refrained from mechanistically projecting Limerick 2, at that time, capacity factors based on the aging trends that were available because as I noted at the time the data, although provacative and suggestive, were still relatively slim.

Q. I would like to direct your attention back at GEC Exhibit 3 for a moment. You're familiar with that document, I take it.

A. I sure am.

Q. Specifically I'm looking at the company's projected capacity factor of 65 percent for Limerick 1.

Would you say that the company's projection lies within a reasonable band that you might draw around your own regression results?

A. Could I again change your words slightly and say within a plausible band? Yes, it does. It's not --

Q. It's not what you would have projected yourself but it falls within a range that could be extrapolated from your regression?

A. Right. And I would say that the 65 -- I think it was really 66 percent after we worked out the numbers, but let's call it 65 -- is about as likely as a 55; and I think both 55 and 65 or somewhat less likely than a 60.

Q. Okay. But it does fall within a reasonable range around your regression?

A. Yes.

Q. I would like to now turn to Exhibit CK-4 and your O&M projections.

On page 18 of your testimony you state that your O&M costs were reached by using a linear model?

A. Not quite. The estimates of the vintage effect that I discussed on page 18 simply for explanatory purposes are those that fall out of the linear model. But as I hope my workpapers and testimony made clear, my O&M estimates are the average of two models: a linear model and a logarithmic model.

Q. And you reached the figures that appear in Exhibit CK-4 by averaging the results of those regressions?

A. Yes.

I sure hope that was clear in the materials I presented.

Q. I think that it was.

A. Okay. Sorry.

Q. Now, in your testimony you stated that your assumed O&M costs were $96 million over an assumed 30 year life of Limerick, and $218 million for a Limerick life of 39 years?

A. Again, this is the difference between the present worth of my string of annual O&M estimates.

Q. When compared to the company's?

A. Yes.

Q. Right. So it's fair to assume, then, just looking at those figures that the bulk of your difference with PECo in O&M costs occur in the later years of your regression in present value terms?

A. That doesn't follow from the previous statement. It happens to be the case --

Q. Well, in the last nine years there is a greater than 50 percent -- greater than 50 percent of your difference with the company falls within the last nine years just on the face of those figures, wouldn't you say?

A. Maybe I could answer this way: in the early years, the first roughly ten years -- that's not precise -- the company actually estimates higher Limerick O&M than I do. Then the lines cross and after that point I'm higher than the company.

Q. Can you tell me in which year the lines cross?

A. Sure.

(Witness perusing documents.)

A. In 1995 that is the first year that my estimate is higher than the company's.

Q. Later in the year in 1995?

A. Well, you know, for the year 1995.

Q. In the year of 1995?

A. Yes. And I'm higher thereafter and PECo is

higher before then.

Q. And a substantial portion of your difference with the company in present value terms occurs in the second half of Limerick's life, by and large?

A. Yes, although I think it's also fair to say that there is not a huge difference between us on this one variable, at least not compared to other things we have been talking about.

Q. Now, you say you used two linear regressions to reach your O&M --

A. No, a linear and a --

Q. And a logarithmic regression?

A. Yes.

Q. Do you recall what the R^2 factor was for your linear model?

A. Yes.

(Pause.)

A. Well, I can recall it in a moment.

(Witness perusing documents.)

Q. Maybe I could help you. Does this figure sound familiar: .629562

A. Actually, let me just check that.

Q. Okay. I would rather have you check.

(Witness perusing documents.)

A. Yes. I'm with you.

Q. The figure I just stated was correct?

A. Yes.

Q. And do you recall what the R^2 factor was for your logarithmic model?

(Witness perusing documents.)

A. .67432.

Q. So the logarithmic model explains more of the variations of the data in your regression; is that a fair statement?

A. Yes, but it's not a -- it's not statistically a better equation than the linear. In fact, statistically it's slightly inferior.

Q. Well, could you tell me what the f statistic was for your logarithmic regression?

A. 116.98.

Q. And the f statistic for your linear equation...?

A. Was 96.0.

Q. If we could just break these down a little bit, an R^2 factor, generally speaking it's preferable to have a higher figure for an R^2 factor. In other words, the higher the figure that you have the more the variation in the data your variable explains; is that correct?

A. That's true. But when we are comparing two different equations we need to make sure that the so-called functional form of the equations are the same. And that's

not the case here.

The linear -- let me put it differently. The log equation is designed to explain a higher percentage of the variance because the logarithmic form takes big differences between observations and compresses them through the use of logarithms in the same way if we are using Base 10, just for illustration. What's the difference between 100 and 1,000? Well, the difference is 900 in linear terms but using logs, Base 10, the log of 100 is 2 and the log of 1,000 is 3 and so the difference is only 1. That is the way logs work.

If we are going to compare the goodness of fit of a linear equation and a log equation we have to do a transformation of the log equation into an equivalent linear form.

This is exactly what I did a year ago in the Limerick 2 case in Exhibit CK -- sorry -- in OCA Statement CK-1B, Exhibit CK-36. I'm following the same procedure here.

The adjusted R^2 after the transformation is done is six percentage points higher in the linear form than it is with the log form, and that signifies that the linear equation is statistically more explanatory.

Q. Taking your f statistics for each of these equations, the f statistic for your linear equation was

96.02, and the f statistic for the logarithmic regression was 116.98; is that correct?

A. That's correct.

Q. Generally, is it preferable to have a higher or a lower f statistic than the company's in any particular regression?

A. Again, it's preferable that all these numbers be higher. But the transformation or correction that I described has to be made if we are going to compare the robustness of two equations that use different form.

Q. Is it true that the significance level for the f statistic in both of your regressions is .000?

A. Yes.

Q. And could you explain what that means, to have a significance level of .000?

A. I can't exactly. I can certainly tell you that a low significance f figure such as that is an indication that all of the variables in the equation are statistically significant.

Q. That's my understanding also.

Q. Given that the two equations -- as between the two equations, the logarithmic equation has both a higher R^2 factor and a higher f statistic.

MR. RUBIN: I object, Your Honor. I don't believe that's what the witness has stated.

MR. LODER: Well, maybe we should let the witness answer to that, because I believe that's a correct statement that both the R^2 factor and the f statistic are higher for the logarithmic equation.

BY MR. LODER:

Q. Is that correct?

A. It's correct but it's at best irrelevant and I do think misleading if we are going to go from that statement into a comparison of the merits of the two equations because of the argument I gave just before.

Q. Using your logarithmic regression, can you tell me what your prediction of O&M costs at Peach Bottom would be for the year 2024?

A. I would be capable of making that calculation, I hope. It would take me some time.

Q. Could I give you a figure subject to check of 177.91 cents per kilowatt in 1985 constant dollars?

MR. RUBIN: Excuse me, Mr. Loder. You stated Peach Bottom. Did you mean Limerick?

MR. LODER: No. I mean Peach Bottom.

MR. RUBIN: I'm sorry. Is that Peach Bottom 2 and 3?

MR. LODER: The Peach Bottom plant.

THE WITNESS: And that was in the year 2025?

MR. LODER: 2024.

THE WITNESS: It's going to be a 50 year old Peach Bottom at that point.

MR. RUBIN: Your Honor, I would have to question the relevance of this comparison. The company has stated in this case that Peach Bottom -- both Peach Bottom units -- will be decommissioned in the year 2008. Now they are asking for an operation and maintenance cost for the year 2024; and I don't see how that's relevant.

JUDGE MATUSCHAK: Does PECo have a response to the objection?

MR. LODER: Well, I'm merely trying to examine the difference in what his two regression equations would look like for a plant at a future date just to get an idea of what kind of different predictive values the regressions would assign to a particular site. It's just to carry it out in the future to see the difference so that we can get an idea of what we have been talking about in terms of the difference between those two regressions.

MR. RUBIN: Your Honor, Mr. Komanoff has provided those numbers in his workpapers for Limerick 1, which is the plant we are concerned with. If Mr. Loder would like to refer to those I'm sure Mr. Komanoff would respond

MR. LODER: Your Honor, Mr. Komanoff has introduced in his direct testimony a comparison between Peach Bottom and Limerick as to what the expected relative costs would

be for capital additions and O&M. That is the basis on which I'm opening this line of questioning, to test the conclusions that he's drawn with respect to what those costs would be for Peach Bottom when compared to Limerick.

JUDGE MATUSCHAK: We will overrule the objection.

BY MR. LODER:

Q. Now, in the year 2024 under your linear regression will you accept subject to check that your figure for Peach Bottom O&M would have been $155.58 in constant 1985 dollars per kilowatt?

A. Well, I guess I have to.

Q. And the difference between those two figures that you would predict under either regression, the logarithmic regression would predict 117 and the linear regression would predict 155 and change -- both with change -- is in fact a difference of $37.67?

A. That falls out of those numbers.

The one thing I'm a little bit puzzled by, although it's certainly in the realm of possibility, is why the Peach Bottom 2024 figure under the log form should be higher than the Limerick figure when I have already testified that I expect, all these being equal, lower O&M costs for Peach Bottom because it's an earlier plant. And I think that the log equation that we are talking about embodies that. So I would have thought that in every year

Peach Bottom would be less.

The other problem that I have is -- well, Peach Bottom is a twin unit plant so there would be a further savings there whereas I'm treating Limerick 1 as a one unit plant. So again I'm puzzled as to why Peach Bottom should come up higher.

Q. Well, the difference that you would have projected for each year of O&M expenses when comparing Peach Bottom to Limerick is that Limerick would cost $30 more per kilowatt than Peach Bottom?

A. Now, again, that was just a rough illustrative number. That was also based on the linear model and here we are on the log model.

Q. Taking the difference between what your projections would be for Peach Bottom, the difference there between your two regressions is $37.67; correct?

A. Okay. Now we are back to just Peach Bottom and comparing the linear and the log in that one particular year?

Q. That's right.

The difference is $37.67; is that correct?

A. Yes.

Q. And that difference is larger than the difference that you would project between Peach Bottom and Limerick O&M expenses?

A. I can't say. Again, the $30 difference in the testimony that I think you're using as the other end of this comparison, was just an illustration of the effect of one important variable, the vintage effect --

Q. Just that single variable?

A. Right.

Q. Okay. I'm satisfied with that.

But to answer my question directly, the difference between what your two regressions would predict on O&M cost is greater than what that single variable would predict, the age factor variable would predict, as differences between the O&M costs between Limerick and Peach Bottom; correct, is a simple proposition?

A. I can't really say. I can say that $37 is greater than $30. But I feel this comparison has two -- I have two problems with it.

Again, one is that the $30 is just the illustrative effect of one variable; and more fundamentally the two differences that are being compared, one difference compares two plants and the other difference compares two models for one plant. So that's why I'm having a problem here.

MR. LODER: Your Honor, I have no further questions of this witness at this time.

I would like to move PECo Exhibits 11 through 21

into evidence.

MR. RUBIN: Your Honor, I would object to the introduction into this record of PECo Exhibit No. 12. That was a document prepared by the company. It's a summary of portions of Mr. Komanoff's testimony. I believe that the company can certainly make that sort of presentation in its brief but I don't think it ought to be an exhibit in this proceeding.

MR. LODER: Your Honor, this is merely a summary exhibit that was verified by the witness. This is a summary of the figures that he was using in his testimony in this case. It was used for the purpose of simplifying the cross-examination and I think on the basis of the figures that are in it and having laid out the figures that the witness himself agreed with, I think it's appropriate as an exhibit.

JUDGE MATUSCHAK: Well, while ordinarily it would be part of the company's case, in this case the witness has verified all the figures in it and we will overrule the objection.

The Exhibits 11 through 21 are admitted into evidence.

MR. LODER: Thank you, Your Honor.

(Whereupon, the documents marked as PECo Exhibits Nos. 12 through 21 were received in evidence.)

MR. LODER: Thank you, Mr. Komanoff.

THE WITNESS: Thank you.

JUDGE MATUSCHAK: Let's take a ten minute recess.

(Recess.)

JUDGE MATUSCHAK: Is there any further cross-examination for this witness? Staff?

MS. CHESTNUT: No, Your Honor.

JUDGE MATUSCHAK: Does any other party have any cross-examination for this witness?

(No audible response.)

JUDGE MATUSCHAK: Is there any redirect?

MR. RUBIN: Yes, just very briefly, Your Honor.

JUDGE MATUSCHAK: Proceed.

MR. RUBIN: Thank you.

REDIRECT EXAMINATION

BY MR. RUBIN:

Q. Mr. Komanoff, you were questioned concerning your analysis in the Limerick 2 investigation and what that showed for your estimate of Peach Bottom operation and maintenance costs versus the actual operation and maintenance costs at Peach Bottom. Do you recall that?

A. Yes.

Q. And have you had an opportunity to review your testimony in the Limerick 2 investigation on that point?

A. Yes.

Q. And could you clarify for us what your analysis in that case showed?

A. Well, Mr. Loder's question on the difference between actual 1984 Peach Bottom O&M and the implied results from my O&M statistical model at that time actually coincides with the question that I asked myself in my surrebuttal testimony in the Limerick 2 proceeding. So I would just like to read the question and answer from that testimony into the record. So I'm in the Limerick 2 investigation, OCA Statment CK-1B, page 25, beginning on line seven.

JUDGE MATUSCHAK: Give us the number of that case.

THE WITNESS: It's I-840381

"Question: Mr. Carroll has emphasized the fact that your nuclear O&M cost equation overpredicts actual Peach Bottom O&M costs for 1984 by approximately 25 percent. Please comment.

"Answer: Mr. Carroll's comparison employs my O&M equation without my TMI adjustment, which applies only half the observed TMI effect. In fact, the difference observed by Mr. Carrol approximately equals my TMI adjustment, implying that my adjusted equation would have predicted 1984 Peach Bottom O&M costs to within one percent.

"More importantly, no statistical model will

duplicate every data point in the data sample. The tests of a model are its statistical significance, explanatory power and intuitive logic, all of which are sufficiently present in my capital additions and revised O&M equations."

MR. RUBIN: Thank you, Mr. Komanoff.

That's all we have. Thank you, Your Honor.

JUDGE MATUSCHAK: Any recross?

MR. LODER: Yes, Your Honor, just briefly.

RECROSS-EXAMINATION

BY MR. LODER:

Q. Mr. Komanoff, didn't Mr. Carroll in that Limerick 2 proceeding put in surrebuttal testimony that responded to the statement that you just read?

A. It would have had to have been sur-surrebuttal testimony.

Q. Certainly.

A. I recall that he did. I don't -- I'm sorry. Go ahead.

Q. You recall that he did? He did respond to the point that you spoke to in your surrebuttal testimony?

A. Yes. I don't now recall the nature of his response.

MR. LODER: But for the record I just wanted to make clear that there was testimony submitted after that statement was made responding to it and taking issue with the

assumptions that he made in his testimony.

Thank you, Your Honor. No further questions.

JUDGE MATUSCHAK: If there is nothing further for this witness, the witness is excused.

THE WITNESS: Thank you, Your Honor.

(Witness excused.)

T1A:j1

JUDGE MATUSCHAK: Mr. Widoff?

MR. WIDOFF: I would like to call as our witness at this time, Your Honor, Paul Chernick.

Whereupon,

PAUL CHERNICK

having been duly sworn, testified as follows:

MR. WIDOFF: At this time, Your Honor, we would like to have marked as Utility Users Committee/University of Pennsylvania Statement No. 1 a multi-page statement with attached exhibits, figures and appendices.

DIRECT EXAMINATION

BY MR. WIDOFF:

Q. I would like to ask you, Mr. Chernick, is this a copy of your prepared testimony?

A. Yes, it is.

Q. Would you give the Commission, please, your full name and address?

A. My name is Paul Chernick. My business address is Analysis and Inference, Inc., 10 Post Office Square, Boston, Massachusetts.

Q. Did you prepare this statement?

A. Yes, I did.

Q. Do you have any additions or corrections to make which you would like to put on the record at this time?

A. Yes. I have a few errata and a point of

clarification.

On page 21, in the last four lines of the text, there are three numbers which should be changed. The reference to "almost 14000 BTU/kWh" should read "almost 13000."

In the next line, in the parentheses, the numbers should be "about 11 cents /kWh, or 4.9 cents in 1986 dollars."

On page 38, the fifth line from the bottom of the text, there is a reference to "Appendix E," which should be "Appendix H."

JUDGE MATUSCHAK: "H"?

THE WITNESS: "H," as in "Henry."

On page 69, the fourth line from the bottom, the figure "$36 million" should read "$31 million."

On Tables 4.6 and 4.7, --

JUDGE MATUSCHAK: What page?

THE WITNESS: The tables are not paginated. They are in numerical order following the text.

BY MR. WIDOFF:

Q. That would be Tables 4.6 --

A. -- and 4.7.

In each case, footnote (2) refers to "Megawatts in Design Electrical Rating (DER)," and in both cases that should read "Maximum Generator Nameplate (MGN)."

Table 2.5 contains two miscalculations or errors.

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As stated in footnote 1, I escalated oil prices at eight percent after 1991. In fact, PECo's assumption, which I intended to use, was for nine percent escalation, and, therefore, that should be changed.

The last column simply had a mathematical error in it and did not properly deflate.

I have corrected those two and prepared a Revised Table 2.5, with today's date.

MR. WIDOFF: Your Honor, I have distributed to the various parties present a Revised Table 2.5 that incorporates the corrections referred to by Mr. Chernick.

JUDGE MATUSCHAK: Very well.

THE WITNESS: Finally, more as a clarification than as a correction -- and I think a good place to insert this would be at page 31 in the footnote there -- all of my comparisons of Limerick 1 costs and benefits are before the gross revenues tax. That was an issue that came up in Mr. Komanoff's cross, and I thought it might be helpful to clarify that.

That concludes my corrections and clarifications.

BY MR. WIDOFF:

Q. Mr. Chernick, with those corrections and clarifications, if you were asked the same questions today that are contained in your prepared statement, would your answers be the same as contained in Utility Users Committee/

University of Pennsylvania Statement No. 1?

A. Yes.

MR. WIDOFF: Your Honor, at this time I would like to move into evidence Utility Users Committee/University of Pennsylvania Statement No. 1, subject to any timely objections or motions to strike.

JUDGE MATUSCHAK: Under those conditions, the motion is granted.

(Whereupon, the document was marked as UUC/UP Statement No. 1 for identification, and was received in evidence.)

MR. WIDOFF: Your witness.

JUDGE MATUSCHAK: PECo.

CROSS-EXAMINATION

BY MR. CALVERT:

Q. Good afternoon, Mr. Chernick.

A. Good afternoon.

Q. Could you turn for a moment to your curriculum vita, which I believe is Appendix A to your materials?

A. (Witness complying.)

Q. Am I correct in saying that basically you have held two positions, one with the Massachusetts Attorney General's Office as a Utility Rate Analyst, and that was from the time you left school until May of '81?

A. Yes.

Q And then with the organization that you just referred to in your direct examination, Analysis and Inference, Inc.?

A Yes.

Q Why did you leave the Massachusetts Attorney General's Office?

A Well, the Massachusetts Attorney General has, particularly in the field of utilities, but, in general, a rather limited technical staff and the opportunity for working with other technical professionals, as opposed to attorneys, was quite limited, and our consultant budget was also very limited, so the ability to work with outside professionals was restricted.

At that point it appeared that the things that I had been doing for the past three-and-a-half years would be very similar to things I would continue to do if I stayed there, and Analysis and Inference gave me an opportunity to do a broader variety of work in a greater range of jurisdictions. It seemed like a more interesting and, frankly, also somewhat more lucrative opportunity.

Q While you were with the Massachusetts Attorney General's Office, what function, basically, did you serve as a Utility Rate Analyst?

A Well, I basically reviewed utility filings and other documents, and helped formulate the Office's position

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on a variety of issues involving rate design and power supply planning issues.

Q. Would it be fair to say that in general you opposed the utilities' various requests?

A. That depends on the nature of the request. Certainly, we opposed a large number of them. In the area of rate design we were frequently in the position of supporting the utilities' requests.

So it really depended upon the particular topic.

Q. In rate design, but not necessarily in rate requests, whatever it happened to be, total rate request.

A. I don't know that I ever testified on a rate level issue while I was at the Attorney General's Office.

Q. With your present company, Analysis and Inference, Inc., have you ever appeared before any Commission on behalf of a utility?

A. No. I have never testified on behalf of a utility.

Q. I take it, based on your resume, that I am safe to say that you have never been employed to operate a nuclear power plant?

A. That's correct.

Q. Nor to construct one or to design one?

A. That's correct.

Q. Have you, for purposes of this case or otherwise,

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analyzed the operations of Limerick 1?

A. Do you mean in terms of the historical record during its startup period, or --

Q. No. What I'm really referring to are the day-to-day operations; how the company functions, what its operating and maintenance procedures are, how it runs on a daily basis.

A. I take it you're talking here about staffing plans and organizational arrangements?

Q. That kind of thing.

A. I haven't reviewed that, no.

Q. Have you studied the design of Limerick 1 in any detail?

A. Not in detail, not beyond the issues of size and cooling water source and general design, BWR, Mark II, and so on.

Q. I am correct, am I not, that you appeared as a witness in I believe it was the last PP&L rate case, which was at R-8426551?

A. Yes.

Q. Whose witness were you in that case?

A. The Office of Consumer Advocate.

Q. The one that is a party in this particular proceeding?

A. Yes.

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Q. Have you studied in detail the differences in design and operating procedures between Limerick 1 and Susquehanna 2?

A. No, I haven't looked at that level of detail.

Q. Have you ever visited the Susquehanna Units, either 1 or 2?

A. No.

Q. What about Limerick 1?

A. No.

Q. Do you recall approximately what Limerick 1's capital costs were?

A. With 50 percent of common, it is about $3.2 billion, and with 100 percent it's $3.8 billion.

Q. If you would turn for a moment to page 32 of your testimony.

A. (Witness complying.)

Q. You indicate there, really the second full paragraph, you say, "After PECo's speculatively long unit life of 39 years, the discounted net savings are roughly $2.7 billion dollars (in 1985 terms) at 10%; this is a large value," and then you say, "but still smaller than the initial investment." Do you see that?

A. Yes.

Q. I take it that the $2.7 billion that you referenced in that sentence takes into account all costs; does

it not?

A. Yes. It's PECo's projection of the costs and of the benefits as would be reflected in retail rates under normal ratemaking, traditional ratemaking.

Q. So that the total benefit, not the net, but the total benefit of Limerick 1 is the cost of Limerick 1 plus any additional benefits, in this case, $2.7 billion?

A. Conceptually, yes; you couldn't quite add up the numbers that I quoted you before of, say, $3.8 billion with this figure of $2.7 billion, because of the ratemaking effects; the cost of the plant to ratepayers in present value terms at, say, a ten percent discount rate, is not going to be the same as the capital investment in the plant. But you get a similar result in terms of order of magnitude by looking at the present value just of the benefit stream that PECo projects and that I use in my Table 3.2.

Q. So is it fair to say that it really isn't relevant that net benefits from the plant are smaller than the initial investment, the same as or greater than the initial investment, since the costs of the plant are already factored into your analysis?

A. Well, it depends on what you mean by "relevant." If you mean: is this the acid test for whether the plant is cost effective, the answer is no. I think I say in my

testimony that given PECo's projections of costs and benefits and the lifetime of the plant, that it would eventually be cost effective, or over the lifetime of the plant it would be cost effective.

In terms of putting that $2.7 billion into perspective, and realizing that after 40 years the present value of the plant to you, while a large number is still less than what you've put at risk to begin with, I think that is a useful thing to bear in mind. But, as I said, it is not the fundamental test of the desirability of the plant.

Q. Turn to pages 83 and 84 of your testimony; I believe there you are suggesting that customers today should not have to pay for future benefits of, in this case, Limerick.

A. Yes.

Q. Isn't it true that customers today are getting the benefits from PECo's investments in plants in the '60s and '70s for which customers back then paid without getting the full benefits from those plants?

A. The first part of the question is certainly true, that the customers are getting the benefits of those plants. However, the customers in the late-'60s and early-'70s were also getting benefits from those plants. In general, baseload plants which came on line prior to the mid-'70s showed very rapid cost effectiveness, especially

where they were backing out oil, and they were usually required to maintain reliable service, or a large portion of their cost was required to maintain reliable service, within a very short period of their coming on line in any case. So that the customers who were on the system contemporaneous with the commercial operation date were receiving net benefits in a fairly short time frame, but those benefits are not as large as the ones being experienced in many cases for many of the plants today.

Q. Is it fair to say then that customers today are better off because PE made investments in plants in the 1960s and 1970s, and customers back then were better off when the plants were not in service?

A. As I have said, my impression -- and I certainly haven't gone back and redone the calculations for each of PECo's plants, but the coal and nuclear plants which entered service before, say, 1975, were, in general, better for the customers; their benefits exceeded their costs within a very short period of their coming on line, if not immediately. And since peaking capacity was more expensive, was a higher percentage of the cost of those units, and they were needed for reliability in general in a fairly short period of time after they came on line, a large portion of their cost was justified by reliability considerations, even if they weren't backing out enough fuel to pay

off immediately.

There may be a counter-example of one or two units which, for some reason, were not very quickly beneficial, but, in general, customers were better off once the plants came on line; and regulators and Consumer Advocates were, until the early-'70s, primarily concerned with whether the utilities were going to bring enough plants on line, not that they would have too many.

Q. Do you recall your cross-examination in the PP&L rate case that I just referred to at R-8426551?

A. I recall that I was cross-examined.

Q. Do you recall that you made the following statement: "But certainly the customers today are better off because those plants" -- referring to the ones in the '60s and '70s -- "were put in service, and probably the customers at the time, in the '60s, were better off when the plants weren't in service"? Do you recall making that statement?

A. No. I would assume that that was a -- I am reluctant to call it transcription error -- that that was a mumbling error on my part.

My recollection of that discussion was that I said essentially what I said today, that customers were better off either immediately or in the very short term when plants came on line.

Unless we were talking about a hypothetical case

referring to a hypothetical plant which did raise rates, that is my recollection of what I believed at the time, and it is certainly what I believe today.

Q. Did you ever go back and make a transcript correction to the transcript of the PP&L rate case?

A. I don't believe I ever saw that transcript.

Q. If you would turn for a moment to pages 38 and 39 of your testimony.

A. (Witness complying.)

Q. You reference there, -- at the bottom you say, "DRI's projections are produced," and then at the top of the next page, "by professional forecasters." Do you see that?

A. Yes.

Q. Do you know anyone at DRI who has ever worked in the coal industry?

A. Not offhand. I've never gone looking for anyone who worked in the coal industry.

Q. I take it the same answer then would apply if I were to ask you: do you know of anyone at DRI that has ever negotiated a coal contract?

A. My answer would be the same.

Q. I take it you have never negotiated a coal contract?

A. That's correct.

Q. Have you compared DRI's historic forecasts with actual results?

A. In a general sense, yes.

Q. When did you do that; in connection with this proceeding?

A. I didn't do anything along those lines with respect to this proceeding. I have seen their forecasts from time to time over the last several years, and so I am generally familiar with what they were projecting at various points in time; and I am doing a retrospective analysis for another case in which I was looking at the utilities' forecasts of oil prices, which were primarily from DRI. So I have recently looked at a number of their forecasts over time.

Q. Have you found their forecasts to be accurate over time?

A. No; I haven't found anybody's oil price forecasts to be accurate over time.

Q. Perhaps then a related question: have you compared DRI's fuel price forecasts with other forecasts done by other professional forecasters?

A. I haven't attempted to determine any difference in reliability. In general, at any given point in time, the oil price forecasting community tends to be fairly tightly packed in terms of their expectations.

Q. If you would turn for a moment to Appendix H.

A. (Witness complying.)

MR. CALVERT: Your Honor, this is near the end of the volume of testimony you have, probably 15 or so pages from the end.

BY MR. CALVERT:

Q. As I understand what your exhibit does, it compares there the DRI forecast, the OCA forecast and the PECo forecast.

A. Yes.

Q. Do you know what inflation assumptions DRI made or used in making its forecast?

A. I remember having looked through their forecast documentation to determine whether inflation rates were specified in there, general inflation rates, and I don't recall whether they were. If they were, they were consistent with what I was expecting to see; but I'm not sure whether they were in there.

Q. Do you know whether or not they were consistent with what OCA and PECo used for their respective forecasts?

A. As I said, if they stated their inflation projections, they were consistent with the underlying assumptions behind PECo's forecast, but I'm not sure that they were stated.

Q. For comparison purposes, would you agree that

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one should compare forecasts utilitizing the same inflation assumptions?

A. Yes, you would want to do that.

Q. Do you know what items make up the non-fuel O&M figures that are set forth in your calculations?

A. There is station labor, purchased materials, contract labor and services. They are basically the costs of running the plant and I guess what would be called normal periodic maintenance, as opposed to upgrading.

Q. In your figures have you broken down the various component parts of the overall figure to reflect what the labor costs may be, what the material cost would be, what the services cost would be and so on?

A. No. In general, O&M figures are not available in that form.

Q. Do your figures either assume or infer a breakdown between, let's say, those three major areas?

A. No. I'm looking at an aggregate cost, which obviously, for different plants would be made up in different ways. And, in fact, the same job can be done, in some cases, by a different mix of contract services and utility labor.

So I am really not making any assumptions about how that total is composed.

Q. So you can't say, for example, how many laborers,

and at what rate, a given O&M figure would be assumed?

A. No.

Q. And you indicated a minute ago that different nuclear plants would have different requirements for labor, and, I assume, depending on where they are, would have different labor rates, also?

A. Yes; there would be some difference in labor rates.

Q. And I assume the same would be true for material, material costs perhaps would vary?

A. Yes; that would depend on how far each plant was from the suppliers of services that it needed.

Q. Then I wanted to ask about the services. Would the same be true about contract services and contract labor?

A. Yes.

Q. If you will turn to page 66 of your testimony.

A. (Witness complying.)

Q. As I understand what you're saying there in approximately the middle of the page, you say that, "I believe that my compound growth projections of $73-85 million in 1986, with 18.5 to 20% annual escalation, is at least as likely as PECo's projection." Do you see that?

A. Yes.

Q. When you say "at least," do you believe that your compound growth projections are perhaps a little bit more

likely? Is that the reason for the term "at least"?

A. Yes.

Q. Do you believe that regression analyses need to be tempered with judgment?

A. Certainly.

Q. So you don't just look at the figures, but you have to put some judgment into their application?

A. Yes.

Q. If you would turn, please, to Table 4.8.

A. (Witness complying.)

Q. Do you have it there?

A. Yes.

Q. As I understand your table here, the columns that have the footnotes of (2), (3), (4) and (5) represent data from plants that are over 300 megawatts?

A. Yes.

Q. And then the columns to the right are for all plants?

A. Yes.

Q. Am I reading your table correctly that in the year 2024, your equasion under the "nominal" amount under column (3) there estimates that you would have $132.7 billion in O&M for that year?

A. If you continue that trend, yes.

Q. And it is your testimony that that $132.7 billion

is a little bit more likely to occur than the $801 million that PECo has projected; is that correct?

A. No. I was talking about the trends being more likely. If you continue along the trend in column (3), then sometime relatively early in the next century the continued operation of Limerick would almost certainly become non-cost effective; and, therefore, whether it is in 2005 or 2010, the plant would be shut down, and you never get to spending $13 billion in 1983 dollars or $132 billion in 2024 dollars because it wouldn't pay. That is the general reason that you don't see protracted exponential growth in most real components. You can see it in inflation, because that's just a change of a measuring stick, if you will. But population growth rates, for example, a classic case, can't go on growing at fixed rates forever because the system winds up changing; you run out of places to put people. In the same way, you reach a point where it no longer becomes viable to spend money on running Limerick; something else would be cheaper.

So the projection can be reasonable, even though a particular number, obviously, would never be reached, because the plant would not last that long.

Q. Let's take another point on your table there. Let's look at the year 1999. As I read this, it says that there would be approximately, under your figures,

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$1.1 billion for that year's non-fuel O&M, and you think that that is a little bit more likely to occur than the $187 million projected by PECo; is that correct?

A. Yes; that is about five times what both PE and I are projecting for 1986 in real dollars, and if you look back, it wasn't that long ago that you were seeing annual O&M in the order of $10 million to $20 million a year. That is a fifth of what we're seeing in 1986.

So I don't think that is terribly implausible.

Q I take it at some point you would run out of a place to put people; if part of that is for labor, you would have an awful lot of bodies walking around these plants, wouldn't you?

So it would become implausible at some point?

A Yes. And you would certainly see, and I think you have seen, a difference in mix between the kinds of costs that you incur. While the number of operators that you need for a plant has gone up, for example, and the amount of time that they have to be out for training, and the amount of prior experience they are supposed to have, and so on, have all increased, I doubt that direct expenditures on operators have increased anything like the historical rate for overall O&M.

I wouldn't expect to find five times as many operators in the control room at any one time; you might find that you have twice as many operators because half of them are in training, but it would be other components, purchased services, greater complexity of control equipment, and therefore greater maintenance requirements and so on which would tend to push up the costs.

Q You are not saying, are you, that based on the history of the nuclear industry that any particular future trend is inevitable?

A That is certainly correct.

Q And just because you may have had a pattern develop over the last 15 years in the nuclear industry, that does not mean that it will necessarily continue for the life of this plant; is that also true?

A That's true.

Q In the past there have been some severe events, I take it, that have had some impact on the increase in the non-fuel O&M figures; isn't that true?

Three Mile Island, as an example; did that have an impact?

A That certainly had some effect, yes.

Q And you're not saying that there is going to be an event of that nature which you are predicting will happen in the future?

A Well, I wouldn't expect an identical event to occur, and if it did occur it probably wouldn't have the same kind of effect that the original event did since some of the lessons about dealing with that particular kind of problems have already been incorporated into O&M costs.

Q And, indeed, some of the benefits of Limerick 1 coming on line when it did after some of these severe events had already transpired is that in its design and in its construction it has incorporated, hopefully, ways to avoid the problems which we saw give rise to these large

O&M figures in the past, at least the escalation?

A Well, I would join with you in hoping that the design of the plant has been modified to reduce the probability of the safety problems which been detected in the past. I don't know whether that reduces the O&M problems and vulnerability to escalation, or increases them.

One of the responses to safety concerns has historically been increased complexity of plant design and operation, and those tend to increase O&M costs.

Q Would you agree with me that no two nuclear plants are the same?

A Yes.

Q And, indeed, hasn't history taught us that some nuclear plants' O&M has been higher and escalated faster than others?

A Yes,there are certainly some differences.

Q Are you aware of any detailed analysis of this historical data which would explain this phenomenon between plants?

A I don't think that I've ever seen any analysis which did a good job of that. I thought that I had explained much of the variability in O&M costs between plants in New England, based on my work in the late '70s, but since then some of the plants which had the highest O&M and were

inflating most rapidly have slowed down considerably, and some of those which had very low and stable O&M have shot ahead; so it's dangerous to try and draw any firm conclusions from the relatively limited data set that we have on any plant, say even a Connecticut Yankee which is 15 years old or so now. It can always fool you next year in terms of where its costs go.

And Connecticut Yankee is a good example, Its O&M costs had been low and very stable for a long time and then in the early '80s those increased very rapidly. Some of the newer plants in New England -- Millstone 2 is the most recent one that was on line -- had had very high and very rapid, 30 percent real increases over the first couple of years of life. And those rates of increase have dropped down to more like normal levels.

So there's a lot of regression toward the mean as you look over time, and the problem of explaining which are the real differences and which are just temporary differentials is a substantial one.

Q Again getting back to my original question, which we may be a little off of, you are not aware of any detailed analysis of this historical data which explains this phenomenon you have just described?

A No.

Q You had indicated earlier, I believe, that if

the O&M costs of nuclear plants continue to rise at any given plant that it would be taken out of service. I believe on page 66 of your testimony at the top you make that point, and then you add in a parenthetical, "unless the alternatives were even more expensive than PECo predicts." Do you see that?

A Yes.

Q Have you made a study of the costs of possible alternatives to Limerick 1?

A In terms of replacing the plant in the first couple of decades of the next century?

Q Or whenever.

A Well, my sections 2 and 3 discuss esentially the replacement of Limerick by existing plants and new combustion turbines. Other than that I haven't looked at any base load construction alternatives or alternatives for replacing the plant later in its life.

Q Would you turn to page 68 of your testimony for just a second?

A (Witness complying.)

Q You state there, "Capital additions vary with a number of factors and vary greatly from year to year, complicating statistical analysis." Do you see that?

A Yes.

Q Now, I'm correct, am I not, that you do not

develop regression equations for your capital additions figures?

A No, not for this testimony.

Q Why was that?

A Basically I've always been very pessimistic about the feasibility of doing a regression analysis which would be able to sort out the difference between variations due to causal factors such as those that I list on page 68 and just the fact that, unlike O&M where every year you put in more or less the same number of manhours of operations and certain kinds of standard maintenance, and if you refuel the plant you have some kind of standard requirements for services to do that job, for capital additions you may have years in which you add essentially nothing, and other years in which you have a major outage and you put a lot of new equipment in.

Therefore, you are going to have very noisy data just by the very nature of the thing you are measuring, complicated by the fact that you have year-to-year variations in accounting; some transmission plant transformers outside the nuclear unit may be shifted from a transmission account to a plant account and then back again. All kinds of variations like that occur. Equipment is retired so it drops out of the costs and, therefore, mask some additions to plant which have been made and so on.

So I really didn't believe that you were going to be able to do any better, that one was going to be able to do any better than looking at averages over time. I have now found that that pessimism on my part was unwarranted.

Q You have now found that is was unwarranted, did you say?

A Yes.

Q Is another way to state the same thing as you did in the interrogatory,that, "The annual variability is so large that I do not expect to be able to derive reasonable regression results"?

A Yes. About two weeks after I responded to that I did derive some reasonable regression results, and, while I haven't reviewed his regressions in detail, I have to say that it appears that Mr. Komanoff has also found, at least on a statistical basis, regression is applicable to capital additions data.

Q Did your regression results confirm the extrapolation approach that you took in your testimony in this case?

A I didn't go back and check that specifically, so I really can't answer that question. This is something that I have really only seen in the last couple of weeks.

MR. CALVERT: I'd like to make a data request if I could, Mr. Widoff, for a copy of those regression analyses

of Mr. Chernick relating to the capital additions.

THE WITNESS: I should warn you they will be in very rough form, but I will do my best to make them comprehensible.

BY MR. CALVERT:

Q Looking at your Table 4.9 for a second, which is your capital additions table, I note that there are swings, as you had mentioned earlier, in your data from year to year. Did you determine and analyze the reasons for the swings in the capital additions figures from one year to the next?

A I have not attempted to do a detailed analysis of changes. Where there were large outliers we have made some attempt to check the data with the owners of the units, and, in fact, a large amount of the variability in the raw data turned out to be due to the kinds of accounting problems that I have discussed, that a plant would show a tremendous positive addition in one year and a negative addition the next year. Transmission plant typically was moved into and out of the nuclear units' cost accounting.

Beyond that I haven't attempted to disaggregate the additions.

Q Do you know if any of the numbers in either of your columns there for the years indicated were as a result of these accounting or reporting glitches versus

something else?

A Where we found reporting problems we corrected them. There may still be some in there, but the most obvious ones anyway have been identified. You can spend a lot of time going back over and over again calling the utilities asking financial people to go through and explain why it was that the costs of the plant appeared to go down in 1976 and then back up in '77, and depending upon the utility and their cooperativeness that can be a very time-consuming process for a very small amount of data. So we really concentrated on the ones where there were large changes, and in particular where there were offsetting positive and negative changes suggesting that either part of the plant's costs attributable to joint ownership was being excluded in certain areas or that something was being counted in the cost of the plant one year and excluded in other years.

Q You did that for some of these figures, but not for all of them, I take it?

A That's correct.

Q At page 55 of your testimony you indicate that -- at the second answer up from the bottom you indicate that the capacity factors as projected by PECo are optimistic; is that correct?

A Yes.

Q Then on page 56 of your testimony you list the various items that were incorporated as variables in your Table 4.2 that you refer to there?

A Yes.

Q And I noticed that the fifth one is "Indicators for various recent years;" do you see that?

A Yes.

Q What are the indicators for various recent years designed to represent?

A Perhaps the easiest way to discuss that is looking at Table 4.2; the indicators have a value of 1 if the data is from that year and zero otherwise. What the indicators are representing is any difference between average historical conditions, performance if you will, and performance in that particular year; so that for Equation 1, for example, we see that compared to pre-1978 data 1979 showed an average improvement of 3 percentage points for a capacity factor, and then that 1980 showed a drop of 4.4 percent from average '78 performance, or over 7 points from the 1979 level, and so on, with larger negative values through 1984 where historical performance was over 19 points below the pre-1979 level.

Q I notice that you have the year indicators in Equations 1 and 2, but then you have a post-1979 indicator for Equations 3 and 4; correct?

A Yes.

Q Why did you make that change in Equations 3 and 4?

A Well, having determined that performance since 1980 had been uniformly consistently bad, low compared to the previous period, I then had to ask the question: well, what do I do with that? Not only is it bad, but it is getting worse every year. It is down 4 points in 1980, 7 points in '81, 9 points in '82, 12 points in '83, 19 or 20 points in '84; if you do a time trend on that you are going to find all the plants shut down in a few years.

One way of approaching that is to suppose,as I do for some of the calculations in the next table, Table 4.3, that the future will be like an average of the last five years, and average those individual year effects.

The other possibility is to approach that directly in the regression and just say: well, let's suppose that this downward trend is a fluke; it is a temporary phenomenon, but after five years of poor performance that we will continue to have relatively poor performance, an improvement from 1984 back to typical post-1979 performance. Therefore, I use one indicator which has a value of 1 if the data is from the 1980s and zero otherwise. And what that shows us is somewhere between

11 and 12 -- performance in the 1980s is 11 or 12 points worse than pre-1980 data, accounting for refueling schedules, size effects and age effects.

Q Did you try to capture any other forms -- did you try any other forms of this equation in order to capture that same information?

A I'm not sure what you mean by "other forms."

Q Did you try any other equations; did you try any other variables, any other approaches, moving around for part of the period from '79 to '84, for example?

A Well, now once you look at the individual years -- and that's basically what I was doing in Equations 1 and 2 was; let's pick out the individual years and see what is happening. And then you can pick a period which you want to look at as a whole; and, given the consistent downward trend in the 1980s, and the fact that performance had been below the 1970s level throughout that period, I just did a run for all five years.

Now, you could have done a regression with an indicator for '82 through '84 performance which would give you a much more negative effect. It would be more or less the average of the individual year indicators shown in Equation 1 or 2.

Q But you didn't attempt to do any of that with any of your equations?

A No.

Q Did you try to explain why there was the decline according to your equations in the capacity factor apparently beginning ln 1980?

A I haven't attempted to go back to any fundamental data source and work out a reconciliation of where all those differences came from. My explanation is that the changing regulatory environment after TMI in conjunction with the kinds of ongoing problems which have come to a head in the 1980s have resulted in those decreases.

Q So, for example, the IGSCC problem, when plants were shut down in order to correct that problem, that had a dramatic effect on capacity factors, I take it?

A Yes, that would be one contribution.

Q Now, if you look at your Table 4.2 there, I notice that you have a variable for size?

A Yes.

Q And I see that they are all negative as you go across here for all your equations. Do the all-negative signs mean that the larger the plant the lower the capacity factor?

A That's true in general, yes.

Q And then if I look down there I see that you have a GT1000; I assume that means for plants greater than 1000 megawatts?

A Right.

Q And I notice that they are all positive. Again if would be that if the plant was over 1000 megawatts that the capacity factor would tend to increase?

A Compared to what you would expect from the general size trend, yes.

Q How do you explain these two apparent inconsistencies?

A That's a good question, and one that I address in the text of my testimony somewhere. The greater than 1000 variable indicates that the two plants on which we have any significant amount of operating data that involve PWRs of more than 1000 megawatts -- that is Brown's Ferry and Peach Bottom 2 and 3 -- they have been better than the trend would indicate.

On the other hand, we also know that Brown's Ferry's capacity factors are going to be very bad for 1985 and, indeed, for the next couple of years, and that would tend to erase a large part of the effect of that variable.

The real question is: have these two plants been either lucky or special in some way? Perhaps Brown's Ferry was special in the sense that TVA was not paying much attention to NRC regulations and, therefore, was able to achieve higher capacity factors. Or is there something fundamental about the very large plants which makes them

better than the smaller plants?

I assumed for the purpose of projection that whatever it was through 1984 and excluding Brown's Ferry's problems in '85 and beyond, whatever it was that made those two plants better than average -- better than the trend would also apply to Limerick. And I think that is the most favorable reading of the situation that one can apply for Limerick.

Q Would you look at your adjusted R-square factors down there for your four equations?

A (Witness complying.)

Q What do these say about the accuracy of your equations?

A What they tell you is that the amount of the annual variation in capacity factor that is explained is less than 20 percent.

Q Looking at your Table 4.3, have you made a study or an estimate of whether or not there is a statistically significant difference between your estimates and PE's estimate of the capacity factor for Limerick?

A I haven't worked out the prediction intervals for my equations. I would expect that PE's projections would be on the high side but within a reasonable confidence interval; so, therefore, I refer to them as being, I believe, not implausible or not inconceivable, but

optimistic.

JUDGE MATUSCHAK: Could you find a place to stop for lunch? How much further cross do you have?

MR. CALVERT: Your Honor, I probably have another half hour to 40 minutes. We could stop now if you would like.

JUDGE MATUSCHAK: If this is a good point.

MR. CALVERT: This would be fine.

JUDGE MATUSCHAK: We will recess until 2:10.

(Whereupon, at 1:08 p.m. the hearing was adjourned to be reconvened at 2:10 p.m. this same day.)

AFTERNOON SESSION

(2:12 p.m.)

JUDGE MATUSCHAK: You may proceed.

Whereupon,

PAUL CHERNICK

having previously been duly sworn, testified further as follows:

CROSS-EXAMINATION (Continued)

BY MR. CALVERT:

Q Mr. Chernick, when we last left off I believe we were looking at Table 4.3. As I understand it, in order to come up with the results utilized in your life cycle analysis you did an average of Equations 2 and 4 to get your projected capacity factor values; correct?

A Yes.

Q Why did you choose to take an average as opposed to merely choosing one of your equations?

A Well, first of all, they are very close together, so you are not talking about making any major decisions here; and I don't really see any fundamental underlying basis for selecting one over the other.

Q I take it then there was nothing you were attempting to capture or not capture by choosing one equation and averaging it with the other equation?

A What I was attempting to do in both cases was

reflect average 1980's performance as opposed to the most recent performance, that is 1984 and, therefore, assume a recovery from the most recent level, but I did that within each equation and got very similar results, and simply took an average of the two.

Q And your analysis stops in '84; you either didn't have or didn't include the '85 data, I take it?

A The 1985 data in any comprehensive form won't be available for some time.

Q Now, I notice on Table 4.3 that in your second column there it says "Value of Refuel."

A Yes.

Q And am I correct in saying that that represents an 18-month refueling cycle?

A Yes, twice in every three years.

Q Twice in every three years. In order to make it twice in every three years, does that assume or did you assume for your calculations that the second 18-month period began at the end of the first 18 months; in other words, it is 18 months, 36 months, and so on?

A Well, actually I didn't approach it that way. What I did was to look at the refuelings implicit in PECo's runs, and by looking at the value of the fuel savings you see very quickly that there is a pattern of two years of lower savings, one year of higher savings, two years

of lower savings, and one year of higher savings, with of course an overall trend as fuel prices rise; and it occurred to me that PECo was simply assuming two refuelings in every three years, two on and one off kind of pattern, and I made the same assumption.

If you made a slightly different assumption about the timing, then you might have a couple of zeros in a row for refueling, a couple of years in a row when you wouldn't refuel, or a year where there was half a refueling in one year and the refueling was completed in the next year, or whatever. I didn't notice that that was going on in PECo's runs, and I simply was mimicking their assumptions about refueling schedules.

Q I take it then that if in fact the refueling -- if there were fewer refuelings that in general your capacity factor figures would increase?

A Yes.

Q Now, if you look for a moment at Table 4.4 on the next page, the bottom set of numbers there, I see that you are comparing original DER and then you have got the actual capacity factor, PECo estimate and your own estimate; is that correct?

A Yes.

Q Now in the PP&L rate case that we were talking about earlier you used for that column that is headed for

yourself, you used Easterling's analysis; is that correct?

A That's correct.

Q Why didn't you do that in this case?

A Well, first of all Easterling's most recent published analysis ended with 1979 data, and so therefore it has gotten quite stale. I have data here through 1984, and, secondly, I have been doing these regressions long enough that I really don't feel there is any need to cite Easterling as an authority on the subject. I'm quite comfortable presenting my own results as the primary basis of my analysis.

Q Both of those conditions, however -- or all three of those conditions would have applied during your PP&L testimony, would they not?

A Well, less so in both cases.

Q By what; approximately a year or so?

A I think I have two years of data that I didn't have at the time of the PP&L testimony. I think I had data for 1982 back then. And to tell you the truth, I think that the controlling factor in the PP&L testimony was how long I had to put together the testimony, and the fact that this table was already set up with Easterling's figures, and it was simpler to leave them in than to redo it.

Q Am I correct in saying that if you had used

Easterling's figures that indeed the average capacity factor would have been higher than yours, although perhaps not quite as high as PECo's stated here? Based on what you did in the PP&L case.

A I haven't made that kind of comparison recently, but it is my impression that Easterling's projections based on data through 1974 -- or his results based on data through 1979, excuse me, would have resulted in somewhat higher projections than mine, yes.

Q Now am I correct that Limerick 1 is similar to Susquehanna 1?

A In a general sense, yes.

Q And as I understand it from your Table 4.5 over here, we have Item number 12, Susquehanna 1, in what I understand to be its first full year of operation attaining a capacity factor of 65.3 percent; correct?

A Yes.

Q Do you think it is reasonable to assume that that is the kind of capacity factor which would not be unreasonable for PECo to expect that it might well attain in its first full year of its unit, Limerick 1?

A I would say that it might well do that in the first year, or in any year, especially if there is no refueling.

Q Now if you will turn to page 23 of your testimony, you are talking there in particularly the first full paragraph -- you are talking about the New England Power Pool.

A I'm sorry; which paragraph?

Q On page 23 of your testimony.

A Yes.

Q In the first full paragraph you are talking about the New England Power Pool indicator relating to the incremental reserve margin associated with nuclear units; do you see that?

A Yes.

Q And am I correct in saying that Table 2.6 is the basis for that statement on page 23?

A Yes.

Q If you will turn for a moment to 2.6, am I also correct that 2.6 was based on -- for the data in 2.6 the source was the minutes of the Executive Committee of NEPOOL for August 12, 1976?

A Yes.

Q Now, you will see up there under your first series of numbers under the 84/85 all the way to the right, the fifth year --

A Yes.

Q -- there is indicated 2700 -- well, 27,370 megawatts?

A Yes.

Q Can you tell us what was the system configuration reflected in that 27,370?

A In terms of the composition of the system in megawatts of various sources?

Q Yes, sources, sizes, that kind of thing.

A Well, New England has I believe about 6,000 megawatts of small nuclear -- small to medium size nuclear units, mostly in the 600 to 800 megawatt range; and that figure would assume five more nuclear units of 1,150 megawatts each. I believe there is somewhere around 1,000 megawatts of conventional hydro, maybe more like 1,500; and about an equal amount, 1,500 megawatts to 2,000 megawatts of pump storage hydro. The remainder is primarily oil with some coal, and that ranges from combustion turbines through small steam plants to 700-megawatt steam plants. I don't have the breakdown of those at my fingertips.

Q And I take it then that that was the system configuration on which this other analysis was conducted, at least for that year?

A Yes.

Q Now, isn't it true that incremental reserve margins for any unit depend on the system configuration in which the unit will be operating?

A Yes.

Q Have you compared the 1976 NEPOOL results with the configurations for the Mid-Atlantic Area Council companies, for example?

A No, I haven't. In order to do that you would really have to put together a reliability model for PJM, including its interconnections with other pools, and do a reliability analysis with a base case system and then add one nuclear unit, for example Limerick, and rerun it to determine how much additional capacity had to be added or how much additional load could be added to provide the same level of reliability. I haven't undertaken that complex an analysis.

Q I take it that the same answer would be given if I were to ask you if you had done it for ECAR or for SERV?

A Yes, that's true.

Q And to that extent you cannot tell, I assume, whether or not the 1976 NEPOOL results would apply on the same basis to the PJM or the MAAC companies or any one of the other areas that I mentioned?

A Well, you wouldn't expect it to apply exactly, and in fact given the larger size of those other pools you would expect that the size effect of the nuclear units of roughly 1,000 megawatts would be smaller; that is the required reserves would not increase as fast on the larger

system where the size of the new unit is spread out more, if you will. And I note that in my testimony. That certainly would be one of the differences between NEPOOL and PJM. And, in fact, when I do the calculations on the next page, depending upon your assumptions about Limerick's forced outage rate, you come up with somewhat -- certainly for the inputs that were used by NEPOOL, you come up with a smaller required reserve for Limerick 1 in the PJM system than for the same unit placed in the NEPOOL system.

Q Now if you look at page 15 of your testimony, as I understand you there, you are suggesting that if PE needed new capacity for reliability purposes, they could purchase CTs to meet that need?

A Yes.

Q Are you recommending that a utility develop its supply system by purchasing CTs whenever its peak demand begins to increase?

A No.

Q I am correct, am I not, that CTs are relatively expensive to operate?

A Yes.

Q If a utility had a fairly steady rise in its peak over time, would it be reasonable to build its system by just adding CTs to it?

A If only the peak were rising you might want to add just CTs to meet that small number of hours of additional use. If the entire load shape is rising smoothly, then you would certainly hope that there was some form of capacity which per kilwatt-hour spread out over the year would be less expensive than combustion turbines.

Q Is a large share of CTs on the system generally advisable or not?

A In general there are more economical supplies for long hours use.

Q Have you ever determined what the optimum mix of CTs on PECo's system should be?

A No, I haven't; and in order to do that of course we would have to define the cost of the alternatives, which is well beyond the scope of my testimony.

Q Have you done that, determined an optimum mix for CTs on any system,of any utility?

A Not for power supply planning purposes. I've done similar kinds of calculations for rate design and cost allocation calculations, but those are essentially for a hypothetical increase in load; how would you meet that, with what mix of capacity?

So the answer is: certainly not in terms of the specific kind of situation we are facing here.

Q On page 16, the next page over there, you are

talking about comparing the various costs to make up the reserve deficiency if Limerick 1 were not available.

A Yes.

Q And you indicate there that you have not included the cost of replacing the CTs after 25 years, and you set forth your reasons for that. I am correct, am I not, that regardless of any of those reasons, there would be some costs associated with replacing those CTs?

A Not necessarily. Depending on how much they were run, they might very well last a little bit longer than the 25 years, and that would take them to the end of Limerick's scheduled life. Of course Limerick might not, and I would suggest that it is prudent to assume that Limerick will not last 39 years; and, therefore, the CTs don't have to stretch as far to reach the end of Limerick's actual life.

But if you did reach the useful lives of the CTs, or the useful lives of the CTs without major investments, then there would be some cost involved in probably extending their lives rather than replacing them.

Q If you will turn to page 17 to Footnote 13, you indicate -- and I think you also indicate in the answer to an interrogatory -- that PE should be able to purchase the leased CTs for less than the cost of new ones?

A Yes.

Q Have you ever reviewed PE's lease for the CTs in question?

A No, I haven't reviewed the lease.

Q So you don't know whether or not the lease has any provisions in it relating to the ability of PE to purchase CTs at the end of the lease?

A That's true, and this does not refer to their right to do so under the lease; it refers to what one would expect from the market value of those combustion turbines.

Q You state here in your answer to interrogatories -- this is Set 3, Question 10. You say, "Therefore" -- after concluding your statement, "PECo should be able to buy the leased CTs for less than the cost of new CTs."

A That's correct.

Q And all I'm saying is: you don't know as a matter of fact whether or not those leased CTs are available to be purchased by PE, do you?

A Well, as I state in the footnote, PE should be able to get the CTs for a lower effective cost than another purchaser who would have to pay for relocating them and establishing supporting facilities and so on; and, therefore, since another purchaser would only pay the market value for those units compared to new units PECo should be able to buy them for less than the effective cost of new units.

Now, of course if there is some other user who has a particular need for that particular size and type of unit, that might conceivably not be true; but based on the general market test PECo should have a competitive advantage here in terms of bidding against other utilities or other power producers who would be interested in the capacity.

Q Unless the lease provided that they weren't allow to purchase them.

A If that were the case then that would be a curious provision, but I suppose that would probably prevent it. I had assumed from some of PECo's analyses that the CTs were available for purchase at full market price.

Q Mr. Chernick, in your answers to interrogatories which we received today, which appears to be Set 8, Question Number 2, I would like to read that question and answer to see if I have it accurately stated.

The question is: What sources or studies were relied upon for background or any other purpose in the discussion of the relationship of availability factors to capacity factors at pages 50 to 52 of Mr. Chernick's testimony?"

The answer was, "There were no specific sources." Is that correct?

A That is correct.

Q And that was an accurate answer?

A Yes.

Q Now, am I correct that you have never prepared a complete load forecast?

A That's correct.

Q On page 3 of your testimony I think you are referring to some of your criticisms of the utility projections and you state that you have pointed out numerous errors in load forecasts of several NEPOOL utilities?

A Yes.

Q In fact, you do not know, do you, if any of these errors appear in PE's load forecast?

A I haven't reviewed the company's load forecast in any detail certainly, and, therefore, I don't know.

Q Have you ever reviewed PE's forecasting methodologies?

A Not in any detail.

Q Do you even know what methodology PE utilizes?

A I have read over a description of the forecast which I believe was provided in response to discovery, but I really wouldn't want to try and test my memory.

Q I take it then it is safe to say that you don't know of any changes that you would make in PE's methodolgy?

A That's correct.

Q Now, just so my question is clear, you didn't

do a comprehensive review of either the current or the previous PE load forecasts; is that what you are saying?

A No.

Q Now, PE is a summer peaking company, is it not?

A Yes.

Q And PP&L is a winter peaking company?

A Yes.

Q And to study the relevant projections for peak demand forecasts for PE you would have to focus on the summer peaks, I take it?

A If your concern was primarily peak demand you would be concerned with both what you might call base loads, non-seasonal, non-weather-related uses and weather-related effects,primarily air conditioning.

Q So you would look at the summer peak is what you are saying?

A For forecasting peak you do look at summer peak, yes.

Q Now, on page 19 you state that there is no reason to suppose that PE's current projections do not contain comparable errors with what you suppose their past projections had; do you see that?

A Yes.

Q I take it that you have not determined specific reasons for the alleged past PECo forecast errors; is that

correct?

A That is correct.

Q And, indeed, you cannot identify any errors that you have detected in PECo's forecast; is that correct?

A Since I haven't reviewed it in any detail, that is correct.

Q Is it also fair to say then that you have no basis for your expectation that any or all of the alleged errors will continue into the future?

A Well, I'm not talking here about a particular error which is repeated so much as a utility, which like most utilities, had quite a poor track record of forecasting demand; and I'm just observing that given a track record of inaccurate demand projections that I would not assume that PECo's current projections are free of what I call comparable errors, by which I certainly do not mean the same mathematical or conceptual problem necessarily, but the general tendency to miss the mark.

Q You haven't considered the impact of the Arab oil disruptions on the accuracy of PE's forecasts, have you?

A No, I haven't because I started looking at PECO's forecasts starting with those after the oil embargo, and therefore forecasts which should have incorporated the knowledge that oil prices had risen.

Q. Was there an Arab oil disruption in 1978 or 1979, also?

A. Well, more of an Iranian oil disruption, but yes, there was another oil price increase in the late-'70s and 1980.

Q. The Iranians are Arabs, I take it, generally?

A. You wouldn't want to tell them that.

Q. Now, if you turn for a minute to Figure 2.2 in your appendix, first of all, I note that --

MR. WIDOFF: Excuse me; I missed the reference. What reference are we --

MR. CALVERT: Figure 2.2.

THE WITNESS: The figures are after the tables.

BY MR. CALVERT:

Q. Is it your position that Figure 2.2 is generally the basis for the conclusions reached on page 19 of your text?

A. Yes; in general.

Q. First I note that it talks about winter peak demand for PECo. Didn't we decide that if you wanted to make a comparison for peak demand purposes, that you should look at the summer peak as opposed to the winter peak?

A. Yes, you certainly would want to do so, and I don't know whether the wrong data was inadvertently entered or whether the title is simply incorrect. I can check that.

That certainly should read "Summer Peak Demand," and

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it should be summer peak demand.

Q. Now, as I read what you have done here, in 1982, and I guess from the text in '83, PE slightly underforecast the peak load; is that correct?

A. Yes; it was underforecast in the short term, and the forecasts in '82 and '83 were below those for '84.

Q. And in '84, it looks to me like it was, although a little over, it was fairly accurate.

A. The 1984 projection for 1984 was fairly accurate.

Q. And, indeed, for 1985, we know that it was within one megawatt of being precisely accurate; isn't that correct?

A. I don't recall the exact numbers, but it was fairly close, yes.

Q. And, in fact, in the Limerick 2 proceeding that we have talked about earlier today, all of the intervenors that bothered to deal with this issue had projected that PECo's '85 peak would be considerably lower than in fact it turned out; isn't that correct?

A. I haven't reviewed that docket.

Q. Is it fair to say that you have not studied how you would forecast PE's load and peak demands?

A. I would say that it is fair to say that I haven't examined the company-specific issues, but based upon my general experience I certainly have a good idea of how I

would start to approach those problems.

Q. In answer to an interrogatory, Set 2, Interrogatory 13, you were asked, "How would you forecast PECo's load and peak demand," and you say, "I have not performed the requested study."

That is accurate, is it not?

A. Yes.

Q. Now, am I also correct that you have not studied the potential for cogeneration, trash burning or small power production facilities in PECo's service territory?

A. Not on a service territory-specific basis.

Q. I take it also that you have not studied the amount of cogeneration, trash burning or small power production for similar facilities which will be developed in PECo's service territory over the period of PE's capacity projections in this case?

A. Well, I certainly haven't studied how much will be, because how much will be depends largely on the actions of the company and the Commission.

As for how much can be, again, I haven't done a service territory-specific analysis of that potential.

Q. Are you aware of the City of Philadelphia's efforts to get a trash-to-steam plant built in or about the Philadelphia area?

A. I think I've read about it in the papers a

little bit. I am not familiar with the details.

Q. Are you aware that this is an effort that has been going on for several years?

A. That certainly wouldn't surprise me.

Q. And that, in fact, there is no such plant at this time?

A. So far as I know.

Q. Turning generally to page 20 of your testimony, are you aware of how PE accounts for cogeneration and small power production in its load forecast?

A. It is my understanding that a forecast of co-generation -- I believe it is primarily cogeneration -- which displaces customer loads is subtracted from the sales projection to the extent that the customer is anticipated to be serving his own load.

Q. Are you aware of whether or not PE has reduced its sales projections generally by the amount of projected cogeneration and small power production?

A. It is my understanding that that -- again, to the extent that the cogenerator is serving its own load, that that is the intent of PECo's forecasters.

Q. Have you done any studies on the reliability of cogeneration or small power production or trash burners for dispatch purposes?

A. I'm not sure what you mean by "dispatch purposes."

Q For purposes of being able to have the utility dispatch the energy generated from those units.

A I don't understand the connection between reliability contribution and dispatchability. Dispatchable plants may provide much system reliability, and vice-versa.

Q My question simply is: have you done any studies relating to the dispatchability -- I will amend it to that effect -- of cogeneration, small power production or trash burning plants?

A I haven't done any studies. I am familiar with some cases around the country.

Q Did you determine if PE's current load forecast took into consideration the rate increase associated with placing Limerick 1 in service?

A Again, it is my understanding that there is some allowance for a price elasticity effect based upon PECo's projection of the rate increases, the net rate increases, caused by Limerick.

Q Are you aware of what that price elasticity effect is?

A I haven't tried to work through those numbers, no.

Q I take it that you have not done a specific study of the electric price elasticity in the PECo service territory, what it would be?

A. A price elasticity study for PECo's customers as opposed to other electric consumers?

Q. Yes.

A. No, I haven't.

Q. Indeed, it is your belief, is it not, that it would be very difficult or impossible to do an empirical study which would measure the size, if any, of the impact of Limerick 1 coming into rates on PE's electric sales?

A. Well, it would be difficult to sort out that factor from -- you're talking about looking back four or five years from now at what the effect of Limerick 1 would be. You're also going to have oil prices falling in the meantime, you're going to have changes in the economy; and if you make some assumptions about what would have happened given those other changes without Limerick, then you can see what the Limerick effect is.

But sorting those factors out for a specific service territory over any reasonably short period of time is very difficult. Therefore, elasticity studies -- studies of demand and its causation in general look across large areas and many years to find general patterns in data that is intrinsically noisy, because many things are going on simultaneously.

Q. That is a very difficult, if not impossible, item to sort out?

A. On the, if you will, microscopic level. If you want to know what was the price elasticity in PECo for each class of customers in PECo's service territory in 1981 and 1982, that is going to be very hard to do well.

If you ask the question, given data from the last ten years across the industrial northeast, what are those elasticities like, you can come up with much more accurate answers.

Q. Have you ever tried to do that?

A. Are you talking now about the micro level or the macro level?

Q. Let's begin with the micro.

A. On the micro level, I know that I have never attempted to do that.

Q. Have you attempted to determine whether or not PE's allowances for elasticities as used in its forecasts are adequate?

A. As I say, it has been some time since I've reviewed the limited amount of documentation on PECo's forecasts that I reviewed, and I don't really recall the details of their treatment of elasticity.

Q. So you can't say whether they are adequate at this point or not?

A. That's correct.

Q. On page 16, footnote 12, you indicate that --

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you refer to PJM, and you say "As long as PJM has excess capacity."

Is it your belief that PJM as a whole has excess capacity?

A. It is my belief that PJM as a whole has more capacity than PJM requires itself to have and its members to have, so there is spare capacity on the system for opportunity sales.

Q. Have you studied PJM's capacity requirements with respect to all its companies?

A. To some extent. I haven't gotten involved in the details; it's a very complicated calculation. But I am generally familiar with the approach that they take.

Q. Are you aware of the various requirements that PJM places on its individual companies for capacity and reserves?

A. I'm not quite sure what you mean by the requirements. What the percentages are?

Q. Yes.

(Witness perusing documents.)

A. It might take me a little while to find the percentages, but I have the 1984 filing with the FERC by PJM setting forth the obligations of the pool, of the members of the pool, for the '86-'87 planning year.

Q. Is that set forth for a different percentage,

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depending on the company, or is it the same percentage for all companies?

A. The percentages wind up being different for the various companies.

Q. Have you analyzed the load shapes and the load forecasts of the various PJM companies?

A. In terms of the contribution of the load shape to their reserve requirement?

Q. Yes.

A. No. I understand the general rationale behind PJM's approach to assessing the margins, but, as I said, it is a complicated formula and I haven't tried to work it through for each one.

Q. Were you aware that in August of 1985, the PJM hit an all-time peak demand as a system?

A. Yes.

Q. On page 10 of your testimony you indicate that -- well, in several spots, but the last sentence there you indicate that --

A. Excuse me; which page?

Q. Page 10. You talk about the reliability value of Limerick to the PJM system.

Why, in your view, is it relevant, the reliability value of Limerick 1 to the PJM; why is that relevant to this proceeding?

A. Well, because of the nature of the PJM pooling arrangement, and, for that matter, the comparable arrangements of other power pools, the reserve margins for heavily nuclear utilities, that is, those which have large investments in large nuclear plants, their reserve margins are being subsidized, in effect, by utilities with smaller plants and plants with lower forced outage rates.

From the viewpoint of the Commission, which is also interested in the welfare of most of the other PJM members who serve other parts of Pennsylvania, the costs and benefits to PJM might be as important as those to PECo.

Were this the Delaware Commission, for example, that situation would be different, since the other PJM companies would be entirely in other states.

Q. I take it you're not suggesting that PE should be penalized by this Commission because some other PJM companies may have excess capacity?

A. No, that wasn't the distinction I was making in this part of my testimony. I was distinguishing not between the difference in reserves in various parts of the pool, so much as the fact that Limerick is worth 1,055 megawatts to PECo for PJM purposes, and that is 1,055 megawatts of just about any kind of capacity, but for PJM, the reliability contribution of the plant is much smaller than 1,055 megawatts of most other kinds of capacity, combustion

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turbines, for example; and when you're talking about the reliability value of a plant and whether it is going to keep the lights on, or how much it contributes to keeping the lights on, you're really talking about a PJM-wide problem, and for that purpose the plant is not as valuable as it is in meeting PECo's obligations to the pool.

Q. In terms of keeping the lights on, if the PJM system, in fact, did not have excess capacity but had too little capacity, then it would contribute, would it not, to PJM's ability to keep the lights on, as you say?

A. Oh, yes. Almost regardless of the capacity situation in the pool, Limerick provides some reliability. It just does not provide as much reliability as 1,055 megawatts of other kinds of capacity.

Q. If you would turn for a second to your Table 2.1.

A. (Witness complying.)

Q. As I understand it, you utilized this table as part of your analysis for determining the reliability of Limerick 1 to PE; correct?

A. The contribution to meeting the pool capacity requirements; yes.

Q. Now, as I understand what you have done here, you include Richmond 9 in your analysis; correct?

A. Yes.

Q. And that is under the column that says "Life

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Extension Capacity [3]," and the first heading there is "R 9 and S 1&2"?

A. Yes.

Q. That is Richmond 9 and Southwark 1 and 2?

A. Yes; those codes are described in footnote 3 below.

Q. Now, with respect to Richmond 9, do you know whether or not it is already retired?

A. It is my understanding that it is retired.

Q. And it is taken out of service?

A. Yes.

Q. With respect to Southwark 1 and 2, for purposes of your testimony here, have you studied their condition, their operating condition?

A. No. I accepted PECo's statements about the cost of refurbishing and maintaining the plant. I did not do a separate study of the costs.

Q. But you're talking about the costs of refurbishing Southwark 1 and 2, as opposed to Delaware 7 and 8? You're referring to the costs from the Limerick 2 investigation?

A. Let me just check and see where we got the data from.

(Pause.)

A. According to Table 2.2, which has the costs that

j33

I assumed for each of the extensions, the source of the data for Richmond and Southwark -- and the reason that they are combined is that I had an estimate of $106 million for extending the life of those three units for another 15 years; and that was from the response to IR-OCA-2-21; those sources are noted at the bottom of Table 2.2.

Q. Have you done any independent analysis of whether or not these plants, either -- well, let's focus in on Southwark 1 and 2 -- whether or not they are in condition to be put back into service or to continue for 15 years?

A. Whether they are today?

Q. Yes.

A. No, and their condition today is not particularly pertinent to this analysis. The question is: if there were no Limerick, what would their condition be today? And given the presence of Limerick, as I note in my testimony, the retirement of Richmond might make sense. But that doesn't mean that allowing Richmond to deteriorate and then retire and -- it may be a pile of rust by now; plants can do that quickly once they are no longer tended to. If that is its condition, that is its condition because Limerick is about to come on line, and you have to look at the costs under a rational capacity plan without Limerick.

Q. Is it your testimony that the retirement of

Richmond 9 had something to do with Limerick? Is that your belief?

A. Yes.

Q. What is that based on?

A. It is based on the fact that given the very low cost of a life extension, as estimated by the company, and the fact that there would have been a need for capacity without Limerick or some other major contribution in the next several years, assuming that the retirements took place, these retirements would have been delayed and these investments would have been made.

Q. On page 17 of your testimony --

MR. WIDOFF: Before we get to that, Mr. Calvert, let the record reflect that the references to the company's projections of costs for renovations of those facilities, which the witness referred to as IR-OCA-2-21, is now in the record as Exhibit 57 of OCA.

BY MR. CALVERT:

Q. On page 17 of your testimony you state that most of the cost of Limerick 1 is not required and would never have been incurred for system reliability purposes. Do you see that?

A. Yes.

Q. You did not analyze, I take it, whether PECo properly projected the need for Limerick 1 back at the time

it began this process in the late-'60s or early-'70s?

A. This statement really doesn't have anything to do with the load forecast. What I'm saying here is that if you want to install 1,055 megawatts of capacity, or if you want to be able to support the amount of firm load that Limerick will support, which requires a smaller amount of additions if they are smaller units, you could have done either of those things, regardless of your load forecast, for a much smaller investment in terms of maintaining system reliability than is embodied in Limerick.

That is a statement which you would expect to be true about most base load plants, and is especially true about very expensive base load plants.

Q. I take it that what you are testifying to here is, from the information you have today, you are making certain projections and stating certain opinions, but you are not stating, if I understand you, that you looked at data that was available at the time that the decision was made to build Limerick in order to make some determination of whether or not that was the option that PECo should properly have chosen?

A. I haven't done a review of generation prudence, generation planning prudence. But, in any case, this paragraph is not a statement about prudence; it is a statement about the cost of providing reliability in various ways.

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I'm sure that at the time that Limerick was being planned, the company knew that it could provide the reliability less expensively, but it hoped that Limerick would be able to produce a lot of energy inexpensively, and that would more than make up for its high fixed costs; and it made the additional investment, decided to go ahead and spend a billion dollars or so on Limerick instead of perhaps a third or a quarter of that on gas turbines, based upon the expectation that the additional investment would be more than paid off in fuel savings.

Q. I am correct, am I not, that you have not attempted to determine whether Limerick 1 is or ever was or ever appeared to be the most economical option for reducing fuel costs?

A. That is covered by the generation prudence review, which I have not undertaken.

Q. Am I also correct that you have not reviewed or analyzed the Limerick 1 scheduling decisions made by PE?

A. That is correct.

MR. CALVERT: That is all I have, Your Honor.

Thank you, Mr. Chernick.

JUDGE MATUSCHAK: Staff.

MS. CHESTNUT: Yes, Your Honor; I have a few questions for Mr. Chernick.

CROSS-EXAMINATION

BY MS. CHESTNUT:

Q. Mr. Chernick, my name is Marci Chestnut. I represent the Commission Trial Staff in this proceeding.

First off, Mr. Chernick, I would like to refer you to page 29 of your prepared direct testimony. The last sentence there, going on to page 30, you state that "Table 3.1 lists, and Figure 3.1 displays, the differences PECo projects between Limerick 1 fuel costs and the fuel costs of the fossil plants it would be backing out."

When you use the term "backing out," do you mean replace?

Q. Well, it would be replacing their power production with its own power production. I assume, except for the ones which are being retired in the short term, that most of those plants would remain on the system; they would just be run much less.

Q. The point is that Limerick 1 would be replacing more expensive fossil fuel units; is that correct?

A. Yes.

Q. And that is what results in the anticipated energy savings?

A. Yes.

Q. You use the term "avoided cost" in various of your tables, Mr. Chernick, such as Table 3.1; is that correct?

A. Yes.

Q. Can you define the term "avoided cost" for us?

A. Well, in Table 2.5, for which we passed out a revision this morning, and I think also in 3.1 -- yes; I'm just referring to the cost of the energy that is backed out by Limerick, as we have just defined the term "backed out;" that is, the purchases from other systems or the fuel burned in PECo's own plants which you don't have to burn because Limerick is there.

I use the "avoided" terminology to distinguish it from the fuel savings, which is the difference between Limerick fuel and the alternative fuel; that is, the fuel that is avoided.

Q. Mr. Chernick, you are familiar with the PURPA 210 Regulations, are you not?

A. At the federal level, yes.

Q. Would you agree with me, as a general statement, that what these regulations are designed to do is to encourage cogenerated energy by providing that cogenerators are to receive energy credits equal to the utility's highest cost source of energy which is displaced; is that correct?

A. Yes.

Q. At page 21 of your prepared direct testimony, Mr. Chernick, lines 1 through 5, you state, "If rates for power purchased under PURPA are based on the same avoided

costs PECo uses in evaluating the economics of Limerick, the incentives for independent power production will increase substantially in the next couple of decades."

Do you see that reference?

A. Yes.

Q. I guess I ought to back up here. In your avoided costs that you used in your tables, Mr. Chernick, I think you indicated that that data was taken from the company's response to IR-OCA-2-25b; is that correct?

A. Yes.

Q. So they are company-supplied figures. You did not generate or derive them yourself.

A. No. The only calculations I did were to essentially add together the fuel savings and the Limerick fuel to get the value, the cost of the fuel and purchased power which was being replaced.

Q. So I am correct, Mr. Chernick, am I not, that in your analysis you did not review the cogeneration filing that PECo is required to make to the Commission every year, such as the last PURPA filing they made on July 25, I think it was, 1985? Is that correct?

A. No. I don't believe I have ever seen one of those.

MS. CHESTNUT: Your Honor, I have extracted the projected and levelized energy cost portion of that filing.

I would like to have that marked as Staff Exhibit No. 22.

JUDGE MATUSCHAK: What number?

MS. CHESTNUT: Staff Exhibit No. 22.

JUDGE MATUSCHAK: Very well.

(Whereupon, the document was marked as Staff Exhibit No. 22 for identification.)

BY MS. CHESTNUT:

Q Mr. Chernick, I have extracted that page. I also have the entire filing here for you to review, if you could take a minute.

(Witness perusing documents.)

BY MS. CHESTNUT:

Q. Have you had a chance to review that document, Mr. Chernick?

A. Yes.

Q. Can you tell us how the avoided cost numbers listed on Staff Exhibit No. 22 compare to the avoided cost dollars supplied by the company to IR-OCA-2-25(b) that you have utilized in your analysis?

A. The figures used in this case for avoided costs are much higher than those used in Exhibit No. 22, comparing the annual all-hours to the data used in this case.

Q. Now, if you refer back to the sentence I had you read on page 21 of your testimony, Mr. Chernick, am I correct that it is your opinion that the cogeneration charges to be paid by PECo should be the same as the avoided costs they used in evaluating the economics of Limerick? Should they be the same?

A. In general, they should be very similar. You might see some discrepancies based upon exactly how they are being calculated.

For example, for 1986, the cogeneration filing gives 3.49 cents, and my Table 2.5 calculates PECo's figures for this case as being 3.84 cents.

Now, that could be because of different weightings across different times of the year, assuming that for example

Limerick is refueled in the winter and so therefore it is out when costs are lowest.

But by the time you get down to 1994, the differentials are too large to be explained in that way.

Q. You have pointed out that there is a discrepancy between the avoided cost numbers supplied by PECo in its PURPA 210 filing and the avoided costs PECo supplied for use in this proceeding, is that correct?

A. Yes.

Q. In your opinion, do you think it is appropriate for the cogenerators to receive payments based on the ... avoided costs supplied by PECo in this proceeding?

A. Well, I guess my problem in answering that is that I haven't reviewed the derivation of these figures enough to have a good sense of why they differ.

What you would really like to do is pay small power producers what they are worth to assist them. And if PECo's avoided costs in this case are really reasonable projections, then you would want to use those for both purposes.

On the other hand, if the figures in the cogeneration filing were reasonable projections of PECo's avoidable costs, then you might want to use those in both this proceeding and the cogeneration proceeding.

I think it is a good idea in general to expect utilities to use basically the same assumptions both when

they are determining the value of their own plants and when they are determining the value of other people's plants.

But for the ratepayers' sake, I think it's a good idea not to just take the higher of the two in all cases. You really want to think about what is going on. But they certainly should be consistent.

MS. CHESTNUT: Thank you, Mr. Chernick.

That's all the questions I have, Your Honor. I would like to move in Staff Exhibit No. 22.

JUDGE MATUSCHAK: Any objections?

MR. CALVERT: Your Honor, I haven't checked it against the filing, but assuming it's accurate, I have no objections.

JUDGE MATUSCHAK: Staff Exhibit No. 22 is admitted into evidence.

(Whereupon, the document marked Staff Exhibit No. 22 was received in evidence.)

JUDGE MATUSCHAK: Any further cross-examination of this witness?

MR. CLARK: I have a few questions, Your Honor.

CROSS-EXAMINATION

BY MR. CLARK:

Q. Mr. Chernick,my name is Roger Clark, and I am with the Governor's Energy Council. I would like to turn your attention first to page 30 of your testimony. You are

addressing on this page the subject of energy cost savings. Ms. Chestnut asked you a couple of questions about this.

Would you please explain for me your answer on page 30, how or where you got the numbers that describe the increase in the savings value of power?

A. Well, basically, if you look at Table 2.5 or at Table -- actually, 3.1 gives you more of the derivation of the numbers.

In there, I calculate the fuel savings, that is the difference between Limerick fuel and displaced fuel and purchased power that PECo projects.

And I add to that the cost of Limerick fuel, both of those stated in dollars per megawatt-hours, and get in Column 6 the total cost of the avoided energy in dollars per megawatt-hour.

And as you can see, those avoided costs rise very rapidly over time. And I believe the 16.7 percent is simply the compound growth rate from the $38 in 1986 to the $1,256 in 2024.

That is just the rate at which PECo is saying the value of a megawatt-hour produced by Limerick will increase.

Q. Have you been able to determine what could possibly cause the dollars per megawatt-hour in avoided energy costs that Table 3.1 shows? What is happening in terms of their generation mix to give you those figures?

A. Table 2.5 is more helpful for addressing that issue, although I prepared it for a different reason. In Column 4, I take PECo's projection of No. 6 oil, 1 percent sulfur --that is typical efficient steam plant oil cost -- and compare that to PECo's avoided cost, and calculate what heat rate would give you that fuel cost if that were your marginal fuel.

And we see that for the first five or six years, the heat rate would be very low. In other words, if that were your fuel, you would have to have an extremely efficient plant in order to have that low an avoided cost.

Well, that is not a surprising result, because PECo says that it is going to be backing out some coal with Limerick, and coal of course will be cheaper than your 1 percent sulfur oil, and you will be purchasing from other utilities who have coal or other inexpensive resources, so you would expect to see those low heat rates in the first few years.

Q. So, those numbers for the first few years are reasonable, in your mind?

A. Yes. And they would be a mix of efficient oil with some coal and with some economy purchases. In the next couple of years, in say 1992 and 1993, you get up to the kinds of heat rates you would expect for a plant which would actually be burning 1 percent sulfur oil; 10,000, maybe

11,000 for some of the older ones, a lot of those being retired, but I think there are still a couple left on the system.

Past 1993, the heat rate at which that avoided cost would make sense for 1 percent sulfur oil goes into the 13,000 and 14,000 Btu range.

Now, I don't think that there are any steam oil-fired plants on PECo's system which are nearly that inefficient. Therefore, what we are really seeing is that you are burning a fuel more expensive than No. 6 oil, that is you are burning No. 2 oil, and you are burning it at a bad heat rate, at a high heat rate in gas turbines.

So, in the 1995 period on into the next century, apparently either combustion turbines or power purchased with combustion turbine costs being part of the formula, the split savings with the combustion turbine being PECo's end of the calculation, that must be supplying a fair amount of the power.

Presumably, off-peak, April Sunday mornings, you are still going to have some very efficient oil or even coal plants being backed out.

So, you've got a range here of some very cheap fuel, these very expensive peakers, and some of your efficient oil in between.

And then, once we get past about 2010, we start to

fall back into a more normal kind of situation in which the marginal unit is no longer a peaker very much. The average heat rate is around 11,000 Btu or a little higher, indicating that probably you've got efficient oil a lot of the time, peakers a little bit of the time, something cheaper like coal or a nuclear based purchased power part of the time.

So that, the bulk of that increase is caused by first high increases in fuel prices, and secondly going from a mix with a lot of cheap power available to an assumption that you are going to be running peakers a lot or buying power at peaker-based prices a lot, and then back to a more intermediate position.

MR. CLARK: Thank you, Your Honor. That is all my questions.

JUDGE MATUSCHAK: Any further cross-examination of this witness?

MR. KLEPPINGER: No, Your Honor.

JUDGE MATUSCHAK: Any redirect?

MR. WIDOFF: May we have a moment, Your Honor?

JUDGE MATUSCHAK: Let's take a 10-minute recess.

(Recess.)

JUDGE MATUSCHAK: When you are ready.

REDIRECT EXAMINATION

BY MR. WIDOFF:

Q. Mr. Chernick, you recall you were questioned by Mr. Calvert with regard to some cross-examination in the PP&L rate case at R-842651, and Mr. Calvert was kind enough to allow me to refer to the specific page of the transcript.

And at this time, I would like to refer you to page 1515 of the transcript in that proceeding, and ask you if the full answer to the question in which you were quoted puts your statement in context, and whether there was in fact a typographical error in that transcript.

MR. CALVERT: Your Honor, I object to the question on the basis that this is a transcript of a hearing which was utilized for purposes of this Commission to act.

It did act based on this transcript. I asked the witness whether or not that transcript was ever corrected to reflect some other meaning than what it states in black and white, and he said no, not to his knowledge.

And therefore, for him to now come and correct a transcript which has already been utilized and acted on by the Commission I think is improper. I would object on that basis.

MR. WIDOFF: Your Honor, I think that first of all the witness should be permitted to provide you the entire answer so that the particular quotation that Mr. Calvert

took out may be put in context, and so that Your Honor can see what the context was of that statement.

With regard to the other point, I would like the witness to be able, after reading it, to indicate to you why there is one particular word that is clearly out of context, and that simply does not make sense when you hear the entire answer.

JUDGE MATSUCHAK: We will overrule the objection until we hear what the transcript reads.

THE WITNESS: The question in this previous proceeding asked me, "And worrying about what they pay for Susquehanna, you have given no weight to whether they benefited from what was paid by the customer back in the sixties and seventies for some particular PP&L units, is that correct?"

And my answer was, "I don't see the connection. To the best of my knowledge, the consumers in the 1960's and 1970's were probably glad to have those plants when they came on line or soon thereafter for reliability and energy saving purposes, for economic dispatch purposes, and therefore they weren't taxed in the same sense that I am referring to here."

And then I go on to the sentence which counsel for the company has quoted, which reads, "But certainly the customers today are better off because those plants were put in

service, and probably the customers at the time in the 1960's were better off when the plants weren't in service."

I would assume that what I meant to say at the time was, "went into service," and that would be consistent with the previous sentence, where I say that the consumers in the 1960's and 1970's were probably glad to have those plants.

MR. CALVERT: Your Honor, I would move to strike the correction to the transcript on the basis of my former objection.

JUDGE MATUSCHAK: Well, we can't change the record in this proceeding, and the witness does not deny that the record is as it is.

But if he wishes to indicate that he meant something else, we will overrule the objection and deny the motion to strike.

BY MR. WIDOFF:

Q Mr. Chernick, you were asked by counsel on cross-examination if you have ever filed testimony on behalf of a public utility company, and you indicated you had not.

Have you ever provided consulting services to utilities regarding their nuclear investment?

A Yes, I have.

Q And would you indicate in general the types of services? I suppose my question specifically describes the

type of services; do you want to indicate the utility companies?

A. Yes, I can certainly do that. I have done some work for a group of the WPPSS participants in the Pacific Northwest with regard to their investments in Units 4 and 5 of the WPPSS undertaking.

I provided consulting services to Dayton Power and Light in connection with the Zimmer plant, and to Southern California Edison in connection with the review of the prudence of construction of San Onofre 2 and 3.

Q. On cross-examination, counsel asked you specifically with regard to Table 4.2, and asked you the significance of the R-squared factors that are shown on that table.

You explained that they show that less than 20 percent of the year to year variation can be explained by the equation.

Would you explain please, what is the practical significance of this?

A. Well, the practical significance is that annual capacity factors fluctuate considerably, even for individual units. And no matter what you do to try and adjust for that in an engineering sense or an econometric sense or whatever, you are going to see wide variations.

Sometimes a plant will be refueled in six weeks, and sometimes it will take 16 weeks, and sometimes that refueling

outage will stretch on for 60 weeks for major backfittings.

It is not realistic to expect a regression equation or an engineering explanation to predict the capacity factor of an individual unit in an individual year with any great precision, because of that kind of variability.

Things don't break in any systematic, measurable, predictable way in detail. Now, in the long run, you can do a much better job. And the significance of the coefficients indicates that all of the factors which I have identified here do make some kind of difference in terms of determining the performance of the plants.

And if we wanted to predict exactly what the performance of Limerick would be in 1986 or 1987 or 1988, we would have a real problem on our hands because nobody would have a very good idea of how to do that.

And no matter what number you came up with, you would almost certainly be wrong, and probably wrong by a fair amount.

What the company is doing, what Mr. Komanoff is doing, what I am doing, is projecting sort of an average, long-run trend. I don't think any of the parties would claim that they have nailed down what the 1994 capacity factor will be, but that each of us feels we picked for 1994, for example, a capacity factor which is representative, and over the long run, our capacity factor will be close to the

long-run average that the plant actually achieves.

I wouldn't expect that any of the parties would, after the fact, have gotten any better than predicting 20 percent of the variation from year to year of Limerick's performance, when we look back 15 years from now at even the best of whichever one of those three forecasts turns out to have been most accurate on average.

So, the practical significance of a low R-squared for something like capacity factors which inherently vary a lot from year to year, or capital additions, for that matter, a low R-squared is not surprising and is not a cause for any great concern.

Q. Directing your attention to your Figure 2.2, counsel directed you to that figure and questioned you with regard to the caption that refers to a winter peak.

And you indicated that that would certainly be incorrect. Have you had an opportunity to review some of your source material during the break, and do you wish to make a correction on that figure?

A. Yes. The figure is not meant to be read very precisely, so that it is difficult to pick particular data points off.

But it appears from the location of the actuals and comparing that to the load data which was in front of me, which happened to be that 1984 report to the FERC from PJM,

which is DR-Staff-LIM-10, that the PECo load shown in that table for summer is consistent with the actuals shown on the figure, and it is my belief that the error on this table is simply that the caption on the vertical axis is incorrect and should read "Summer Peak Demand" rather than "Winter Peak Demand."

Q. Finally, Mr. Chernick, with regard to Table 2.1, counsel questioned you with regard to that table and with regard to your use of combustion turbines as opposed to other types of capacity for replacing Limerick 1.

I wonder if you would explain, please, to the Administrative Law Judge why you used combustion turbines in performing that exercise.

A. I didn't use combustion turbines because I thought that would have been the optimal way of planning the PECo system in the absence of Limerick 1.

Rather, what I am trying to do here is estimate the total benefits generated by Limerick 1. And we already have an estimate of the fuel savings benefits for Limerick, assuming no replacement efficient capacity.

So that, as I pointed out, once we get several years out into the future, combustion turbines are going to be running a fair amount of the time, or the combustion turbines will be the basis of purchased power pricing.

Therefore, it would be inappropriate to add in the

cost of some more efficient kind of capacity, say a coal plant, without modifying those production costing runs to reflect the lower cost of replacing Limerick energy with coal energy rather than replacing it with gas turbines and existing oil and so on.

So therefore, I added in the combustion turbines, which have no fuel savings effect, that is they are not going to be any cheaper to run than the combustion turbines that PECo already has, and are not going to be any cheaper than purchases from other members of the pool.

So, I calculated the cost of the avoided capacity based on combustion turbines, because that was consistent with the energy cost savings figures that I had.

If I could have redone production costing runs with a mix of new plants, I would have done that, and we would have wound up with lower savings due to Limerick, lower benefits in the longer term.

MR. WIDOFF: That's all we have, Your Honor.

MR. CALVERT: Your Honor, I just have a couple of fairly quick questions.

RECROSS-EXAMINATION

BY MR. CALVERT:

Q. Mr. Chernick, when you were being cross-examined by Mr. Clark, you referred to your Revised Table 2.5?

A. Yes.

Q. And you referred to the heat rate column, which I believe is Column 4?

A. Yes.

Q. And you were hypothesizing as to what might have been the cause for the various heat rates to go up, I believe beginning in 1993 or 1994 until some time after the turn of the century.

Am I correct that scrubbers that are put on fossil fuel plants have the effect of increasing the heat rates?

A. Yes, somewhat.

Q. And that is because you are utilizing energy basically to run the scrubbers?

A. That is correct.

Q. And am I also correct that beginning in 1993 is when PECo has assumed that scrubbers for both SO_2 and NOX would go on its various plants?

A. I would have to check the details of that in the information response, but that would be about the right timing.

Q. I have here GEC Exhibit No. 3. I will be happy to show it to you, if you would like. I think I have opened it to the page, which is Item 1.

(Document handed to the witness.)

A. The acid rain benefits start in 1993, so that

would be about the right timing.

Q. And that would be consistent with a heat rate increase in your Table 2.5, I take it, during that time frame?

A. It would cause some heat rate increase, although since those scrubbers would be primarily on the coal plants and since coal clearly is not a marginal fuel, is not affecting the avoided cost very much -- not much of that cost can be coal, because coal should be considerably cheaper than the oil -- I don't think that that would have a big effect on those averages.

But some of the off-peak energy savings may be coal, and those may be a little bit less efficient because of the scrubbers.

But if you look at the relative size of the two effects, the fuel savings without the acid rain effects are on the order, for example for 1993, of $423 million, and the acid rain effects which include O and M and capital investments are -- excuse me, fuel savings is already in there.

Q. Let me ask it this way: You haven't done an analysis which would indicate the amount of the heat rate increase that would be referable to the acid rain effects that you just indicated?

A. Again, I haven't looked at that specific issue,

but the increases from roughly 10,000 Btu per kilowatt-hour to 14,000 Btu per kilowatt-hour are just the wrong order of magnitude for those effects.

You might see a change of 50 or 100 or a couple hundred Btu per kilowatt-hour, but moving up to 14,000 Btu per kilowatt-hour is just not a plausible effect of modern scrubber technology.

Q. But some effect?

A. There would be some, yes.

Q. Now, you have also indicated that you had done some consulting work for some public utilities, and I think you mentioned three companies. Did you prepare written reports for those companies, for the work you did?

A. There were written products for all three clients. There is nothing that is public from the first two.

Q. Meaning the WPPSS unit and Zimmer?

A. That is correct. I contributed to the testimony of Dr. Irvin C. Bupp on behalf of Southern California Edison. There is no separate product with my name on it.

Q. What about with respect to the WPPSS and the Zimmer products? Were those yours alone?

A. Well, they were either products that were mine or there were portions of reports which were primarily mine.

Q. I would like to make a data request for the WPPSS and the Zimmer plant projects, the reports that you did, or

at least the portions that you did, and also a copy of whatever you did for Southern California Edison that was incorporated in Dr. Bupp's presentation.

MR. WIDOFF: May we have a moment, Your Honor?

(Pause.)

THE WITNESS: I don't have any problem with providing the SCE testimony. As I said, there aren't any public documents from the other two pieces. It is my understanding that Dayton considers all of the work that we did for them proprietary, and they have indicated that if we do similar work for anyone else, we have to do it afresh.

We are allowed to remember how we did it, but we can't use their figures or tables. And the WPPSS matters are still in litigation, and I am quite sure our clients would not allow us to release anything.

BY MR. CALVERT:

Q. Did those reports relate to matters such as estimations of capacity factor and capital additions and nuclear O and M, non-fuel O and M?

A. I think there were some on capital additions, but primarily all of those issues involved capital costs of plants and scheduling issues.

Q. So that basically they were issues unrelated to the testimony you are giving here today?

A. I wouldn't say unrelated to, but they certainly

aren't exactly parallel. They involve issues such as the overall reliability of nuclear plant cost estimates and schedule estimates.

Q. But you are not testifying about that in this proceeding. All I am trying to get at is, what information did you provide to Dayton and to WPPSS that would be equivalent or similar to the information that you are testifying about here in this case?

(No response.)

Q. You mentioned perhaps some cap. adds. Is there anything else?

A. No. The testimony dealt substantially with nuclear construction issues rather than operating issues.

Q. And with respect to the cap. adds. analysis that you did for them, did you use a regression equation approach, or did you use an extrapolation approach as you have done in this case?

A. I'd say our work on capital additions is very similar to what we did in this case.

MR. WIDOFF: Just for clarification, Your Honor, based on the witness' response, so that the company is on notice, we will provide the public information that is available. With regard to that information that the utility companies consider to be proprietary, we are not at liberty at this time to provide it.

MR. CALVERT: That's all right. To the extent that it relates to things other than what he is testifying about here, I withdraw my request, because I am not trying to pry into other people's business.

JUDGE MATUSCHAK: Very well.

Is there anything further?

(No response.)

JUDGE MATUSCHAK: The witness is excused.

(Witness excused.)

JUDGE MATUSCHAK: Do we have another witness?

MR. CALVERT: Your Honor, I think that is it for the witnesses we have today.

MS. CHESTNUT: Your Honor, if you wanted to go further today, I have Mr. Hall available. He was scheduled for tomorrow, but if you want to take him now, we could do it.

JUDGE MATUSCHAK: What is the pleasure of counsel?

MR. CALVERT: Your Honor, I think as a practical matter, Mr. Hall is going to be cross-examined by Mr. Hall. And as a result, he is not available, because they had planned to do it tomorrow. So, I think, with Your Honor's permission, we would do it tomorrow as scheduled.

JUDGE MATUSCHAK: Is the consensus to adjourn at this time and to continue tomorrow?

(No response.)

JUDGE MATUSCHAK: Very well. We will adjourn at this

time, to reconvene tomorrow at 10:00.

(Whereupon, at 4:05 p.m., the hearing was adjourned, to be reconvened at 10:00 a.m., Tuesday, February 11, 1986, in Harrisburg, Pennsylvania.)

C E R T I F I C A T E

We hereby certify, as the stenographic reporters, that the foregoing proceedings were taken stenographically by us and thereafter reduced to typewriting by us or under our direction; and that this transcript is a true and accurate record to the best of our ability.

COMMONWEALTH REPORTING COMPANY, INC.

By: Robert J. Stonaker

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By: John A. Kelly

John A. Kelly

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