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Before

THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

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In re: R-79060865, etc. - Philadelphia Electric Company. Investigation into a requested $123 million annual rate increase.

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Harrisburg, Pennsylvania

December 5, 1979

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Before

THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

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In re: R-79060865, etc. - Philadelphia Electric Company. Investigation into a requested $123 million annual rate increase.

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Stenographic report of hearing held in Hearing Room No. 2, North Office Building, Harrisburg, Pennsylvania,

Wednesday,
December 5, 1979,
at 10:20 o'clock a.m.

--oOo--

JOSEPH KLOVEKORN, ADMINISTRATIVE LAW JUDGE

--oOo--

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MR. SAYRE: Your Honor, I want to give notice to the parties that an order will be coming out reflecting the Commission's ruling in public session on the 29th of November, directing that the parties of record be notified that the Commission intends to take official notice of the management audit and the findings contained therein in this rate case proceeding, R-79060865.

Because of that Commission order, it is Trial Staff's position that no one will be sponsoring the management audit and that it is up to any parties who wish to raise objections to the Commission's official notice to do so in a timely fashion in this proceeding before Your Honor.

I also understand that the Managing Director of that project, Mr. Guernsey, will be available on December 13 in Harrisburg for questioning on the record by all parties.

The second matter I would like to bring up, Your Honor, is to read into the record --

THE ADMINISTRATIVE LAW JUDGE: Do you know how the parties are to obtain copies of this management audit?

MR. SAYRE: The Commission has directed that the report be made public. I am aware that the Commission had only a very limited number of copies for internal distribution, and in fact I have had a good deal of trouble getting ahold of one myself.

I don't know what arrangements have been made for the other parties.

THE ADMINISTRATIVE LAW JUDGE: Will you supply me with a copy of that order of the 29th?

MR. SAYRE: It has not been issued. This is just what I understand took place orally at the meeting and I wanted to give advance notice. When the order comes out I will make it available to everyone.

MR. SEGAL: Your Honor, if I may, I would request on the record at this point that the Commission provide all parties with a copy of that audit as quickly as possible.

THE ADMINISTRATIVE LAW JUDGE: Apparently we are dealing with an audit that is not an order.

MR. SEGAL: The audit, yes.

MR. SAYRE: I cannot speak on behalf of the Commission, Your Honor. I can only speak on behalf of the Trial Staff and we have not been furnished extra copies. In fact, we were only able by scrounging to get one for ourselves.

THE ADMINISTRATIVE LAW JUDGE: It seems unusual, doesn't it, that something that is going to be a part of the record here that nobody has any copies of it?

MR. SAYRE: I will tell you, Your Honor, I was not a participant in that meeting or in any reports that led up to it.

MR. SEGAL: Your Honor, I would say for the

record that notwithstanding Mr. Sayre's plight we feel that we would seriously be deprived of our right to cross-examine concerning this document if we are not provided with a copy as quickly as possible.

THE ADMINISTRATIVE LAW JUDGE: Mr. Segal, I feel slightly handicapped, too, because I don't have a copy.

MR. SAYRE: All I can say, Your Honor, is that copies are available for examination.

THE ADMINISTRATIVE LAW JUDGE: Where?

MR. SAYRE: I presume in the File Room.

MR. HALL: Of course, the question, Your Honor, is whether or not it is proper for the Commission to take official notice of it. If the Commission can take official notice of it whether we have a chance to look at it or not is irrelevant.

The question is whether or not under the statute they can do that.

THE ADMINISTRATIVE LAW JUDGE: Your next point, Mr. Sayre?

MR. SAYRE: Thank you, Your Honor. I would like to read into the record by stipulation with Mr. Hall the answer to a transcript request that I made of Mr. Hill at Transcript 117. The question was: Please provide your estimate for the in-service date for scrubber equipment at Eddystone Station.

The answer supplied by the company is as follows: Under the consent agreement between the company and the EPA the scrubber equipment at Eddystone Station must be fully operational by December 31, 1982. However, part of the project dealing with the particulate scrubbing at Unit No. 1 must be operational by March 1, 1981.

I would like a stipulation entered into the record that that may be considered as evidence.

MR. HALL: Yes, that is no problem.

MR. BURGRAFF: Could we have for the record the number of the response?

MR. SAYRE: That is TR-1Q2. I think everybody got a copy.

I would also like at this time to distribute the staff's testimony on the Limerick issue, Statement REN-2 and DLB-2 and also Dr. Birx's answers to the interrogatories that the company directed to him, which are submitted pursuant to Your Honor's order under protest. The staff would wish to reserve its right to except, if it feels necessary, at the appropriate time to Your Honor's order.

I am ready to put Dr. Birx on now, Your Honor.

THE ADMINISTRATIVE LAW JUDGE: If there are no more preliminary matters.

DONALD L. BIRX, called as a witness on behalf of Commission Trial Staff, having been duly sworn according to law, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. SAYRE:

Q Dr. Birx, could you state for the record your name, address, employer and position.

A It is Donald L. Birx, my address is the Pennsylvania Public Utility Commission, Post Office Box 3265, Harrisburg, Pennsylvania, and I am the Electric Industry Advisor with the Energy Division of the Bureau of Rates.

(Trial Staff Statement No. DLB-1, document entitled Direct Testimony of Donald L. Birx Concerning Valuation, was produced and marked for identification.)

BY MR. SAYRE:

Q Do you have before you a document marked Trial Staff Statement No. DLB-1 including testimony and a large number of schedules?

A Yes, I do.

Q Was the testimony portion of it prepared by you?

A Yes.

Q Were the exhibits prepared by you or under

your direct supervision and control?

A Yes.

Q Do you have any corrections or additions that you wish to make at this time to your statement or exhibits?

A There is one I thought should be made. I am not sure if it just occurs on my copy or whether it got out.

On Schedule 6 of the exhibits about one-third up from the bottom of the page in the line identified as Eddystone 3 & 4, under the original cost column, there I have an extra one on the end of that number which should be deleted. It should read 224 million 775.

Q Is that all?

A I think so.

Q If I were to ask you the same questions as are asked in your testimony today, would your answers be the same?

A Yes.

Q Are the facts and opinions in your statement and exhibits true and correct to the best of your knowledge, information and belief?

A Yes.

MR. SAYRE: Dr. Birx is available for cross-examination.

CROSS-EXAMINATION

BY MR. HALL:

Q Good morning, Dr. Birx.

A Mr. Hall.

Q How are you this morning?

A Fine.

Q Dr. Birx, as stated in your Appendix A setting forth your qualifications, following the receipt of your Doctorate degree you were employed for approximately 16 years at the Franklin Institute Research Laboratories, is that correct?

A That is correct.

Q While you were in that organization's employ did you perform any depreciation studies?

A No, not depreciation studies.

Q Also, as indicated in Appendix A, following your employment at the Franklin Institute you were employed for approximately three years at the General Electric's Space Division. Did you while in the employ of General Electric prepare any depreciation studies as we would understand that term for regulatory purposes?

A We were concerned about the lifetimes of equipment and we did quite a few analyses with regard to that; but depreciation as we normally do it here was not part of that work, no.

Q Following that employment Appendix A indicates that you were employed by the Hamilton Watch Company. Did you during the approximate 7-year period that you were employed by that company prepare any depreciation studies?

A No.

Q Now I believe you have indicated in your statement that you first joined the Commission in August of 1977, is that correct?

A That is correct.

Q What was your first assignment with the Commission?

A I think that is listed there also. Mainly I was concerned with PRMD-7 at that time.

Q What was the subject matter of that proceeding?

A That was a generic rate structure study.

Q Am I correct that that did not involve depreciation issues?

A That is correct.

Q Since January of 1978, I take it, you have been in the Electric Utility Evaluation Section of the Commission's Trial Staff?

A That is correct.

Q And that section is responsible for depreciation matters, is that correct?

A That is correct.

Q And that has been your principal responsibility?

A That is correct.

Q Now in that role, am I correct that the principal function has been the reviewing and analyzing of depreciation studies which have been presented to the Commission by utilities seeking rate increases?

A That probably is a large part of the work, yes.

Q Is there anything in addition?

A Well, where necessary we make our own adjustments to what the respondents have submitted.

Q However, do I understand correctly that it is not part of this responsibility to actually prepare depreciation studies, shall we say, from the ground floor up?

A Not from the ground floor up.

Q In your prepared statement in this proceeding you have proposed, have you not, a 40-year life span for use in depreciating nuclear plants?

A That is correct.

Q In arriving at this recommendation, Dr. Birx, have you relied upon data which has only become available within the last several months or is this data which, in your opinion, would have been available over the last several year period?

A I don't know if you have something particular

in mind. There are two studies referred to in the text, one of which is very recent and the other one which was put out in 1975, plus the data that we had available to us from the respondents.

(Transcript continues on Page 2662.)

Q With the exceptions?

A All the rate cases.

Q With the exception of the study by Mr. Sivulich which I understand is relatively new?

A Yes.

Q I take it all the other data is data that has been in existence for some time. It may have been presented to you in this case. It probably was proper in other prior cases as well, but was available for review in this case?

A 1975 isn't too old.

Q Am I correct that Mr. Sivulich's study was principally employed in your determination with respect to the depreciation recommendation which you made for the company's fossil fuel plants in this proceeding?

A Principally?

Q Principally.

A I don't know if I would give it that characterization. It was one of the elements.

Q Is it not true, Dr. Birx, that in the Philadelphia Electric Company's last electric rate proceeding at RID-438 that the Commission Trial Staff proposed a 40 year life span for this company's nuclear plants or depreciation of this company's nuclear plants?

A That's correct.

MR. HALL: Your Honor, based on what I would

term the blindman's bluff theory of regulation which have been proposed here by some parties with respect to various issues in this case, it seems to me this is an issue similar to the company's Salem issue whereas virtually all of the data which Dr. Birx has relied upon in his analysis and I believe all of it as to nuclear plants was available at the time of the last case, was in fact considered by a Commission witness who presented the same recommendation in the last case, which recommendation was rejected by the Commission, I will at this time move to strike pages 6, lines 16 through page 11, line 3 of Dr. Birx' testimony on the grounds of res judicata.

Now, as Your Honor is doubtless aware, I do not believe that that is a valid motion to strike. I have argued strenuously in this proceeding that res judicata does not apply to regulatory proceedings of this nature. I still hold to that opinion. However, I do not have Your Honor's order as to the Salem matter before me and if, indeed, that order establishes the opposite rule of law, then to protect my clients and take advantage of that rule of law, I propose this motion.

I would suggest that we hold it in abeyance. I'm prepared to go forward with Dr. Birx and that we act upon the motion at some future time, when it becomes known that Your Honor will rule.

MR. SAYRE: Trial Staff will, of course, vigorously oppose the motion and I might point out to Your Honor that Trial Staff did not take a position in the prior argument over whether res judicata applied to the Salem 1 adjustment.

MR. HERSHEY: I would add only that at the time we know the order on the Salem 1 issues, we have a chance to examine that order and its application to this situation and to make argument on the applicability of that order to the situation.

MR. HALL: I would agree with that comment and that's the reason I have suggested that the motion be held in abeyance.

MR. BURGRAFF: Yes. We likewise will reserve our position until a later time. Could I ask Mr. Hall to repeat once againthe particular information? I got through page 11, but I missed the line.

MR. HALL: It was page 6, line 16 through page 11, line 3. It is the testimony that deals with the nuclear plant proposal.

MR. BURGRAFF: Thank you.

MR. HALL: Proposed forty year life for the nuclear plant.

THE WITNESS: I beg your pardon. It is not.

MR. HALL: It is not?

I will amend that. You are correct, Dr. Birx. It should begin at line 22 on page 6. Is that the correction that you wish to make? Other than that, it does deal with nuclear plants, through that period. Or through those pages?

THE ADMINISTRATIVE LAW JUDGE: I will take the motion under advisement.

MR. SAYRE: And I also understand that your motion would except table A?

MR. HALL: That's correct. It would not include table A.

THE WITNESS: Did you say through page 11? What page did you say?

MR. HALL: Page 11, line 3.

THE WITNESS: Okay.

BY MR. HALL:

Q Dr. Birx, would you agree that the function of the depreciation allowance is to recognize that all property used in utility operations wears out or becomes less useful over time and must be replaced?

A Yes. That's the basic principle.

Q And would you further agree that a principal element of depreciation or of the depreciation concept as used for regulatory purposes is physical depreciation caused by wear and tear, action of the elements and other physical injuries?

A. Yes.

Q. Finally, would you agree that a second principal element of the depreciation concept as used for regulatory purposes is functional depreciation? And I will define that somewhat more specifically as including obsolescence, inadequacy, changes in the art or Government requirements?

A. Yes. The weight of these various things keeps changing with time, of course, Present day, there's being more consideration given to extending the life of plants by replacing elements than there is towards building entirely new plants.

Q. And what do you base that opinion on, Dr. Birx?

A. Well, statements by PP&L that this is the way they intend to go, statements from Duquesne that this is the way they intend to go and I think it is generally recognized in the industry that you can refurbish a plant for the order of $200.00 a kilowatt where a new plant would cost you $700.00 or $800.00 a kilowatt.

Q. Could you tell us who at PP&L made these statements?

A. Well, it was Shaffer in Duquesne. I don't recall the name for PP&L.

MR. SAYRE: Are you requesting that name or not?

MR. HALL: No. I do not request that you provide the name for me.

BY MR. HALL:

Q On page 7 of your prepared statement, Dr. Birx, you state that you have done considerable research with regard to the life of a nuclear plant. Am I correct that the various elements which comprise this research are set forth in your testimony and in the response to the interrogatory requests that we made to you with regard to the nature of this research?

A Most of them. Not all.

Q And what would not be included?

A Well, as you recall, in the answers to those interrogatories, the procedure from which I reached my conclusions involved first of all, comparing a nuclear plant with a fossil plant and I think we will agree that the primary consideration when one is comparing life would be what's the life of the steam generator of a nuclear plant compared to the life of a steam generator of a fossil plant, since all the rest is pretty similar.

So I concentrated my efforts on the steam generating portion and it is true that you have most of the material there. There is one other report which I didn't think of including. It is a Government Accounting Office report in which they are concerned about the life of the reactor vessel, itself, particularly with regard to whether it would last long enough to contain all the reactive elements for a length of time necessary for the radioactivity to decay

to a level at which dismantling would be feasible. And they estimated that after its use as a power plant, still with all the radioactivity in it, there would be no problems in having that vessel remain intact for over a hundred years.

MR. HALL: Your Honor, at this time, I would like to identify the response to the interrogatories that Dr. Birx sent to us in response to our questions as PECO Exhibit 5.

THE ADMINISTRATIVE LAW JUDGE: Without objection, it will be identified.

(Philadelphia Electric Company Exhibit No. 5, response to interrogatories posed by Philadelphia Electric Company, was produced and marked for identification.)

MR. BURGRAFF: Is that what was submitted today by the staff?

MR. HALL: Excuse me?

MR. BURGRAFF: Is that the same thing the staff submitted today?

MR. HALL: Yes.

BY MR. HALL:

Q Now, Dr. Birx, you indicated that you did not provide us with a copy of this Government report which you have just referred to, is that correct?

A Yes. I have it before me.

Q I take it did you not consider that a written document which was a basis of your conclusion as requested in

question five in our interrogatories?

A. No. Perhaps it - - I would say it was an oversight. It was one that I could not locate at the time that I filed the answers to the interrogatories.

Q. But with that additional document, I take it the rest of the material that we have before us reflects your complete research?

A. It is a good representation of my research, yes.

Q. Well, my question was did it reflect your complete research?

A. Will you settle for 99 percent?

Q. I will settle for 99 percent.

Doctor, I would like to examine the various elements that you list as the research on page 7 or as what constitutes the research that you undertook. As I take it, at least in my understanding, the first element is inspecting modern plants and noting the construction practices employed. Do I understand in that regard that you have visited three nuclear plants?

A. That is correct.

Q. One of those is an operating plant?

A. Peach Bottom.

Q. The other two are under construction at this time?

A. Correct.

Q. Could you tell me what type of units, what type of nuclear plants these are?

A. Feedwater reactors.

Q. Boiling water, pressurized water?

A. Boiling water.

Q. All of them are boiling water?

A. Yes.

Q. Now, I take it, Dr. Birx, were these one day visits to each of these plants?

A. Yes.

Q. Have you ever had any professional responsibility, Doctor, for either designing or operating a generating plant? Either a nuclear plant or a fossil plant?

A. Yes.

Q. You have?

And when was that?

A. When was that?

Well, my experience with the operation of a plant goes back to I guess about 1941 or '2.

Q. And have you had experience with operating nuclear plants continuously since that time?

A. Nuclear?

Q. Nuclear or fossil.

A. There weren't any nuclear plants at that time.

No. Not with the operation.

Q And what was the nature of your operating, your professional responsibility, with respect to operating in 1941?

A We operated a plant and conducted all the measurements required and made a complete heat balance analysis and an overall efficiency calculation of the plant.

Q Was this a large generating station employed in public service?

A About ten to twenty kilowatts.

Q And what was your position in operating this plant? What was your title?

A Student.

Q You were a student?

Did you have overall responsibility with respect to the operation or were you one of those who learned in the process?

A We shifted responsibilities over a twenty-four hour period so that we would each get a chance to do everything.

Q Since that occasion, have you had any other occasion to operate either a nuclear or fossil plant?

A No.

Q Now, with regard to design, Dr. Birx, I think you have indicated you have had some design experience with respect to the design of either nuclear or fossil plants,

is that correct?

A. Yes.

Q And what is the nature of that experience?

A. Again, that was mostly in college related studies which we designed plants. I have had occasions to do smaller projects at the Franklin Institute. For instance, Philadelphia Electric Company was one of our customers or sponsors as we called them at that time, so I did have an opportunity to work on various pieces, not the whole plant.

Q What would the nature of these pieces be?

A. Well, at the Franklin Institute, of course, for a number of years, we operated the computer for Philadelphia Electric and I guess it was the PJM group. I don't know if it was the PJM group at that time. It was a consortium of companies. One project that I do recall that fell to my responsibility and dealt with a feedwater gauge which we did some development work to improve the visibility and the accuracy of the gauge.

Q Did you actually go through the process of designing the gauge or was it a matter of designing a computer program?

A. Yes. We designed the gauge and particularly the optics associated with that.

Q Now, the next element that you mention on page 7, Dr. Birx, is talking to design engineers with respect to

nuclear plant lifespans and in response to our interrogatory question number three, answer three C, I believe you identified two design engineers. Is that correct?

A. Well, I identified all the people I talked to. I tried to.

Q. And I take it the first of these - -

A. I'm not sure of some of the titles of some of them.

Q. I take it the first of these was an unidentified Bechtel engineer?

A. That's correct.

Q. Who you spoke to on July 5, 1978. Do you recall that individual's position with respect to Bechtel?

A. No. He was just one of the ones that was showing us around the plant.

Q. Now, the second individual that you mentioned is Mr. Garland, who is the depreciation manager of the GPU Service Corporation. Would you agree with me, Dr. Birx, that GPU, in its most recent cases before this Commission, has not proposed a forty year life span for nuclear plants?

A. Oh, that's correct.

Q. And what has that company proposed?

A. It is hard for me to remember, but I think that - - I don't remember the exact number. I think that when it comes to nuclear, we have been beseiged by applications which

are for shorter lifetimes than we had. Usually, it was the licensing period originally. Then - - we ranged anywhere from twenty-eight years to thirty years. It fell in that area.

Q And in fact, would you agree, Dr. Birx, that that is what GPU has proposed in its recent cases which resulted in a range of around 32 or 33 years?

A It does on the length of construction.

Q You do agree that that's what they have proposed?

A Yes.

Q Now, did you testify in the recent Penelec and Met Ed cases on nuclear plant lifespans, Dr. Birx?

A Yes.

Q And was your testimony in that case substantially similar to what you have presented here today?

A Yes.

Q Do you recall what life span the Commission ultimately adopted for - -

A Thirty-five years.

Q Thirty-five years? Is that correct?

A Yes.

MR. SAYRE: I move to strike the last question and answer as being irrelevant in this case. Those orders can speak for themselves.

MR. HALL: They certainly can, but the witness did agree that that is in fact what they say. It is certainly

relevant to know what the result of his prior recommendations have been. And indeed, there is evidence included in that question to the extent that he presented the same material in those cases.

THE ADMINISTRATIVE LAW JUDGE: The objection is overruled.

(Transcript continues on next page)

Q Now the next element that you mentioned, Dr. Birx, as an element of your research in this proceeding, has been conversations with various NRC officials, is that not correct?

A Yes.

Q I believe in response to Question 3, Subsection A you mention three of those officials, do you not?

A Yes.

Q I take it these were a single conversation with each official occurring on August 21, 1978?

A That is an approximate date, and I am not sure that all of them were talked to on that date, but around that date.

Q But each one was a single conversation?

A That is correct, and I think I also provided scribblings, notes.

Q Yes, you did. Exhibit 5 includes that material. Now in addition to this research that we have just discussed, I believe you indicate that a principal basis of your conclusion with respect to 40 years for a nuclear plant is that nuclear plants are better constructed in your opinion than fossil plants and can be expected to have a longer life span, is that correct?

A That is correct, but that is not the only basis for my recommendation of 40 years.

Q I understand that, Doctor, and we will discuss the others later. Now you have indicated previously in responding to my questions, and you also indicate, I believe, at page 9 of your testimony, that you view nuclear plants and fossil plants, at least to the extent of two-thirds of the plant, as being -- and I think these are your terms -- identical in all respects, is that not correct? I think that is at lines 16 to 17.

A That two-thirds would be based on dollars, you understand. What we are distinguishing here, we are saying that other than the steam generators they are very similar.

Q I take it other than for the same generator part of the plant, you would view all of the other plants as being physically identical?

A I don't know that I know what you mean by that.

Q Well, in your conception of being identical in all respects, do you include that with respect to everything other than a steam generator a nuclear plant and a fossil plant are physically identical, it is the same pieces of equipment in the same general arrangement?

A In the sense that you would say that Chevrolets, Fords, Cadillacs all are the same.

Q Because they are generically cars?

A Yes.

Q Let's see if we can examine that somewhat, Doctor. One could have a Pinto and one could have a Cadillac. Would you agree that that would be quite a difference for certain purposes?

A (No response.)

Q Would the nature of similar in all respects between fossil plants and nuclear plants be that kind of a relationship, a Pinto to a Cadillac, or would it be some other relationship?

A Well, let's talk about a Chevrolet and a Cadillac. I am familiar with that. Let's talk about lifetimes, because that is what we are primarily interested in here.

I don't think that one could necessarily look at a Chevrolet and say it won't last as long as a Cadillac, or one can look at a Cadillac and say it won't last as long as a Chevrolet. One normally thinks of a Cadillac as being a superb vehicle. One of the interesting things that I picked up in my experience with Hamilton Watch was that for years Hamilton Watch supplied the clocks for Chevrolets; they could never break into the market for Cadillac because they could never build a clock cheap enough for Cadillac to buy.

Q In your view, Doctor, would the same principle apply with respect to nuclear plants and fossil plants? As I

understand the principle as you have stated it, there can be in the Cadillac, i.e., the nuclear plants, some materials that are cheaper --

MR. SAYRE: Objection to your characterization of Cadillac as nuclear plant.

BY MR. HALL:

Q I have been speaking of the Cadillac as the nuclear plant. Now if you disagree with that, Dr. Birx, you can state that in response to my question.

A I would not consider a nuclear plant as being a Cadillac. The life of a plant depends on a number of things, the maintenance that is afforded it is going to be important, and the quality of the parts that go into it are important.

To get back to the cars, again, I have got a car that my son is using out in California that has 190,000 miles on it, it has still got the same universal joints, it still has the same transmission.

I have got a 1976 truck that I use and I just had to replace every universal joint in the drive chain.

Now to me, I suspect that the universal joints that were put into that truck were faulty. If you go to the dealer and say, how come? He says, well, they don't make them the way they used to.

But if we are talking about nuclear plants, they better be making them the way they used to or they better

be improving the way they used to, improving on the construction, because the other problem with a nuclear plant is if you get down to a too short a lifetime, then you got a problem justifying the plant economically.

I think that with 40 years we are on the fringe of that right now. If we go to 30 years, if we are going to say the nuclear plant would only last 30 years, then it is not a viable economic investment.

I think if these companies come to us and keep wanting to shorten the lifetimes of nuclear plants because of all these other things, then we have a valid reason for going to them to prove to us, before we let it into the rate base, that it is still economically viable.

Q Doctor, do you have a written study that you can provide to us with respect to whether or not a nuclear plant at 30 or 35 years is economically viable?

A I have got lots of studies which I could direct you to which compare nuclear plants with fossil plants and they say, let's assume both plants at the same lifetime, and up until now, at any rate, over a good portion of the country -- it is not true in all portions of the country -- but over a good portion of the country the nuclear plant came out to the advantage.

Now if you start comparing a fossil plant with a 40-year lifetime against a nuclear plant with a 30-year

lifetime, I have not seen any studies of that nature done and I don't know what the answer would be, but I have my suspicions.

Q I take it Philadelphia was one of those areas where the matching of equal life spans came out to favor nuclear plants, is that correct?

A It did 15 years ago.

Q How about five years ago?

A Five years ago. But today, I don't know.

Q Now, Dr. Birx, you have indicated that it is your understanding that the normal life span for a fossil plant is 40 years, is that correct?

A I would like to consider it such, and I think that if you look at Dixon's testimony and so forth, there is fairly good agreement on that.

I will help you out to this extent. Nowadays people have been asking for shorter and shorter lifetimes, but this is primarily the result of the environmental problems they have run into, and they have had to retire plants earlier and so forth.

If we built a plant the way it should be built today, with the proper environmental considerations given to it, there is no reason in my estimation why it should not continue to perform as well as the older plants.

Q Mr. Dixon's testimony was given before the

U.S. Congress, was it not, back in 1954?

A Yes, because there was some uncertainty then over what lifetime nuclear plants should be depreciated and he argued that if we make the lifetime too short we are not going to be able to build them, they won't be economically feasible.

But he said 40 years was the normal lifetime for depreciating a plant.

Q Do you have anything to cite to us, Dr. Birx, which is somewhat more recent than 1954, which indicates that the normal life span for a fossil plant is 40 years?

A Well, look at the Sivulich study.

Q We will look at that in a minute. Are you familiar, Dr. Birx, with a study done by the Edison Electric Institute in 1978 with regard to depreciation rates and average service lives employed by their members in depreciating fossil fuel plants?

A Yes.

Q Are you familiar with the median average service lives that were found to be used by Edison Electric Institute members in that study?

A We can make them anything we want.

Q Can you tell us what the Edison Electric Institute found was in fact being used by these companies?

A I don't remember the exact figures.

Q Would you accept, subject to check, that it was 32 to 33 years?

A I would not be surprised.

Q Now you have mentioned the Sivulich study and I take it that is referred to at page 11 of your prepared statement. Now in the quotation that you have taken from that study it speaks of economic life spans. What is an economic life span, Dr. Birx?

A From the cradle to the grave.

Q Would you agree with me, Dr. Birx, that the Sivulich study is in fact an application to Pennsylvania experience of an earlier study which was done by Mr. Egg, which you also refer to?

A It has no relationship to the Egg study.

Q Does it not employ the same principles and merely applies those principles in the context of Pennsylvania data?

A In my opinion it went further than the Egg study. It started out along similar principles, yes.

Q In what respect did it go further?

A Well, it did a more complete statistical analysis than at least was published in the Egg study. Mr. Sivulich would be very upset if you implied that he extended Egg's study.

Q I would hate to do that. Both studies, would

you agree, Dr. Birx, employ economic life spans, the same concept as to what an economic life span was, in measuring depreciation?

A They use that term but we might as well define what it is. It is the period of time from when a plant starts as a brand-new baby to where it is taken off line or retired.

Q That is in both studies?

A Yes. It is a decreasing function, as you know, because they look at the generation of the station today as a percentage of what it was when it first came on line and project this down to the point where the generation becomes zero.

Q Why don't we look at a specific example of that which will set it forth pictorially, Doctor, and perhaps help His Honor and the other parties to follow the discussion.

On page 26 of Appendix C, would we not see there indicated a measurement of a composite economic life span as measured by Mr. Egg in his study?

A I think that is correct.

Q Is this not a composite or 12 companies' data as to generating plant life spans?

A That is correct.

Q Doctor, can you indicate for me what the various black dots are which go down the curve? What do those

represent?

A Well, that would be, as I mentioned before, you find that over on the left-hand side of the graph, the annual kilowatt hour output in percent of base load output, basically comparing it to what the plant put out in its original condition.

Q Does that reflect data as to a plant which is still in operation or is that a theoretical point, Doctor?

A Well, the data had to be generated by plants that were still in operation.

Q Mr. Egg computes an economic life span based on this data of 55 plus years. Does that indicate that there is a generating plant out there which is still producing at 55 plus years, Dr. Birx, or is that an extrapolation from the actual data?

A Let me say there are plenty of generating plants out there that are still producing after 55 years. But this 55 plus years would represent where this curve comes down and crosses the abscissa.

Q The abscissa would be the lower --

A That is right, the lower horizontal scale.

Q Doctor, what do the points at the bottom which are surrounded by little circles, to be very technical, represent?

A The open circles represent the ages at which

units have been retired and they are clustered in two groups, one finding retirement earlier at 20 years of age and the other group, I would estimate, averaging about 41 to 42 years of age.

Q Could we agree, Dr. Birx, that these points represent the actual units retired, the actual generating units retired?

A That is correct.

Q By the companies that were studied by Mr. Egg?

A Right.

Q Would you know the average date of retirement or the average age at time of retirement for those plants?

A One group was averaged about 20 years and the other group averaged about, I would guess, 42 years.

Q If we put them together would you agree that the average age at retirement was 31 years?

A I don't think you can put them together because they are different situations.

Q In what way do they differ?

A Well, Egg felt that they differed because of the growth rate of the companies. The companies that had higher than normal growth rates had more opportunity to retire the equipment early. Companies with slower growth rates did not have that opportunity. Whether or not this was the correct assumption on his part or correct conclusion on his

part, I am not sure.

I think Mr. Sivulich could not find any kind of correlation in that regard himself.

Q If we ignore Mr. Egg's division and we did put them together, would you agree that the average age of the actual experienced retirements for the companies studied by Mr. Egg was 31 years?

A If you insist on grouping them all together, yes.

Q Dr. Birx, returning to the statement in your testimony at page 9, lines 16 to 17, that two-thirds of a nuclear plant is identical with a fossil plant, I would still like to explore that concept somewhat more.

Am I correct in understanding identical in all respects to mean identical with respect to the nature of a component and its general arrangement within the plant and its physical form?

A The alternator in a nuclear plant to the untrained eye would look identical to the alternator in a fossil plant, and they would be basically similar. Similarly for the turbines.

The main differences that you find in a nuclear plant are the shielding. If anything, everything is built to much higher standards so you would find things bigger, find things better reinforced.

A good example is I asked one of my colleagues the other day how long a reactor vessel would last, and he has quite a bit of experience in this, and he said, well, look at the pyramids.

I mean, that is the impression you get when you go into a nuclear plant. It is built to last.

But most of this heavy construction deals with preserving the integrity of the nuclear reactor portion of the plant, and to someone not experienced with it, or who has not seen it -- General Electric, their favorite saying out on the West Coast is in the case of an earthquake, go as quickly as possible to your nearest nuclear plant, because that is going to be the safest place in the world.

Q Do I deduce from your answer --

A I am trying to give you a picture of what is different and what is the same.

Q Doctor, you have spoken from the point of view of the untrained eye. Suppose we inject a trained eye into the situation: would that create additional differences?

A Other than the radioactive portions of the plant, the generators, the turbines, they look quite similar to me, and I would say I have a trained eye.

I think there is a lot of similarity between a fossil plant and a nuclear plant in all regards except for the reactor portion and its associated safety factors.

Q Doctor, on page 10 of your prepared statement, line 11, you refer to a design life which is based on engineering considerations. Could you define for me what you mean by a design life which is based on engineering considerations?

A Well, one of the factors that you take into account when you design a piece of equipment is how long it has to last, and with a nuclear plant the basis of that consideration was that we certainly expect it to do as good or better than a fossil plant.

Now, in having that experience with a fossil plant and knowing some of the problems that we have to look out for with a nuclear plant, in your design you employ safety factors which will assure that there is nothing in the design of the equipment which will create a premature failure.

So when I say the design life, I am asking -- taking all these considerations into effect, safety factors, et cetera, -- how long should the plant last, with primary concern being given to the reactor vessel itself? And from what I have been able to determine, the lifetime is indeterminate, certainly no less than -- I mean the design life -- certainly no less than over a hundred years, a hundred to two hundred.

(Transcript continues on Page 2689.)

Q This is for the reactor vessel that you are speaking about?

A Yes.

I might add to that one of the areas I inquired into, when you talk about wearout and changes in efficiency, because one might consider if a nuclear plant becomes inefficient as a result of its use, that this would affect its economical performance and thus make it more likely for the owner to want to retire it early. The best answer I can get on that is other than seals going out which can be replaced and problems with pumps, which can be repaired, there is nothing that would cause the efficiency of the plant to deteriorate measurably over the years.

Q You say the best answer you can get on that, Doctor. Who have you checked with? As far as obtaining the information?

A You've got the list.

Q I have a list here.

A Yes.

Q This is the list that we discussed earlier that's in PECO Exhibit 5?

A Yes.

Q Now, would you agree with me, Doctor, that a design life is the life when you are building whatever it is you are building, in this case let's say a reactor vessel?

Is the life that you intend for that vessel to have based on the material that you have used to construct it. Is that a fair definition of the design life?

A We are having problems in our own group over this terminology design life. I don't like it. I am sure that when they built the original DC-3's for a single purpose of carrying supplies in World War II, they didn't expect them to be operating today. But the number of DC-3's still operating today is just fantastic.

Q But the key concept that I am getting at, Doctor, is that the design life is a life that is intended at the time we constructed the item. It is what we intend. Would you agree with that? As a key concept of design life?

A If I were an engineer, I would look at it this way.

Q You are not an engineer?

A If I were a design engineer for a nuclear plant, let me put it that way.

Q I just wanted to check that.

A It is the same way with the space system. You are looking to design a nuclear plant. I would not worry too much about the seals in the turbine or the insulation in the generator. I think the technology is there and it is accessible and it can be - - it's something that can be repaired. There are certain systems that cannot fail and when

you tell an engineer that we have got something here that cannot fail, the design which he produces is one that approaches as nearly as he has the ability to do it, that concept. That's what you see in your reactor vessel. What can happen to it? What dangers does it face?

This has to be designed for. I mean it is a fantastic experience. I mean design experience. Now, there are areas which you can accept failure and build in redundancy to compensate for that failure. In other words, when you say it cannot fail, you can have a takeover system ready to take over if some part does fail. They do that in space all the time and I'm sure it is done in nuclear.

But with the reactor vessel and its safety systems, they dare not fail. There's a limit to what you can put in there in redundancy, so that's why they build four and six foot reinforced concrete walls.

Q Doctor, do I understand your position correctly that in your view, the design life of a nuclear plant is indefinite? There's no limitation?

A At this stage in our experience, I think I would have to say that, yes.

Q Could you describe for me, Doctor, what is neutron radiation?

A Neutrons are uncharged particles which are utilized to bombard the nuclei of an atom in order to produce

the heat which generates the steam which runs a nuclear plant.

Q And could you describe for me what is meant by thermal cycling?

A Thermal?

Q Thermal.

A Cycling?

Q Yes.

A Do you have a reference? I mean is it something I said?

Q No. It is not. Do the terms mean anything to you?

A I guess they mean cycling the temperature up and down.

Q Is that what they mean with respect to a nuclear plant?

A I would suppose. I can't imagine anything else it would be.

Q Now, Doctor, you have indicated that it is your understanding that the design life of a nuclear plant is virtually indefinite. Could you state for me the basis of that belief?

A The reactor vessel we're talking about.

Q Reactor vessel, yes. Could you state for me the basis of that belief?

A. My judgment.

Q. Does your judgment have any inputs to it?

A. All that we have been discussing this morning, yes.

Q. Just what we have been discussing this morning?

Now, in your testimony - - first of all, you would agree that it is just what we have been discussing this morning? Is that correct?

A. Visits to the plant, conversations with design engineers, yes.

Q. Now, one item that you discuss in your prepared statement is a GE test reactor which you indicate has operated for twenty years.

A. Over twenty.

Q. Over twenty years. With no measurable deterioration to the reactor vessel as a result of neutron radiation. Is that not correct?

A. That's correct.

Q. Can you describe for me the nature of that GE test reactor? How big? What pressure does it operate at? What temperature does it operate at?

A. I don't know all of the details. I was primarily interested in the effect of the neutron flux and I received assurances from General Electric that this would not be a limiting factor in the life of the vessel.

Q I take it this was in a telephone call to a consultant of General Electric's out in California?

A That's correct.

Q Do you know what material the GE reactor is made of? And do you know would it be the same material that a commercial nuclear reactor is made of?

A I didn't check that point. It was designed, put in test to check out the problems that they might run into in commercial reactors, so I took for granted that the materials would be representative.

Q Referring you to the first penciled note page in PECO Exhibit 5, which I take it are the penciled notes of your conversation with a Linn Wallis, who is the contact you had with General Electric?

A I'm having difficulty finding mine. Okay.

Q Okay?

Now, I take it this was a single telephone converation. Was it a Mr. or Mrs.?

A Mr.

Q Wallis?

A However you spell the masculine form of Linn.

Q I note in the boxed portion of the notes, and it is the second box down on the right hand side, the notation neutron radiation of vessel, integrity affected. What did you mean when you said integrity affected?

A. Okay. That's the danger of putting your personal notes out like this. But I thought we should have the complete picture ahead of us. That was a note to myself to ask him whether the integrity is affected and his reply is below that. That they have not experienced any deterioration over twenty-five years, even though the GETR works at a higher neutron flux.

Q. Now, referring again to PECO Exhibit 5 and to the discussions which you had with Nuclear Regulatory Commission personnel.

A. Okay.

Q. Referring to the prior page, where you are putting down the notes of your conversation with Commonwealth Edison, you refer to an Oak Ridge study which shows that the prudent life of a vessel, a nuclear vessel is thirty to forty years. Have you reviewed that study, Doctor?

A. I'm not sure that I have. But that's what - - their estimate - - I'm pretty positive - - it has been a long while back. But that was their estimates based on - -

Q. That was Oak Ridge's estimates?

A. That's correct.

Q. As to what the design life of a nuclear vessel would be, is that correct?

A. Yes.

Q. And what is Oak Ridge Doctor? The Oak Ridge

Laboratories?

A. That's where the Atomic Bomb was - - one of the places during the War that it was made.

Q Is that a Government research organization?

A. Yes.

Q Devoted to primarily nuclear research?

A. During the War, it was operated by Eastman Kodak. I know I had an offer to go there and they couldn't tell me what the work was, but they told me I would be working for Eastman Kodak and I wouldn't have to worry about being drafted.

THE ADMINISTRATIVE LAW JUDGE: Mr. Hall, would this be a good time to take a break?

MR. HALL: Fine.

THE ADMINISTRATIVE LAW JUDGE: We will resume at 11:45.

(A brief recess was taken.)

THE ADMINISTRATIVE LAW JUDGE: Shall we proceed?

MR. HALL: Yes.

(THE WITNESS RESUMED THE STAND)

BY MR. HALL:

Q Dr. Birx, would you agree that an additional concern which must be recognized and which is in addition to concerns that one would have with respect to a fossil plant in establishing depreciation lives is the license that a

nuclear plant must operate under?

A. You need a license to operate, yes.

Q. I take it that is required under the Federal Statutes which govern nuclear energy?

A. Yes.

Q. Would you agree with me that the limitation which is placed upon that license is forty years?

A. Yes.

Q. And that that forty years is from the date that the construction permit is initially granted, is that not correct?

A. Yes. It is renewable.

Q. And it is renewable. Now, would you agree with me that a concern that one must have in establishing a depreciation life for a nuclear plant which is not present as to a fossil plant is with the term of that license?

A. That's one of the concerns. Probably there are a lot of concerns with respect to operation of a nuclear plant that one would not experience with the fossil plant, and a company has to weigh these concerns to decide whether they should build a nuclear plant or a fossil plant at the time the initial decision was made.

Q. Well, what are the other concerns that are special to a nuclear plant as they relate to depreciation purposes, because we are here speaking of depreciation lives

for these plants?

A Well, if you restrict it to depreciation purposes, my main concern in that regard is what's proper for rate making purposes, which would be the difference from what's proper if I want to make sure I get all my money back as quickly as possible or what's proper if I want to make my cash flow as good as possible. In the company.

Q Well, Dr. Birx, let's try and think of it in terms of what is the right period to depreciate the plant, to assure that both the company and customers are treated fairly and the investment is in fact recovered. Now, treating it from that light, what other concerns are there with nuclear plants that are not present with fossil plants other than for the license period that we have just discussed?

A Well, from an engineering point of view, and that's primarily the way I am looking at it, once I decide the license is renewable, that means there's no limitation on lifetime from that point of view. And my primary guiding principle is to suit the depreciation to the lifetime of the plant. How long is it going to last, and I don't know of any serious concerns that would affect that.

Now, you could have a changing Government policy which says all nuclear plants have to shut down or something as crazy as that, in quotes.

Q I take it that could be an additional concern

that you would have concerning the life for your plant?

A Well, that would be a concern that we would all have to live with at the time it happened.

Q Wouldn't it be a concern that you would have to consider today in terms of an uncertainty that could arise in the future and that would impact on your judgment today as the equivalent life of that plant?

A I think we have too many restrictions.

Q Would you consider that as something which must affect your judgment of the life of the plant today or not for depreciation purposes?

A If you consider all the things that might happen that would prevent you from getting your money back before the plant went out of use, if you considered all of those things, you would probably want to depreciate it over twenty years, maybe. That would be the safest for the company. But if you should come to that conclusion, then you would never build a nuclear plant in the first place because it is just not economical.

Q Well, Dr. Birx, in your recommendation of a forty year life span for depreciation purposes, for the nuclear units of the Philadelphia Electric Company, did you or did you not consider the potential effect of future Government policies which could reduce the physical life of those plants?

A. I considered it. And what I come up with is that I anticipate the nuclear plants going on beyond forty year lifetime. I anticipate refurbishing. I anticipate maintenance, replacements over that period of time. But I feel like we are going to need them for so long a period of time in the future that they are going to continue to exist.

Q. Have you considered the potential effect on the lifespans of existing nuclear power plants of alternative technologies, either nuclear or non-nuclear?

A. Yes.

Q. And what alternative technologies have you considered?

A. Well, you name them.

Q. Well, I'd like you to name them.

A. Fusion is one that we have hopes for.

Q. And when would fusion be available, Dr. Birx?

A. I would like to answer that to say as soon as possible. Fusion is what is possible, because it does have definite advantages, but at the stage it is in right now, and I have a son worrying about that problem out at Livermore, unless some miracle happens, I don't anticipate it being available until well into the next century.

Q. Are there any other - -

A. In any scale that would be of use to us.

Q. Are there any other alternative technologies that

you have considered?

A. You know we really don't have a lot of options. We've got fossil and we've got nuclear. People are hoping for solar, but the economy is going to have to change radically before that would ever be feasible on an extensive scale. I think that all these things are going to be beneficial to us and help us as much as we can use them.

But on the kind of scales we are talking about now, I mean you can look at how long has it taken. The first atomic bomb was dropped back in when? And then we got to use a technology that was available for power generation. It did not replace our fossil plants. We are still sticking to them. We have made inroads with nuclear over the past twenty-five years.

I anticipate when fusion comes along that if it becomes available in, say, the year 2020 or even in the year 2000, we just can't turn off our nuclears like that. It will be another twenty-five or thirty years before it makes an appreciable inroad into our total power system generation capability. You are asking me to look into my crystal ball.

We are all doing it and we are hoping it. I don't know when we will ever be able to shut down our nuclear plants. I feel that we are going to be more and more dependent upon them in the future.

Q Doctor, do you have an opinion as to what the cost of uranium for use in light water reactors will be in, say, the year 2000, 2010?

A I have not looked at that extensively. We might very well come to the place where it is not so much what it costs as what is available.

Q I take it you would agree that that could be a limitation upon the physical life of these nuclear facilities?

A That would be hard for me to imagine. Do you mean the price?

Q Either as a matter of economics or as a matter of supply.

A I don't think it will run out and I don't think that we will get to the point where, we will say, it is too expensive to use.

Q What is the basis of your belief?

A I have seen the predictions as you have of what might happen to the price of uranium. The same thing will happen to the price of coal. I have seen all kinds of assurances that even if we don't reprocess our spent fuel there will be adequate uranium to use well past the year 2000.

So I don't see any cut-off in fuel supply that would limit the useful life of a nuclear plant.

Q Returning to the license period, you would

agree with me, I take it, that the statute permits relicensing, is that not correct?

A Yes.

Q Has there been any definitive statement from the Nuclear Regulatory Commission or any regulation adopted by that agency which states that relicensing will be permitted?

A We could all wish for more definitive statements from the Nuclear Regulatory Commission.

Q Well, the question is, do we have any?

A No. As you see in my notes there, I pointedly asked this question of the people that I did talk to down there and nobody is going to stick their neck out and arbitrarily say at this time that a nuclear plant could be relicensed. When that time comes, they will look and see.

The only one, to my knowledge, that we have experience with is Dresden and that is being relicensed.

Q Setting aside Dresden, then, based on these three telephone conversations that you had with Nuclear Regulatory Commission officials, the answer is maybe yes, maybe no, we will see when we get there?

A No, the answer is that they are not going to tell me at this time, give me a carte blanche as it were to say that they would automatically relicense a nuclear plant.

Q Did they tell you that in fact when the time comes they will have a policy that will permit it? Or did

they just refuse to say?

A They are mute on that point.

Q There is one notation in your notes, Doctor, that intrigues me. It is the fifth line, I guess you would call it, down on the page which deals with the Nuclear Regulatory Commission telephone calls. It says: No renewal for big pressurized reactor.

A Yes, that is what I just said. They have never at this stage relicensed a reactor of the size that is common to our experience today. Further down on that page, that note that says he thinks relicensing is a possibility. And, of course, it is held out in the document -- it should be in here somewhere -- what do you do with a nuclear plant after 40 years --

Q I take it the document is in the exhibit and will speak for itself.

A It holds that open as an option. You seek a new operating license, you seek to repower the station, which could be either repowered with nuclear or fossil fuel, or you seek to retire and decommission. These three options are held out to any licensed owner of a nuclear plant.

Q Assuming the Nuclear Regulatory Commission will permit it to occur.

A Of course.

Q Doctor, you expressed the opinion that

relicensing will not be economically prohibitive because any major plant design specification changes which are adopted by the NRC will be retrofitted to the plant during the initial licensed period, is that not correct?

A I am not reading along with you. I trust you are quoting --

Q I believe that appears at page 8, lines 14 to 20 of your prepared statement.

A That is considering the investment in the original plant. If Limerick, for instance, is economically viable when it comes on line, and it is hard for me to imagine that itwould not be economically viable at the cost of that plant for doing such retrofitting that might be needed at the time of relicensing.

Q That is going to depend on the cost of the retrofitting, isn't it, Doctor?

A Yes.

Q Do you have any idea what the cost of that retrofitting would be at this point?

A I expect it would be considerably less than building a new plant. But, no, I don't think anybody knows.

Q In your conversations with the Nuclear Regulatory Commission officials did they indicate that it was Commission policy to require retrofitting to existing plants during the license term, whenever the NRC changes its

regulations as to plant design?

A Not in all cases, no.

Q In some cases they do, some they don't.

A That is correct.

Q I take it you would agree that one of the questions that must be answered, once we get to the re-licensing stage, is how many of these requirements which are not required during the license period, will be required prior to the time that you can get a relicense, is that not correct?

A That is correct, and that is one of the reasons I cited what we do know about Dresden.

Q Referring to Dresden, Doctor, would you agree with me that in fact the Dresden situation is a situation where the license was suspended because the plant did not comply with certain NRC cooling water regulations?

A They are updating their cooling requirements. They are not being required to reconstruct the plant, for instance, for seismic stress the way a modern plant would be, but they are requiring a new cooling system, yes.

Q The question, Doctor, is that Dresden is not a relicensing, it is a matter of a suspension of an existing license, is that not correct?

A Well, as I recall, the folks at Commonwealth Edison informed me that it is being relicensed.

Q So it is your understanding it is a re-licensing and that is based on your telephone conversation with the individual at Commonwealth Edison?

A That was the terminology they were using, yes.

Q Do you know when the Dresden plant was constructed, Doctor?

A Somewhere around 1960.

Q Do you know how large the plant is?

A I think around 500 megawatts.

Q Do you think that the original 40-year license would have expired?

A Or is it fifty?

Q Do you think the original license would have expired given a 40-year term at this point?

A I don't think it was licensed originally for 40 years. I think it was only licensed for a period of 20 or 25 years.

Q Is that a guess or do you have a specific written reference?

A That is my recollection.

Q Doctor, in your prepared statement you refer to the cost of retrofitting in making the decision to relicense, and what I am referring to here is the substance of the decision whether to relicense or not. You refer to that decision as involving a comparison of the cost

of retrofitting to the original cost of construction of the plant, is that not correct?

A I think I said that, yes.

Q I believe that is at page 8, lines 17 to 20. Now would you agree with me, Doctor, that as a financial manager -- and first off, Doctor, I take it you do not have qualifications in the area of financial management, is that correct?

A It depends on your definition of qualifications.

Q Outside of home budgetary matters.

A Well, I have had to responsibly answer for the operations of laboratories and certain departments of companies financially, but other than that, go ahead.

Q Doctor, in making a decision whether to retrofit a nuclear plant -- let us assume that we have a nuclear plant, it has gone through its original license period, we are now deciding whether or not we should seek relicensing or we should build some other plant to provide the necessary kilowatt hours: would you not agree, Doctor, that the nature of the financial decision that would be appropriate is one of measuring the cost of the retrofitting to get the relicense, and taking into account the amount of additional years that the relicensing will permit, against both the cost and also the benefits of building a new plant which would presumably or which may have greater efficiency?

Would that be the nature of the decision that would be made in your view?

A Several points there. From what I have been able to determine there is no serious deterioration in efficiency of a nuclear plant.

Q I am not asking you the substance of the decision, Doctor. Just is that the nature of the decision? Without regard to what the specific components are, is that the evaluative process that you would recommend a utility go through in determining whether to seek relicensing?

A I would think that one would have to look at all the options available to them as they existed at that time, certainly.

Q So you would agree with that process?

A The Commission and your customers in a way put in the company's trust the responsibility of finding the least cost solution to this problem of power supply, and I would think it is the responsibility of the Commission to assure the customers that the company has done this.

I think it would behoove them to look at all the options. But I am saying, our experience with fossil plants now is that it is far cheaper to retrofit them and to continue on, it makes much more economic sense to do that than to build a new plant.

Q In essence, Doctor, as I understand your

answer, you have agreed with me that the nature of the judgment would be as I have described it?

A Yes, with qualifications I have agreed.

Q Doctor, on page 11 of your prepared statement you have recommended that this Commission employ as the basis for depreciating the company's more recent fossil plants, these are coal plants, a 40-year life span, is that not correct?

A Yes.

Q Am I correct that a principal basis of this recommendation is what you refer to as the average retirement age as shown in the Egg study and also the composite life span from the Sivulich study?

A They were two of the ingredients.

Q What additional ingredients were there?

A Again, I go back to setting life spans for rate-making purposes, and if you look at the life spans of these particular plants, particularly where there are co-owners, you find there is a disagreement amoungst themselves as to what the proper depreciation life span should be for these plants, and if you combine that with what has been experienced in the past, the fact that companies are telling us now that they are going to refurbish -- that is why I was asking Mr. Waddington how he would handle a plant renewal rather than a new plant as a matter of depreciation, I was

trying to get his ideas on that -- taking all these factors into account, I feel that 40 years is a proper, or is a good depreciation life span for rate-making purposes.

Q Would you agree with me, Doctor, that an economic life span as employed in the Egg and Sivulich studies is the maximum period that a plant could remain in service prior to its retirement from economic reasons?

A I don't anticipate the economic reasons as were pointed out and particularly described in the Egg paper as being a major factor in determining the lifetime of plants today.

Q You don't believe economic concerns would be a major factor in determining life spans?

A No, I did not say that.

Q That is what I understood you to say.

A I said as he used the term.

Q Well, Doctor, my question was, do you agree that I have correctly stated the definition of an economic life span as employed in the Egg and Sivulich studies?

A The life span is a projection, as employed in those studies, of how long the plant would last from the time it was put on line until its final retirement based on information that is available today.

Q In other words, it is a projection and not a measurement of actual experience, is that the gist of your

answer?

A We are finding that actual experience actually exceeds that life span in some cases, yes.

Q The answer is, it is a projection?

A We are on both sides of the fence. Yes, it is a projection.

Q Referring you again to page 26 of Appendix C, and referring you to the annual kilowatt hour output ordinate, or whatever that is termed here -- you are more qualified to say that than I -- where it appears in the 20 to 30 percent range, what would you say the pressure and temperature of generating units which would appear in that range of the chart, which I would think are related to the 30 to 40-year age range, are? Have I confused you with that question or is that clear?

What I am seeking to have you do, Doctor, is to indicate to me the nature --

A Let me see if I can answer it.

Q Let me try and restate it so it is clear for the record. What I am trying to ask you to do, Doctor, is to identify for me the nature, in terms of operating pressure, operating temperature, of the plants -- and I take it these are fossil plants -- which would be shown on page 26 between the 30 to 40 age bracket, and that would correspond to the 20 to 30 percent kilowatt hour bracket in that chart.

A My answer would be, I don't know, but over the period of the last 30 to 40 years there has been initially an increase in pressure and temperature, as our experience was improved and as materials were improved, up to a point, and now there is a backing off from those high pressures and temperatures, and the fact is, I think, that -- well, I don't remember the exact numbers -- but I will say that of 10 or 15 fossil plants that are expected to come on line within the next five to ten years, only one or two of those is super critical, all the rest of them we are returning now to the subcritical area.

(Transcript continues on Page 2713.)

Q. By super critical, what pressure and temperature range do you refer to?

A. Oh, we are talking about temperatures in the range -- don't tie me down to fractions -- we're talking about temperatures in the range of 800 to a thousand degrees and pressures 3000 pounds per square inch. Somewhere in that area.

Q That's the super critical?

A Yes. That's the point at which water and steam cease to be as separate entities. You just have one uniform bit of matter in the boiler.

Q Now, Doctor, would you agree with me that the reason that we backed down, now, for super critical units, is that various operating problems were experienced with those units which involved high maintenance cost. High replacement costs for various interim component failures?

A This is a factor, yes.

Q Now, to try and get the historical progression in focus, here, would you agree that we are initially starting with units in the thirties and forties, 1930's and 1940's, which were relatively low temperature, low pressure units? Is that correct?

A That's correct.

Q And what would we be talking about on a normal average for those types of units?

A. We are going to have to pull out the curve I used in the West Penn rate case, but I don't have it with me. It depends on what particular time you picked, but - -

Q I'm only interested in order of magnitude, Doctor. Procedure is not that important.

A I mean you work around 500, 700 pounds per square inch on up, I guess. That's where we started progressing from.

Q What was the temperature?

A The temperature, too, would be 700 degrees on up to - - we've got up to 1200 degrees.

Q Would that be back in the 1930's and '40's?

A Not back in the 1930's and '40's, but Eddystone 1 and 2 operated at that. I think they have backed off, now, to a thousand degrees and that was a plant that was conceived in the '60's.

Q Well, would you agree with me, Doctor, that back in the '30's and '40's, we were talking about principally low temperature units? In fact, entirely. Is that not correct?

A Boilers and generating units have always operated at temperatures and pressures which fit the materials with which they were constructed.

Q The answer to my question though is yes? My question referring to 1930's and '40's?

A. The important question is - -

Q. I would like to have the answer to my question, Doctor. Then we will deal with the important question.

A. They were operated at lower temperatures and pressures because the equipment would not stand any higher pressures and temperatures.

Q. Now, I take it, would you agree with me, that those lower pressure and lower temperature units are the ones that would be reflected at the 30 to 40 year age level on page 26 of appendix C?

A. I would agree with you that that is probable, but I would not agree with you that this would necessarily, the lower temperatures and pressures would necessarily have an effect on the life which is contrary to what our normal experience is today.

Q. You would have to agree with me, though, that as the 1930's and '40's was the period in which these lower pressure and temperature units were installed, and as only units that were installed during that period could have reached the age of 30 to 40 at this point, the two must be identical?

A. That's true. Obviously.

Q. Now, moving forward from the 1930's to the 1940's, we see that pressures and temperatures rose in generating plant construction is that not correct, Doctor?

A. That's correct.

Q And I believe that was because it was felt to be more efficient? You could get more energy or reduce costs by doing that. Is that not correct?

A Well, efficiency really doesn't have anything to do with costs, but it is normally related.

Q Well, it is a cost function?

A Yes.

Q This continued, did it not, up through the early 1960's? We kept increasing the temperatures and pressures?

A Yes. That's correct.

Q But then in about the early 1960's, there was a turnaround and we started reducing temperatures and pressures, is that not correct?

A That's correct.

Q And that was because problems were experienced in terms of maintenance problems and component failure problems in the higher temperature pressure plants, is that not correct?

A That's correct. But the kind of failures you're talking about here are things like super heater tubes and boiler tubes which is becoming a more or less routine maintenance function in plants. I mean it would not have anything, necessarily, to do with the overall lifetime of the plant.

Q Doctor, at page 12 of your prepared statement, lines 2 to 7, you refer to a statement by the Eddystone plant

superintendent, a Mr. Mount. Does this statement form a principal basis of your recommendation as to the Eddystone plant?

A. No. It does not form a principal basis for my recommendation of the Eddystone plant. I just pointed out that if his expectations come true, there will not be any difficulty reaching the four year life on that plant.

Q. I take it you don't know the basis of his information upon which he made that statement?

A. I would hardly know that.

Q. I mean he could have been just guessing as far as you know?

A. Well, if you knew Mr. Clyde Mount as I came to know him at the time that I talked to him, I'm quite sure that he wasn't guessing. He knew that plant.

Q. Now, on lines 21 to 23 on page 12, Doctor, you state that early retirements should be handled on an individual basis, and I take it by this you are referring to a situation where a - -

A. Excuse me. I lost the reference.

Q. It's page 12, lines 21 to 23.

A. Okay.

Q. And you state here if and when a valid reason develops to require early retirement, such a case should be handled on an individual basis. Do I understand that sentence

to refer to the situation where a lifespan has been established for a plant? For depreciating it for rate making purposes, but for good and sufficient reasons, the plant must be retired prior to the end of that period? Is that correct? Is that the situation you are referring to here?

A. That's basically the situation I'm referring to, yes. Basically I am saying at that time, let's sit down and have you present the options that we were discussing before, and what is the best way to proceed.

Q. Now, assuming that it was decided that the best way to proceed was to retire the plant, and assuming that it could be established that the utility in question had not recovered its original cost in this plant, would it be your recommendation to the Commission, given those assumptions, that the utility be permitted an amortization allowance to recover those costs?

A. Amortization, did you say?

Q. Yes.

A. If that study was available which looked at all the options and all the reasons, I would imagine I would, yes.

Q. Do you have an opinion as to what type of showing would be required, Doctor, to convince you that in fact the utility had not recovered its full original cost of the plant? What would you look for in the way of a showing?

MR. SAYRE: Your Honor, I think I will interpose an objection at this point. Mr. Hall is asking the witness to substitute his judgment for the Commission's here.

MR. HALL: I'm just asking the witness for his opinion which the Commission can treat as it chooses.

MR. HERSHEY: That's not an area where he is an expert.

MR. HALL: Then he can state that. I would find that surprising. He is a witness on depreciation.

THE ADMINISTRATIVE LAW JUDGE: I will overrule the objection. The witness can answer.

THE WITNESS: Well, if we are worried about me speaking for the Commission, of course, I do not do that and I could not guarantee what they would do as the NRC cannot guarantee what they might do. I really don't think, Mr. Hall, that since we have put in this lifespanning technique, and if the records are available, and everyone is reasonably agreed at the start how we proceed with these plants, we are not facing a situation where records were not kept this way, depreciation was handled some other way, depreciation was handled for tax purposes and not for depreciation purposes and all the difficulties you get into for a plant retired today that went in service in 1924.

And I feel that with all the facts available and all the records there, that we wouldn't be worried about

the same sorts of questions that we are at this time.

MR. HALL: Your Honor, I'm going on to another subject area. I have perhaps twenty more minutes of Dr. Birx. I do understand that there were other staff witnesses that they wanted to move through early this afternoon. I would be willing to break now and come back after lunch, have the other staff witnesses and then go forward with Dr. Birx or whatever the other parties prefer.

MR. SAYRE: Could we go off the record, Your Honor?

THE ADMINISTRATIVE LAW JUDGE: Yes.

(Discussion off the record)

THE ADMINISTRATIVE LAW JUDGE: Back on the record. Why don't we break for lunch now and come back at 1:35.

(Whereupon at 12:35 p.m. the hearing recessed to reconvene at 1:35 p.m. the same day.)

(Transcript continues on next page)

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AFTERNOON SESSION

--oOo--

(The hearing resumed at 1:43 o'clock p.m.)

MR. SAYRE: I have one preliminary matter, Your Honor. I would like to request -- I hope it is not too presumptuous -- that in light of your concerns about the management audit not being available to Your Honor and to a number of the parties, that you request in your advisory and administrative capacity of the appropriate people in the Commission that it be made available to those parties.

The reason I make this request of you is that we are, as Trial Staff, prosecutory and we don't have access to or contact with the people who did that audit.

THE ADMINISTRATIVE LAW JUDGE: You don't have contact with the audit, but don't you have contact with John Dial?

MR. SAYRE: John Dial is advisory, and I feel a very great reluctance in asking him to do things, particularly since that audit will impact on the merits of this case, because we are prosecutory.

I can represent to Your Honor, again, that we had no input whatsoever into the audit or into the Commission's decision of last week.

THE ADMINISTRATIVE LAW JUDGE: Who is writing up the order?

MR. SAYRE: I have no idea.

MR. HALL: Do we have any idea when the order will be available?

MR. SAYRE: I just know what happened at public session, Your Honor. I know nothing more than that.

MR. HALL: Can we inquire and perhaps hurry it up? I would like to see the order so that the company could develop its position, and perhaps once we have seen the order and Your Honor has seen the order, we can resolve the matter.

THE ADMINISTRATIVE LAW JUDGE: Yes. Let's proceed.

MR. SAYRE: Trial Staff calls Mr. Hagan.

HARRY J. HAGAN, JR., called as a witness on behalf of Commission Trial Staff, having been duly sworn according to law, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. SAYRE:

Q Would you please state for the record your name and address and employer and position?

A My name is Harry J. Hagan, Jr. My business

address is Post Office Box 3265, Harrisburg, Pennsylvania, 17120. I am employed by the Public Utility Commission of Pennsylvania as Public Utility Engineer.

Q Do you have before you a document entitled Trial Staff Statement No. HJH-1, which consists of three pages of testimony, two tables and an appendix?

A Yes.

Q Was the statement portion of that document prepared by you?

A Yes, it was.

Q Were the tables and exhibits prepared by you or under your direct supervision and control?

A Yes, by me.

Q Do you have any corrections or additions that you would like to make to the statement or the exhibits?

A Yes, two corrections. On page 1, line 15, during the original typing, the page number was omitted. It should be page number 4. And the last page of the Appendix, line 25, where it has RID, it should be capital R.

Q If I were to ask the questions that are listed in the statement today, would your answers be the same?

A Yes, they would.

Q Are the facts and opinions in the statement and the exhibits true and correct to the best of your knowledge, information and belief?

A Yes, they are.

MR. SYARE: I would request that Statement No. HJH-1 be marked for identification.

THE ADMINISTRATIVE LAW JUDGE: Without objection, it will be so marked.

(Trial Staff Statement No. HJH-1, document entitled Direct Testimony of Harry Joseph Hagan, Jr. Concerning Plant Held For Future Use, was produced and marked for identification.)

MR. HALL: Is HJH-1 the only one he is going to be crossed on today?

MR. SAYRE: Yes.

MR. HALL: He can't go forward with HJH-2? My questions are very simple.

THE WITNESS: No, I wasn't prepared for it.

MR. SAYRE: HJH-2 deals with revenues and expenses.

CROSS-EXAMINATION

BY MR. HALL:

Q Mr. Hagan, would you state for me your understanding of the Commission's established position with respect to the inclusion in rate base of land held for future use? What are the criteria?

A I am not aware there are any per se criteria.

Would you please elaborate, Mr. Hall? Is there any Commission policy you are referring to that I should --

Q Well, this Commission, you will agree, would you not, has permitted land held for future use in utility rate base claims for a number of years.

A Yes, they have.

Q Have they not developed certain criteria which they apply to utility rate base claims for land held for future use to determine whether it is a proper claim or not? Is that not correct?

A Mr. Hall, I am not aware of anything in writing. I have never seen any written criteria as you refer to.

I am aware that at times they have allowed plant held for future use in measures of value up to ten years in a claim, as long as there was a definite plan or plans for its use.

Q Have you reviewed any Commission orders in which the Commission has discussed allowances for land held for future use?

A Which ones are you actually referring to?

Q I am not referring to any. Whichever ones you have reviewed are the ones I am referring to.

A I have read some Commission orders. I am not familiar with all the Commission orders. I have only

been with the Commission for a little better than two years.

Q Can you name me one that you have reviewed?

A I am sure the most recent West Penn order.

Q Was there a claim for land held for future use in that case?

A Yes, there was. I believe the company claim was a little better than $14 million.

Q Now it is your understanding -- and I take this from a prior answer of yours -- that there are at least two factors that must be satisfied before a claim for land held for future use would be allowed, the first factor being that there be a definite plan for the land's use, and secondly, that that definite plan be consummated within ten years.

A I object to the word, consummated. I said the Commission has allowed land held for future use in measures of value for up to ten years that had a claim date.

Q What does the ten years mean? What does it refer to?

A I am missing your point, Mr. Hall.

Q What has to happen within ten years to satisfy the second factor?

A There has to be a definite plan to be in service.

Q It is your position that there has to be

a definite plan that the land will be in service within ten years?

A Yes, the land or property will be in service.

Q Can you cite me a Commission order which holds that?

A I have to go back and check.

Q Would you provide me with such a citation if you can find one?

A Certainly.

Q You propose a number of disallowances of company's land held for future use, and I take it this is principally on the ground that there is not a definite plan for the use of this land, is that not correct?

A Yes, there is no definite plan.

Q Referring you to Table B, I note that the date that construction is expected to start on a number of transmission and distribution plant facilities has changed over the last several years between rate cases, is that correct?

A Yes, it has changed.

Q By that I mean that the company when it originally claimed a parcel of land would have planned for it to go into service in, say, 1980 in the first case, which for purposes of our example is RID 295, but then in a subsequent case, such as this one, it would come in and claim

the parcel but say that it would not actually go into service until 1983, that would be the change, is that correct?

A You are using in service. The company has not used those terms.

Q I don't mean to use those terms. Whatever the key is. We will get to that in a minute. The company used the term, construction expected to start.

A Yes.

Q So I will use those terms for this purpose. Do I understand your testimony correctly that it is your position that where there has been a change in this anticipated service date from one rate case to another, that indicates that as to those parcels of land the company does not have a definite plan for their use, therefore it does not meet this Commission criterion?

A Being there is changing -- we will refer to it as in-service dates, we both understand it is not in-service dates -- but being there are changing dates involved, I cannot construe that to be a definite plan for its use.

As an example, we can go back up to, let's look at the 500 KV line, Bradford-Newlinville line, it is up in the Transmission Areas, it was first claimed in RID 29 as a 1976 date and now it is being claimed as a 1988 date.

You may indeed wish to use it as a 500 KVA transmission line, but then we don't know when you are going

to use it.

In RID 29 you are saying you are going to use it in 1976 and now it is 1979 and you are saying 1988 it is going to be used.

I can't construe that as being a definite plan.

Q Let's look at another one. Why don't we look at the 220 KV line, New Hope-Buckingham, the second item under Transmission. That shows a steady 1980 anticipated date and then a 1983 date in the current case. I take it you would consider that one change in in-service date as indicating a lack of a definite plan for the company for the use of this property?

A I don't quite understand what you are saying.

MR. HALL: Could I have the question reread, please?

(Question read.)

THE WITNESS: Yes, I would agree with that.

BY MR. HALL:

Q Do you consider it at all surprising, Mr. Hagan, that over a ten-year planning period, and under this Commission standard we are dealing with -- would you not agree with a ten-year planning period, ten-year limitation, is that not correct?

A Up to ten years the Commission has allowed

land held for future use to be included in measures of value.

Q So we have a ten-year planning period?

A You can take it that way, yes.

Q Would you consider it surprising that the company's plans with respect to a specific parcel of property would change by one, two or even three years as one moves through this ten-year planning period, do you think that is sufficiently surprising that you can infer from that that there is not a definite plan for use?

A I realize that up to a ten-year planning period there may be changes in one's plans. What I find surprising is a company the size of PECO missing their forecasts, or whatever you wish to refer to them as, or definite plans by two, three, four or five years.

You refer to three years and now you come back -- now you refer to the 500 KV line at Bradford which was 1976, 1988, that is 12 years right there.

Q If you refer to the 220 KV line, New Hope-Buckingham, though, that was first proposed for 1980 in RID 29 which was back in, I believe, about 1971 or 1972. Now over a ten year period since that date, the date of its expected in-service has been delayed three years but that is over a 12-year planning period. Does that surprise you?

A Once again, I go back to a company the size of PECO should meet their definite plans, their forecasts

within a reasonable length of time, reasonable being, I would say, a year, year and a half.

PECO I believe to be the largest utility in the state, and for a company with that amount of assets, with the amount of people and the quality of people who work for PECO, they should be able to come a little closer on their planning dates or their forecasting dates.

(Transcript continues on Page 2731.)

Q Am I correct that you have never been employed by an electric utility in planning its distribution or transmission system? Such as you would be making decisions as to when particular parcels of land or other facilities would be built? Is that correct?

A I have not been employed in that position by a utility, right.

Q Have you reviewed the experiences of other electric utilities throughout the State with respect to whether or not they experience similar delays in the usage of particular pieces of property?

A You say my testimony, I testified in West Penn Power. They were postponing in-service dates. I did not testify in Duquesne, although I did look at Duquesne Power and Light's Account 105 and they, too, were postponing some in-service dates but not all in-service dates.

Q I take it Philadelphia Electric Company has not postponed all of its in-service dates, either. You don't propose the disallowance of the entire claim?

A No. In fact, you will note on the first page of Table B you have the Peach Bottom lines with an asterisk next to them. I recommend this inclusion in measures of value in that this is the first time they were claimed. In another rate case, Mr. Hall, if you postpone the in-service dates, I will be here again testifying.

Q I take it your experience in reviewing other utility filings, though, that indeed a similar postponement occurs in other utility situations as well, West Penn and Duquesne? You have stated that?

A On occasion, yes. But not to the extent as taken here.

Q Am I correct that it is your understanding of the Commission's test that in fact the facility that's going to be built on this land must be in service within ten years?

A You used the word test.

Q Whichever word you wish to use.

A I'm not aware of any written policy or criteria the Commission has come up with concerning this particular item. I stated that before. Now, I'm aware that the Commission has allowed land held for future use to be included in measures of value for up to ten years from this present proceeding.

Q Well, do you know whether they have applied that as being in service within ten years or have they applied that as construction going on on the land within ten years?

A Mr. Hall, we went through this about seven or eight questions ago and you asked me to cite a case. So I will let that go until I find the case and bring it to your attention.

Q In other words, at this time, you don't know how they have applied this in past decisions? Which one of those two formulations they have used?

A Just one second, please. Mr. Hall, I can refer you, this may help the problem you're having here, on page 3 of my direct testimony, lines 12 through approximately line 15, I'm referring to filing requirements 52 Pa. Code Section 53.53 I-A-14 required the respondent to supply the expected date of use, not the date construction is expected to start.

Q Isn't that a matter of semantics, Mr. Hagan? The date of use? What is the use of the land? Isn't the land in use when you start construction?

A When you start construction, I believe it goes to account 107, CWIP. I'm not exactly sure on that number. But I know when you start construction, it should be CWIP, and not 105. CWIP can accrue AFUDC and it cannot do that in account 105.

Q How does that bear on our interpretation of the wording date of use?

A Date of use to me means the date it goes into service. I believe date of use to you means the date you start construction.

Q Neither of us has a particular Commission interpretation of that language to back us up?

A Right. But I will supply you with one. With my

interpretation. Or I will try, Mr. Hall.

MR. HALL: Fine. Your Honor, that's all the questions that I have.

THE ADMINISTRATIVE LAW JUDGE: Mr. Burgraff?

MR. BURGRAFF: No questions of this witness, Your Honor.

THE ADMINISTRATIVE LAW JUDGE: Do any parties have any questions of this witness?

MR. SAYRE: May I have two minutes of the witness' time, Your Honor? Before we go to redirect? I have just a couple of questions, but I would like to - -

MR. HALL: Cross or redirect?

MR. SAYRE: Did I say cross?

MR. HALL: You said before redirect.

MR. SAYRE: I would like your indulgence in the form of a two minute recess.

THE ADMINISTRATIVE LAW JUDGE: Fine.

(A brief recess was taken)

THE ADMINISTRATIVE LAW JUDGE: Let's go back on the record.

MR. SAYRE: I have a brief amount of redirect of Mr. Hagan, Your Honor.

REDIRECT EXAMINATION

BY MR. SAYRE:

Q Mr. Hagan, during your cross examination, was it

your intent to criticize PECO's failure to meet their planning dates for the various projects that you have listed in your testimony?

A. I wasn't criticizing the dates per se. The problem I have is there is no definite plan or plans in the property being there's no definite plan or plans is not to say that it is to be used and useful.

Q. With respect to the other companies that you reviewed and discussed in cross examination that have made claims for land held for future use, do those companies, the ones that you have reviewed, file on the basis of in-service dates or construction start dates?

A. In-service dates.

Q. Did you request Philadelphia Electric Company to provide the in-service dates as opposed to construction start dates for the land held for future use? In that case?

A. Yes.

Q. What was Philadelphia Electric Company's response?

A. Do you want me to read them both into the record?

Q. If you could just give the substance of the first response.

A. PECO was of the opinion that since the items were parcels of land that once construction was started,

that the land in question is being used.

Q Did you, then, subsequently make a further request of the company to provide in-service dates of that land?

A Yes, sir. I did.

Q Could you read the company's response?

A TR-1 question three, I will read the question and the response. Is that all right?

Q Yes.

A Please provide expected in-service dates for the project claimed as land held for future use on pages C-23 and C-23-A of DPS-1 and DPS-2. The response was the company does not maintain specific projections of in-service dates for land held for future use, account 105. Estimates of use are based only upon expected start dates for the construction. Certain guidelines to apply for estimation of the construction period.

These are as follows: New production facility, ten years. Transmission substations and lines, two years and distribution substations and lines, one to two years, normally one year.

Q Mr. Hagan, are you aware of anything in writing from the Philadelphia Electric Company that states its understanding of what the Pennsylvania Public Utility Commission's position is on the period of time within which

land held for future use must be used?

A. Yes, sir. I am.

Q. And what is that document?

A. A letter dated June 18, 1979 from the Office of Mr. Paquette in which they go into on page 2, the basis of the letter is they want some property removed from account 105 that has been included in measures of value, and they would like to have it removed from account 105 and I believe it was supposed to be put into account 121.

In the beginning of the second paragraph it says: The Pennsylvania Public Utility Commission has taken the position to allow in rate base only that future use property that will be used within ten years of a test year.

MR. SAYRE: I would request that the copies of that letter be marked for identification as Staff Exhibit HJH-1-A and I provide three copies for the reporter.

THE ADMINISTRATIVE LAW JUDGE: Without objection.

(Staff Exhibit HJH-1-A, a letter dated June 18, 1979 to Mr. Lorin H. Drennan, Jr. was produced and marked for identification.)

MR. SAYRE: No further redirect.

MR. HALL: I have one or two questions.

RECROSS EXAMINATION

BY MR. HALL:

Q. Mr. Hagan, on this page 2 of the letter from Mr. Paquette, the terminology is used, now, you don't know

how that's interpreted, do you?

A. Your position of use?

Q. I don't know if it is my position or anybody else's position.

A. I'm quite sure that if Mr. Paquette was here, we would be debating what used means in his opinion and what used means in my opinion. Used for my mind is in-service date being used and useful.

Q. Since Mr. Paquette wrote the letter and he is a representative of the company, would you not consider it logical that he intended to use the word used as the company uses it?

A. It depends how the company uses it.

Q. Have we not agreed the company uses it to mean the beginning of the construction on the land?

A. I believe we did agree upon that, yes. Which I disagree.

Q. You disagree that it is appropriate but that's the company's definition?

A. Right.

Q. This letter is consistent with that definition?

A. As per your discussion right now, yes. It is important to note, Mr. Hall, that this property was claimed in account 105 and was in measures of value and they have since -- I believe they have transferred property off or sold property,

they were going to sell off some of the property, but it was in the measures of value and rate of return.

Q Is there any significance to this letter in your mind as it relates to this rate case? Other than for the passage that you have read into the record?

A. Once again, it belies the fact of a definite plan.

Q Excuse me?

A. It belies the effect of a definite plan for use. They had a definite plan for this property on page 2. They had it claimed in account 105 and allowed in rate base. They have since changed their mind on it and hence their definite plan for this property went out the window.

(Transcript continues on next page)

Q Is this property also property which is claimed in this rate case, is that your position?

A No, I didn't say that.

Q Then what significance does it have that the company changed its mind as to certain property, as to which it at one time had a plan for definite use, and having changed its mind, removed that property from the land held for future use category?

A You just said it did have at one time a definite plan. It has since changed its mind. Now who is to say that the remainder of the property in Table 2 they may not change their mind next year or the year after or in subsequent years?

Q But isn't that true of all land that every utility claims as part of land held for future use in any rate proceeding? You could always change your mind, couldn't you?

A You can change your mind in reference to anything at all, yes.

Q Then why aren't you under that theory recommending the disallowance of the company's entire claim?

A Because as I said before, Mr. Hall, the property I am recommending inclusion in measures of value, two Peach Bottom lines, are claimed for the first time in this present proceeding.

As I said before, if two years down the road

or a year down the road you come up with another rate increase and you change your dates on these two Peach Bottom lines, I will be back up here testifying and you will probably be sitting there cross-examining me, too.

Q In other words, it is your position that if the company ever changes its mind, then there is not a definite plan for use; one can only have one definite plan for use and if one ever changes one's mind as to the date, then there is no more possibility of there ever again being a definite plan for use?

A No, not at all. Let's take the Sparrow Utility Company --

Q Take what?

A Let's take a hypothetical utility company called Sparrow Utility Company and let us presume they have come in with four or five rate requests, and during the period of those four or five rate requests they have indeed met the majority of their planned in-service dates. If there were one or two items that did not meet their planned in-service dates, I would not go up and testify saying they have no definite plan because the majority of the planned in-service dates were indeed met.

In this case here, everyone has changed except for the two claimed for the first time in this rate case.

MR. HALL: That is all the questions I have, Your Honor.

THE ADMINISTRATIVE LAW JUDGE: Thank you, Mr. Hall. Mr. Hagan, you are temporarily excused. Counselor, are you going to supply copies of that exhibit to all parties?

MR. SAYRE: Yes, to all parties who request it, Your Honor. I think I have given everybody who is here a copy.

THE ADMINISTRATIVE LAW JUDGE: I think you forgot one person.

MR. SAYRE: Your Honor, I was one short. We are prepared to call Mr. Markovci at this time, Your Honor.

GEORGE F. MARKOVCI, called as a witness on behalf of Commission Trial Staff, having been duly sworn, according to law, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. SAYRE:

Q Could you state your name and address and employer and position for the record, please?

A My name is George F. Markovci. I am employed by the Pennsylvania Public Utility Commission, P. O. Box 3265, Harrisburg, Pennsylvania. I am an Analyst in the Electric Section of the Bureau of Rates.

Q Do you have before you a document marked Trial Staff Statement No. GFM-1 which includes testimony and an appendix and three exhibits, GFM-1A, 1B and 1C?

A Yes, I do.

Q Was the statement prepared by you?

A Yes.

Q Were the exhibits prepared by you or under your direct supervision and control?

A Yes, they were.

Q Do you have any corrections or additions that you wish to make to the statement or exhibit?

A No, but I wish to make a comment on Exhibit GFM-1, C, Sheet 1. The daily O&M requirement of $2,114,000 claimed by PECO was used by me in calculating the cash working capital requirement. This figure is subject to change if the Judge or the Commission makes any adjustment to the claimed O&M expenses of $771,721,000.

Q If I were to ask you the questions that appear in the statement today, would your answers be the same as you have provided therein?

A Yes, they would.

Q Are the facts and opinions in the statement and exhibits true and correct to the best of your knowledge, information and belief?

A Yes, they are.

MR. SAYRE: Trial Staff requests that Statement No. GFM-1, of which I have just provided three copies to the reporter, be marked for identification.

THE ADMINISTRATIVE LAW JUDGE: Without objection it will be so identified.

(Trial Staff Statement No. GFM-1, document entitled Direct Testimony of George F. Markovci Concerning Cash Working Capital, was produced and marked for identification.)

MR. SAYRE: Mr. Markovci is available for cross-examination.

CROSS-EXAMINATION

BY MR. HALL:

Q Good afternoon, Mr. Markovci.

A Good afternoon, Mr. Hall.

Q Mr. Markovci, would you agree with me that approximately 50 percent or even more than 50 percent of the adjustment that you have proposed to the comany's cash working capital claim is on account of a deduction for interest payments and dividend payments?

A That is correct.

Q Am I correct that the theory of this adjustment as you have proposed it is that the company has available to it, during the course of any given period, an amount of

money which represents money which it has collected from ratepayers to pay long-term debt interest and also preferred dividends, but which it is holding pending the time that that money becomes payable?

A That is correct, Mr. Hall.

Q And you have, in calculating the amount of this deduction, have you not, taken the total amount of the company's annual interest and dividend payments, and in the case of interest you have backed that down to use one quarter of the annual amount based upon the semi-annual payment period, and a further halving of that amount to reflect a midpoint in the accrual cycle which gives rise to the semi-annual payment, and a similar principle has been used with respect to preferred dividends only there you are dealing with a quarterly payment period, is that not correct?

A That is correct, Mr. Hall.

Q In determining the amount of this deduction you have assumed, have you not, that the company is collecting the bond interest payment for the preferred dividend payment, as the case may be, beginning with the first day upon which service is provided, in your measurement period, is that not right?

A Not the first day of a new company, but the first day of a mature ongoing company, yes.

Q Would you explain to me what you mean by

a mature ongoing company?

A Well, an explanation of a mature ongoing company would suit Philadelphia Electric very well.

Q Let us take a typical cash working capital computation. Would you agree with me, Mr. Markovci, that in such a computation one normally begins from day one, which is the beginning of a monthly service period, and one measures the lag in payment of expenses from that day one as compared to the lag in receipt of revenues from that day one to determine one's cash working capital requirement?

A Yes, I would agree with you on that.

Q Your bond interest accrual begins on that day one, too, does it not?

A Yes.

Q Would there not be a lag in revenue collection to offset against your bond interest accrual which you have not considered in your prepared statement?

A In the case of Philadelphia Electric I don't think that would be the case, there would not be a lag.

Q Why not?

A Because the company in its own claim has failed to consider the revenue lag days in its federal income tax accrual calculation. Also, as I said before, PECO is a mature company and their revenues are being provided on a continuous ongoing basis.

Q Isn't that true of the whole cash working capital computation? If you applied that theory, there would be no need for a cash working capital computation, assuming that were a valid theory?

A Yes, that would be true.

Q And I take it you have not accepted that as a valid theory because you have not used it?

A I have not used it in PECO's particular instance here for the reasons that I have just stated.

Q Now referring to your second point with regard to a revenue lag with respect to tax calculations, could you explain to me how that relates to whether or not there should be an adjustment for lag in revenues associated with the accrual of bond interest?

A Would you please repeat that question?

Q You answered an earlier question of mine as to why you had not taken into account the fact that revenues lag by saying that the company did not take that fact into account in considering accrued taxes, and I fail to see the connection, and I am asking you to explain it to me.

A All I am trying to say, if there is a pre-collection of interest then there is a pre-collection of federal income tax, too. That is what I am trying to say.

Q Who has assumed that there is a pre-collection of interest?

A Well, the company has failed to assume that there is a pre-collection of -- did you say taxes? In its own claim it has presupposed the pre-collection of federal income tax.

Q The company has used an offset to its cash working capital claim based on a philosophy which has been repeatedly approved by the Commission with regard to accrued taxes, has it not?

A Yes.

Q Would you agree that that philosophy is independent of any revenue lag calculations? By that I mean that that particular methodology is not dependent upon revenue or expense lags, it is a balance sheet methodology.

A That is correct, your methodology is a balance sheet methodology.

Q Your interest lag methodology, though, is a revenue and expense lag methodology and you have taken into account the expense lag but I am contending that you have not taken into account the revenue lag.

A That is correct, I have not taken into account the revenue lag for the reasons that I have stated.

Q And those reasons are?

A I believe I have answered that question.

Q Could you state it again, please?

A I will ask you the question: why didn't the

company take into account the pre-collection of its federal income tax?

Q I have one advantage, Mr. Markovci --

A You can ask the questions.

Q I can ask the questions. Would you please answer my question?

A Will you please repeat the question?

(The following was read by the reporter:

Question: Your interest lag methodology, though, is a revenue and expense lag methodology and you have taken into account the expense lag but I am contending that you have not taken into account the revenue lag.

Answer: That is correct, I have not taken into account the revenue lag for the reasons that I have stated.

Question: And those reasons are?

Answer: I believe I have answered that question.

Question: Could you state it again, please?)

THE WITNESS: If you are looking for more reasons, Mr. Hall --

BY MR. HALL:

Q I will accept the same reasons. I just want to hear what they are.

A I have repeated myself with the reasons. I have lagged the revenues of the company on my Exhibit GFM-1C, and in addition, I have testified in two previous other cases before this Commission on this methodology, and my methodology has been accepted. In Penelec R-78040599 and Met-Ed R-78060625 the Commission has accepted my methodology.

Q Passing that by, because obviously it is a question for decision here as to whether that is correct or not, even if the Commission has accepted it, it is not necessarily right, you have indicated that you have lagged the revenues. However, that lagging of the revenues, would you not agree, is not connected with your lagging of interest expense?

In other words, your lagging of interest expense is a separate adjustment which you have separately calculated from the revenue lag?

A That is correct.

Q Now, Mr. Markovci, your adjustment is made up of three elements, as I understand it. The first two we have been discussing, which are the interest payments and the dividend payments?

A That is correct.

Q I take it those arevariable amounts, they go up and they go down depending upon where you are in the accrual cycle relative to the next bond payment or the next preferred stock dividend payment, is that correct?

A That is correct.

Q In other words, once you have made a payment, in theory, and you have little or no bond interest that has accrued and available for working capital, the day before you have to make a payment you have quite a bit, the same is true of preferred stock?

A That is correct.

Q The third adjustment that you have stated here, which is entitled Cash Required to Finance O&M Expenses, that is a reduction which you propose in the company's revenue lag, is that not correct?

A That is correct, Mr. Hall.

Q And that is calculated on Exhibit CFM-1C?

A Yes, Mr. Hall.

Q Now the lag days that you show by the various tariff classifications on that page, which are in the third column heading down, those are the company's tariff payment periods, is that not correct?

A That is not exactly correct. I would say with the exception of one item. Basically it is the company's tariff dates, right.

Q Wouldn't that be true for Rate R through perhaps the transformer rental rider?

A That would be correct.

Q And moving down to the Late Payment Penalties, you have through a procedure here sought to reflect the extent to which customers pay after the due date as specified in the company's tariff, is that correct?

A That is correct, Mr. Hall.

Q Have you considered late payment charges that were forgiven in this analysis?

A No, I have not.

(Transcript continues on Page 2752.)

Q Now, finally, Mr. Markovci, I note that the total adjustment to cash working capital that you propose is in excess of the company's total cash working capital claim, is that not correct?

A That is correct.

Q Do you propose that the excess be deducted from the company's plant in service capitalization?

A Yes, I do, Mr. Hall.

Q In your opinion, could these funds which we have agreed arise from variable sources, i.e. sources where the money goes up and down over time, be used to support plant in service?

A Could these funds be used to support plant in service?

Q Could we take them and invest them in plant in service?

A Yes. You could do that.

Q How could you do that if their level varies from month to month and week to week? As we have agreed?

A I don't know what you mean by the funds varying from level to level and week to week.

Q Well, we have agreed that your interest payment deduction, your dividend payment deduction varied?

A Right.

Q In other words, the amount of money that would

be available for the company's use will differ from month to monthand week to week?

A. Right.

Q. Now, if that is so, how can the company use those funds to support plant in service?

A. Well, I don't think we are looking on this as a day to day and a month to month situation.

Q. How are we looking at it?

A. We are taking a broad overview of the situation. We are talking about a period in time, namely a year. We are not looking, we are not delving into the daily aspects of this. We are looking into it on a broad overview.

I would like to further make a comment on my negative cash working capital position here. I have given the Judge and the Commission a methodology. I don't really know what the final figures are going to be. That's up to the Judge and the Commissioners. So I don't really know if we are going to have a negative situation. I'm not in a position to project this.

Q. Assuming that we do, could you state for me how the company could finance permanent physical installations with a fund source that varies over time?

A. That would be rather difficult to do.

MR. HALL: Thank you. That's all the questions I have.

MR. SAYRE: May I approach the witness for just a moment? I want to see what his answer is going to be for one question.

(The witness and counsel conferred)

THE ADMINISTRATIVE LAW JUDGE: Mr. Burgraff?

MR. BURGRAFF: No questions of the witness, Your Honor.

THE ADMINISTRATIVE LAW JUDGE: Does any party have any questions of this witness?

MR. SAYRE: No questions.

THE ADMINISTRATIVE LAW JUDGE: Let's take a brief recess before we call Dr. Birx back.

THE WITNESS: Am I excused, Your Honor?

THE ADMINISTRATIVE LAW JUDGE: You're excused.

(A brief recess was taken)

THE ADMINISTRATIVE LAW JUDGE: We will resume cross examination of Dr. Birx.

DONALD L. BIRX, resumed the stand and testified further as follows:

CROSS EXAMINATION (Continued)

BY MR. HALL:

Q Dr. Birx, I have just two additional questions in the depreciation field before we move on. With respect to the data that you received from Commonwealth Edison Company with respect to the Dresden 1 plant, I

understand that that data was obtained through a telephone call to an individual in their management. I believe that call was on what? September 22, 1978, is that correct?

A. Probably correct without checking.

Q. I believe that's in PECO Exhibit 5 that you have included the letter?

A. Yes.

Q. And I take it that that is the only telephone call that you have made to Commonwealth Edison at this point? There has not been a subsequent call?

A. I'm not absolutely sure of that. But what calls there were dealt with the same subject.

Q. Okay. But you have no specific recollection of any other call other than the September 22, 1978 call?

A. Correct.

Q. Now, with respect to the call, the telephone call to Mr. Wallis, with regard to the GE test reactor, do you recall the date upon which that telephone call was made?

A. Earlier in '78, but around the same period of time, I would say.

Q. Perhaps in the summer of '68. Would that be a good time frame? An accurate time frame?

A. Yes. I think so.

Q. Now, finally, with respect to your conversation

with Mr. Mount, the company's manager at Eddystone, on how many occasions have you had conversations with Mr. Mount?

A. Just that one day.

Q. Just that one day?

And how long were you at the plant that day?

A. Two to three hours.

Q. And I take it all of this time was not spent with Mr. Mount?

A. Oh, yes. Practically all of the time.

Q. Virtually all of it was?

A. Yes. We discussed the various topics and then he took us on a tour of the plant, but he was present at all times, as I recall.

Q. Dr. Birx, do you believe that in establishing rates, which will be in effect and which will be charged for service to be rendered in a future period, that we should attempt to be forward looking? And by that, I mean we should attempt to recognize changed operating circumstances and cost levels which will exist during the future period, that the rates that we have proposed will be in effect or we are considering will be in effect?

A. You mean should we use a future test year?

Q. Well, I think it goes a little bit beyond that. It is not -- my question is not constrained by a specific time frame, but why don't we put one on it for purposes of clarity.

In this case, the rates in question will go into effect approximately on May 1. Would it be your opinion that we should, in establishing those rate levels, give consideration to operating condition and cost level changes that we would expect the company to experience at or by that time?

MR. SAYRE: Your Honor, I will object to that question insofar as it goes beyond the area of testimony for which this witness is furnished. I have no objection provided that it is limited to the areas of rate base that Dr. Birx is testifying upon.

MR. HALL: I will accept that limitation.

THE WITNESS: I think this is reasonable, yes.

MR. BURGRAFF: Mr. Hall, could I have what was the question and the answer? I'm making the assumption that your last phraseology was the question. Am I not correct?

MR. HALL: That is correct.

MR. BURGRAFF: Could I have that repeated, please?

(The pending question was read by the reporter)

THE WITNESS: I might add that for the purposes of settling the rate case, it would be helpful if we just set a date on that, too. Because the numbers keep changing all the time. We are dealing with a dynamic thing.

BY MR. HALL:

Q But in general philosophy, I take it you will agree that one should seek to look forward, as we have discussed,

is that not correct?

A. Correct.

Q. Dr. Birx, have you ever previously recommended an adjustment to rate base or some other adjustment on account of allegedly excessive reserve generating capacity?

A. I don't think I have.

Q. Dr. Birx, could you explain to me the manner by which the reliability criteria employed by Philadelphia Electric Company is determined?

A. I don't know if I am - -

Q. I think I misstated the question. Let me state it more clearly. Given the reliability criteria, one day in ten years, can you explain to me the manner by which that criteria is translated into a reserve requirement?

A. I was about to say I don't know that I am the best qualified witness on that, because of all the details that go into it. But in general principles, one starts with the installed capacity and takes into account all factors which might detract from that installed capacity based on experience with outages, based on plant maintenance, and basically one does the same thing with the load one anticipates. And once one determines what those two distributions are, which are determined plus or minus some accuracy, then those curves which I have in my testimony show that there is a finite probability that conditions could prevail where the

capacity available would not always be sufficient to meet the load, and once you define the distributions to work with, one can calculate that probability, and translate it into some - - once you know the probability, I mean it is easily translated into a loss of load probability which most companies try to keep that loss of load probability to some value which they think is adequate for their system, one year in ten years.

I think CAPCO uses one day in one year. But it is a statistical procedure.

Q It is your understanding that CAPCO uses one day in one year?

A I have seen that in some of the documents I have been reviewing lately.

Q And once you have determined that the appropriate criteria is one day in ten years, as this company has, how would you take that and translate it into a reserve requirement of say 20 percent or 25 percent or whatever the percent should be?

A Well, the reserve - - basically what you would come up with is a - - like I say, we started with an installed capacity. So based on your system parameters, you can determine what that installed capacity must be in order to give you a loss of load probability of one day in ten years. And the amount by which that installed capacity is higher than your

maximum peak on the system at any one time is what we normally define as service.

Q Referring to page 14, lines 12 to 15 of your prepared testimony, if you know, Doctor, does the Philadelphia Electric Company employ any of the load management technologies which you have identified on these lines?

A I think that they are, since the last rate case, they have gotten started on experiments involving some of these, yes, and controlled water heating has been -- well, controlled to the extent that time clocks are used. That's been in effect for a considerable time.

Q What about off peak incentives?

A Yes. I say a number of those things have been looked at and experiments are currently being conducted.

Q But it is your understanding that a number of these techniques are currently being employed by the company?

A That's my understanding. I didn't mean to imply that you weren't working in these areas.

Q Could you describe for me, Doctor, the improved maintenance procedures which you refer to on lines 16 and 17 of this page?

A Here again, I think that it is a little difficult to put my finger on everything, but I just noted one stood out that I questioned somewhat in talking to the plant superintendent. It was pointed out that a seal had gone out in a turbine, a

Westinghouse turbine, and that immediately shut down the equipment.

Q Was this a separate standard combustion turbine that you are speaking of or is this something else?

A. No. I guess it was in Eddystone. I'm pretty certain that that was. But you were inquiring about a long outage that they had experienced earlier. At any rate, I would just point out that the seal that went out had gone out and it shut down the equipment. The seal was ordered from Westinghouse and six months later, it was delivered.

Now, it may be that that seal was such an expensive item that it doesn't pay to keep it in stock, but I doubt that that's the case. But what I'm trying to suggest is that one take a look at the spare parts situation, so that, and among other things, whatever looks possible and I will commend you in effect that you do have a group studying these outages now, trying to come up with answers.

I recognize with the amount of capacity you have, there's no great emergency in getting equipment back on line, but if you could accomplish quicker repairs and have material on hand provided it was economically feasible, that this would probably be a means of keeping those forced outages as short as possible. That's what I'm trying to suggest there.

Q Now, Doctor, referring you to lines 12 to 19 on page 15, what data can you offer us at this time which would

indicate that reserve requirement reductions could be achieved by means of load management?

A. Are you going to take them one by one?

Q If you wish.

A. I mean you've got load management and optimum maintenance. I've been grouping them altogether. All I have to offer there is as I cited, the New York study, North Carolina study, and I, myself, do not know. I have been, as I said, I urged Met Ed to make a study and the fact is I wanted to make that a requirement prior to the next rate case, what could be done in these areas. I, myself, personally felt that we just can't keep climbing up to the 30 percent reserve capacity in order to assure reliability. There have been a lot of suggestions recently and I, myself, attended a conference on the cost of over building versus under building, and there are a number of economic models available and people have tried to put a price tag on an outage, and that's pretty difficult to do because the cost of an outage means different things to different people.

An outage of 10 to 15 minutes would affect me very little, but, and if I were able to get service which permitted me to be interrupted in no more than 15 minutes at a time, maybe two or three or five times a year, if someone offered me lower rates if I was willing to put up with that, I would probably buy it.

Now, some industrial company might find the situation much different. So we have various groups arguing that this should be, a look should be taken at this to try to determine the social costs of outages and that rates should be designed so as to charge people appropriate rates for the amount of reliability that they require.

And the other thing is, of course, that the outages that we have experienced are primarily caused by outages on the transmission system and that is an affected law by this loss of load probability technique. So having the excess capacity does not guarantee that one will not have their service interrupted.

Q Am I correct, Doctor, that the material that we have been discussing and the ideas that you have put forth are put forth by you for purposes of discussion and analysis as opposed to any assertion that there's some defalcation by the company with respect to these matters?

A Correct. Except that I do feel that Philadelphia Electric has too much capacity at the present time. I mean that's correct.

Q Now, at page 16, lines 17 to 23, you provide an example of savings that could be achieved by reduction in reserve requirement. Is this a hypothetical example, Doctor?

A Sure.

Q You don't mean this to imply that that's necessarily

applicable in Philadelphia Electric?

A. That's strictly hypothetical.

Q. Doctor - -

A. I'm just asking the question what can we do about the situation. I think when we are saying that PJM is telling us that contractual reserve requirements now are 22 percent and next year they are going to be 25 percent and by the mid '80's, they are going to be 28 percent, I think that's a danger signal like the economic indicators going down and that you and we and everybody else has to figure out what we are going to do about this, because I think there's too much pressure on us right now to run as tight as ship as possible and keep things lean.

Q. Doctor, referring you to page 17, you there indicate that your first choice as the basis for a capacity adjustment was the leased combustion turbines, is that not correct?

A. Correct.

Q. Doctor, did you calculate the amount of the adjustment either to rate base or to expenses which would have resulted had you eliminated 500 MW of leased combustion turbines?

A. I don't think I pursued that any further. Once I got a copy of the lease agreement, that turned me off.

Q. Well, Doctor, the reason that you did not pursue

the leased equipment elimination, as an option, is it not true, is that you found the company was locked into these leases? That they could not be terminated at the company's option?

A. That is correct.

Q. Is it not true that with regard to capacity, that the company has actually purchased with investors' dollars, the company is similarly locked in with respect to the necessity to provide a return on those investor dollars?

A. The company might be obligated to that, but the question in my mind is whether any lock-in of the company should involve the customers or should be passed on to the customers.

(Transcript continues on next page)

Q Doctor, you have used as the basis for --

A I mean, you might say the same thing about Met-Ed when TMI blew up, but they were not locked into and one of the first things they did was cut their dividend.

Q I would appreciate if you would let me finish asking my question before you --

A I was just trying to complete my thought.

Q Doctor, you have used on page 18 as the basis for calculating the rate base adjustment which you propose a combination of plants including Eddystone-3 and 4, Muddy Run and Croydon, to determine the average cost per megawatt to use in your calculation, is that not correct?

A Correct.

Q Did you make any analysis, Doctor, of the value of these plants, those that you used, as compared to other plants which you did not use, either in terms of the energy cost savings experienced by the company as the result of these plants' availability or on the basis of capacity factors or whatever other factor, which led you to choose these plants as opposed to other plants?

A I will try to run you through my thinking in this regard. First of all, I determined that Philadelphia Electric has, as I said somewhere in the testimony -- well, it is right there at the top of page 18 -- an excess of peaking capacity, which in my estimation they have now. This

is primarily because of the combustion turbines that have been installed recently. Eddystone-3 and 4 the company itself refers to as a peaking plant. Well, I won't get into that.

Q You say the company itself refers to as a peaking plant. Could you provide me with a reference for that, please?

A Well, Mr. Mount said that anything that is on oil they consider peaking. When I was down there, Eddystone-3 and 4 was being used primarily like a capacitor. They were generating megavars not megawatts.

Q You base this opinion then on a comment made by Mr. Mount during a tour of the plant?

A He seemed very definite about it. As soon as anything goes to oil it is peaking. And that is primarily because of the cost involved.

Q Doctor, my question, which is a relatively restricted one --

A Is trying to explain to you why I picked those plants, that is what I understood your question.

Q My question was, did you do the kind of analysis that I stated in making that selection? Did you or did you not?

A I wanted to do the kind of analysis where I felt the problem was, that was the thing.

Q Did the problem require the kind of analysis that I stated? Did you do the analysis that I stated, yes or no?

A In the last rate case we looked at taking -- well, let me tell you what I did do --

Q Could you answer my question yes or no, and then tell me what you did.

A You asked for an analysis. I made an analysis to this extent. I took the entire plant of Philadelphia Electric and determined the average cost per kilowatt using the entire plant. That came up to a much higher figure than this. I said that would be unfair to the company to use that dollar amount.

I took the most fully depreciated plants that I could think of, and that came out to a much smaller dollar amount, and I said that would be unfair to the customer, because if you take Eddystone-3 and 4, for instance, at the time of the Arab oil embargo Philadelphia Electric had about $40 million invested in that, the signal flags were all flying, and yet they went ahead and completed that plant at a cost of $550 million or somewhere around there.

So I am saying that the problem is with peaking capacity. Looking the whole plant over, we say that is unfair to the company. The problem is not with the most fully depreciated plants, the problem is with peaking. Now

how can we be fair to both the company and the customer by looking at peaking? And I tried to pick a combination of plants here.

The Muddy Run is low dollar amount, I mean it is a very efficient plant. Croydon, you got a mixture of combustion turbines, you got pumped storage. And you got Eddystone-3 and 4, another oil-fired plant which its usefulness is questionable at the present time.

By averaging those three I came out with a dollar amount which I felt was representative that we should look at, because it would be fair to both the company and to the customer if we were going to make any adjustment. So that was the way I thought about it.

Q Dr. Birx, would you provide me with the material that you based your statement on with respect to the fact that in your belief the company had only spent $40 million on Eddystone at the time of the Arab oil embargo? You don't have to do it now. You can provide this to me in written form later, whatever written documentary material you base that statement on. Okay?

A Okay. You don't question the $550 million?

Q No, I do not. Dr. Birx, referring you to Schedule 4 of your exhibit and your fair value calculations, in Method 2 and again in Method 5 you have employed a ratio for determining fair value which is based upon what is termed

Commission findings, is that not correct?

A Yes.

Q Could you explain to me what Commission findings you have employed in determining that ratio?

A Let's go back to Schedule 3, Line A, the solid line is a plot of the ratio of fair value to original cost based on unadjusted company claims in past rate cases and the current rate case, if one is consistent in calculating fair value as the average between original cost and five-year trended original cost.

Now in order to get the trend here, it doesn't make any difference which method you use to calculate fair value or to come up with a ratio as long as you are consistent and always use the same one.

Since I have been testifying I have been using that as the basis to establish trends.

The dotted line is the ratio of fair value to original cost as determined by the Commission. And, of course, we have data up to 1977. The rest is extrapolated.

The top line in Schedule 3 from the company data, I have made adjustments to the ratio based on comparison with the norm determined from other companies. That is the statistical procedure described elsewhere.

My adjustment to bring Philadelphia Electric's data into what I consider the norm with other companies is

shown in Line B.

Q Could I stop you right there, Doctor? I am just having a little trouble following. The 1.2841 figure which is entitled A, is that a fair value to original cost ratio based on the company's measure of value claims in prior cases?

A This case.

Q This case?

A This case.

Q That is based on this case?

A Right, those last two --

Q 1.2841 --

A 1.2584 would be, what is it --

Q Historic test year --

A March 31, 1979, and 1.2841 would be March 31, 1980.

Q Is that using five-year trended original cost?

A Yes, the average between original cost and five-year trended.

Q You have adjusted that down to 1.2152, is that correct?

A Yes, sir.

Q For 1980 and that is based upon your interpretation of other Commission fair value findings with regard

to other companies, is that correct?

A No, it has absolutely nothing to do with any Commission findings.

Q What is it then?

A It has to do with a comparison of Philadelphia's trended values and the ratios that are determined thereby with what other companies presented in late rate cases.

Q Why have you made that adjustment?

A Well, that is explained in the testimony also, because of the fact that the trending procedure involves matters of judgment, it involves matters of who does it -- if Gilbert Associates did it, they come up with different figures than if Mr. Waddington did it, in all probability.

What I have done, back in Schedule 1, is to plot these same ratios based on company data unadjusted that UGI, West Penn, Penelec, and Duquesne have come up with, and you see that there is a scattering of points there, and I put a least squares line through it.

I am making the point that since this trending does involve so much judgment and since we always have arguments as to who is right and were the right indexes used and what would happen if you did this and what would happen if you did that, I am saying that if we take the conglomeration, what many people have looked at and come up with and put a least squares line through it, we are reasonably assured of

being in the right ballpark.

Q Would you agree, Dr. Birx, that the level of a company's fair value to original cost ratio as you have computed it here and the difference between that and the trend line that you have drawn for these various Pennsylvania utilities could be the result of individual cost considerations in a particular company's territory?

A They could be the result of many, many different things. But suppose a company had experienced costs for building a plant which were double somebody else's, I mean we could not justify giving them double the rates of the other company.

Q Do you know if that is the case with the Philadelphia Electric Company?

A If what is the case?

Q Do you know whether or not that is the case with regard to this company?

A No, I don't know that that is the case.

Q Why have you chosen UGI-Luzerne Division, West Penn, Penelec, Duquesne?

A I put on every company there for which I have data. There wasn't any choosing.

Q Doesn't the Commission have data for all of the other companies in the state in its files?

A Not data that I can get this information from.

Q I notice West Penn is here. Did you in the West Penn case recommend that the fair value to original cost level for West Penn as computed on its individual data be increased to the level of your trend line in determining fair value?

A No. Do you think I have been unfair?

Q I think the answer is no, you did not. You would agree with that answer, would you not?

A If a company comes close to the line or below, I have not adjusted their figures. If Philadelphia Electric comes below the line, I won't adjust their figures.

Q On the 1.193 figure on Schedule 3, that is titled Commission Findings --

A You notice the line changes there.

Q I see.

A The dots are Commission's findings in the past rate cases.

Q What does the dashed line refer to?

A The dashed line says that if the fair value of the company in 1977 was such that the ratio of fair value to original cost was 1.145, and that has to be our anchor point because it is the Commission who finds fair value, then we could project a fair value in this case by taking into account all changes in the company's plant between then and now, taking into account all changes in economic conditions

between then and now, and that is what the company has tried to do in its trending procedures and in its continuing property records, so I have borrowed from the company's data, which I have adjusted, and I put in a line which parallels the company's data to get us up to our current rate case, which goes from the last Commission finding up to what would be an estimate of fair value for March 31, 1980, taking into account all those factors.

Q Am I correct, Doctor, that what you have done is take the last Commission finding and increase it by the same slope, as you increased the company's claim from the last case, the 1.1670 figure, for what I will call the average utility fair value original cost ratio which you computed on Schedule 1 that we looked at before, is that basically what you have done?

A Right. If the company's data had not been adjusted, that trend line would have followed the top line.

Q Now on Schedule 4 in your various fair value computations, with the exception of Method 3 and Method 4, that would be Methods 1, 2 and 5, you have employed as a basis for determining fair value either the point labeled B or the point labeled C on Schedule 3, is that not correct?

A Well, the A's and B's refer to curves.

Q The 1.2152, which is right next to the B and the 1.1933 which is right next to the C --

A Right.

Q The first one of those, the higher one, the 1.2152, is your interpretation of this company's measure of value cost data as adjusted to reflect the measure of value cost data of selected other utilities in the state, is that correct?

A Yes, the 1.2152 is my ratio based on taking unadjusted company data and then correcting it according to my method and bringing it into conformity with what other utilities have found.

Q By correcting it, in essence what you do is just reduce it, don't you, from the company's actual --

A I reduce it to the least squares line.

Q You reduce it to the least squares line as if it was just like any other company?

A Right.

Q The other point which you have used is based upon a prior Commission fair value finding, is that not correct?

A That is correct. If we are looking at fair value, that is where we have to go to, because that is the latest fair value we have by definition.

Q Would that point in any way take into account or give consideration to the increase in the current value of the company's facilities as shown in the evidence in this proceeding?

A Say that again, would you please, Mr. Hall?

Q Would that point, the 1.1933, give any effect, or if it does to what extent does it give effect, to the increase in current value as measured by trended original cost of Philadelphia Electric Company's facilities as shown by the evidence in this proceeding?

A Certainly.

Q To what extent does it do that?

A Well, if it did not, the line would go horizontally over to March 31, 1980. The very fact that the line goes up from 1.145 to 1.1933 is a measure of the extent to which it gives recognition to the increase in value of Philadelphia Electric's facilities.

Q The extent to which it does that is to the extent of the increase in the value over time of the joint utility group that you have computed on Schedule 1, is that not correct?

A That is correct.

Q Now, in your Method 3 on Schedule 4 for determining fair value you have employed five-year trended original cost, is that not correct?

A That is correct.

Q Do you expect, Doctor, that the price levels in the future will ever drop to this five-year level? Why don't we put a time limit on that. Within the foreseeable

future do you expect that to occur?

A I don't know.

Q You don't know, you have no opinion?

A I hope.

Q You hope it will but do you expect it to?

A Probably not.

MR. HALL: Your Honor, that is all the questions I have.

THE ADMINISTRATIVE LAW JUDGE: Mr. Burgraff?

MR. BURGRAFF: No questions.

THE ADMINISTRATIVE LAW JUDGE: Does any party have questions of this witness?

(No response.)

THE ADMINISTRATIVE LAW JUDGE: Mr. Sayre, would you like some time?

MR. SAYRE: Yes, could we take a break, Your Honor?

THE ADMINISTRATIVE LAW JUDGE: Let's take a five-minute break.

(Short recess.)

(Transcript continues on Page 2779.)

THE ADMINISTRATIVE LAW JUDGE: Mr. Sayre?

REDIRECT EXAMINATION

BY MR. SAYRE:

Q On redirect, Dr. Birx. You testified in response to a question from Mr. Hall that GPU Utilities have proposed less than 40 year lifespans for their nuclear units. Is that correct?

A Yes.

Q What is the relationship between a lifespan period in a rate case and a revenue requirement?

A Well, if you consider the revenue requirements over the lifetime of the plant, total revenue required will increase, if you go to longer lives.

Q But over the short run?

A Well, your cheapest plant is the one you pay cash for. But the problem here is to be fair to all rate-payers, to extend the costs of the plant over its life so that the proper people will be paying for it.

Q Also on cross examination, Dr. Birx, you used the term economic lifespan and I think you mentioned that as a definition for it, a cradle to grave concept. Could you elaborate what you meant by those two time periods?

A Well, what we are talking about here is what we can expect in the way of the total lifetime of the plant from the time it first goes in service to the time that it is retired.

Now, in the Egg study, the normal progression, what was plotted there was the decrease in kilowatt hours generated as a function of age. The normal progression has been to go from a baseload plant to an intermediate load plant, in other words, the plant that was originally baseload when more efficient plant goes on line, then it moves to an intermediate type of operation and then to a kind of peaking operation until it's finally retired, and this, I think was clear that this should not be construed as meaning that this would be what would be expected of a nuclear plant. Nuclear plant by its nature would be expected to remain a baseload plant throughout its lifetime of usefulness, and Egg made a statement there that this kind of operation, because it reduces the cycling, would normally extend the life of the plant.

Q Could you turn to page 26 of that study, appendix C, in your testimony? On cross examination, you were asked a number of questions about the units retired that are graphed along the bottom. How many units in that study were not retired?

A Well, there were 35 that were retired and total number of units in the study were 35, so of all the 303 plants studied here, approximately 10 percent of them had been retired at the time the study was done.

Q Can you say again what was the total number

studied?

A. 303.

Q. So the difference between those figures, 303 minus 35, as of the end of the study, that number were still on line?

A. Yes. Approximately 268 were still operating.

Q. Could you turn to your notes of your August 21, 1978 conversation in the interrogatory answers identified as a PECO exhibit? About a quarter of the way up from the bottom, the second one up from the bottom that is underlined is a line that I believe reads doesn't envisage line of dead nuclear plants. Is that what your notes say?

A. Yes. I asked, I explained to Mr. Wulsh the situation that the companies were using or attempting to use the license -- remaining years in the original license period for depreciation and my question to him was what did he envision at the end of forty years? Did he envision our rivers lined with dead nuclear plants and he said that no, he did not envision that.

MR. SAYRE: No further questions on redirect.

MR. HALL: If I could have just one minute, Your Honor.

(Pause)

RECROSS EXAMINATION

BY MR. HALL:

Q Dr. Birx, just two questions. One, referring you to page 9, Mr. Egg's study in your appendix C, am I correct that Mr. Egg's reference to a potentiality for increased lifespans for nuclear plants is set forth in the last two sentences on page 9, is that correct?

A Yes.

Q Would you read those two sentences into the record, please? Or into the transcript?

A We might need more than two sentences.

Q Let me read them and ask you a question with regard to them.

A Let me do the last three, if you'd like.

Q Okay.

A The heavy financial burden of the nuclear fuel at low output factors may preclude the operation of nuclear units for peakload service. This may result in a general shift to a two tiered development of system generating capacity, one exclusively baseload nuclear capacity with the accent on lifetime load cost per kilowatt hour of output and two, exclusively peakload capacity such as combustion turbines with the accent on lowest possible investment cost per kilowatt of capacity.

Such a development could extend the economic lifespan of nuclear units and thus reduce the lifetime financial cost.

Q Would you agree with me, Doctor, that Mr. Egg's statement, then, is conditioned upon the occurrence of future events which he does not speculate as to their probability?

A I never met Mr. Egg, but I do not think that's the case. There's general agreement that you cannot use a nuclear plant for cycling operations.

MR. HALL: Thank you. That's all I have.

THE ADMINISTRATIVE LAW JUDGE: If there are no further questions, we will adjourn until Monday --

MR. HALL: I have a couple matters.

MR. SAYRE: I guess two of us have some final matters. Your Honor, Trial Staff would request a continuing objection so as to preserve our rights of exception with respect to additional interrogatories being served on staff witnesses. We have received interrogatories towards four more witnesses today.

THE ADMINISTRATIVE LAW JUDGE: You've got it.

MR. SAYRE: Thank you.

MR. HALL: From the company's point of view, two things. One, Mr. Paquette will be available for cross examination on the 20th. Now, in addition, with regard to the filing of additional rebuttal testimony, so there's no unclarity, the company's understanding of the schedule at this point is as follows: The company will file rebuttal

testimony as to load forecasting and as to Dr. Shakow's testimony on the 12th which is Wednesday. We will file testimony as to the other excess capacity material hopefully on the 13th.

The reason for that is that Miss Boonin and Barrett are not scheduled until the 12th, so we can't very well file our testimony before we cross them.

As to all other rebuttal testimony, it is the company's understanding that that is due on the 17th. Now, finally, the company is going to request certification of Your Honor's ruling of yesterday with respect to exhibit RCW-6. That is the only item as to which the company has a difficulty.

The company will both request certification and a stay of the order and also reconsideration of the order with regard to these two arguments. I do not know how Your Honor wishes to proceed on this. Obviously, we have very little time for a decision.

I'm willing to argue the point now and take Your Honor's decision now or as Your Honor chooses to give it. It is the company's view that Exhibit RCW-6 is well within the time period delineated in Your Honor's prehearing order and was provided prior to the November 30 date which was specified in that order for the provision of final accounting adjustments by the company. For that reason, the company

feels that this exhibit is timely and should be permitted.

In addition, the company believes that this particular exhibit, even more than any other exhibit in this particular matter is well within the test which Your Honor stated on page 2 of that order for permitting additional material.

This particular claim is based upon the company's filing which was made on October 30 with the Commission for the cap on the energy clause. It could not be filed, in the company's view, until that cap was approved because the claim would be greatly changed, depending upon whether the Commission in fact approved cap or did not. The company therefore waited until the approval was received, which was November 21, the very date that the exhibit was submitted. Prior to submitting it.

Therefore, events which in the company's view made this claim possible and made it justified occurred on the very day it was submitted. For that reason, we think we come well within the test stated by Your Honor as being changed circumstances or data which was not previously available.

Finally, I would note that this particular item, this additional hundred million dollars of investment is a very significant item in the company's view in terms of the effect upon the company's financial position and is

discussed at some length in Mr. Paquette's rebuttal testimony which sets forth the company's current financial position. For all of those reasons, we would request that Your Honor reconsider Your Honor's ruling as to this one item and that in the event that Your Honor would not do so, that Your Honor would agree to certify the matter to the Commission and stay your order as to that one item.

MR. BURGRAFF: If I might comment, Your Honor, I don't have the exhibits with me. I'm making the assumption that RCW-6 is for fuel clause?

MR. HALL: That's correct.

MR. BURGRAFF: I would only note that what Mr. Hall has raised is perhaps in a less additional factual background for raising the claim. What we are faced with now is approximately two weeks left in the case. It would be our position and we are not giving up or waiving the right to respond to this by writing.

I am making the assumption that there will be something in writing from the company, that Your Honor's ruling is still applicable for the reasons that we stated originally and for the reasons you stated in your order.

We would simply note that once again, the company had total control over when they chose to file for a cap on their energy clause. They were aware of the timing of the rate case. I don't see where that particularly makes any

change in what we are faced with here. I don't know why the company petitioned for the cap when they did or whether they did not.

But once again, that was totally within their control. And they were aware of it when they filed the rate case. We would simply suggest that it really doesn't change the matter at all.

(Transcript continues on next page)

MR. HERSHEY: I would further note that Mr. Hall indicated that the company knew in October that they anticipated filing this exhibit and waited only for approval of the cap. They might in order to mitigate the disadvantage to the other parties have notified the parties in October prior to approval of their intention to file the exhibit, and even submit the proposed exhibit in whatever preliminary form to those parties to allow the parties to prepare.

So I would second Mr. Burgraff's position.

MR. SAYRE: Your Honor, unlike Mr. Hall, I am not prepared to orally argue the question of certification and stay at this time, and I would agree with Mr. Hershey that it is somewhat disingenuous of the company to wait until the Commission acts on the clause to submit the exhibit and then insist on a early, quick argument on certification when Your Honor has ruled against it.

I would object to any procedure for certification that did not allow for the written briefing as provided in the regulations.

MR. HALL: If I could be permitted to respond just briefly, first, the company would like to decide the issue through argument and is prepared to do so.

Secondly, there was no reason for the company in its view to supply this material any earlier than it did.

Our supplying of the material is well within

the scope of our understanding of Your Honor's prehearing order with respect to establishing a date beyond which the company would be cut off from making adjustments. Secondly, the company would not have had this material to supply until, at the very earliest, assuming we had rushed this through and had not waited for a Commission order, about November 7 or something of that nature.

We filed with the Commission on October 30. Assuming we put it through I suppose it could have been November 3 or 4 at the very earliest.

I would note for Your Honor, with respect to the argument that the company could see this coming, indeed the company could not. The company until October 20 did not see a continuing pattern of increases in its fuel adjustment clause, and you can see this from revised page C26 in Exhibit RCW-6, whereby you do not see a continuing series of increases, especially major increases, until you come to the September figure, and the company would not have that September figure available to it until October 20, at which time the company moved immediately to file the cap request with the Commission, and then thereafter prepared this adjustment.

Now, I finally note that I fail to see how there could be any disadvantage to these parties with respect to this one or even all of the matters that the company has

filed, on November 21, which amount to some eight pages as compared to the Trial Staff's entire revenue and expense case which we received on that date and which we must review and discover against.

I think the burden placed upon them is extremely small relative to the burden which the company is undertaking in this proceeding to assist in scheduling.

I think their arguments are groundless when those two burdens are compared.

MR. BURGRAFF: I would certainly disagree with the latter point. The company has as much time as it cares to take in preparing their case. The staff, Consumer Advocate, and other parties, of course, do not. We have a certain limited amount of time to prepare our direct case, limited amount of time to initiate discovery. I don't see the analogy at all between Mr. Hall's receiving our direct case and us receiving Mr. Hall's direct case and having a limited amount of time to prepare and to initiate discovery and to file perhaps what we have to now on top of revised testimony in a two-week span.

MR. HALL: I would note that the company only has three months to prepare its direct case. The parties in this case have had significantly longer than that. Under the Commission's regulations we have a limited period.

MR. BURGRAFF: Mr. Hall has stated a number

of facts in the record here. We are making the assumption that there will be a written request. We certainly would request, as the staff has done, a chance to review the information and prepare a written response.

MR. HALL: I would note, Your Honor, that, of course, a written request with a week's delay is indeed a denial.

MR. SAYRE: Your Honor, my point on that is that I got Your Honor's order this morning. I haven't even yet had a chance to sit down and read it through seriously. I am not prepared to argue it today.

THE ADMINISTRATIVE LAW JUDGE: As far as Mr. Hall's request for reconsideration goes, that request is denied for the reasons stated in my order of yesterday.

I might note, however, that the company witness on October 10th stated that he saw $70 million of unrecovered fuel costs existing at that time.

Also I believe the prehearing order states something about adjustments upon which the parties have a chance to cross-examine.

Again, the request for reconsideration is denied. The request for certification will be dealt with according to the rule established by the Commission. If necessary, the parties should be prepared, and in the event that certification is granted and the Commission rules

adversely, we will just have to be prepared to set aside some time in January to face this one issue in a separate set of hearings.

If there is nothing further, we will then adjourn until Monday at 10:00 o'clock.

- - - - -

(The hearing was adjourned at 4:18 o'clock p.m.)

I hereby certify that the evidence and proceedings are contained fully and accurately in the notes taken by me during the hearing of the within cause, and that this is a true and correct transcript of the same.

BY Eugene W. Holbert
Eugene W. Holbert, RPR, CP

BY James P. O'Hara
James P. O'Hara

12-5-79

(THE FOREGOING CERTIFICATION OF THIS TRANSCRIPT DOES NOT APPLY TO ANY REPRODUCTION OF THE SAME BY ANY MEANS UNLESS UNDER THE DIRECT CONTROL AND/OR SUPERVISION OF THE CERTIFYING REPORTER.)

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R-79060865

Trial Staff Statement No. DLB-1
Witness: D. L. Birx

12-5-79

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PHILADELPHIA ELECTRIC COMPANY

Docket No. R-79060865

DOCKETED
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COMMISSION

Direct Testimony

of

Donald L. Birx

DOCUMENT
FOLDER

Concerning

Valuation

Summary

Adjustments have been made to the rate base claimed by the respondent based upon (1) excess capacity, (2) an increase in the life-span of the base load plants to 40 years, (3) disallowance of some land held for future utse, (4) disallowance of cash working capital, (5) disallowance of deferred income taxes, and (6) certain audit adjustments. Items (1) and (2) are explained herein while the rest are covered in separate testimony, (3) by H. Hagan, (4) by G. Markovci, (5) by W. Doyle and (6) by R. Stover. The resulting measures of value advocated by the staff are as follows:

Philadelphia Electric Company
Measures of Value
March 31, 1980
($000)

	Original Cost $	Spot Trended Cost $	3-Yr. Avg. Trended Cost $	5-Yr. Avg. Trended Cost $
As Claimed by Respondent	2,501,021	4,275,396	4,121,063	3,922,103
Staff Adjustments				
Excess Capacity	(85,000)	(129,000)	(124,000)	(118,000)
40-Yr. Life Span (Base Load)	45,114	102,225	98,523	92,870
Plant Held for Future Use	(2,338)	(2,338)	(2,338)	(2,338)
Cash Working Capital	(55,560)	(55,560)	(55,560)	(55,560)
Deferred Income Taxes	1,920	1,920	1,920	1,920
Audit Adjustment	(4,053)	(16,509)	(15,881)	(15,018)
Salem Audit	(10,500)	(10,500)	(10,500)	(10,500)
Adjusted Measures of Value	2,390,604	4,165,634	4,013,227	3,815,477

Based upon these adjusted measures of value, a fair value in the range of $2,828,000,000 to $2,889,000,000 is recommended.

Q. State your name and the name and address of employer.

A. Donald L. Birx. I am employed by the Pennsylvania Public Utility Commission, P. O. Box 3265, Harrisburg, Pennsylvania 17120.

Q. What is your position with the Public Utility Commission?

A. I am Electric Industry Advisor in the Energy Division of the Bureau of Rates.

Q. Describe briefly your educational background and professional qualifications.

A. My educational background and professional qualifications are presented in resume form, in the attached Appendix A.

Q. Describe your experience with the Pennsylvania Public Utility Commission.

A. I joined the Public Utility Commission in August 1977. I have conducted analyses in support of the Generic Electric Rate Structure Investigation and, since the publication of the Final Report on 76-P.R.M.D.-7 in December, 1977, I have been involved with valuation studies in all electric rate cases coming before the Commission.

Q. Have you previously testified before this Commission?

A. Yes. I offered testimony in the area of valuation in the Philadelphia Electric Company's rate case, R.I.D. 438, Pennsylvania Power Case R-77110521, UGI-Luzerne Case R-78030572, Pennsylvania Electric Co.'s Case R-78040599, Metropolitan Edison Co.'s Case R-78060626, West Penn Power Co.'s Case R-78100685, and Duquesne Light Co.'s Case R-79010740.

Q. To what is your testimony in this case related?

A. My testimony in this case addresses fair value, valuation of the respondent's plant for rate making purposes, the life-span used for depreciation purposes, and excess installed capacity.

Q. What is your definition of Fair Value?

A. Fair Value is the valuation of a utility's property by the Commission for rate making purposes at the time the rates are established. It is the value of property used and useful in the public service, and its determination requires a consideration of original cost of construction and depreciation, amount expended in permanent improvements and the average price reproductive cost as compared to the original cost of construction.

Q. How would you relate fair value to the original cost measure of value?

A. As noted above, the relation between fair value and the original cost measure of value is a matter of judgment by the Commission based upon the facts and factors of record. A factor which has a significant effect upon the ratio (F.V./O.C.) of fair value to original cost is the age of the plant. If a company is engaged in a significant building program, for instance, one would find that the average age of the entire plant would tend to decrease. Furthermore, as the average age decreases, the ratio of fair value to the original cost measure of value also decreases, approaching the vicinity of unity as a limit. For a new plant, the fair value would approach or be equal to the original cost, depending upon the method of determination.

Q. Have you analyzed this ratio (F.V./O.C.) as it relates to the age of

Philadelphia Electric Company's plant?

A. Age of plant data are available for the test years ending March 31, 1979 and March 31, 1980. The median plant ages at these dates are 5.66 and 6.54 years respectively according to company data. The corresponding ratios (F.V./O.C.) for these dates are 1.2584 and 1.2841 based on respondent's data if one calculates fair value as being the average of original cost and 5-year average trended original cost.

Q. Is this ratio reasonably consistent with those found for other companies with similar situations during this period?

A. It is higher than those found with other companies with which I have had recent experience. The new standard interrogatories now provide data which permit the examination of the correlation between the ratio (F.V./O.C.) and the age of plant. Schedule 1 is a plot of these data as derived from the filings of Penelec, UGI Luzerne, West Penn, and Duquesne.

A least squares trend line (App. B) is fitted to these data points to provide comparison. The equation for this line is:

Ratio (F.V./O.C.) = 0.0407 (age) + 0.9490

Correlation coefficient (r) = 0.917
Coefficient of Determination (r^2) = 0.841

Note that the Philadelphia Electric point is considerably above the trend line. The trend line value of the ratio for a plant of age of 6.54 years is 1.2152.

Q. Why is the trend line value of the ratios for a plant a valid measure for comparison?

A. Trended original cost calculations are estimates which are based on

numerous subjective judgments, e.g. the source of indexes, the appropriateness of using particular indexes to trend specific property groups, component selection and weighting when devising composite indexes and the splicing or linking of indexes. It would be rare indeed that two engineers would arrive at the same trended cost figure for a company's plant.

In the light of all the uncertainties involved, I feel that the ratio from the trend line provides a higher probability of being correct because it represents a mean of results obtained by most of the major utilities in Pennsylvania.

Q. Have you looked at the trend of this ratio as it has been influenced by Philadelphia Electric's construction program?

A. Yes. Schedule 2 indicates the dollar value of Philadelphia Electric's plant in service over the past 10 years. No new plants have been added since Salem I, and the period 78-79 is similar to that of 75-76.

Schedule 3 is a plot of the ratio of F.V./O.C. during this same time frame.

Three curves are shown on Schedule 3. The first, Curve A, shows the ratios as derived from unadjusted company claims in the past and present rate cases. Curve B is the result of adjusting the ratios from the company data to those corresponding to the trend line (norm for Pennsylvania utilities) in Schedule 1.

The third curve, C, represents the ratio (F.V./O.C.) as determined from Commission findings in previous rate cases. Knowing this ratio, as determined in R.I.D. 438, one may determine the ratio for the current test year by accounting for all changes in property values, additions

and subtractions, and all economic changes since that date. The latter is accomplished by Curve B. Therefore, the Commission ratio in R.I.D 438 has been extrapolated to March 31, 1980 following the trend established by Curve B. The value of the ratio as of this date based on Commission findings is found to be 1.1933.

Q. Did you consider these ratios in your derivation of fair value?

A. Yes, both the ratio derived from respondent's data adjusted to the trend line value (1.2152) and that found from Commission findings as described (1.1933) were employed in derivation of fair value.

Q. Did you consider any other means of deriving a fair value figure?

A. Yes, I have derived estimates of fair value based upon a price level increase to the common equity component of the Company's capital structure and based upon spot trended original cost prices and the trended original cost at five-year average price levels as adjusted by the staff. All these calculations are shown in Schedule 4.

An attempt has been made here to consider both the high and the low value of the range, which, in my estimation, could be considered as providing a reasonable fair value. The average of the above four determinations is also given in Schedule 4.

Q. Does this complete your analysis of fair value?

A. No. I invite your attention to Method 5 also shown in Schedule 4. Here, Philadelphia Electric Co.'s plant is considered in two parts, (1) that in existence at R.I.D. 438 and (2) that which has been added (new plant) since that date.

The fair value has been computed in this method by trending only the old plant through March 31, 1980 and adding new plant additions at original cost.

Q. How did you determine the fair value of the old plant?

A. I utilized the ratio based on Commission findings as explained above (1.1933) to trend the original cost value of plant accepted by the Commission in R.I.D. 438.

Q. Have you summarized the staff's position regarding the Measures of Value?

A. Yes. Refer to Table A.

Q. Would you explain the staff's adjustments to the Measures of Value?

A. Mr. H. Hagan and W. Doyle will be presenting separate testimony dealing with the plant held for future use, fuel reserves and deferred tax adjustments. Mr. G. Markovci will explain adjustments to cash working capital and Mr. R. Stover will cover the audit adjustment. I will endeavor to explain the position of the staff with regard to the other adjustments.

Q. Have you examined the life-spans used by Philadelphia Electric Co., in computing the depreciation rates for their plants?

A. Yes, and with a few exceptions, I feel that the life spans are reasonable. I have made adjustments to change the life spans of Peach Bottom 2 and 3, Salem 1, Eddystone 1 and 2, Keystone 1 and 2 and Conemaugh 1 and 2.

Q. Why did you change the life spans of Philadelphia Electric Co.'s nuclear plants from 35 to 40 years?

TABLE A

Philadelphia Electric Company
Measures of Value
March 31, 1980
($000)

As Claimed by Respondent	2,501,021	4,275,396	4,121,063	3,922,103
Staff Adjustments				
Excess Capacity	(85,000)	(129,000)	(124,000)	(118,000)
40-Yr. Life (Base Load)	45,114	102,225	98,523	92,870
Plant Held for Future Use	(2,338)	(2,338)	(2,338)	(2,338)
Cash Working Capital	(55,560)	(55,560)	(55,560)	(55,560)
Deferred Income Tax	1,920	1,920	1,920	1,920
Audit Adjustment	(4,053)	(16,509)	(15,881)	(15,018)
Salem Audit	(10,500)	(10,500)	(10,500)	(10,500)
Adjusted Measures of Value	2,390,604	4,165,634	4,013,227	3,815,477

A. I have done considerable research with regard to the life of a nuclear plant. As a result, my conclusion, after inspecting modern plants and noting the construction practices employed, talking to design engineers, and officials of the NRC, is that a life span of 50 or more years would be probable. Apparently, the only basis for the 40-year licensure term is the experience gained from fossil fueled plants, where forty years is the normal period for amortizing or depreciating a generating unit.

Arguing against shorter depreciation periods for nuclear facilities, Mr. E. H. Dixon, Chairman of the Committee on Atomic Power of the Edison Electric Institute and President of the Middle South Utilities, Inc., testified in a 1954 hearing before the Joint Committees on Atomic Energy as follows:

> "If atomic power is to be competitive with standard orthodox fuels, the need for amortizing facilities over 20 or 25 years puts an undue price burden on that product. These reactions may work fifty years, we don't know. But forty years is the normal period for amortizing or depreciating a generating unit."

Moving to a nuclear plant from a fossil plant is like entering a new world. Earthquake proof construction, six-foot reinforced concrete walls,--a design capability aimed at coping with any hazard man can think of becomes the norm. So far as design life is concerned, we start with all of the technology basic to a proven 40-year lifetime, add to it, and continuously update it.

I submit, therefore, that 50 years would be a reasonable estimate of the design life of a modern nuclear plant.

Q. Are you aware of the fact that these life spans extend beyond the license period?

A. Yes, even 35 years is beyond the license period. It is obvious that the license would have to be renewed, but I find no problem with this insomuch as the regulations state explicitly that a license may be renewed.

The licensing period for nuclear facilities is statutorily derived from the Atomic Energy Act of 1954, 68 Stat. 936, 42 U.S.C. 2133(c):

> "Each such license shall be issued for a specified period, as determined by the Commission, depending on the type of activity of the license but not exceeding 40 years; and may be renewed upon the expiration of such period."

Q. Assuming that relicensing is a possibility, isn't there a strong possibility that NRC may require so much retrofitting or modification before granting a license extension that it would prove to be an uneconomical venture for the company?

A. In the first place, considering the billions of dollars involved in the site preparation and construction of a nuclear plant, it is unlikely that any such modifications would be extensive enough to make it uneconomical.

In addition, any major changes, which would be caused, say, by health or safety considerations, would be added to existing plants as well as to new construction, so that one can expect the plant to be updated to this extent over its lifetime. The number of such changes of this type expected over the next 25 years would reasonably be expected to be reduced compared to that which happened during first 25 years of the nuclear age.

Q. Even so, since we have never confronted the problem of relicensing a major nuclear plant, doesn't a strong doubt still exist as to the possibility?

A. We do have the experience of Dresden which is currently being retrofitted in preparation for a license extension. Thus far, NRC is not requiring conformity with latest construction rules as a requirement for relicensing,

but Dresden is being chemically cleaned and updated to comply with the latest emergency requirements for cooling.

Q. Is there a problem with neuton radiation and its effect on the reactor which may shorten its serviceable life?

A. The reactor vessel is the most ruggedly constructed part of the entire plant. General Electric Company has a test reactor (GETR) which has operated for over 20 years with a much higher neutron flux density than is permitted in any commercial reactor. No measurable deterioration has occurred. Ample evidence exists, therefore, that the reactor vessel will not be a limiting factor in the life of the plant.

Q. Is there any other evidence available which would give us additional assurance that a nuclear plant may be expected to last for forty years?

A. At this time, of course, we have no major nuclear installation which has been in service that long. We could observe, however, that the only difference between a nuclear plant and a fossil plant is the steam source. Thus about two-thirds of a nuclear plant is identical in all respects to a fossil plant.

Mr. Joseph C. Egg, Duquesne Light, recently completed a study of life span for fossil plants using data from 15 companies. The average life span derived from these data is 44+ years. (Appendix C - p. 29). I would certainly expect the nuclear plants to do at least this well.

Q. But Mr. Egg points out that the normal progression for a fossil plant is from base load to intermediate to peaking unit. Do you expect this to be true of nuclear plants also?

A. No. A nuclear plant is unsuited for cycling operation. I would expect a nuclear plant to continue in service as a base load unit for the duration of its life span. I agree with Mr. Egg when he states that this kind of operation--

> "could extend the economic life span of nuclear units and thus reduce the lifetime financial cost." (App. C, p. 9)

Q. What then is your recommendation for the life span of nuclear plants to be utilized for rate making purposes?

A. My recommendation is based on a number of considerations. First of all, the construction of a nuclear plant is superior to that of a fossil plant. Hence its design life, based on engineering considerations, exceeds that of a fossil plant. Secondly, the high initial cost (capital investment) will make it economically feasible to expend a greater amount in maintenance expense to keep it functioning at a high level of efficiency and safety.

On the other hand there is the decommissioning problem to consider. Some states allow accelerated depreciation with the company in return providing for the expense of decommissioning. In Pennsylvania, however, an annual accrual expense is allowed to cover the cost of dismantling and removing the radioactive portions of the plant. Until a finalized version of the decommissioning rules are available, there is some uncertainty as to whether these funds will be adequate to cover total cost.

Therefore, although a life span of 50 years is possible based upon design considerations, I would recommend a shortening to 40 years, because of the possible effects of these uncertainties. This would bring the life span of nuclear plants for rate making purposes down to that which

has been found to be normal for fossil plants.

Q. Would a 40-year life span have any effect on Decommissioning expense?

A. Yes, this subject is addressed in separate testimony.

Q. Why did you take exception to the life spans used by the respondent for Eddystone 1 and 2, Keystone 1 and 2 and Conemaugh 1 and 2?

A. These plants represent Philadelphia Electric's most efficient fossil generation and the life spans of 30 and 35 years being employed are not reasonable for this type of modern plant. I recommend 40 years as being more realistic for these three units.

Q. Why do you feel that 40 years is an appropriate life span for these plants?

A. Again, referring to the Egg study, actual experience has shown retirements to be based on economic considerations and not wear-out. The Egg study, as mentioned before, found the average retirement age to be 44+ years. More recently, Mr. J. Sivulich, of this staff has completed, as part of his Master degree requirement, an independent study(1) which finds even longer life spans for Pennsylvania utilities using data through 1977. Appendix (D) contains several pages from this study. Table 20 therein lists the historic life spans obtained for Pennsylvania utilities. A composite life-span of over 61 years was found. In his conclusions, Mr. Sivulich states

> "this research has shown that economic life spans of 50 to 60 years for fossil-fueled generating units are possible and that an expectation of 50 years is certainly not unreasonable."

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(1) "Statistical Analysis of Life Spans of Electric Generating Power Production Units in Pennsylvania", Joseph J. Sivulich, September, 1979

Q. Is there any other basis for your recommendation?

A. Yes. At the time we inspected Eddystone, Mr. Clyde Mount, Plant superintendent, stated that while funds were not available for maintenance in the mid 70's, be expected the precipitators to be upgraded in 1981, the scrubbers finished in 1982, and that Eddystone 1 and 2 should continued as base load units for another 20 years. Of course, this would bring the life of the plants up to the 40 years I am recommending.

In the case of Conemaugh, Metropolitan Edison, a co-owner with PECO, is depreciating Unit 1 over 41 years and Unit 2 over 40 years. It's difficult to see how the same plant would last longer for one co-owner than for another.

When we come to Keystone, we find that it is in almost all respects identical to Conemaugh. I know of no basis anyone could use to determine that the lifetime of Keystone should be any different from that of Conemaugh, yet PECO is claiming a 5-year shorter life span for Keystone.

Q. Why do you feel that the life span is so important?

A. It is a basic principle in establishing rates that the consumers who derive benefit from a plant should be the ones to pay for the cost of the plant. Thus the cost of a plant should be spread over its useful life. All the evidence I have been able to find, would support a 40-year life span as providing a reasonable average depreciation rate for a modern plant. If and when a valid reason develops to require early retirement, such a case should be handled on an individual basis. As a general rule, however, shorter life spans should not be permitted for rate case purposes unless it can be proven by thorough study and presentation of evidence that a shorter life span will be of benefit to the customers.

Q. What effect will this change to a 40-year life span have on the respondent's

claimed measures of value and operating expenses?

A. These adjustments were derived from data provided by the respondent, Appendix E. The change to a 40-year life span will result in an increase to the O.C. measure of value of $45,114,000 and a decrease in depreciation expense of $5,432,000.

Q. Do you believe that the customers of Philadelphia Electric Co. should be charged for a reasonable amount of reserve capacity?

A. Yes, reserve capacity is necessary to provide for reliability of service when units are down for either scheduled or forced outage.

Q. How much reserve is necessary to provide for such outages?

A. At the present time utilities have excellent statistical tools available for determining the loss of load probability based on installed capacity limitations. As shown in Schedule 5, a utility can determine from historical outage data and planned maintenance schedules a probability distribution of available capacity at any given time. In like manner a probability distribution of system load can be determined. The cross hatched overlapping area represents a finite probability, which is readily calculated, for the capacity not being sufficient to meet the demand. The larger this cross-hatched area, the greater is the probability of the system capacity not being able to meet demand. Many utilities have standardized on limiting this overlap so that loss of load probability does not exceed 1 day in 10 years.

Q. How can this cross-hatched area be controlled or managed?

A. If one does not undertake to manage the load and capacity distributions, the only way to reduce the overlapping area is to increase the separation of the curves. This can only be accomplished by installing more capacity. This is the primary reason that we have witnessed claims on the part of some utilities for increasingly larger reserve margins to maintain the same loss of load probability.

Q. What other factors affect the loss of load probability?

A. The primary factors influencing the loss of load probability are the size of the installed units, the forced outage experience, and the peak load probabilities.

Q. Can these factors be controlled?

A. Yes. A variety of load management techniques such as controlled water heating, off-peak incentives, interruptible provisions and demand metering are available which can be employed in controlling the shape of the load probability function. Also forced outage rates and durations could be managed much more effectively than they are through better maintenance procedures. Finally, the reliability could be improved by installing smaller plants.

Q. Do you feel that it is important to employ these alternate routes to reliability at the present time?

A. I feel that we have already exceeded the limit so far as relying on reserve capacity to solve our reliability problem. North Carolina has recently

determined[2] that a 15% reserve capacity is adequate for their system. New York State [3] has determined that a 20% reserve is adequate to maintain a loss of load probability of 1 day in 10 years for their system. We should be moving in a similar direction.

Q. What is the present reserve margin for Philadelphia Electric Co.?

A. One may obtain different values for reserve margin depending upon how one calculates installed capacity. According to Company figures (Exhibit VSB-2, Table I, p. 8) the present reserves for Philadelphia Electric amount to 36%.

Q. What do you feel is a proper reserve requirement for the Philadelphia Electric System?

A. If all known load management techniques were employed, optimum maintenance procedures instituted and detailed analysis performed to determine optimum sizes for future capacity additions it should be possible to achieve a significant decrease in reserve requirements while maintaining the same reliability. To my knowledge, no studies have been performed by Philadelphia Electric or any other utility in the state to examine these areas.

In a recent Penelec rate case (R.I.D. 599), I asked Mr. E. Newton, Jr., Vice President--System Operations of a General Public Utilities Service Corporation what factors were contributing to the need for higher reserve requirements, and he listed three (TR 336-342):

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(2) "Analysis of Long Range Needs for Electric Generating Facilities in North Carolina," 1978, State of North Carolina Utilities Commission, Public Staff Report

(3) "Reliability Criteria--A Cost Benefit Analysis," August 1975, New York State Public Service Commission.

1. Narrowing of the differential between summer and winter peaks.

2. Higher maintenance times that are being experienced.

3. Increased generating capacity of units currently being installed.

As a means of countering the rise in reserve requirements, Mr. Newton stated, (TR 339):

> "The only way it could be done would be by installing units considerably smaller than we have, more reliable, and in so doing, this, of course, sustaining the tremendously increased installed cost that relates to the lower units, giving up the advantages of size which we have achieved, giving up the efficiencies of scale."

When asked where the increased cost of smaller units would be offset by saving the additional cost of increased reserves, Mr. Newton replied,

> "I really couldn't say where the cross-over point is, ". . . and he agreed that a study to determine this cross-over point ..." would be a very valuable thing."

So, without the necessary analysis, it is impossible to predict how large a saving could be made in reserves without sacrificing reliability. It should be pointed out, however, that the provision for 20% reserves for $3 billion of plant in service amounts to $600,000,000. Just a 10% reduction in the reserve requirement would amount to a saving of $60 million.

Q. What does PJM recommend as a reserve requirement?

A. The PJM reserve requirement at the present time is 22%.

A. In the light of this would you recommend any adjustment to be made to Philadelphia Electric Company's installed capacity?

A. Yes. Philadelphia Electric presently has reserves of 36 percent. The difference between this and the PJM requirement of 22% amounts to 773 megawatts excess. Referring to Table I, VSB-2, p. 8, it will be

noted that the Respondent has a number of retirements and deratings amounting to 185 MW planned for the near future. Giving a credit for these brings the excess down to 588 MW. Rounding this off, I would suggest the removal of 500 MW of plant in service.

Q. Do you have any suggestion as to which equipment should be eliminated?

A. I originally felt that the leased CT's would be plant that could readily be eliminated. Leasing arrangements are usually beneficial on two counts. First of all, they free capital for other uses and secondly, when properly formulated, they permit a high degree of flexibility.

As an example of the latter, the General Electric Space Division at Valley Forge at the peak of the space effort was housed in one permanently owned building and nine leased buildings in a neighboring industrial park. In 1967, a severe drop in the space effort required a corresponding cut-back at G.E. Less than a year later, G.E. had rid itself of all its leased buildings with the resulting saving of all the expenses associated therewith.

Unfortunately, the lease that Philadelphia Electric has negotiated does not afford this kind of flexibility. Philadelphia Electric is locked into this lease for 25 years regardless of whether or not the equipment is needed or useful.

Q. In light of the above, what do you suggest?

A. I feel that an adjustment should be made to rate base to account for 500 MW of excess capacity. The basis for the adjustment is explained in Schedule 6.

In this schedule, I have endeavored to derive a value for rate base in $/MW for Philadelphia Electric's peaking capacity. It's really an excess of peaking capacity that the company is saddled with (Sched. 7) Even Eddystone 3 and 4, the cost of which equalled that of a base load unit, is presently used only for peaking.

Using Eddystone 3 and 4, Muddy Run, and Croydon as typical of PECO's peaking capacity we find the net O.C. amount in rate base for these plants is $344,497,000 which amounts to $169,487 per megawatt of installed capacity. To remove 500 MW of excess at this dollar amount would require an adjustment of 500 x $169,487 = $84,743,356. Rounding this figure, I have made an adjustment to rate base of $85,000,000 in original cost and pro-rated amounts in the trended Measures of Value as shown in Table A.

Q. Have you read Mr. Boyer's testimony as to how this excess capacity came into being?

A. Yes. Mr. Boyer did an excellent job of presenting the difficulties inherent in forecasting. However, in the 60's, a period when load growth was relatively stable, Philadelphia Electric had permitted their reserves to drop to such a dangerously low level that this Commission had to strongly urge a prompt increase in installed capacity. Today, with the situation reversed, there is still evidence of lack of response to changing load growth conditions. Although there has been no growth in peak load for six years Philadelphia Electric has been following an attitude of doing no more than maintaining a holding pattern until some day in the future load hopefully will grow again to meet installed capacity. Furthermore, Philadelphia Electric is in the embarassing position of

having an over-abundance of oil-fired capacity with heat rates so high as to limit their usefulness severely. Even with all its excess of capacity Philadelphia finds it more economical to purchase from PJM. In a typical off-peak period, company data show 33% of the energy being purchased at a system load level of only 3000 MW.

Mr. Boyer states that "factors such as wars, rapid changes in conservation and curtailment of usage, population migration, and recessions are very powerful forces which are without control and impossible to forecast accurately." This may be true for utilities, but all these events plus more were found in all long range planning documents I was familiar with in industry, and contingency plans were developed accordingly. Planning in unregulated industry is very extensive and comprehensive because the future of your company and your income depend upon it.

Q. Have you examined the effect that your recommended reduction in capacity would have on the projected future reserve capacity of Philadelphia Electric?

A. First of all, it would be Philadelphia Electric's decision as to whether or not to retire plants because of excess capacity. My suggestion is to remove the excess from rate base until such time as it could be justified as being used and useful. Depreciation expense would continue and a return sufficient to cover the fixed capital obligations of the respondent would be allowed.

If physical retirement of 500 MW actually occurred, one would find according to PECO's forecast (VSB-2, Table I, p. 8) that the reserves

would hit a low point in 1984. In fact, if the load growth Mr. Boyer is predicting actually materialized, the reserves would be 9% with the removal of the suggested 500 MW.

Q. Could Philadelphia Electric tolerate such low reserves?

A. I would not recommend allowing the reserves to drop to this level. There are at least two alternatives for achieving an adequate reserve level in 1984 even with a 500 MW reduction now.

1. It would be a very reasonable management goal to shave 9% off the projected peak load for 1984. Such a goal is fully in accord with the conservation measures being urged upon us and this one factor alone would restore the reserves to 20%. Appendix F provides a good example of a conservation program which is working well in the Northwest.

2. Eliminate the recent two-year delay announced for Limerick. Bringing Limerick on line in the 1983-1985 period rather than in 1985-1987 would raise the 1984 reserves to 25% even with the projected load growth and save the customers the high cost of this delay.

Q. Would you please explain the Salem Audit adjustment?

A. This adjustment was ordered by the Commission in R.I.D. 438 and disputed by the Respondent in this rate case. The Administrative Law Judge on October 29, 1979 granted the motion to strike the Respondent's testimony on this issue. The $10.5 M adjustment sustains the previous Commission order.

Q. Do you have a final recommendation of Fair Value applicable to Philadelphia Electric Co.'s test year ending March 31, 1980?

A. Yes. Based on the previously described investigations and adjustments by the staff, it is my opinion that, a fair value rate base in the range of $2,828,000,000 to $2,889,000,000 would be reasonable in this proceeding provided that there are no further changes to the Measures of Value.

Q. How did you arrive at these figures?

A. These figures represent the fair value of the respondent's plant as it would be determined using Method 5 and Method 3 respectively.

Resume of Educational and Professional Background of Donald L. Birx

Donald L. Birx graduated from The Johns Hopkins University in 1944 with a degree of Bachelor of Engineering. Following two years of service with the U.S. Navy, during which time he taught at the U.S. Navy Materiel School at the Naval Research Laboratory in Washington, D.C., he returned to Johns Hopkins receiving his Doctor of Engineering degree in 1951.

From 1951 through 1967 Dr. Birx was a staff member of The Franklin Institute Research Laboratories, a non-profit organization performing research for industry and government. There, he managed the Optics and Electronics Laboratory. In 1967, he joined the General Electric Co. - Space Division for three years - first as Manager, Design Review and audit, and then as Manager, R & D performance Evaluation. Beginning in 1970, Dr. Birx devoted his attention to directing new product development efforts, first as Director of Engineering for Hamilton Watch Co., Systems Division, and then as New Product Manager of Reeves Hoffman Division. In 1977, he joined the Pennsylvania Public Utility Commission as a Management Research Associate in the Bureau of Rates and Research. He now holds the position of Electric Industry Advisor.

Dr. Birx is a registered professional engineer in the Commonwealth of Pennsylvania, a senior member of the Institute of Electrical and Electronics Engineers, a member of the American Physical Society and of the National and Pennsylvania Society of Professional Engineers. He belongs to Tau Beta Pi, national honorary engineering society and Sigma Xi, honorary research society.

Regression Analysis

The techniques of regression and correlation provide a convenient means of determining the form of a relationship between two variables and for determining the strength of that relationship respectively. The starting point for such an analysis is the plotting of a scatter diagram in which the value of the independent variable is measured along the x axis while the dependent variable is measured along the y axis. Each point on the scatter diagram is the value of "y" which is determined for a fixed value of "x". The appearance of the array of points will usually help the analyst to decide initially if a fit to the data can be best satisfied by a straight line, quadratic, or exponential function, etc. In any event, any form of curve or line may be tried and tested to derive a "best fit". One is often interested in knowing if a linear relationhip (straight line) exists.

To obtain the desired line, the method usually employed is the "method of least squares", and the resulting line is called the "least squares line". The general equation for a straight line is given by

$$y = a + bx$$

where y is a value on the vertical axis, x is a value on the horizontal axis, "a" is the point where the line crosses the vertical axis (y - intercept), and "b" shows the amount by which the line rises (slope) for each unit increase in "x". By definition, the "least squares line" is that line such that the sum of the squared vertical deviations of the observed data points from that line is smaller than the sum of the squared vertical deviations of the data points from any other line.

Mathematical procedures for deriving a least squares line are described in most basic texts on statistics(1). Many hand calculators are also available with stored programs which will automatically compute the line

(1) Paul G. Hoel, "Elementary Statistics", John Wiley & Sons, 1975.

parameters once the x and y coordinates of the data points in the scatter diagrams are sequentially entered.

Once the regression line has been obtained, it should be evaluated to determine whether it adquately describes the relationship between the two variables. To do this, we may compare the scatter of points about the regression line with the scatter about $\bar{y}$, the mean of the sample values of y. The deviation of each point from the means $(y_i - \bar{y})$ is the "total deviation" and may be considered as made up of the vertical distance from the mean to the regression line $(y_c - \bar{y})$, the "explained deviation" plus the vertical distance of the observed point from the regression line $(y_i - y_c)$, the "unexplained deviation". We have then

$$(y_i - \bar{y}) = (y_c - \bar{y}) + (y_i - y_c) \qquad \text{See Fig. 1}$$

Total deviation = explained deviation + unexplained deviation.

and if, for each value of yi and yc, we square each deviation and sum the squared deviations, we have

$$(y_i - \bar{y})^2 = (y_c - \bar{y})^2 + (y_i - y_c)^2$$

Total sum of squares = explained sum of squares + unexplained sum of squares.

From the above series of squares we can derive the "coefficient of determination" (r^2) which is the name given to the ratio of the explained sum of squares to the total sum of squares, or

$$r^2 = \frac{\Sigma(y_c - \bar{y})^2}{\Sigma(y_i - \bar{y})^2}$$

The coefficient of determination, then, multiplied by 100, gives the percent of the total variation in y_i that is explained by the regression. The largest value r^2 can assume is 1 which would occur if all the observations fell on the regression line.

The lower limit of r^2 is "o" which would obtain when the regression line and the line through $\bar{y}$ coincide. The square root of the ratio of the sum of squares, r, is given the name "coefficient of correlation".

When r^2 is large, the regression line has a good match to the data points and is accepted as representing well the variability in the data. When r^2 is not high enough to give this assurance, statistical tests may be accomplished by means of an analysis of variance which can be used to determine whether the assumed linear relationship is significant or not. If the derived regression equation is going to be used to interpolate the data or to predict values of y for given x's, it is useful to bracket the line with the 90 or 95% confidence limits derived from the variances. Methods of testing and deriving confidence limits are fully described in all basic statistical books.

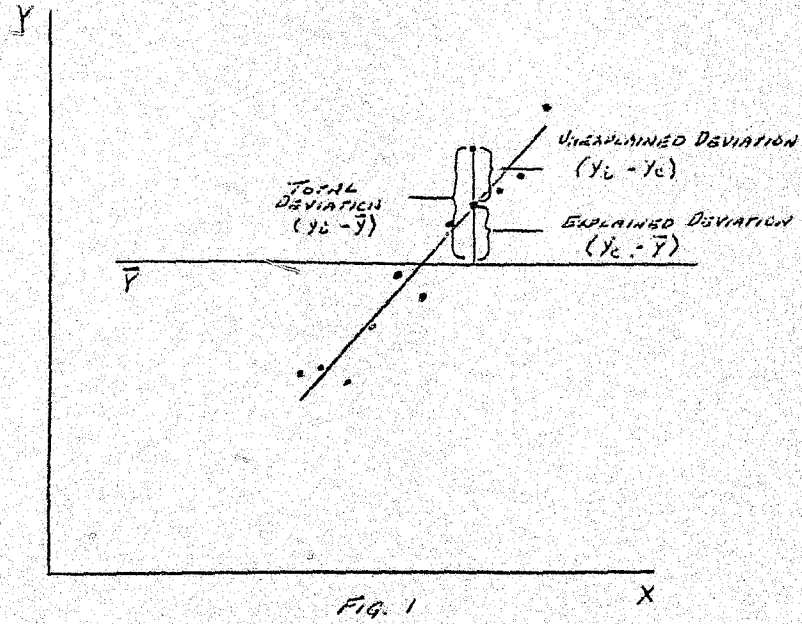


FIG. 1

APPENDIX C

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

Presented At
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ANNOTATION

An analysis of fifteen electric utility systems indicates that the life span of power production units is a characteristic of the individual system related primarily to economic obsolescence.

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ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

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ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

An analysis of fifteen electric utility systems indicates that the life span of power production units is a characteristic of the individual system related primarily to economic obsolescence.

Presented by
Joseph C. Egg

Duquesne Light Company
Pittsburgh, Pennsylvania

I believe most of us are aware of the increasing attention our industry is giving to the factor of obsolescence of equipment. The Executive Committee of the EEI Accounting Division asks the Depreciation Committee, "Are you giving enough attention to obsolescence?" Individual company managements ask their depreciation experts, "Are our depreciation rates adequate to take care of obsolescence?"

The questions reflect a memory, for instance, of manufactured gas plants which were rendered useless, long before they were fully depreciated, by the extension of natural gas mains. And they reflect fears, for example, that the enormously expensive fossil and nuclear power production units now being installed may become prematurely obsolete by the advent of the breeder reactor---or of magneto-hydro-dynamic generation---or of fusion power---or of solar power.

The questions---and such answers as are given---and the fears ---are equally obscure because nobody has defined precisely the nature of obsolescence as applicable to specific types of equipment; nor has anybody quantified the development rate of such obsolescence. Lacking a precise understanding of obsolescence and some way of measuring it we can't get a very good "handle" on it. Thus, estimates of future obsolescence are frequently only seat-of-the-pants expressions of opinion.

Probably most people instinctively know that there is a difference between the nature of, for instance, style obsolescence that killed the Edsel car and quality obsolescence that eliminated ordinary plate glass in favor of safety glass in automobile windshields; or technological obsolescence which replaced direct current generation with 60-cycle, 3-phase alternating current; or whatever type of obsolescence, if any, that occurs in modern electric power plants.

Electric power production facilities account for about 40% to 45% of all investment in electric plant. The cost of individual production units currently runs into the hundreds of millions of dollars. The premature obsolescence of such a unit could result in a very serious financial burden to the stockholders and/or the customers. This is the reason that this study is concerned specifically with such facilities.

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

In this report the terms "power production unit", "power production facilities", and "power production equipment" are used interchangeably to mean a turbine-generator and all necessary equipment associated with it including boiler, fans, pumps, transformers, buildings, etc.

PURPOSE AND SCOPE

The purpose of the study is fivefold:

1) To identify the type of obsolescence that affects modern electric power production units.
2) To define precisely that type of obsolescence.
3) To develop a procedure for quantifying such obsolescence.
4) To determine the rate of development of the obsolescence for each of the participating companies.
5) To discuss some of the inferences that may be drawn from the findings of the study.

This study is based on an analysis of 8487 unit-years of operating experience with 387 fossil fuel fired steam power production units in fifteen large electric utilities located from the Atlantic to the Pacific and from the Canadian Border to the Gulf of Mexico.

MECHANISM OF OBSOLESCENCE

An idealized illustration of the mechanics of the progression of a given Unit A from base load (high output) service to peak load (low output) service is illustrated by the system load duration curves shown on Figures 1a, 1b and 1c on page 10.

When a new generating unit is first installed it generally is the most efficient unit on the system. For maximum system economy it is loaded to its full capacity for as many hours during the year as possible. Ideally the newest unit is loaded in such a manner that it provides the output at the very base of the annual system load duration curve as shown by Unit A in Figure 1a. The width of the crosshatched band in Figure 1a is a measure of the kw capacity of the unit, and the area of the band is a measure of its kwhr output during the Year (1).

As the system load grows it is necessary to install additional power production units in step with the load growth. These units, being more efficient than Unit A, are loaded before Unit A. Thus Unit A is displaced upward to the middle load range of the load duration curve at Year (1 + N) as shown in Figure 1b. Note that in this load range the output from Unit A is no longer needed for all of the hours in the year.

In the year (1 + 2N) in Figure 1c, Unit A is in the peak load range and the system need for its kwhr output is substantially reduced.

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

MECHANISM OF OBSOLESCENCE (Continued)

However, the need for the kw of capacity is still as great as ever for part of the time. Finally the unit has so little potential for output during its remaining life that any unusual expenditure required to keep it in service precipitates its final retirement and complete obsolescence.

The progressive reduction in output from Unit A as it moves from base-load status (Figure 1a) to peak-load status (Figure 1c) is at once both the manifestation and the measure of its loss in service value due to obsolescence. The period of time required to go from maximum output to zero output (retirement) is its economic life span.

DEFINITION AND NATURE OF OBSOLESCENCE

A precise definition of the type of obsolescence which afflicts modern power production facilities may be deduced from an understanding of the mechanisms of obsolescence as described above. In this respect economic obsolescence is defined as the replacement or retirement of power production facilities because of 1), the development of more economic types of such facilities combined with 2), the opportunity to install such types because of increasing loads. Thus, the more rapidly the load on an electric system grows, the more rapidly economic obsolescence develops---and the shorter is the economic life span.

A second deduction is that development of economic obsolescence and the duration of the economic life span normally are relatively independent of the size of the power production unit which is installed. Suppose that the capacity of Unit A (in Figures 1a, 1b and 1c) had been only ½ of the capacity assumed in the example. Since it is the installation of newer, more efficient units after Unit A that causes the displacement of Unit A towards peak-load status, it is evident that the size of Unit A itself has nothing to do with its rate of displacement---both the ½ size unit and the full size unit would take about equally as long to progress from base load to peak load.

The definition of depreciation given in the FPC Uniform System of Accounts suggests that there are many factors other than obsolescence which cause a loss in service value of facilities. It defines depreciation as "the loss in service value not restored by current maintenance, incurred in connection with the consumption or prospective retirement of electric plant in the course of service from causes which are known to be in current operation and against which the utility is not protected by insurance. Among the causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the art, changes in demand and requirements of public authorities."

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

DEFINITION AND NATURE OF OBSOLESCENCE (Continued)

Many of the factors listed above contributing to loss in service value of power production facilities are more or less susceptible to the conscious control of company management---wear and tear, action of the elements, etc., can be counteracted almost indefinitely by maintenance and interim replacements; even the action of public authorities may sometimes be counteracted---for instance, a plant that violates environmental regulations may be brought into conformity by various means generally involving higher operating costs and/or additional investment. The cost-benefits of such counteractions must, of course, take into account the potential output during the remaining life of the facility.

Obsolescence on the other hand, being related to system load growth, is not readily susceptible to management control. Years ago obsolescence of older low pressure units was delayed somewhat by the installation of high pressure topping units; nowadays obsolescence may be delayed to a degree by the installation of peaking capacity such as combustion turbines or pumped storage units or by the purchase, usually involuntary, of peak capacity from other systems.

Generally however, obsolescence runs its course throughout the economic life span influenced only by the rate of system load growth. Thus, the economic life span is the maximum attainable life of a power production unit on a given system; factors such as wear and tear can only shorten the life of the unit; good maintenance practice cannot lengthen the economic life span but it can tend only to restore the life more or less close to the economic life span.

The relationship between economic life span and the average service life for depreciation purposes should be understood clearly. The economic life span is not the average service life for depreciation purposes but it is the principal factor in the composition of the average service life. If there were no interim retirements and replacements during the life of a production unit---or if all interim rehabilitation work were charged to maintenance expense---the average service life would be equal to the economic life span. Since there are interim retirements and replacements the average service life for depreciation purposes must be shorter than the economic life span in order to recover not only the original cost but also the cost of the interim retirements and replacements. Thus the average service life is a composite which reflects both the economic life span and the interim retirements and replacements.

There is a corollary which follows from the above concept. The expenditures for interim retirements and replacements depend on the degree of refinement of the system of retirement units adopted by a company. Since those retirement units are applicable to all production

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

DEFINITION AND NATURE OF OBSOLESCENCE (Continued)

facilities on a system-wide basis and also since the economic life span of the facilities depends mainly on system load growth as shown hereinbefore, it then follows that the average service life of power production equipment is a system characteristic. Only to a limited degree is it a characteristic of the specific production units. Thus the average results of a service life study of a sample of the production units on a system, for instance coal fired units, are applicable to all other similar units on the system within a range of random final retirement dispersion between units.

MEASUREMENT OF OBSOLESCENCE

The rate at which economic obsolescence develops can be quantified by the progressively reduced output from a unit as newer more economic units are installed. This rate is expressed as the average economic life span of all of the units on a given electric system---the age at which the units are expected to produce no additional output. As examples, the power production units on one electric system may become completely obsolete in an average of 30 years whereas those on another system may reach 100% obsolescence at an average age of 50 years. The actual experience of 15 electric utility systems in this respect is shown on Figures 2 through 16, pages 11 to 25, and in Table 1, page 29.

The study includes all fossil fuel fired units for which annual output data was available. Units for which output data were unavailable for more than the initial 4 years of service were eliminated from the study. Units which were installed specifically for peak load service, such as combustion turbine driven units were also eliminated because these are not ordinarily operated as base load units on large systems even when new. Hydro units were eliminated because they are operated generally in accordance with water availability. There were too few nuclear units to provide reliable statistical data and these also were eliminated from the study.

Figure 2 shows the historic progression of power production units from base-load status to peak-load status for Company A. The scale at the left---the "Y" coordinate---is the annual output in kilowatt-hours at various ages of a unit in relation to the maximum annual kilowatt-hour output during base-load operation, averaged for all units on the system passing through the respective ages. The scale is an output factor which reflects not only reductions in output due to outages but also reductions due to system conditions. For instance at certain times the system load may not be large enough to absorb all of the potential output of the most efficient base-load unit in addition to the minimum outputs required from other operating units.

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

MEASUREMENT OF OBSOLESCENCE (Continued)

The exact method of calculating the average output factors of the units is self-evident in Table 2, page 30. Each of the data points plotted against age in Figure 2 is the average output factor of all units passing through the particular age. The smooth curve is the least-squares locus of all plotted points determined by means of a second-degree equation of the type $y = a + bx + cx^2$.

The significant deduction from Figure 2 is that the progressive reduction in output as the unit ages is practically entirely due to the onset of obsolescence as defined on page 3. More or less random early retirements of units, an example of which is shown at about 20 years of age, contribute somewhat to the shape of the curve, but such retirements may be considered to be part and parcel of the obsolescence factor since they are generally triggered by at least a judgment decision with respect to the cost of rehabilitation weighed against the potential remaining lifetime output from the unit. Any progressive reduction in output due to progressively longer or more frequent maintenance outages or to progressive loss on capacity of the unit during its lifetime is likely to be of little or no consequence in affecting the shape of the curve.

The trend of the smooth curve indicates that on an average basis the Company A units will become completely obsolescent at about 47 to 48 years of age---assuming that the historic rate of load growth continues and that the installation of additional capacity keeps pace with the load growth. Thus the average economic life span of the Company A power production units is about 47.5 years.

The area under the smooth curve for Company A, Figure 2 is an index of the average lifetime output of the production units. To illustrate the mechanism of the economic considerations which lead to final physical retirement of a unit, an expenditure of "x" dollars to repair a certain breakdown might be justified at age 15 years in view of the substantial remaining potential lifetime output whereas the same expenditure may not be justified at age 40 years when the potential remaining lifetime output is very little.

There is considerable variation among the companies in the rate at which obsolescence develops. Each company displays a more or less unique pattern. For instance, the economic life span of Company G, as shown in Figure 8, page 17 is substantially shorter than that for Company C, page 13---28.6 years in contrast to 53.5 years. It should be noted here that inherent differences or changes in technology in the individual production units could not account for a difference in life span of almost 2 to 1. All the units are fossil fuel fired steam power units and unit characteristics with respect to size, speed, temperature,

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MEASUREMENTS OF OBSOLESCENCE (Continued)

pressure, reheat, hydrogen cooling, etc. tend to be uniform among all companies for the same vintages of units.

The composite pattern of obsolescence shown on Figure 17, page 26, for twelve companies (the data for three companies were submitted too late to be included) has no significance for any individual company. Since the data for each company is unique, any different random grouping of companies could show quite different composite characteristics. The curve has some significance only in relation to the next curve which appears on Figure 18, page 27.

The ages of the units included in the study ranged up to about 55 years. The rate of growth, and the indicated economic life span, for a given company could have changed considerably during such a long period, or some other unidentified factor could have affected the obsolescence pattern. To test whether there was any significant change in this respect, the composite obsolescence pattern of all units which were installed prior to 1946 was determined for comparison with the composite pattern of all units which were installed after 1945. The comparison, as shown on Figure 18, indicates that the output factors of the units installed after 1945 are moderately higher than those of the units installed prior to 1946. Neither the reason nor the significance of the difference were determined.

The data indicate an inverse relationship between economic life span and long-term annual rate of growth in system output as shown in Figure 19. For purposes of this study the long-term annual rate of growth in system output was defined as the compound rate of growth during the 23-year period from 1948-1950 to 1971-1973. Although it would be desirable to have more data at the higher rates of growth, logic supports the indicated relationship. For instance, if a system had no growth whatever, the economic life of the power production units could be indefinitely extended as long as they could be maintained in a state of repair.

Although the data for most of the companies show little variability from the smooth trend in the progression from base-load status to peak-load status, a few companies, notably B-Figure 3, H-Figure 9, I-Figure 10, and L-Figure 13, showed fairly wide variations from a uniform trend with the annual data falling above the trend line during the last half-dozen years or so. One company explained that the installation of "a large unit was delayed" in this period and two other companies stated that they were in a "purchasing situation" during the period. With either explanation the effect is a magnified variability in the output of the relatively few peak-load units on the respective systems during the most recent few years. Although it is believed that the high variability in these cases reflects a temporary situation no

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MEASUREMENT OF OBSOLESCENCE (Continued)

attempt was made to adjust the data or to eliminate any of it from the study and in the interests of consistency all data was subjected to the same statistical operations.

THE FUTURE

It is apparent from this study that the type of obsolescence to which power production facilities are susceptible is mainly economic obsolescence in contrast to style obsolescence as was incurred, for instance, by the Edsel car or technological obsolescence as exemplified by the change from direct current generation to alternating current, from 25 cycle to 60 cycle, or from single phase to three phase.

Thus in answer to the questions which were posed in the first paragraph of this paper---the average service lives which in the past have been established for accounting purposes on the basis of statistical analysis or sound judgment, have reflected economic obsolescence regardless of whether or not the name "obsolescence" was applied to the principal determinant of the average service life.

Economic obsolescence becomes effective in discrete steps---it occurs at the time when the company decides to install a unit, to serve increased load, of a type that is more economical than any that are currently operating. In only the most unusual circumstances could the installation of a new unit be justified solely on the basis of an improvement in economy. In such a case the new unit has the burden of fixed charges on 100% of the installation cost in contrast to the fixed charges on the older units which are partially or completely depreciated. Such a burden can not readily be outweighed by the decremental operating costs that could be realized. However substantial changes in the relationship between the financial and fuel costs of fossil compared with the nuclear units may nullify this evaluation in the future.

It is most likely that the loss in service value of power production facilities due to economic obsolescence will continue in the same pattern in the future as it has in the past. If the current nation-wide efforts to slow down the rate of growth in electric energy use are effective there may be some general lengthening of the economic life span. Also changes in the relationship between the financial and fuel costs of nuclear plants vs. those for fossil fuel fired plants, as mentioned above, may have some effect on the economic life spans.

Although the economic life spans of nuclear units may differ from those of fossil fuel fired units the same pattern of development of economic obsolescence is likely to persist and to proceed slowly in orderly discrete steps as described above for fossil fuel fired units.

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

THE FUTURE (Continued)

However, the obsolescence pattern may change because of one characteristic of the nuclear unit. Whether a nuclear unit is operated at say, an 85% output factor or at a 15% output factor the high investment in fuel on hand is about the same, whereas the much more modest investment in fuel stock for a fossil fuel fired unit is generally reduced in proportion to the reduction in output factor. The heavy financial burden of the nuclear fuel at low output factors may preclude the operation of nuclear units for peak-load service. This may result in a general shift to a two-tiered development of system generating capacity---one, exclusively base-load nuclear capacity with the accent on lifetime low cost per kwhr of output and two, exclusively peak-load capacity such as combustion turbines, with the accent on lowest possible investment cost per kw of capacity. Such a development could extend the economic life span of nuclear units and thus reduce the lifetime financial cost.

End

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

Idealized Economy Loading Of System Generating Units
Illustrating The Progression Of Unit A
From Base Load To Peak Load Status

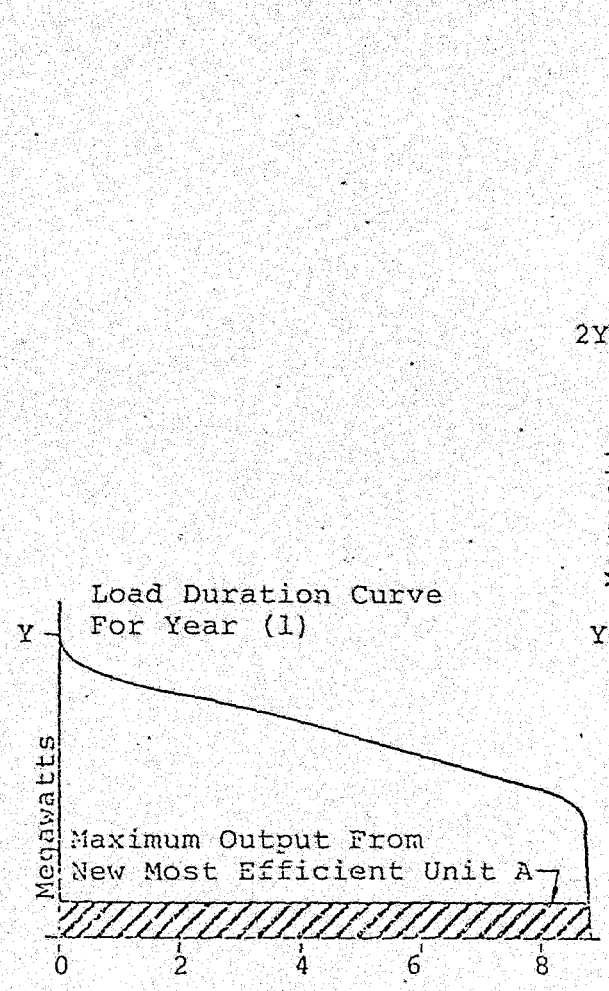


Figure 1a

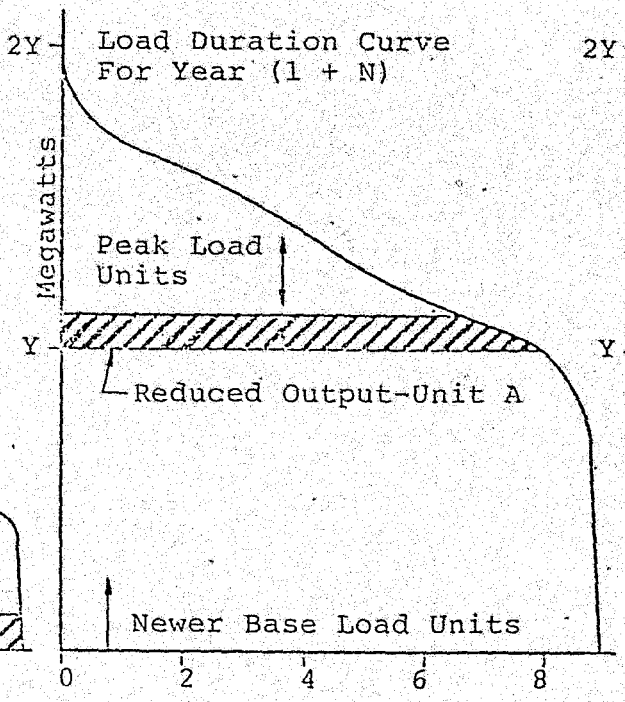


Figure 1b

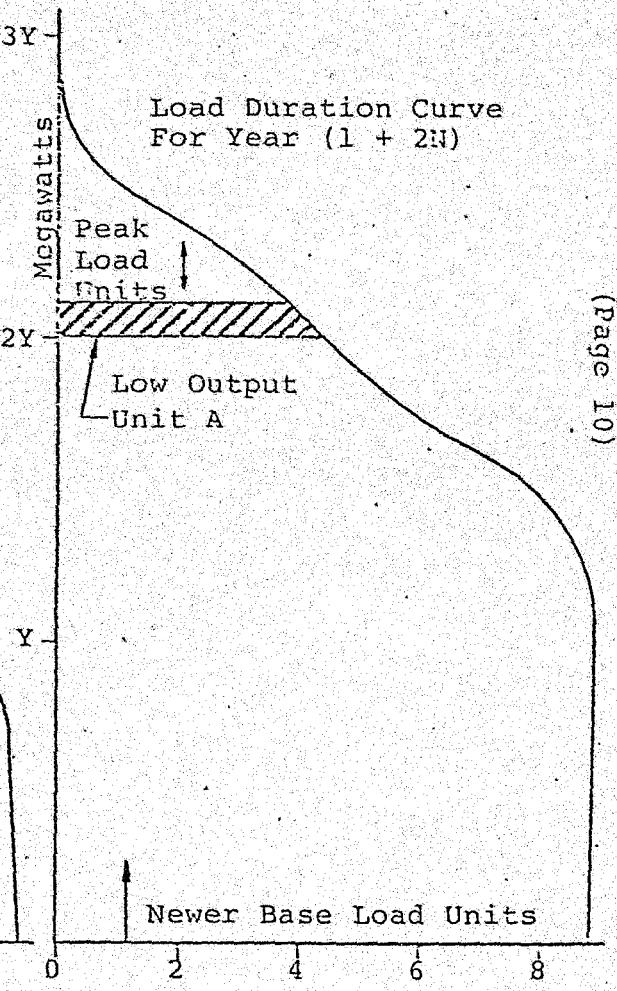
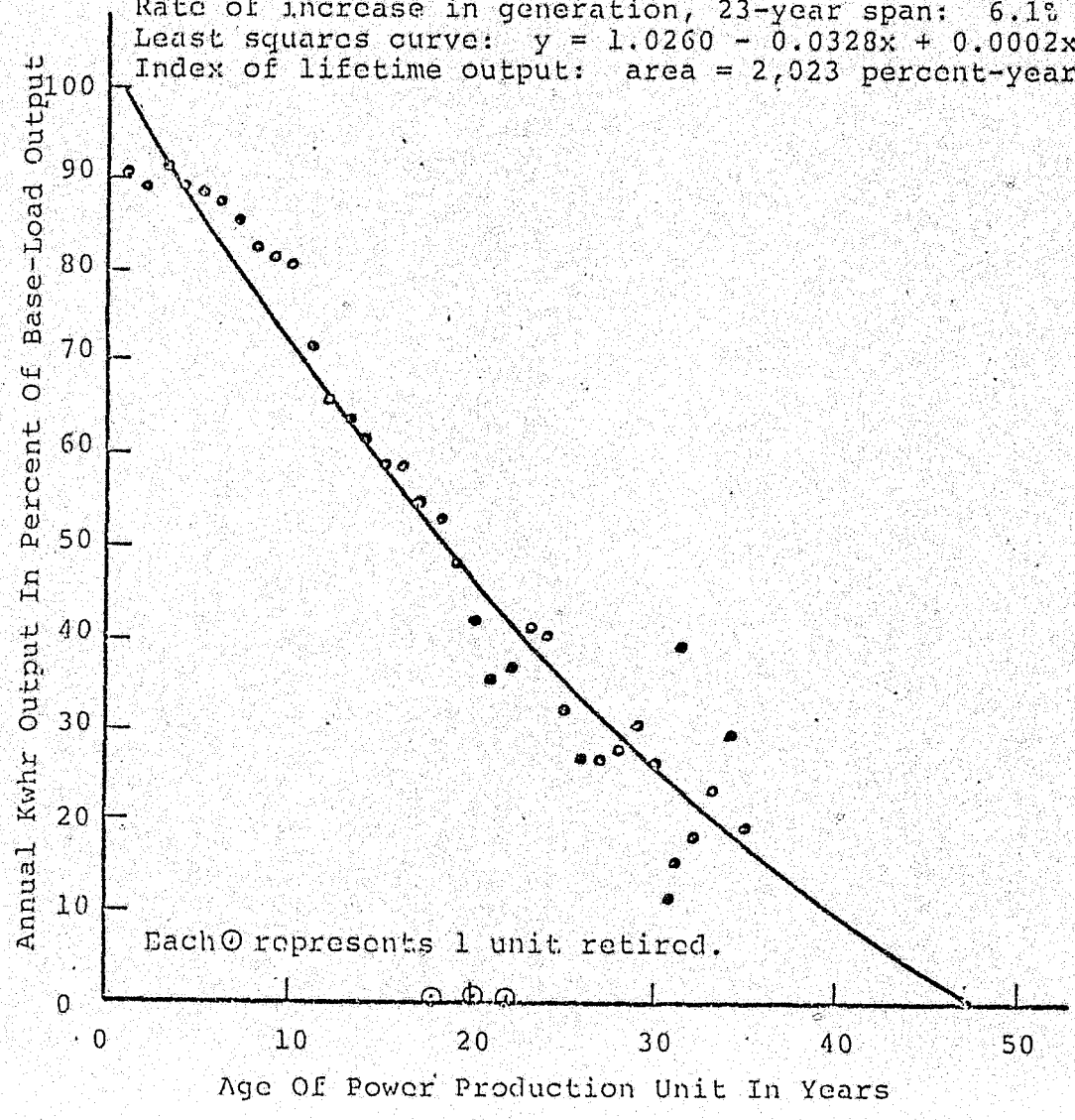


Figure 1c

Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY A Ohio Edison Company – R-C

Economic life span: 47.5 years
Data base: 648 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 6.1%
Least squares curve: $y = 1.0260 - 0.0328x + 0.0002x^2$.
Index of lifetime output: area = 2,023 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY B Atlantic City Electric Company-A

Economic life span: 50+ years
Data base: 166 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 7.8%
Least squares curve: $y = 1.0049 - 0.0175x + 0.0001x^2$
Index of lifetime output: area = 2,908 percent-years

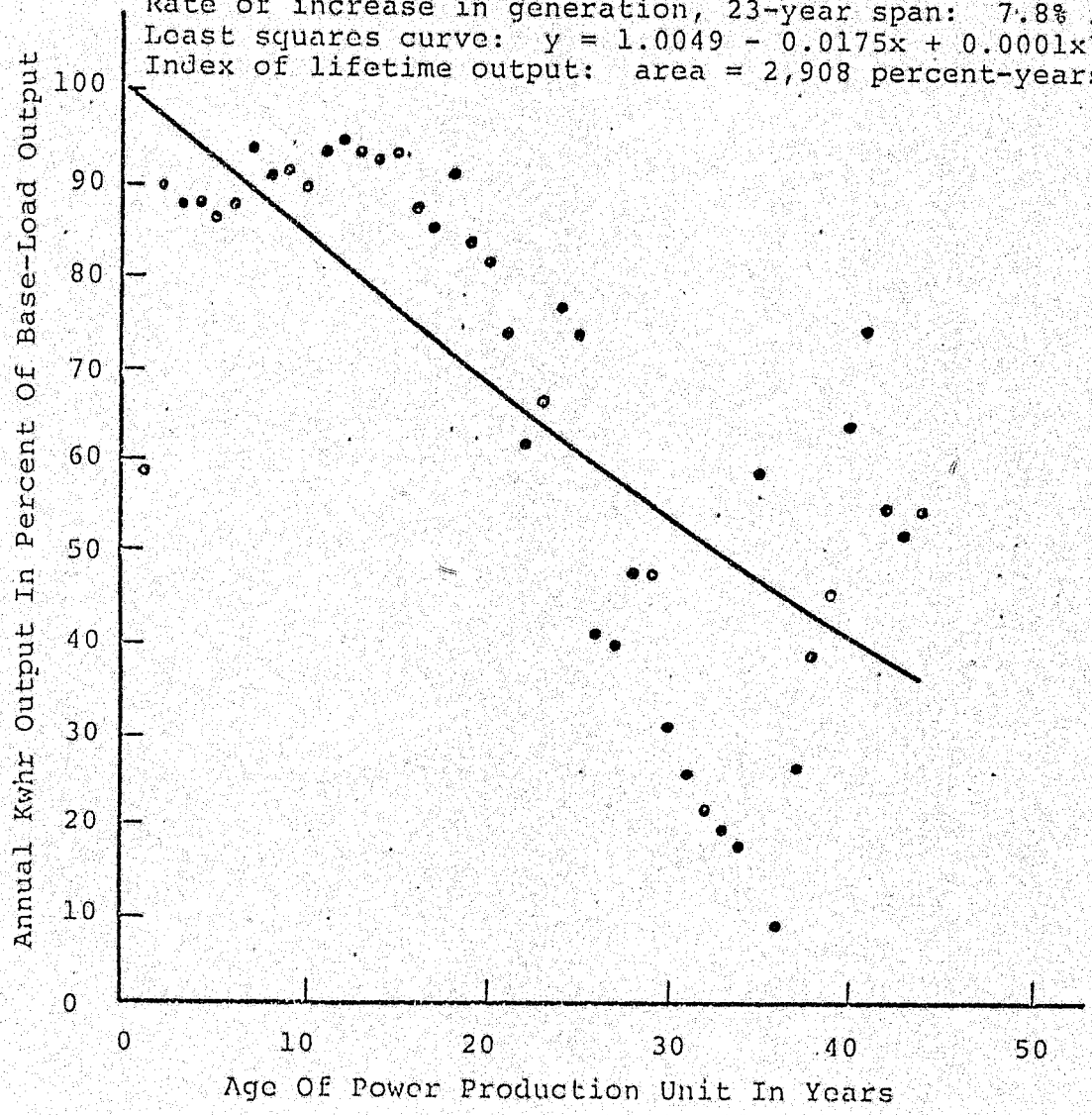
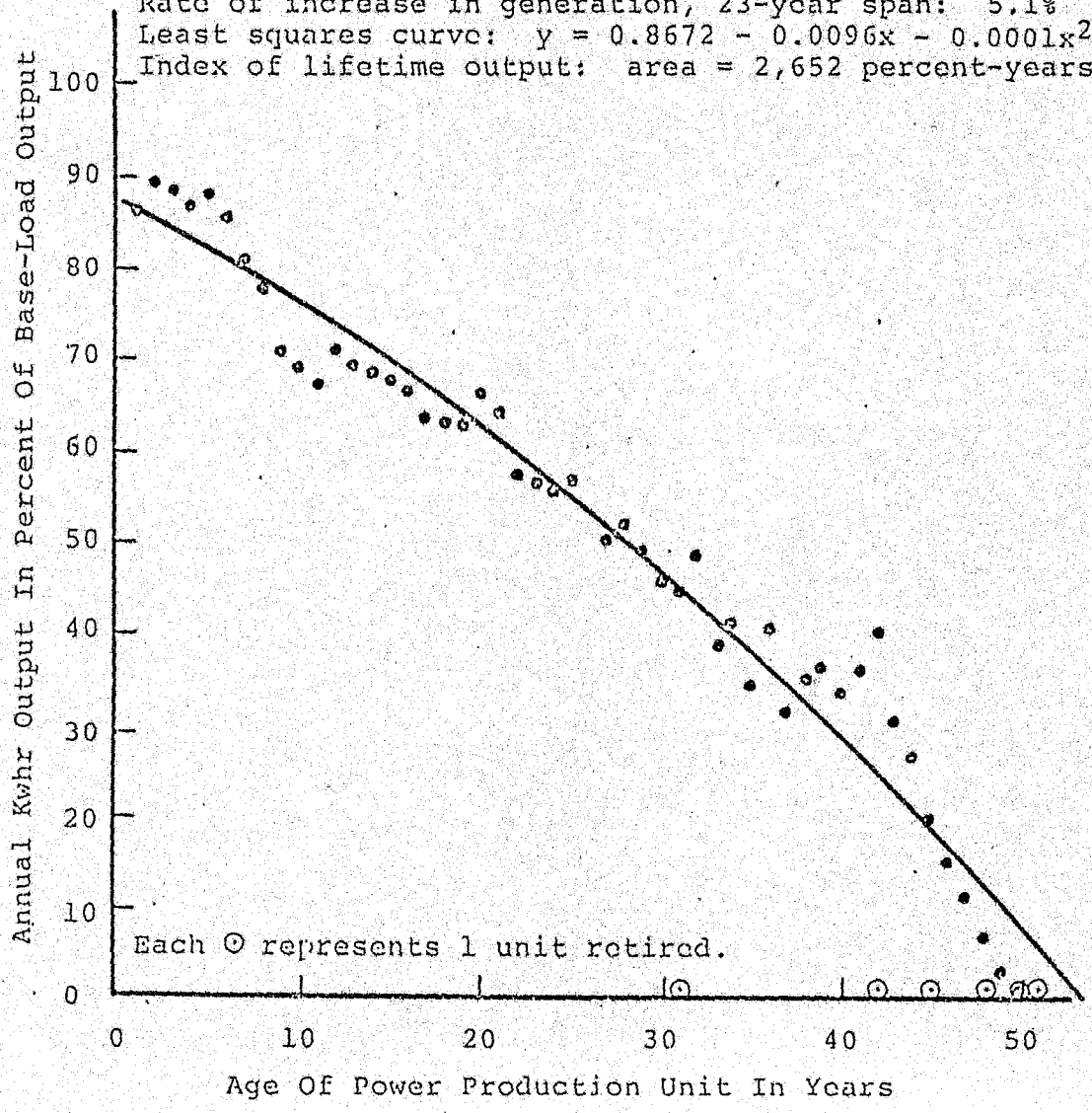


Figure 3

Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY C Duquesne Light Company - F. V

Economic life span: 53.5 years
Data base: 536 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 5.1%
Least squares curve: $y = 0.8672 - 0.0096x - 0.0001x^2$
Index of lifetime output: area = 2,652 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY D Cleveland Electric Illuminating Company - R. C.

Economic life span: 44.7 years
Data base: 935 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 5.99%
Least squares curve: $y = 0.8458 - 0.0176x - 0.0000x^2$
Index of lifetime output: area = 1,933 percent-years

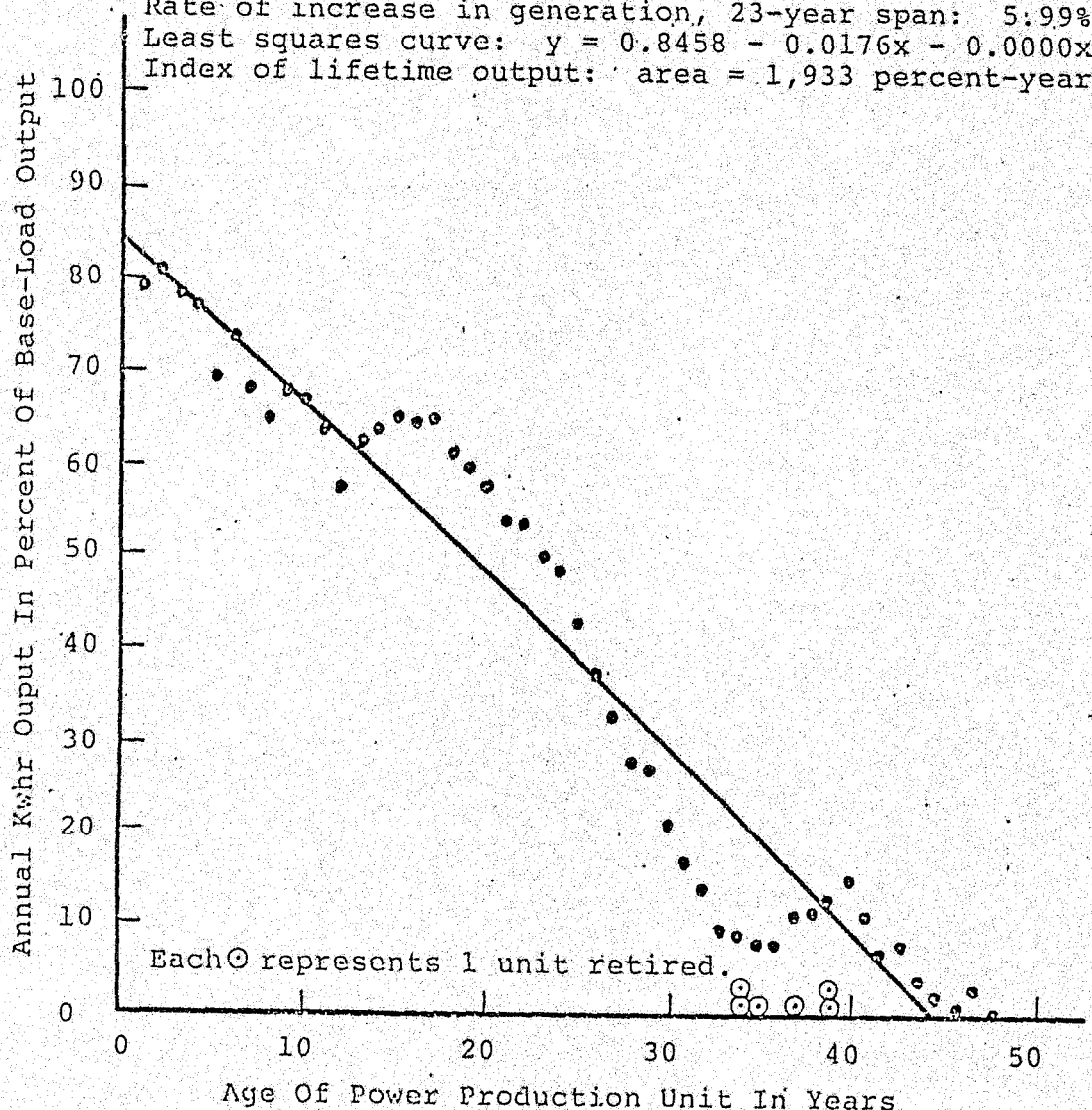
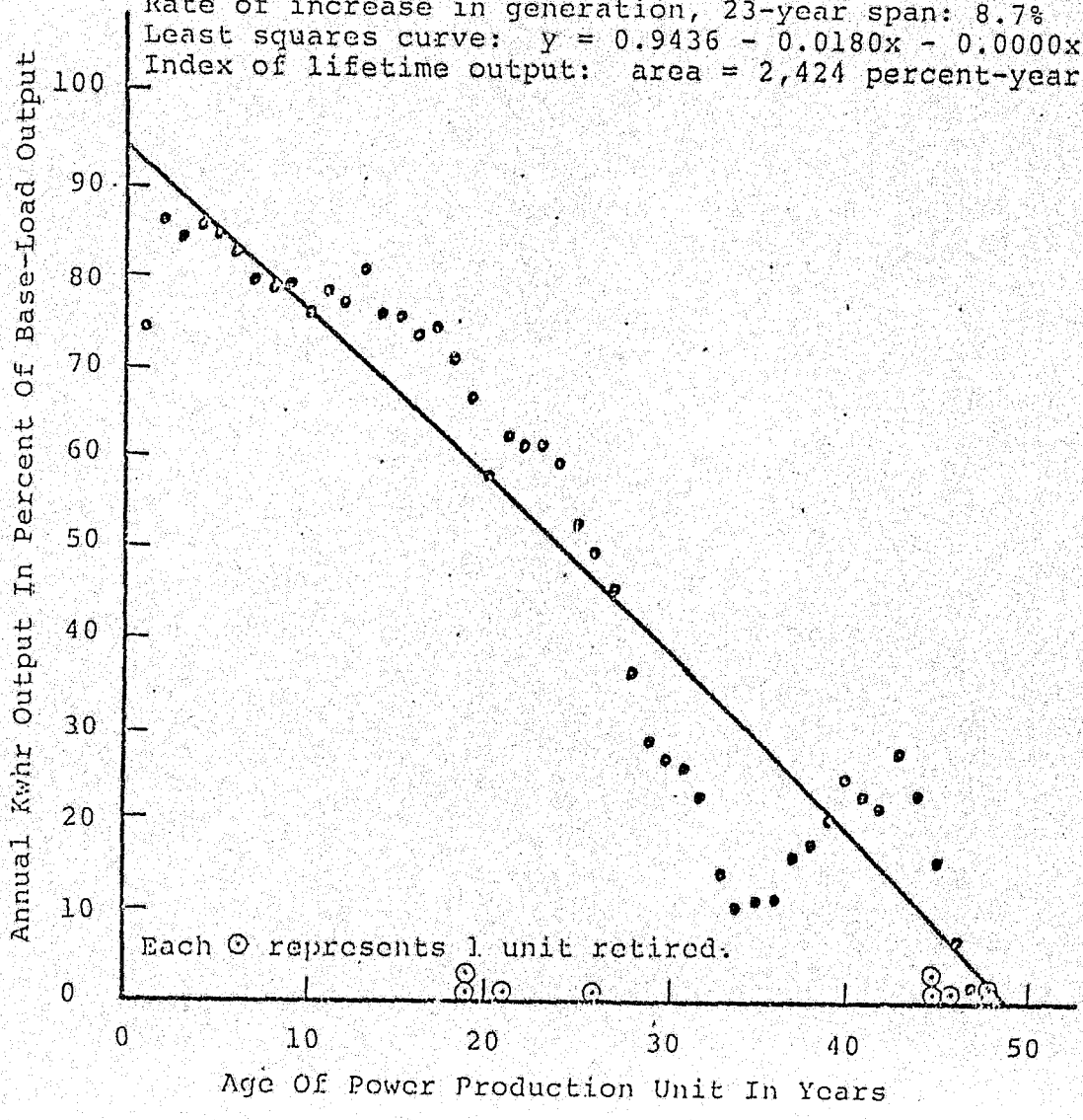


Figure 4

Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY E 7 F. V. (Probably PP47

Economic life span: 49.1 years
Data base: 483 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 8.7%
Least squares curve: $y = 0.9436 - 0.0180x - 0.0000x^2$
Index of lifetime output: area = 2,424 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY F Northern States Power Company - D.C.

Economic life span: 50+ years
Data base: 784 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 8.3%
Least squares curve: $y = 0.8782 - 0.0253x + 0.0002x^2$
Index of lifetime output: area = 2,124 percent-years

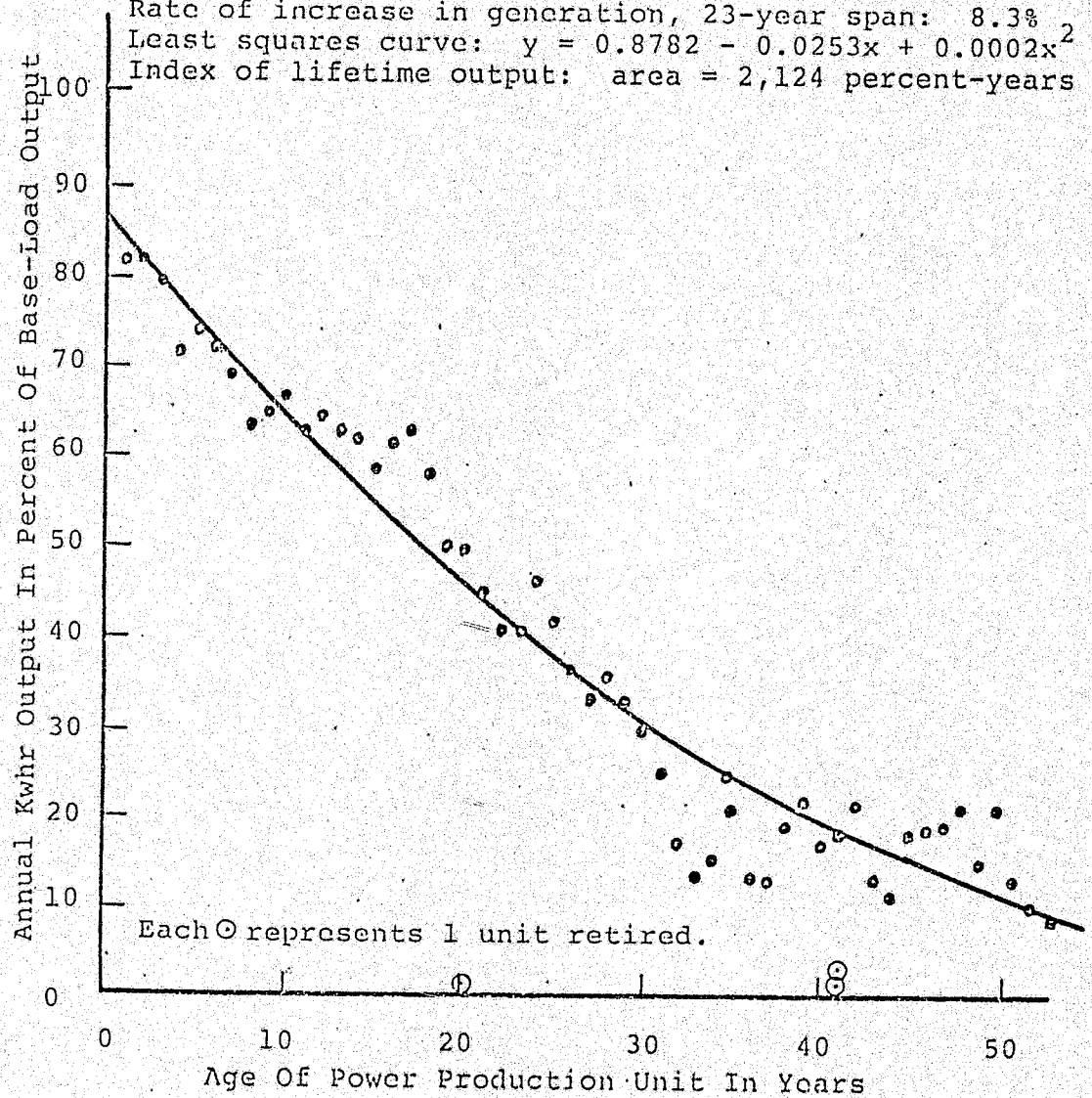


Figure 7

Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY G Florida Power & Light Company — S. C.

Economic life span: 28.6 years
Data base: 452 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 13.8%
Least squares curve: $y = 0.9636 - 0.0248x - 0.0003x^2$
Index of lifetime output: area = 1,502 percent-years

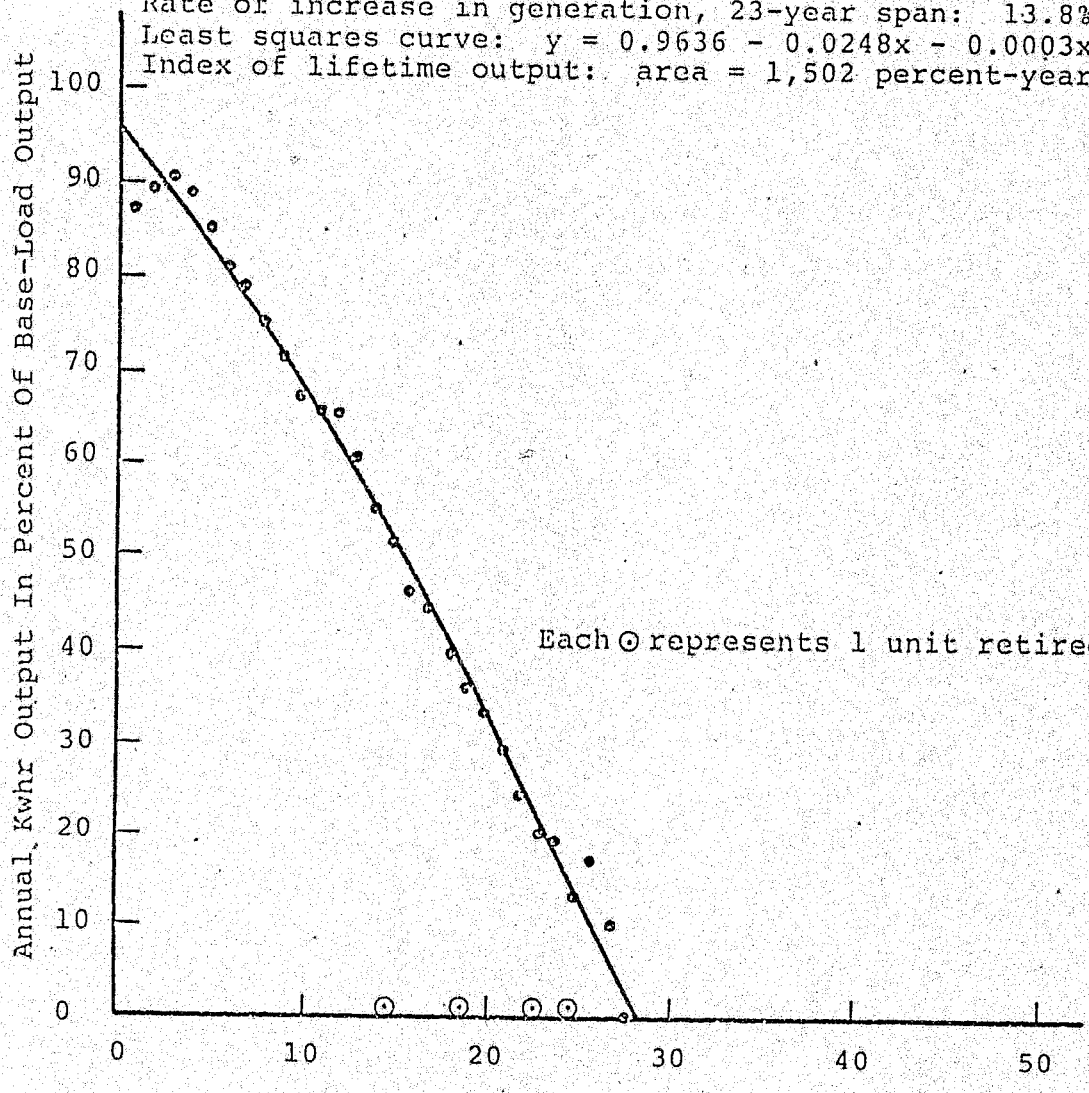
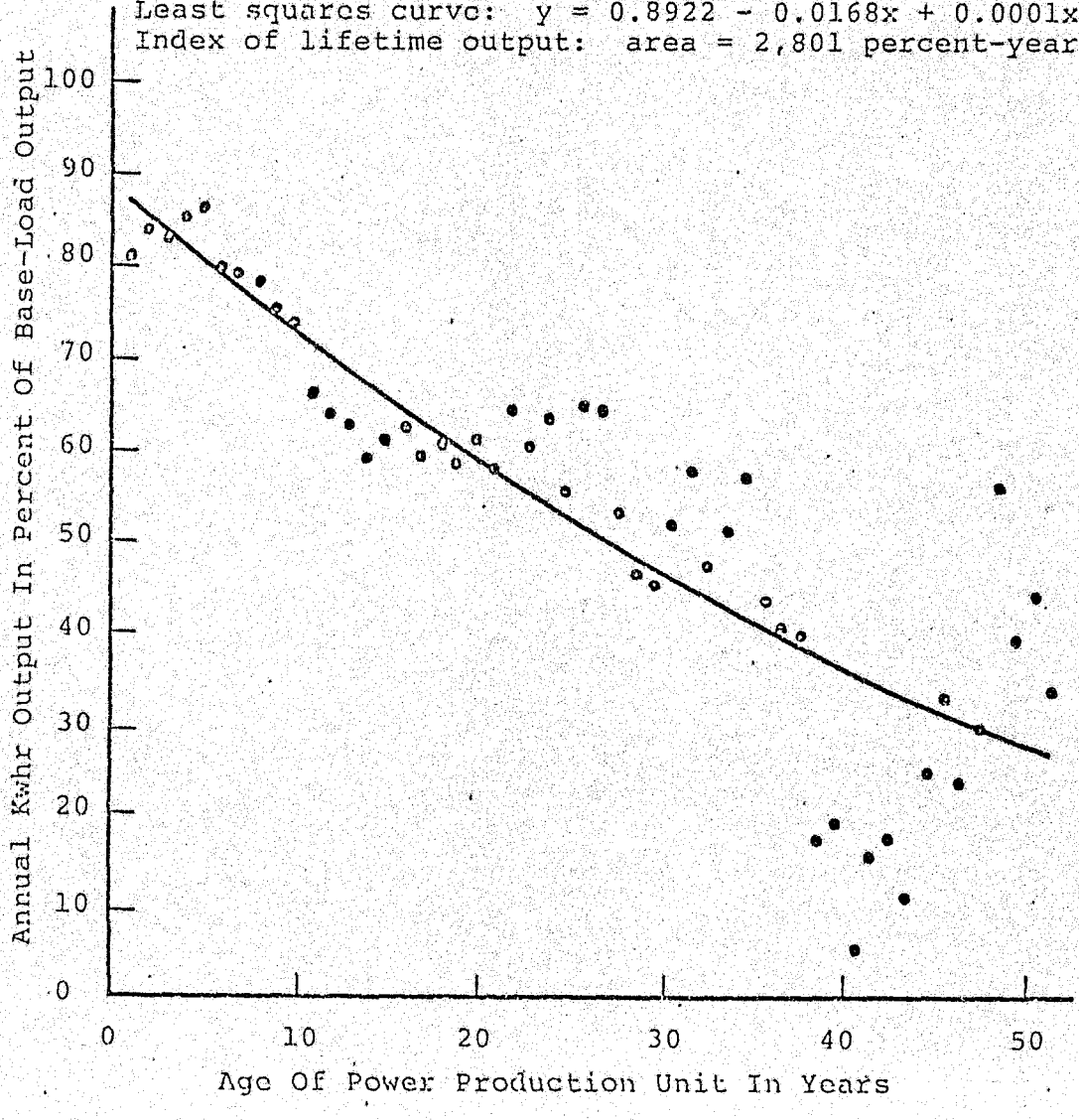


Figure 8

Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY II (Virginia Electric Power Company — D. C.

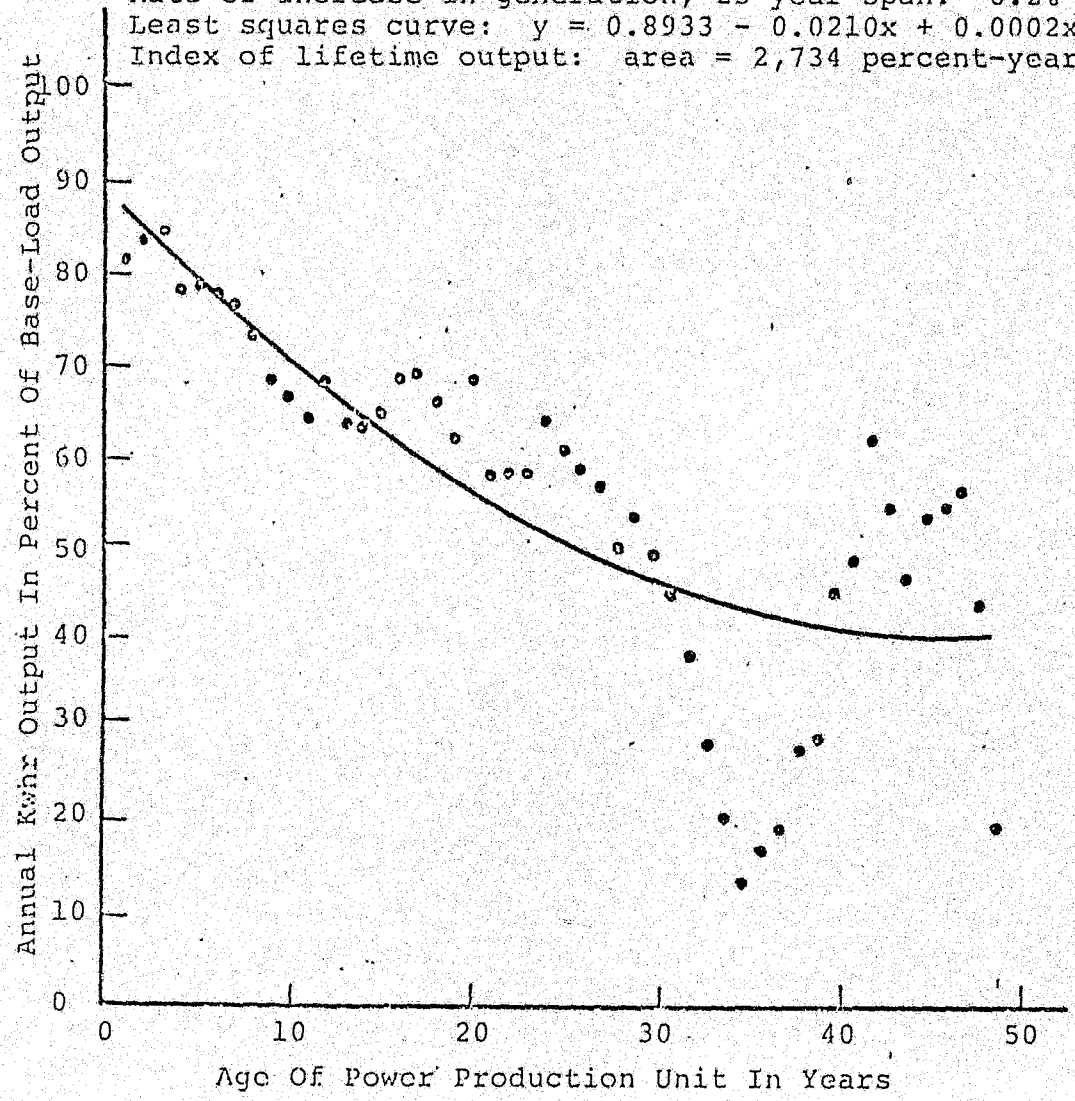
Economic life span: 50+ years
Data base: 315 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 6.8%
Least squares curve: $y = 0.8922 - 0.0168x + 0.0001x^2$
Index of lifetime output: area = 2,801 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY I T O.C.

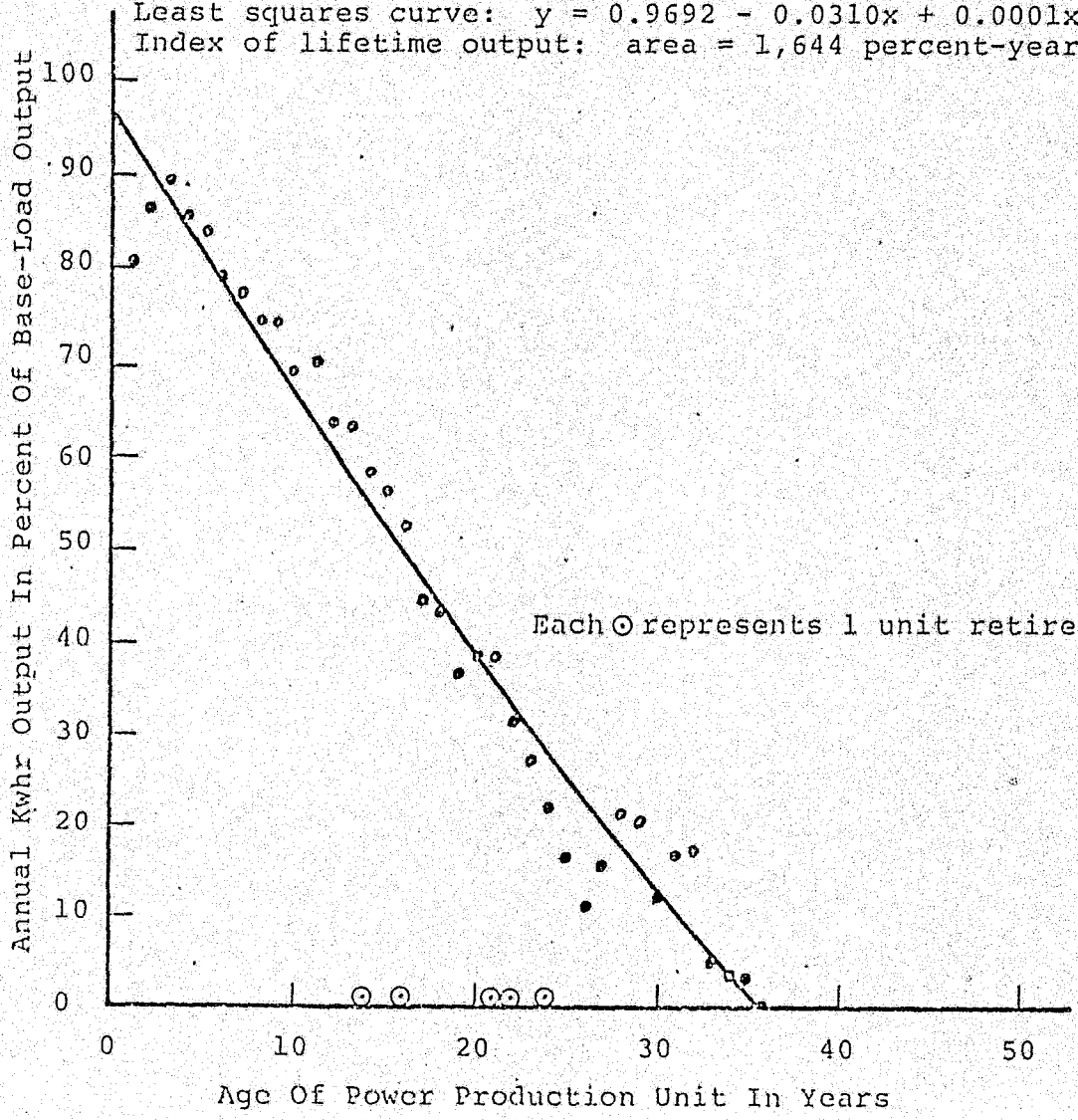
Economic life span: 50+ years
Data base: 486 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 8.2%
Least squares curve: $y = 0.8933 - 0.0210x + 0.0002x^2$
Index of lifetime output: area = 2,734 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY J Virginia Electric and Power Company - F. V.

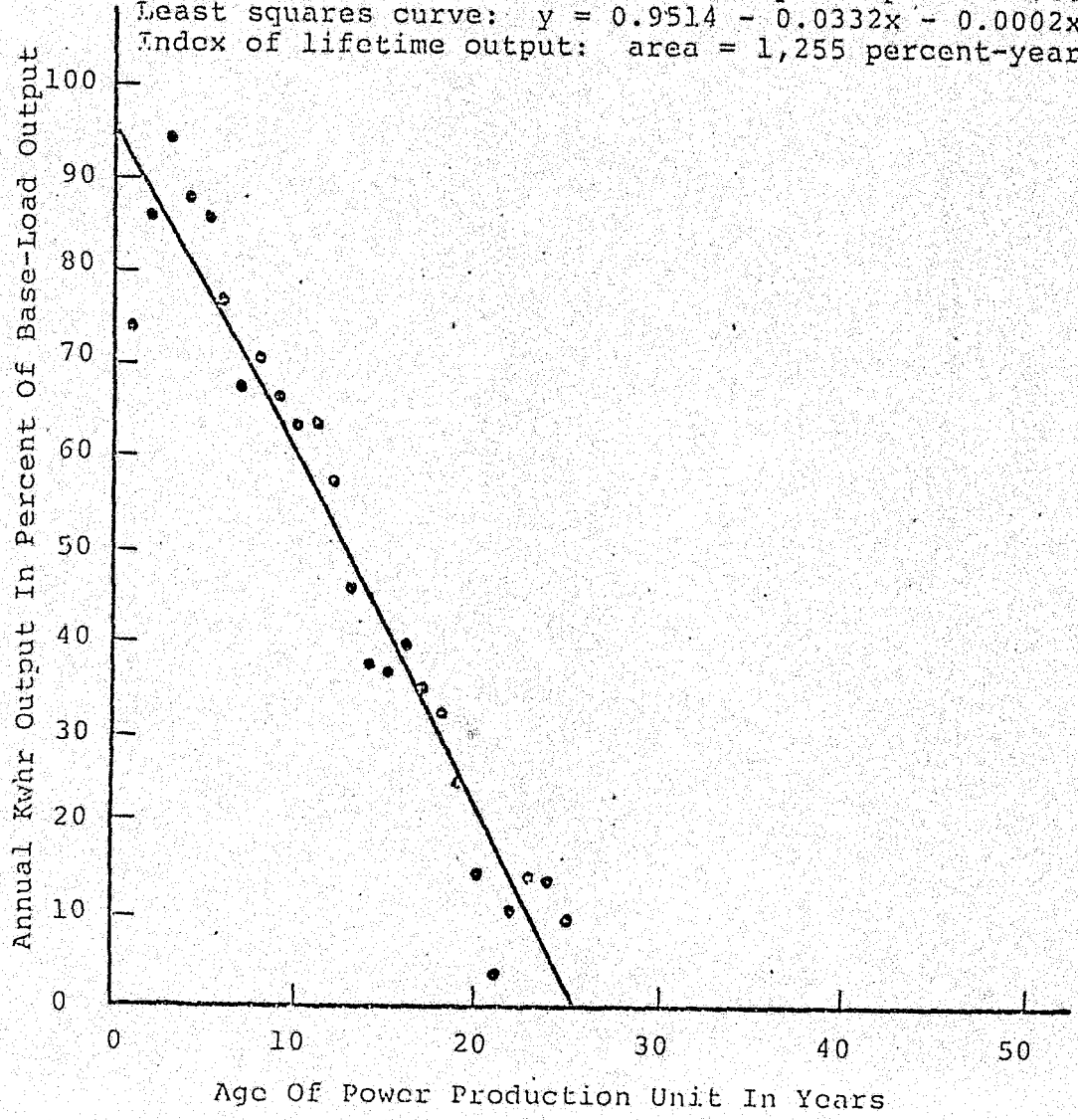
Economic life span: 35.6 years
Data base: 589 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 10.04%
Least squares curve: $y = 0.9692 - 0.0310x + 0.0001x^2$
Index of lifetime output: area = 1,644 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY K ? O. C.

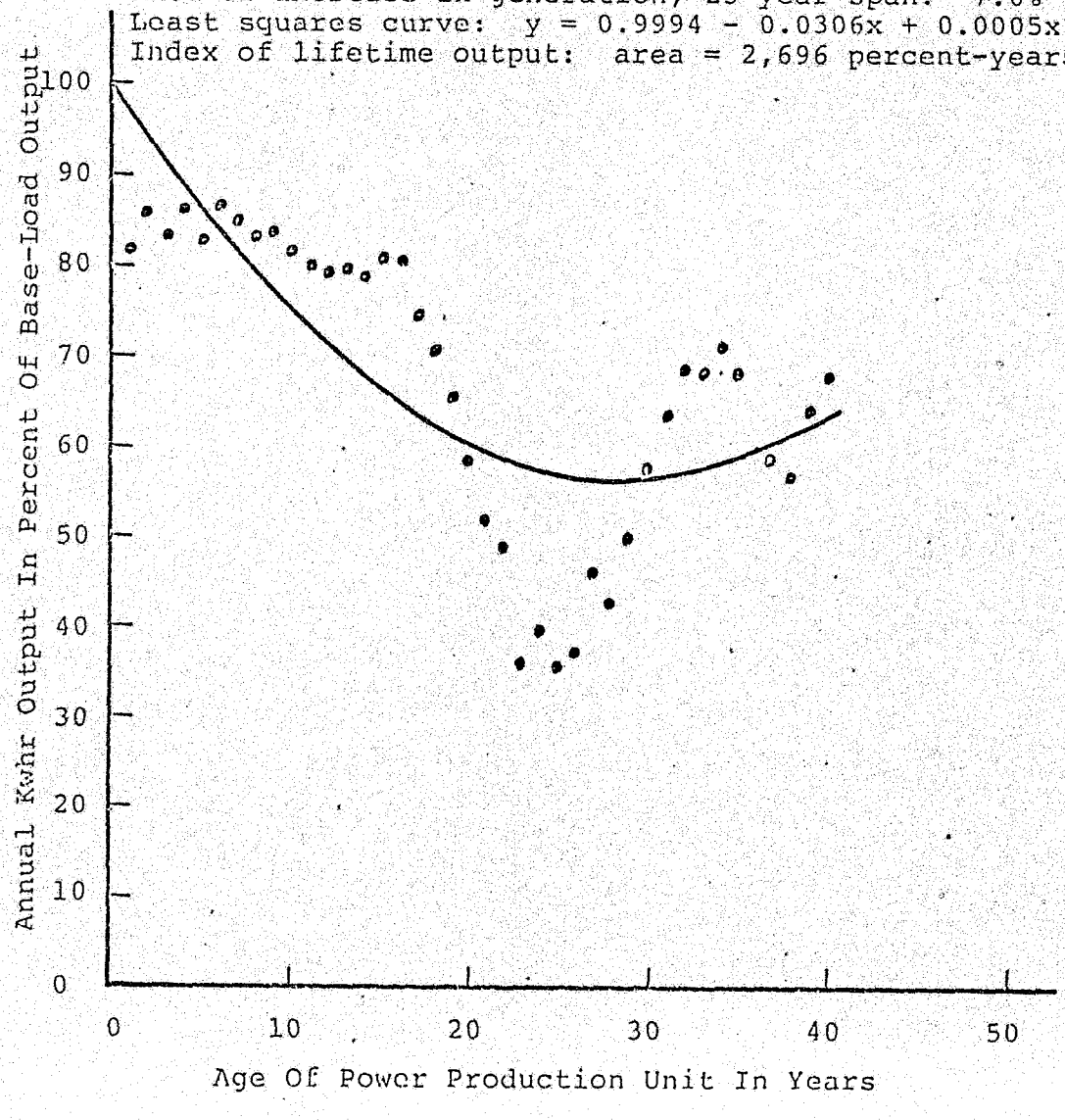
Economic life span: 25.5 years
Data base: 589 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 12.4%
Least squares curve: $y = 0.9514 - 0.0332x - 0.0002x^2$
Index of lifetime output: area = 1,255 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY L Potomac Edison Company D. C.

Economic life span: 50+ years
Data base: 678 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 7.0%
Least squares curve: $y = 0.9994 - 0.0306x + 0.0005x^2$
Index of lifetime output: area = 2,696 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY M Boston Edison Company. D.C.

Economic life span: 50 years
Data base: 342 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 6.4%
Least squares curve: $y = 0.8415 - 0.0052x + 0.0002x^2$
Index of lifetime output: area - 2,597 percent-years

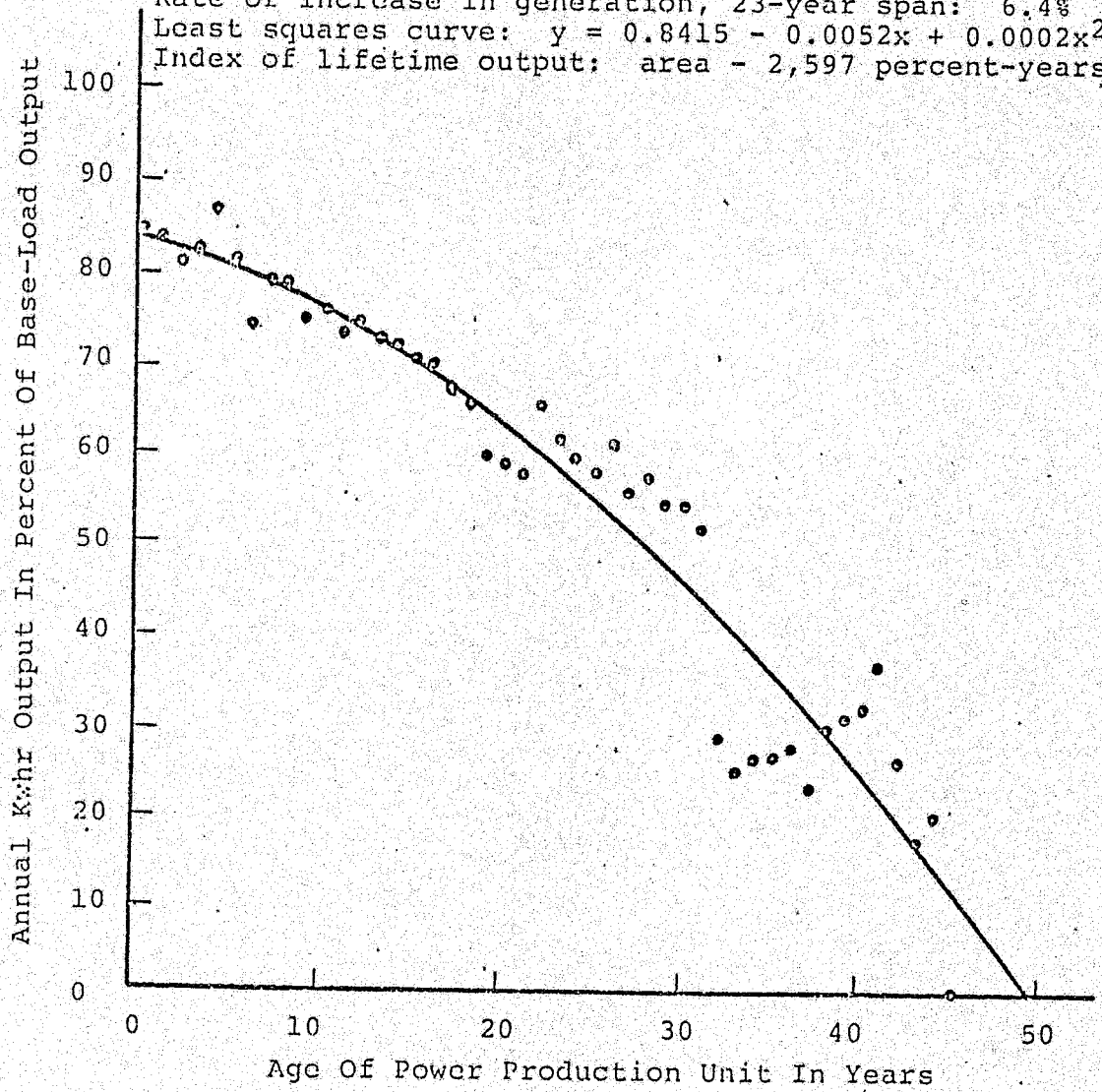


Figure 14

Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY N Houston Lighting and Power Company - F.V.

Economic life span: 31.5 years
Data base: 404 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 10.5%
Least squares curve: $y = 1.0257 - 0.0558x + 0.0007x^2$
Index of lifetime output: area = 1,227 percent-years

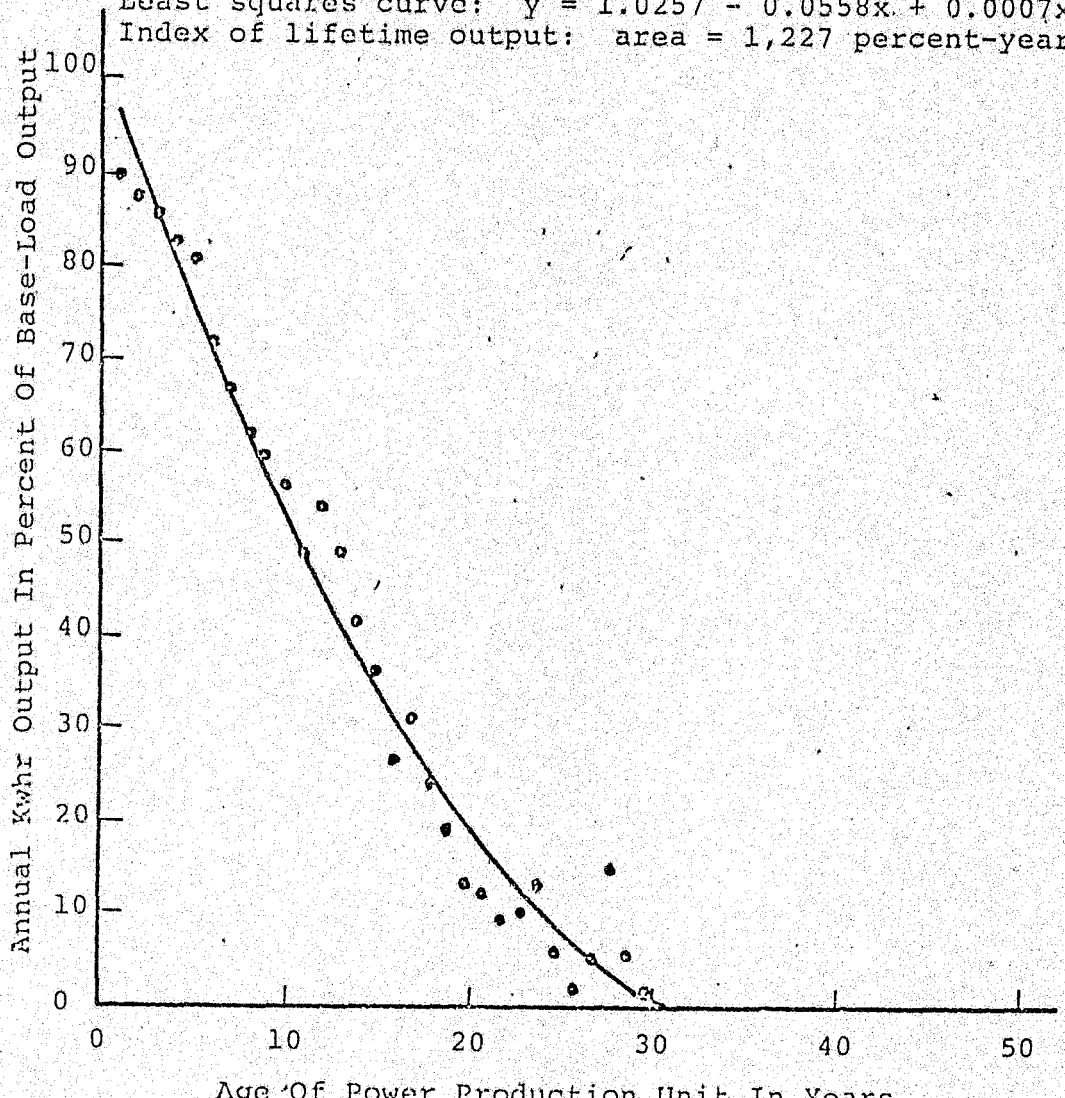
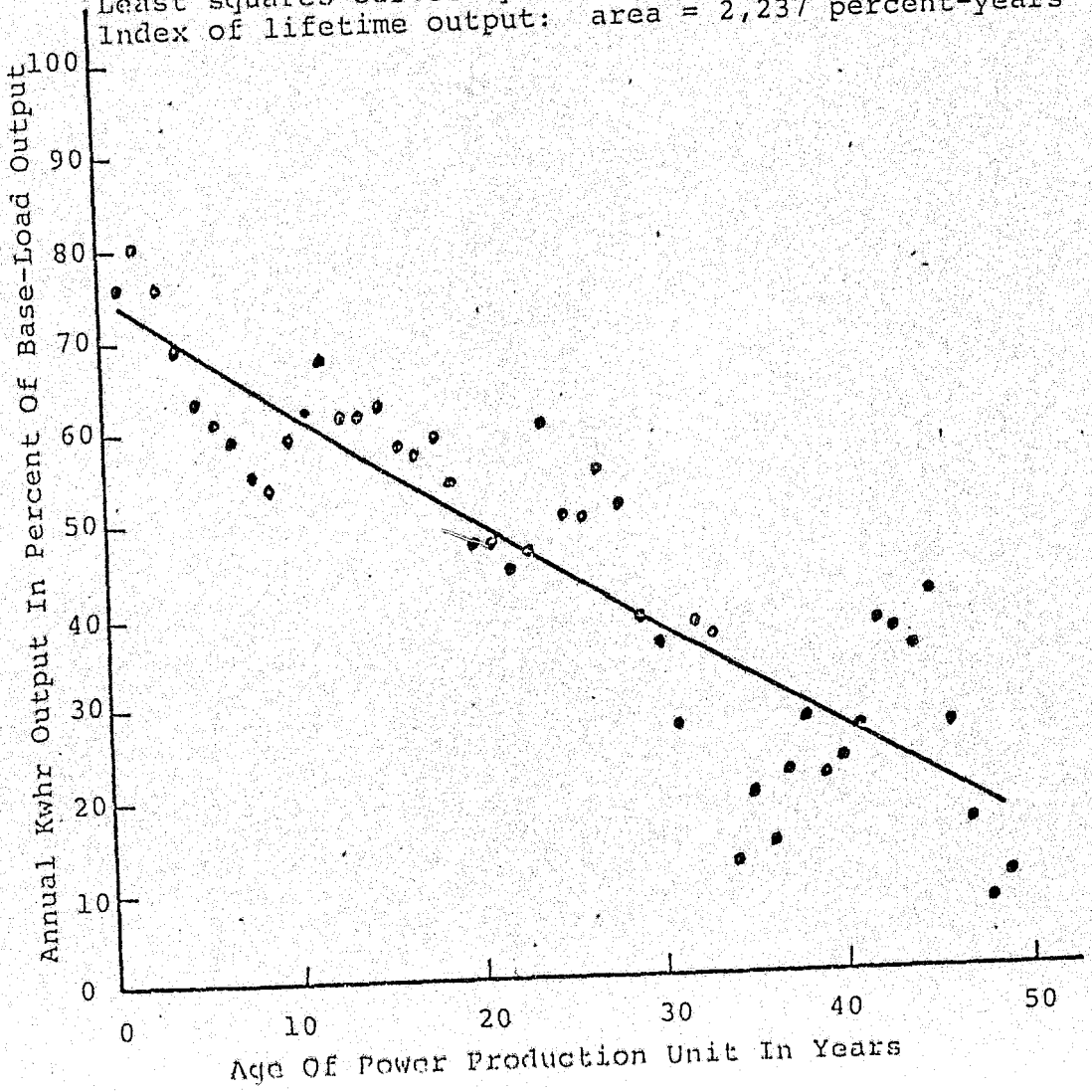


Figure 15

Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPANY O Duke Power Company — F.V.

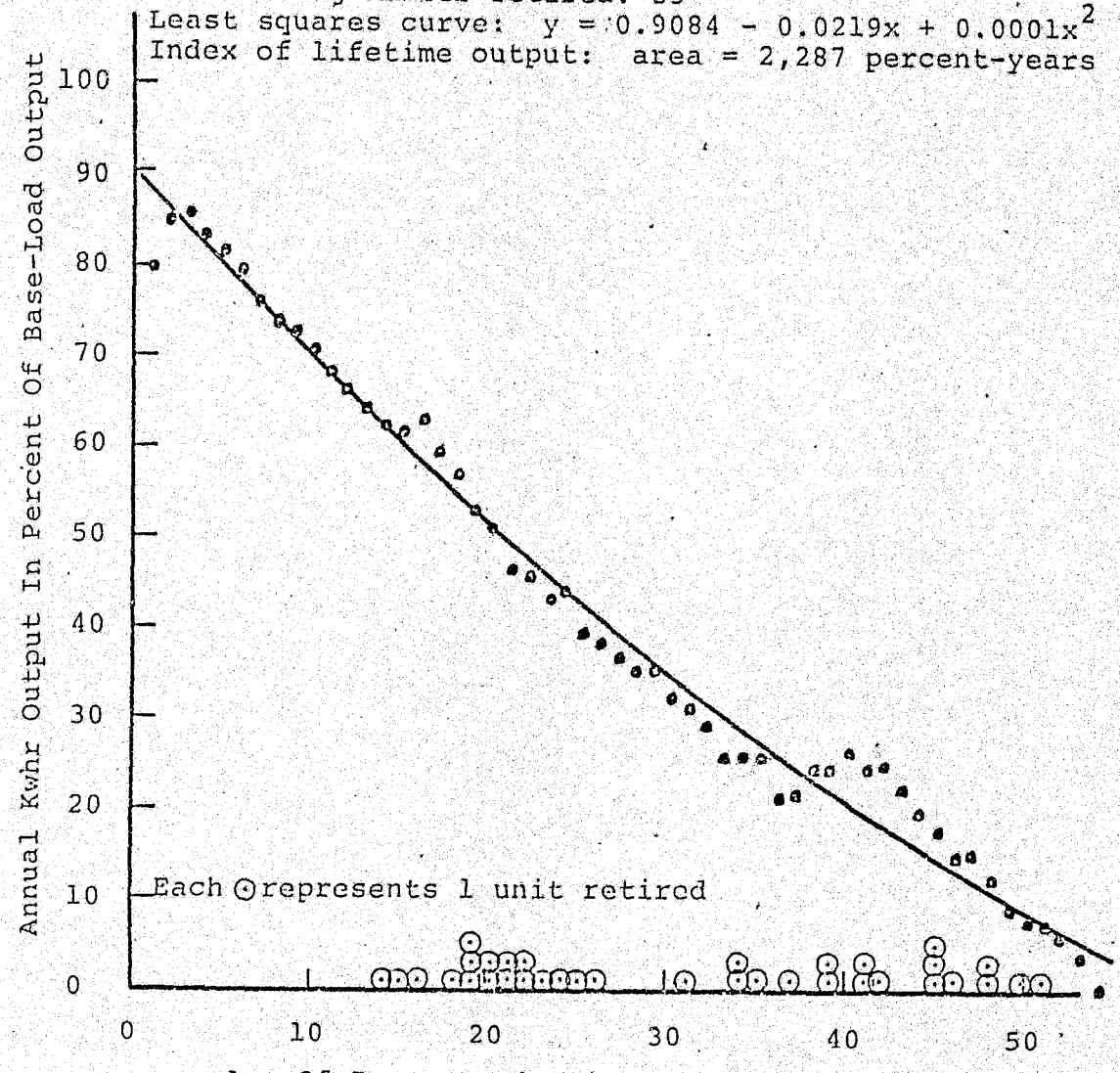
Economic life span: 50+ years
Data base: 1033 unit-years of experience at 12-31-73
Rate of increase in generation, 23-year span: 8.2%
Least squares curve: $y = 0.7593 - 0.0135x + 0.0000x^2$
Index of lifetime output: area = 2,237 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPOSITE OF TWELVE COMPANIES
(Excludes Companies M, N & O)

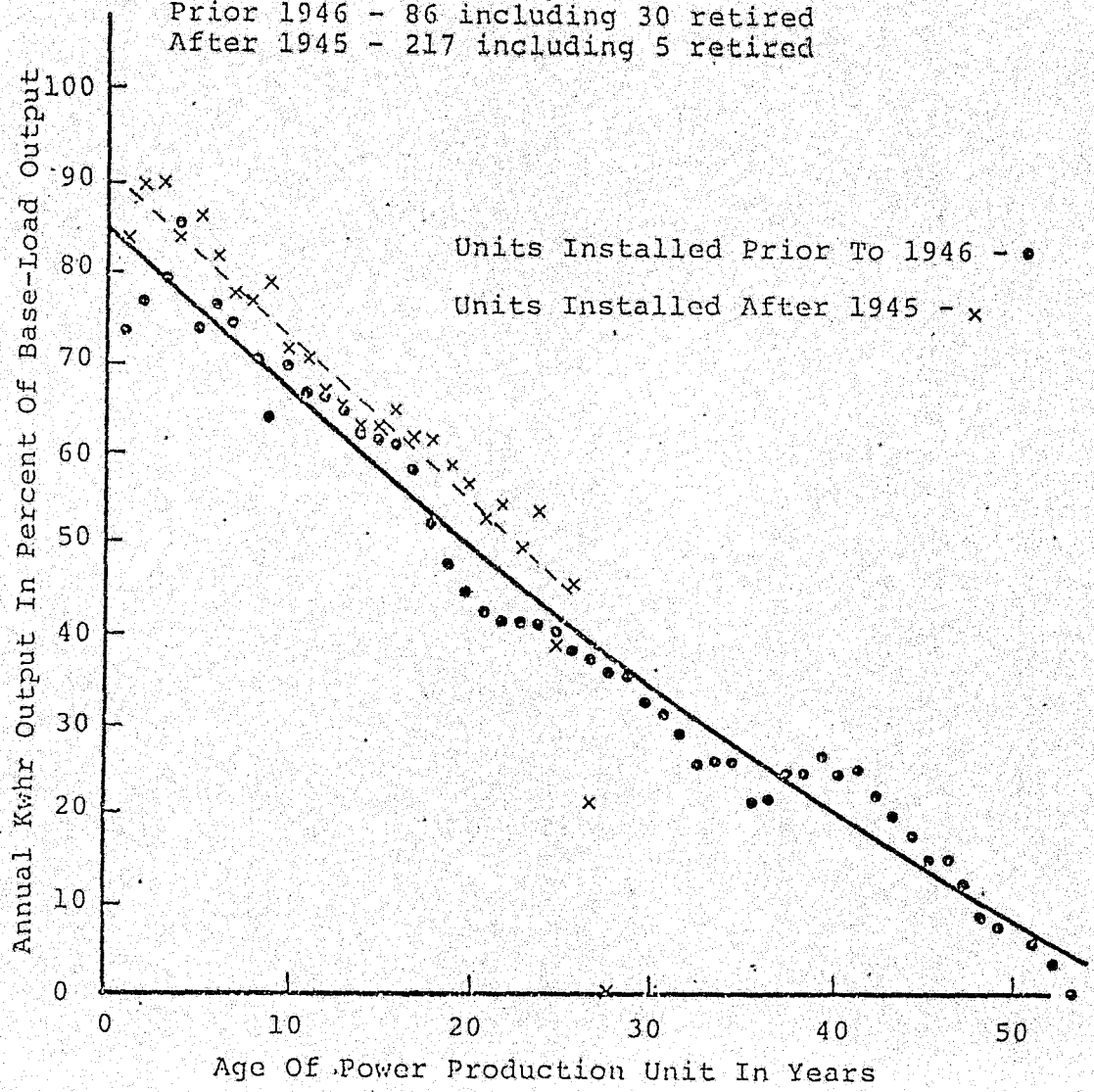
Economic life span: 55+ years
Data base: 6,708 unit-years of experience at 12-31-73
Number of units in study: 303
including number retired: 35
Least squares curve: $y = 0.9084 - 0.0219x + 0.0001x^2$
Index of lifetime output: area = 2,287 percent-years



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

COMPOSITE OF TWELVE COMPANIES
(Excludes Companies M, N & O)

Data base:
Prior 1946 - 3404 unit-years at 12-31-73
After 1945 - 3304 unit-years at 12-31-73
Number of units in study:
Prior 1946 - 86 including 30 retired
After 1945 - 217 including 5 retired



Historic Progression Of Power Production Units
From Base-Load Status To Peak-Load Status

Inverse Relationship Between Economic Life Span
And Annual Rate Of Growth In System Output

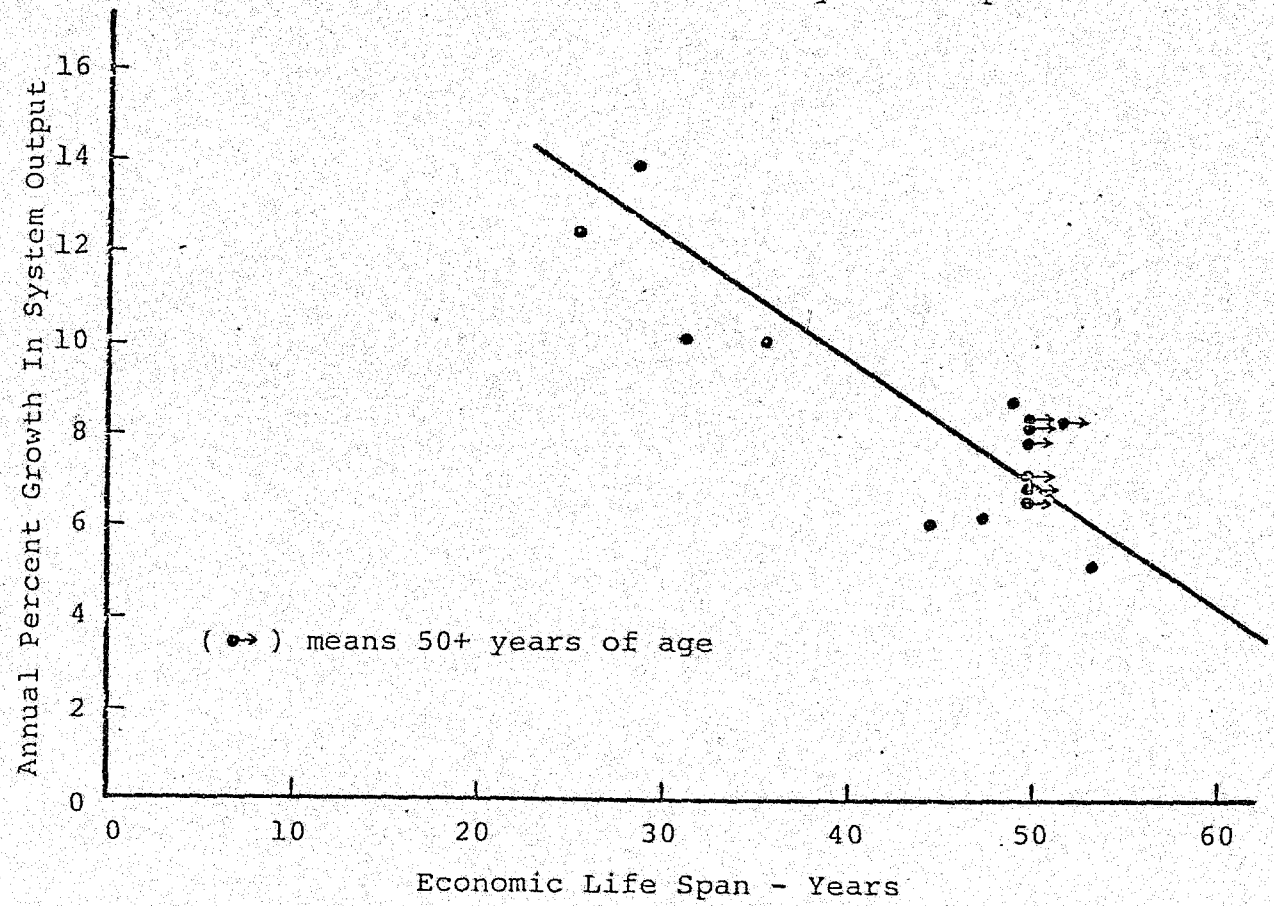


Figure 19

ECONOMIC LIFE SPAN OF POWER PRODUCTION UNITS

Table 1
Summary Of Data For Fifteen Companies

Company	Fig. No.	No. of Units	Data Base Unit-Yrs.	Economic Life Span Years	Annual Growth Rate* %	Lifetime Output Index %-Yrs.
A	2	31	648	47.5	6.1	2,023
B	3	10	166	50+	7.8	2,908
C	4	19	536	53.5	5.1	2,652
D	5	30	935	44.7	6.0	1,933
E	6	23	483	49.1	8.7	2,424
F	7	28	784	50+	8.3	2,124
G	8	29	452	28.6	13.8	1,502
H	9	16	315	50+	6.8	2,801
I	10	19	486	50+	8.2	2,734
J	11	28	589	35.6	10.0	1,644
K	12	40	589	25.5	12.4	1,255
L	13	30	678	50+	7.0	2,696
M	14	14	342	50	6.4	2,517
N	15	27	404	31.5	10.5	1,227
O	16	43	1,033	50+	8.2	2,237
Composite		387	8,487	-	-	-

avg = 44.4

*Compounded rate of increase during 23-year span from 1948-1950 to 1971-1973.

Note: (50+) means percent output reaches zero (if determinable at all) at a point greater than 50 years.

ECONOMIC LIFE TABLE OF POWER PRODUCING UNITS

Table 1

Formula of Determination of Average Output Factors for Age

Applicable to Category C

| Age | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

TABLE 20

COMPARISON OF HISTORIC PROGRESSION ECONOMIC LIFE SPANS
WITH RETIRED AND TO BE RETIRED LIFE SPANS

Company	Historic Progression Economic Life Span Years	Retired Units Experienced Life Spans			To Be Retired Units Expected Life Spans *		
		Number of Units	Range Years	Average Years	Number of Units	Range Years	Average Years
Duquesne	52.9	8	32-53	45	14	40-58	45
Met Ed	53.6	7	30-57	44	7	40-44	42
Penelec	61+	16	28-58	48	18	37-63	42
Penn Power	61.0	-	-	-	8	40-61	46
PP&L	59.6	61	19-56	37	19	28-42	36
Phila. Elec.	61+	19	42-60	50	23	30-72	39
West Penn	57.4	17	19-59	45	12	31-39	35
Composite	61+	128	19-60	43	101	28-72	37

*Does not reflect any reevaluation of operating plans following the Three Mile Island Unit 2 nuclear accident.

Growth Rate

Egg contends that there is an inverse relationship between the long term growth rate in generation and economic life span.[8] To examine this contention the economic life spans indicated by Figures 6 through 12 were plotted against the 32-year compound annual growth rate shown in Table 19 for each company, respectively. The reported 32-year growth rates ranged from 4.5 percent to 8.7 percent, while the expected future growth rates ranged from 2.5 percent to 4.5 percent. The indicated economic life spans ranged from 52.9 years to 61+ years. The resulting Figure 24 shows no statistically reliable relationship between growth rate and economic life span for the companies studied. In fact, a linear regression of the data points shown on Figure 24 had $R^2 = 0.0316$, which indicates a poor relationship. The present analysis of Pennsylvania data does not appear to support the conclusion drawn by Egg.

Conclusions

This research has developed a methodology for analyzing Pennsylvania power unit output data, statistically testing the fitted models, and verifying the resulting economic life spans with past experience and present expectations. In addition, this research has shown that economic life spans of 50 to 60 years for fossil-fueled generating units are

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[8] Economic Life Span of Power Production Units by Joseph C. Egg, Public Utilities Fortnightly, September 11, 1975, Volume 96, No. 6.

possible and that an expectation of 50 years is certainly not unreasonable. The statistical analysis of the trends in Chapter III indicate the following economic life spans:

Duquesne Light Company	52.9 years
Metropolitan Edison Company . .	53.6 years
Pennsylvania Electric Company .	61+ years
Pennsylvania Power Company . . .	61.0 years
Pennsylvania Power & Light Co. .	59.6 years
Philadelphia Electric Company .	61+ years
West Penn Power Company	57.4 years
Composite for Seven Companies .	61+ years

The analysis of the life spans of retired and to be retired power units in Chapter IV has shown that the statistically indicated economic life spans are reasonable and applicable to the studied utilities (see Table 20, Page 75).

The expected remaining life in each power unit of the major electric utilities in the Commonwealth of Pennsylvania can be determined from use of Figures 6 through 15. A comparison of a power unit's pattern of output to the one shown in the appropriate figure will indicate the expected number of years of economic life remaining.

The major reasons for retirement of power units in the past was given as economics and pollution control requirements. These same forces are active now and will continue into the future.

The present analysis of Pennsylvania data does not support the conclusion of an inverse relationship between economic life span and the long term growth rate in generation.

APPENDIX E

Q.V.9. Please provide a schedule showing changes to all measures of value and depreciation expense caused by the following changes in life spans:

Conemaugh 1 and 2 from 35 yr. to 40 yr.
Keystone 1 and 2 from 30 yr. to 40 yr.
Eddystone 1 and 2 from 30 yr. to 40 yr.

A.V.9. The requested schedules are provided as follows:

Eddystone - Attachment V.9a. (11 sheets)
Conemaugh - Attachment V.9b. (7 sheets)
Keystone - Attachment V.9c. (7 sheets)

It should be noted that the Company's depreciation claims for these stations are detailed in Exhibit HTW-4. The Company's basis for its depreciation lives and dispersions are provided in Exhibit HTW-2 and Statement #8, the Direct Testimony of H. T. Waddington.

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 EDDYSTONE NOS.1&2 BRICK AND CONCRETE BUILDINGS
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE.. GANNETT & FLEMING INDEX 4-2
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G402	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	886,471	3267	3.050	2,703,737	39.6	2.53	19.75	0.4939	437,828	1,335,376
1963	498	3537	2.817	1,403	36.7	2.72	16.75	0.4528	225	635
1969	3,855	4697	2.121	8,176	30.8	3.25	10.75	0.3468	1,337	2,835
SPOT BASE		9964	1.000							
TOTAL	890,824			2,713,316					439,390	1,338,846
3-YEAR AVERAGE		9658	0.969	2,629,203						1,297,342
5-YEAR AVERAGE		9189	0.922	2,501,677						1,234,416

O.C. ACCRUAL RATE = 2.53 PCT., AMOUNT = 22,538

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 EDDYSTONE NOS.1&2 STEEL BUILDINGS
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-3 SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G403	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	2,165,658	3010	2.985	6,464,489	39.6	2.53	19.75	0.4939	1,069,618	3,192,811
1964	15,210	3133	2.868	43,622	35.7	2.80	15.75	0.4375	6,654	19,085
1970	5,521	4417	2.034	11,230	29.8	3.36	9.75	0.3250	1,794	3,650
SPOT BASE		8985	1.000							
TOTAL	2,186,389			6,519,341					1,078,066	3,215,546
3-YEAR AVERAGE		8613	0.959	6,252,048						3,083,709
5-YEAR AVERAGE		8075	0.899	5,860,888						2,890,776

O.C. ACCRUAL RATE = 2.53 PCT., AMOUNT = 55,316

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 EDDYSTONE NOS.1&2 BRICK AND STEEL BUILDINGS
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1960

INDEX SOURCE.. GANNETT & FLEMING INDEX 4-1
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G401	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	85,533	3228	3.023	258,566	39.6	2.53	19.75	0.4939	42,245	127,706
1963	486	3390	2.879	1,399	36.7	2.72	16.75	0.4528	220	633
1964	139	3486	2.799	389	35.7	2.80	15.75	0.4375	61	170
1966	324	3760	2.595	841	33.8	2.96	13.75	0.4044	131	340
1967	285	4034	2.419	689	32.8	3.05	12.75	0.3864	110	266
1968	2,192	4284	2.278	4,993	31.8	3.14	11.75	0.3672	805	1,833
SPOT BASE		9759	1.000							
TOTAL	88,959			266,877					43,572	130,948
3-YEAR AVERAGE		9403	0.964	257,269						126,234
5-YEAR AVERAGE		8873	0.909	242,591						119,032

O.C. ACCRUAL RATE = 2.55 PCT., AMOUNT = 2,268

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 EDDYSTONE NOS.1&2 BRICK & METAL-SIDED BUILDINGS
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-6
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G406	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	21,473,391	3119	3.005	64,527,540	39.6	2.53	19.75	0.4939	10,605,708	31,870,152
1961	1,330	3127	2.997	3,986	38.6	2.59	18.75	0.4809	640	1,917
1962	1,232	3174	2.953	3,638	37.7	2.65	17.75	0.4672	576	1,700
1963	15,932	3232	2.900	46,203	36.7	2.72	16.75	0.4528	7,214	20,921
1964	72,933	3310	2.831	206,473	35.7	2.80	15.75	0.4375	31,908	90,332
1965	14,638	3412	2.747	40,211	34.7	2.88	14.75	0.4215	6,170	16,949
1966	5,129	3562	2.631	13,494	33.8	2.96	13.75	0.4044	2,074	5,457
1967	5,247	3835	2.444	12,824	32.8	3.05	12.75	0.3864	2,027	4,955
1968	6,617	4073	2.301	15,226	31.8	3.14	11.75	0.3672	2,430	5,591
1970	282	4665	2.009	567	29.8	3.36	9.75	0.3250	92	184
1971	9	5032	1.862	17	28.9	3.46	8.75	0.3017	3	5
1973	224	5701	1.644	368	26.9	3.72	6.75	0.2500	56	92
1974	13,227	6396	1.465	19,378	25.9	3.86	5.75	0.2211	2,924	4,284
1975	903,813	7310	1.282	1,158,688	24.9	4.02	4.75	0.1900	171,724	220,151
SPOT BASE		9372	1.000							
TOTAL	22,514,004			66,048,613					10,833,546	32,242,690
3-YEAR AVERAGE		9008	0.961	63,472,717						30,985,225
5-YEAR AVERAGE		8474	0.904	59,707,946						29,147,392

O.C. ACCRUAL RATE = 2.59 PCT., AMOUNT = 583,113

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 EDDYSTONE NOS.1&2 YARD CONSTRUCTION
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1960
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-7
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G407	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1957	247	683	2.857	706	42.5	2.35	22.75	0.5292	131	374
1960	2,395,253	692	2.819	6,752,218	39.6	2.53	19.75	0.4939	1,183,015	3,334,920
1961	1,811	693	2.815	5,098	38.6	2.59	18.75	0.4809	871	2,452
1962	1,001	703	2.775	2,778	37.7	2.65	17.75	0.4672	468	1,298
1964	4,632	719	2.713	12,567	35.7	2.80	15.75	0.4375	2,027	5,498
1965	5,862	740	2.636	15,452	34.7	2.88	14.75	0.4215	2,471	6,513
1966	687	754	2.588	1,778	33.8	2.96	13.75	0.4044	278	719
1967	7,484	765	2.550	19,084	32.8	3.05	12.75	0.3864	2,892	7,374
1970	963	926	2.107	2,029	29.8	3.36	9.75	0.3250	313	659
1975	1,000	1483	1.316	1,316	24.9	4.02	4.75	0.1900	190	250
1977	178,917	1635	1.193	213,448	22.9	4.37	2.75	0.1195	21,381	25,507
SPOT BASE		1951	1.000							
TOTAL	2,597,857			7,026,474					1,214,037	3,385,564
3-YEAR AVERAGE		1806	0.926	6,506,515						3,135,032
5-YEAR AVERAGE		1685	0.864	6,070,874						2,925,127

O.C. ACCRUAL RATE = 2.66 PCT., AMOUNT = 69,103

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 EDDYSTONE NOS.1&2 WHARVES AND DOCKS
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-10
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G410	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	2,352,255	188	1.766	4,154,082	39.6	2.53	19.75	0.4939	1,161,779	2,051,701
1965	1,788	202	1.644	2,939	34.7	2.88	14.75	0.4215	754	1,239
SPOT BASE		332	1.000							
TOTAL	2,354,043			4,157,021					1,162,533	2,052,940
										2,003,669
3-YEAR AVERAGE		324	0.976	4,057,252						1,818,905
5-YEAR AVERAGE		294	0.886	3,683,121						

O.C. ACCRUAL RATE = 2.53 PCT., AMOUNT = 59,557

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 EDDYSTONE NOA. 1&2 RAILROAD
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE.. GANNETT & FLEMING INDEX 4-11
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G411	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	660,775	218	1.633	1,079,046	39.6	2.53	19.75	0.4939	326,357	532,941
1962	11,816	209	1.703	20,123	37.7	2.65	17.75	0.4672	5,520	9,401
1964	35,602	205	1.737	61,841	35.7	2.80	15.75	0.4375	15,576	27,055
1966	2,173	213	1.671	3,631	33.8	2.96	13.75	0.4044	879	1,468
1967	288	213	1.671	481	32.8	3.05	12.75	0.3864	111	186
SPOT BASE		356	1.000							
TOTAL	710,654			1,165,122					348,443	571,051
3-YEAR AVERAGE		352	0.989	1,152,306						564,769
5-YEAR AVERAGE		339	0.952	1,109,196						543,641

O.C. ACCRUAL RATE = 2.55 PCT., AMOUNT = 18,122

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 312.11 BOILER PLANT EQUIPMENT EDDYSTONE STA
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING 3-1
SURVIVOR CURVE.. IOWA 70-R2, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G301	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1954	2,270	441	3.907	8,869	42.9	2.33	25.75	0.5553	1,261	4,925
1960	71,440,315	587	2.935	209,677,325	37.9	2.64	19.75	0.4896	34,977,178	102,658,018
1961	62,584	598	2.881	180,305	37.0	2.70	18.75	0.4769	29,846	85,987
1962	669,231	607	2.839	1,899,947	36.2	2.76	17.75	0.4632	309,988	880,055
1963	849,270	623	2.766	2,349,081	35.3	2.83	16.75	0.4490	381,322	1,054,737
1964	31,007	635	2.713	84,122	34.4	2.91	15.75	0.4339	13,454	36,501
1965	381,715	655	2.631	1,004,292	33.5	2.99	14.75	0.4179	159,519	419,694
1966	449,265	678	2.541	1,141,582	32.6	3.07	13.75	0.4010	180,155	457,774
1967	232,022	694	2.483	576,111	31.7	3.15	12.75	0.3831	88,888	220,708
1968	2,561,463	722	2.386	6,111,651	30.8	3.25	11.75	0.3643	933,141	2,226,474
1969	29,595	778	2.215	65,553	29.9	3.34	10.75	0.3440	10,181	22,550
1970	189,605	868	1.985	376,366	29.0	3.45	9.75	0.3224	61,129	121,340
1971	70,685	958	1.799	127,162	28.1	3.56	8.75	0.2993	21,156	38,060
1972	9,854	1000	1.723	16,978	27.2	3.68	7.75	0.2745	2,705	4,660
1973	35,231	1042	1.654	58,272	26.2	3.82	6.75	0.2479	8,734	14,446
1975	23,395,309	1372	1.256	29,384,508	24.4	4.10	4.75	0.1886	4,412,355	5,541,918
1977	2,371	1564	1.102	2,613	22.5	4.44	2.75	0.1187	281	310
1978	91,668	1685	1.023	93,776	21.5	4.65	1.75	0.0789	7,233	7,399
1979	7,360,000	1723	1.000	7,360,000	20.6	4.85	0.75	0.0354	260,544	260,544
1980	584,000	1723	1.000	584,000	20.0	5.00	0.13	0.0065	3,796	3,796
SPOT BASE		1723	1.000							
TOTAL	108,447,460			261,102,513					41,862,866	114,059,896
3-YEAR AVERAGE		1657	0.962	251,180,618						109,725,520
5-YEAR AVERAGE		1563	0.907	236,819,979						103,452,326

O.C. ACCRUAL RATE = 3.14 PCT., AMOUNT = 3,405,250

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 314.11 TURBOGENERATOR UNITS EDDYSTONE STA
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING 3-2 SURVIVOR CURVE.. IOWA 80-R2, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G302	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	35,665,094	654	2.598	92,657,914	38.3	2.61	19.75	0.4896	17,461,630	45,365,315
1961	34,130	613	2.772	94,608	37.4	2.67	18.75	0.4767	16,270	45,100
1963	247,058	610	2.785	688,057	35.6	2.81	16.75	0.4489	110,904	308,869
1965	9,153	661	2.570	23,523	33.8	2.96	14.75	0.4180	3,826	9,833
1966	460,822	679	2.502	1,152,977	32.9	3.04	13.75	0.4011	184,836	462,459
1967	473,237	725	2.343	1,108,794	32.0	3.13	12.75	0.3832	181,344	424,890
1968	743,704	751	2.262	1,682,258	31.0	3.23	11.75	0.3642	270,857	612,678
1970	101,336	878	1.935	196,085	29.2	3.42	9.75	0.3224	32,671	63,218
1972	38,218	1000	1.699	64,932	27.3	3.66	7.75	0.2747	10,498	17,837
1974	4,806,983	1175	1.446	6,950,897	25.4	3.94	5.75	0.2195	1,055,133	1,525,722
1977	12,058	1550	1.096	13,216	22.6	4.42	2.75	0.1187	1,431	1,569
1979	174,694	1699	1.000	174,694	20.7	4.83	0.75	0.0355	6,202	6,202
SPOT BASE		1699	1.000							
TOTAL	42,766,487			104,807,955					19,335,602	48,843,692
3-YEAR AVERAGE		1639	0.965	101,139,677						47,134,163
5-YEAR AVERAGE		1530	0.901	94,431,967						44,008,166

O.C. ACCRUAL RATE = 2.79 PCT., AMOUNT = 1,193,185

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 315.11 ACCESSORY ELEC EQUIPMENT EDDYSTONE ST1

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE.. GANNETT & FLEMING 3-3

SURVIVOR CURVE.. IOWA 90-R2, NET SALVAGE.. 0 PCT.

PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G303	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1960	8,552,802	603	2.647	22,639,267	38.6	2.59	19.75	0.4896	4,187,452	11,084,185
1961	17,110	605	2.638	45,136	37.7	2.65	18.75	0.4768	8,158	21,521
1962	15,916	614	2.599	41,366	36.8	2.72	17.75	0.4632	7,372	19,161
1963	97,373	627	2.545	247,814	35.9	2.79	16.75	0.4490	43,720	111,268
1964	24,121	650	2.455	59,217	34.9	2.87	15.75	0.4340	10,469	25,700
1965	135,149	670	2.382	321,925	34.0	2.94	14.75	0.4181	56,506	134,597
1966	13,575	691	2.310	31,358	33.1	3.02	13.75	0.4012	5,446	12,581
1967	47,263	719	2.220	104,924	32.1	3.12	12.75	0.3834	18,121	40,228
1968	136,647	752	2.122	289,965	31.2	3.21	11.75	0.3644	49,794	105,663
1969	3,156	797	2.003	6,321	30.3	3.30	10.75	0.3440	1,086	2,174
1970	71,023	896	1.781	126,492	29.3	3.41	9.75	0.3224	22,898	40,781
1971	8,271	947	1.685	13,937	28.4	3.52	8.75	0.2994	2,476	4,173
1972	19,787	1000	1.596	31,580	27.4	3.65	7.75	0.2746	5,434	8,672
1973	218,867	1082	1.475	322,829	26.5	3.77	6.75	0.2481	54,301	80,094
1974	2,138	1268	1.259	2,692	25.5	3.92	5.75	0.2195	469	591
1975	3,339,212	1357	1.176	3,926,913	24.6	4.07	4.75	0.1886	629,775	740,616
1976	3,869	1419	1.125	4,353	23.6	4.24	3.75	0.1552	600	676
SPOT BASE		1596	1.000							
TOTAL	12,706,279			28,216,089					5,104,077	12,432,681
3-YEAR AVERAGE		1557	0.976	27,538,903						12,134,297
5-YEAR AVERAGE		1489	0.933	26,325,611						11,599,691

O.C. ACCRUAL RATE = 3.02 PCT., AMOUNT = 383,730

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 316.11 MISC POWER PLT EQUIPMENT EDDYSTONE STI
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING 3-4
SURVIVOR CURVE.. IOWA 80R2.5 NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2000

YEAR	ORIGINAL COST	INDEX G304	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1929	45	244	7.795	351	64.1	1.56	50.75	0.7152	32	251
1948	72	365	5.211	375	49.5	2.02	31.75	0.6089	44	228
1952	139	458	4.153	577	46.0	2.17	27.75	0.5764	80	333
1960	1,873,556	638	2.981	5,585,070	38.8	2.58	19.75	0.4921	921,977	2,748,413
1962	13,907	653	2.913	40,511	37.0	2.70	17.75	0.4656	6,475	18,862
1963	59,281	664	2.864	169,781	36.1	2.77	16.75	0.4512	26,748	76,605
1964	10,256	677	2.809	28,809	35.1	2.85	15.75	0.4360	4,472	12,561
1965	592	696	2.733	1,618	34.2	2.92	14.75	0.4200	249	680
1966	328	729	2.609	856	33.3	3.00	13.75	0.4030	132	345
1967	6,714	752	2.529	16,980	32.3	3.10	12.75	0.3851	2,586	6,539
1968	1,052	784	2.426	2,552	31.4	3.18	11.75	0.3659	385	934
1969	3,090	829	2.294	7,088	30.4	3.29	10.75	0.3456	1,068	2,450
1970	6,314	907	2.097	13,240	29.5	3.39	9.75	0.3239	2,045	4,288
1971	9,478	952	1.998	18,937	28.5	3.51	8.75	0.3007	2,850	5,694
1972	1,213	1000	1.902	2,307	27.6	3.62	7.75	0.2759	335	637
1973	21,873	1062	1.791	39,175	26.6	3.76	6.75	0.2492	5,451	9,762
1975	104,950	1452	1.310	137,485	24.7	4.05	4.75	0.1894	19,878	26,040
1977	6,932	1686	1.128	7,819	22.7	4.41	2.75	0.1192	826	932
1979	8,564	1902	1.000	8,564	20.8	4.81	0.75	0.0357	306	306
SPOT BASE		1902	1.000							
TOTAL	2,128,356			6,082,095					995,939	2,915,860
3-YEAR AVERAGE		1800	0.946	5,753,662						2,758,404
5-YEAR AVERAGE		1683	0.885	5,382,654						2,580,536

O.C. ACCRUAL RATE = 2.70 PCT., AMOUNT = 57,466

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 CONEMAUGH STEEL BUILDINGS
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-3.1
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2011

YEAR	ORIGINAL COST	INDEX G431	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1970	3,675,319	4579	2.008	7,380,041	40.6	2.46	9.75	0.2384	876,196	1,759,402
1971	14,669	5104	1.802	26,434	39.6	2.53	8.75	0.2193	3,217	5,797
1972	7,375	5539	1.660	12,243	38.6	2.59	7.75	0.1991	1,468	2,438
1973	66,327	5816	1.581	104,863	37.7	2.65	6.75	0.1780	11,806	18,666
1974	147,574	6317	1.456	214,868	36.7	2.72	5.75	0.1557	22,977	33,455
1975	3,855	6969	1.319	5,085	35.7	2.80	4.75	0.1322	510	672
1976	3,350	7554	1.217	4,077	34.7	2.88	3.75	0.1073	359	437
1977	97,301	8193	1.122	109,172	33.8	2.96	2.75	0.0810	7,881	8,843
1978	4,661	8875	1.036	4,829	32.8	3.05	1.75	0.0531	247	256
1979	574	9195	1.000	574	31.8	3.14	0.75	0.0235	13	13
SPOT BASE		9195	1.000							
TOTAL	4,021,005			7,862,186					924,674	1,829,979
3-YEAR AVERAGE		8754	0.952	7,484,801						1,742,140
5-YEAR AVERAGE		8157	0.887	6,973,759						1,623,191

O.C. ACCRUAL RATE = 2.49 PCT., AMOUNT = 100,123

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 CONEMAUGH YARD CONSTRUCTION
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-7
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2011

YEAR	ORIGINAL COST	INDEX G407	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1973	194	1122	1.739	337	37.7	2.65	6.75	0.1780	35	60
1974	399,667	1410	1.384	553,139	36.7	2.72	5.75	0.1557	62,228	86,124
1975	28	1483	1.316	37	35.7	2.80	4.75	0.1322	4	5
1976	9,101	1524	1.280	11,649	34.7	2.88	3.75	0.1073	977	1,250
1977	4,320	1635	1.193	5,154	33.8	2.96	2.75	0.0810	350	417
1978	63,064	1833	1.064	67,100	32.8	3.05	1.75	0.0531	3,349	3,563
1979	420	1951	1.000	420	31.8	3.14	0.75	0.0235	10	10
SPOT BASE		1951	1.000							
TOTAL	476,794			637,836					66,953	91,429
3-YEAR AVERAGE		1806	0.926	590,636						84,663
5-YEAR AVERAGE		1685	0.864	551,090						78,995

O.C. ACCRUAL RATE = 2.77 PCT., AMOUNT = 13,207

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 CONEMAUGH RAILROAD SIDING
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-11 SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2011

YEAR	ORIGINAL COST	INDEX G411	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1970	122,266	228	1.561	190,857	40.6	2.46	9.75	0.2384	29,148	45,500
SPOT BASE		356	1.000							
TOTAL	122,266			190,857					29,148	45,500
3-YEAR AVERAGE		352	0.989	188,758						45,000
5-YEAR AVERAGE		339	0.952	181,696						43,316

O.C. ACCRUAL RATE = 2.46 PCT., AMOUNT = 3,008

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 312.18 BOILER PLANT EQUIPMENT CONEMAUGH STA
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
EX SOURCE.. GANNETT & FLEMING 3-1 SURVIVOR CURVE.. IOWA 70-R2, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2011

R	ORIGINAL COST	INDEX G301	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
0	14,338,688	868	1.985	28,462,296	38.8	2.58	9.75	0.2370	3,398,269	6,745,564
1	11,338,844	958	1.799	20,398,580	37.9	2.64	8.75	0.2179	2,470,734	4,444,851
2	49,364	1000	1.723	85,054	37.0	2.70	7.75	0.1979	9,769	16,832
3	1,699,141	1042	1.654	2,810,379	36.2	2.76	6.75	0.1768	300,408	496,875
4	174,609	1202	1.433	250,215	35.3	2.83	5.75	0.1546	26,995	38,683
5	231,147	1372	1.256	290,321	34.4	2.91	4.75	0.1314	30,373	38,148
6	20,488	1472	1.171	23,991	33.5	2.99	3.75	0.1067	2,186	2,560
7	151,205	1564	1.102	166,628	32.6	3.07	2.75	0.0805	12,172	13,414
8	52,479	1685	1.023	53,686	31.7	3.15	1.75	0.0528	2,771	2,835
9	5,898,195	1723	1.000	5,898,195	30.8	3.25	0.75	0.0233	137,428	137,428
0	180,000	1723	1.000	180,000	30.3	3.30	0.13	0.0042	756	756
T	BASE	1723	1.000							
AL	34,134,160			58,619,345					6,391,861	11,937,946
EAR	AVERAGE	1657	0.962	56,391,810						11,484,304
EAR	AVERAGE	1563	0.907	53,167,746						10,827,717

O.C. ACCRUAL RATE = 2.74 PCT., AMOUNT = 935,276

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 314.18 TURBOGENERATOR UNITS CONEMAUGH STI
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING 3-2
SURVIVOR CURVE.. IOWA 80-R2, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2011

YEAR	ORIGINAL COST	INDEX G302	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1970	7,467,014	878	1.935	14,448,672	39.2	2.55	9.75	0.2364	1,765,202	3,415,666
1971	5,808,102	937	1.813	10,530,089	38.3	2.61	8.75	0.2174	1,262,681	2,289,241
1972	9,583	1000	1.699	16,282	37.4	2.67	7.75	0.1975	1,893	3,216
1973	4,972	1046	1.624	8,075	36.5	2.74	6.75	0.1765	878	1,425
1974	8,008	1175	1.446	11,580	35.6	2.81	5.75	0.1544	1,236	1,788
1976	620	1438	1.182	733	33.8	2.96	3.75	0.1065	66	78
1977	15,179	1550	1.096	16,636	32.9	3.04	2.75	0.0804	1,220	1,338
1978	2,884	1668	1.019	2,939	32.0	3.13	1.75	0.0527	152	155
1979	874,464	1699	1.000	874,464	31.0	3.23	0.75	0.0233	20,375	20,375
1980	27,000	1699	1.000	27,000	30.5	3.28	0.13	0.0040	108	108
SPOT BASE		1699	1.000							
TOTAL	14,217,826			25,936,470					3,053,811	5,733,390
3-YEAR AVERAGE		1639	0.965	25,028,694						5,532,721
5-YEAR AVERAGE		1530	0.901	23,368,759						5,165,784

O.C. ACCRUAL RATE = 2.62 PCT., AMOUNT = 372,507

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 315.18 ACCESSORY ELEC EQUIPMENT CONEMAUGH ST1

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE.. GANNETT & FLEMING 3-3

SURVIVOR CURVE.. IOWA 90-R2, NET SALVAGE.. 0 PCT.

PROBABLE FUTURE RETIREMENT YEAR.. 2011

YEAR	ORIGINAL COST	INDEX G303	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1970	1,562,728	896	1.781	2,783,219	39.5	2.53	9.75	0.2359	368,648	656,561
1971	1,227,858	947	1.685	2,068,941	38.6	2.59	8.75	0.2171	266,568	449,167
1975	370	1357	1.176	435	34.9	2.87	4.75	0.1310	48	57
1976	6,740	1419	1.125	7,583	34.0	2.94	3.75	0.1064	717	807
1977	551	1501	1.063	586	33.1	3.02	2.75	0.0804	44	47
1978	586	1573	1.015	595	32.1	3.12	1.75	0.0525	31	31
1979	915,000	1596	1.000	915,000	31.2	3.21	0.75	0.0232	21,228	21,228
1980	28,000	1596	1.000	28,000	30.6	3.27	0.13	0.0040	112	112
SPOT BASE		1596	1.000							
TOTAL	3,741,833			5,804,359					657,396	1,128,010
3-YEAR AVERAGE		1557	0.976	5,665,054						1,100,938
5-YEAR AVERAGE		1489	0.933	5,415,467						1,052,433

O.C. ACCRUAL RATE = 2.72 PCT., AMOUNT = 101,778

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 316.18 MISC POWER PLT EQUIPMENT CONEMAUGH ST1
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING 3-4
SURVIVOR CURVE.. IOWA 80R2.5 NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2011

YEAR	ORIGINAL COST	INDEX G304	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1970	394,529	907	2.097	827,327	39.8	2.51	9.75	0.2379	93,858	196,821
1972	26,675	1000	1.902	50,736	37.9	2.64	7.75	0.1987	5,300	10,081
1973	19,942	1062	1.791	35,716	37.0	2.70	6.75	0.1776	3,542	6,343
1974	59,722	1227	1.550	92,569	36.1	2.77	5.75	0.1553	9,275	14,376
1975	1,262	1452	1.310	1,653	35.1	2.85	4.75	0.1319	166	218
1976	8,288	1563	1.217	10,086	34.2	2.92	3.75	0.1071	888	1,080
1977	24,536	1686	1.128	27,677	33.3	3.00	2.75	0.0808	1,983	2,236
1978	5,809	1813	1.049	6,094	32.3	3.10	1.75	0.0530	308	323
1979	1,634	1902	1.000	1,634	31.4	3.18	0.75	0.0235	38	38
SPOT BASE		1902	1.000							
TOTAL	542,397			1,053,492					115,358	231,516
3-YEAR AVERAGE		1800	0.946	996,603						219,014
5-YEAR AVERAGE		1683	0.885	932,340						204,892

O.C. ACCRUAL RATE = 2.59 PCT., AMOUNT = 14,048

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 KEYSTONE STEEL BUILDINGS
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-3.1 SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2008

YEAR	ORIGINAL COST	INDEX G431	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1967	51,632	3801	2.419	124,898	40.6	2.46	12.75	0.3115	16,083	38,906
1967	2,640,358	3801	2.419	6,387,026	40.6	2.46	12.75	0.3115	822,472	1,989,559
1968	37,840	4022	2.286	86,502	39.6	2.53	11.75	0.2942	11,133	25,449
1970	16,138	4579	2.008	32,405	37.7	2.65	9.75	0.2570	4,147	8,328
1971	185,771	5104	1.802	334,759	36.7	2.72	8.75	0.2368	43,991	79,271
1972	44,874	5539	1.660	74,491	35.7	2.80	7.75	0.2156	9,675	16,060
1973	35,514	5816	1.581	56,148	34.7	2.88	6.75	0.1931	6,858	10,842
1974	6,758	6317	1.456	9,840	33.8	2.96	5.75	0.1693	1,144	1,666
1974	114,262	6317	1.456	166,365	33.8	2.96	5.75	0.1693	19,345	28,166
1975	55,874	6969	1.319	73,698	32.8	3.05	4.75	0.1441	8,051	10,620
1976	6,603	7554	1.217	8,036	31.8	3.14	3.75	0.1173	775	943
1976	766	7554	1.217	932	31.8	3.14	3.75	0.1173	90	109
1977	119,502	8193	1.122	134,081	30.8	3.25	2.75	0.0888	10,612	11,906
1978	20,836	8875	1.036	21,586	29.8	3.36	1.75	0.0584	1,217	1,261
1978	27,721	8875	1.036	28,719	29.8	3.36	1.75	0.0584	1,619	1,677
1979	972	9195	1.000	972	28.9	3.46	0.75	0.0259	25	25
1979	256,928	9195	1.000	256,928	28.9	3.46	0.75	0.0259	6,654	6,654
1980	168,000	9195	1.000	168,000	28.2	3.55	0.13	0.0046	773	773
SPOT BASE		9195	1.000							
TOTAL	3,790,349			7,965,386					964,664	2,232,215
3-YEAR AVERAGE		8754	0.952	7,583,047						2,125,069
5-YEAR AVERAGE		8157	0.887	7,065,297						1,979,975

O.C. ACCRUAL RATE = 2.66 PCT., AMOUNT = 100,823

REVISED ATTACHMENT V 9C
1 OF 7

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 KEYSTONE RESERVOIR
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 3-5 SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2008

YEAR	ORIGINAL COST	INDEX G305	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1967	1,142,686	521	2.430	2,776,727	40.6	2.46	12.75	0.3115	355,947	864,950
SPOT BASE		1266	1.000							
TOTAL	1,142,686			2,776,727					355,947	864,950
5-YEAR AVERAGE		1212	0.957	2,657,328						827,757
5-YEAR AVERAGE		1139	0.900	2,499,054						778,455

O.C. ACCRUAL RATE = 2.46 PCT., AMOUNT = 28,110

REVISED 3 OF 7

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 311 KEYSTONE RAILROAD SIDING
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING INDEX 4-11
SURVIVOR CURVE.. IOWA 100-R3, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2008

YEAR	ORIGINAL COST	INDEX G411	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1967	397,692	213	1.671	664,543	40.6	2.46	12.75	0.3115	123,881	207,005
SPOT BASE		356	1.000							
TOTAL	397,692			664,543					123,881	207,005
3-YEAR AVERAGE		352	0.989	657,233						204,728
5-YEAR AVERAGE		339	0.952	632,645						197,069

O.C. ACCRUAL RATE = 2.46 PCT., AMOUNT = 9,783

REVISED ATTACHMENT 1 PG 2 OF 7

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 312.19 BOILER PLANT EQUIPMENT KEYSTONE STA

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE.. GANNETT & FLEMING 3-1

SURVIVOR CURVE.. IOWA 70-R2, NET SALVAGE.. 0 PCT.

PROBABLE FUTURE RETIREMENT YEAR.. 2008

YEAR	ORIGINAL COST	INDEX G301	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1967	11,358,394	694	2.483	28,202,892	38.8	2.58	12.75	0.3093	3,513,151	8,723,154
1968	8,899,661	722	2.386	21,234,591	37.9	2.64	11.75	0.2923	2,601,371	6,206,871
1969	1,160	778	2.215	2,569	37.0	2.70	10.75	0.2742	318	704
1970	77,993	868	1.985	154,816	36.2	2.76	9.75	0.2552	19,904	39,509
1971	1,075,059	958	1.799	1,934,031	35.3	2.83	8.75	0.2351	252,746	454,691
1972	158,576	1000	1.723	273,226	34.4	2.91	7.75	0.2140	33,935	58,470
1973	318,529	1042	1.654	526,847	33.5	2.99	6.75	0.1917	61,062	100,997
1974	1,562,883	1202	1.433	2,239,611	32.6	3.07	5.75	0.1680	262,564	376,255
1975	1,767,583	1372	1.256	2,220,084	31.7	3.15	4.75	0.1432	253,118	317,916
1976	539,788	1472	1.171	632,092	30.8	3.25	3.75	0.1165	62,885	73,639
1977	113,102	1564	1.102	124,638	29.9	3.34	2.75	0.0882	9,976	10,993
1978	156,857	1685	1.023	160,465	29.0	3.45	1.75	0.0580	9,098	9,307
1979	415,478	1723	1.000	415,478	28.1	3.56	0.75	0.0257	10,678	10,678
1980	272,000	1723	1.000	272,000	27.5	3.64	0.13	0.0047	1,278	1,278
NOT BASE		1723	1.000							
TOTAL	26,717,063			58,393,340					7,092,084	16,384,462
5-YEAR AVERAGE		1657	0.962	56,174,393						15,761,852
10-YEAR AVERAGE		1563	0.907	52,962,759						14,860,707

O.C. ACCRUAL RATE = 2.73 PCT., AMOUNT = 729,376

REVISED ATTACHMENT 1 PAGE 4 OF 7

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 314.19 TURBOGENERATOR UNITS KEYSTONE ST1

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE.. GANNETT & FLEMING 3-2

SURVIVOR CURVE.. IOWA 80-R2, NET SALVAGE.. 0 PCT.

PROBABLE FUTURE RETIREMENT YEAR.. 2008

YEAR	ORIGINAL COST	INDEX G302	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1967	4,974,479	725	2.343	11,655,204	39.2	2.55	12.75	0.3088	1,536,119	3,599,127
1968	4,783,683	751	2.262	10,821,143	38.3	2.61	11.75	0.2917	1,395,459	3,156,527
1970	3,780	878	1.935	7,314	36.5	2.74	9.75	0.2548	963	1,864
1971	18,240	937	1.813	33,069	35.6	2.81	8.75	0.2348	4,283	7,765
1972	202,206	1000	1.699	343,548	34.7	2.88	7.75	0.2138	43,232	73,451
1973	55,964	1046	1.624	90,886	33.8	2.96	6.75	0.1915	10,717	17,405
1976	9,334	1438	1.182	11,033	31.0	3.23	3.75	0.1164	1,086	1,284
1977	1,355	1550	1.096	1,485	30.1	3.32	2.75	0.0881	119	131
1978	701,005	1668	1.019	714,324	29.2	3.42	1.75	0.0580	40,658	41,431
1979	3,930	1699	1.000	3,930	28.3	3.53	0.75	0.0257	101	101
1980	2,000	1699	1.000	2,000	27.7	3.61	0.13	0.0045	9	9
SPOT BASE		1699	1.000							
TOTAL	10,756,176			23,683,936					3,032,746	6,899,095
3-YEAR AVERAGE		1639	0.965	22,854,998						6,657,627
5-YEAR AVERAGE		1530	0.901	21,339,226						6,216,085

O.C. ACCRUAL RATE = 2.64 PCT., AMOUNT = 283,963

ATTACHMENT NO 4
REVISED

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 315.19 ACCESSORY ELEC EQUIPMENT KEYSTONE ST1
ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980
INDEX SOURCE.. GANNETT & FLEMING 3-3
SURVIVOR CURVE.. IOWA 90-R2, NET SALVAGE.. 0 PCT.
PROBABLE FUTURE RETIREMENT YEAR.. 2008

YEAR	ORIGINAL COST	INDEX G303	TREND FACTOR	TRENDED ORIGINAL COST			AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1967	1,388,841	719	2.220	3,083,227	39.5	2.53	12.75	0.3086	428,596	951,484
1968	799,272	752	2.122	1,696,055	38.6	2.59	11.75	0.2916	233,068	494,570
1970	23,867	896	1.781	42,507	36.8	2.72	9.75	0.2545	6,074	10,818
1971	4,231	947	1.685	7,129	35.9	2.79	8.75	0.2346	993	1,672
1972	10,206	1000	1.596	16,289	34.9	2.87	7.75	0.2136	2,180	3,479
1973	372	1082	1.475	549	34.0	2.94	6.75	0.1913	71	105
1974	2,002	1268	1.259	2,521	33.1	3.02	5.75	0.1678	336	423
1977	5,816	1501	1.063	6,182	30.3	3.30	2.75	0.0882	513	545
1978	16,560	1573	1.015	16,808	29.3	3.41	1.75	0.0578	957	972
SPOT BASE		1596	1.000							
TOTAL	2,251,167			4,871,267					672,788	1,464,068
3-YEAR AVERAGE		1557	0.976	4,754,357						1,428,930
5-YEAR AVERAGE		1489	0.933	4,544,892						1,365,975

O.C. ACCRUAL RATE = 2.56 PCT., AMOUNT = 57,630

REVISED ATTACHMENT No. 6 OF 7

Q.V.23. Please provide a reserve requirement analysis for Salem and Peach Bottom using a 40-year life span.

A.V.23. The requested schedules are provided as follows:

Peach Bottom – Attachment V.23a (5 sheets)
Salem No. 1 – Attachment V.23b (5 sheets)

It should be noted that the Company's depreciation claims for these stations are detailed in Exhibit HTW-4. The Company's basis for its depreciation lives and dispersion are provided in Exhibit HTW-2 and Statement #8, the Direct Testimony of H. T. Waddington.

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ATTACHMENT V-32a
10FC

PHILADELPHIA ELECTRIC CO. - ELECTRIC

PEACH BOTTOM

STRUCTURES AND IMPROVEMENTS - ACCOUNT 390.11 LEASEHOLD

ORIGINAL AND ESTIMATED SURVIVOR CURVES, NET SALVAGE AND DEPRECIATION FACTORS AND ORIGINAL AND TREND COST AS OF MAY 31, 1980

PROPERTY GROUP ESTIMATED FUTURE RETIREMENTS, BOOK COST AND BOOK RESERVE AS OF DEC. 31, 1979

INDEX SOURCE: GANNETT FLEMING

YEAR	ORIGINAL COST	INDEX	TREND FACTOR	ORIGINAL COST	TRENDED COST	ESTIMATED FUTURE RETIREMENTS	BOOK RESERVE
1974	916,055,169	1000	1.718	1,573,193,940	1,573,193,940	1,573,193,940	1,573,193,940
1978	21,375	1062	1.021	22,182	22,182	22,182	22,182
1979	808,000	1118	1.000	808,000	808,000	808,000	808,000
TOTAL	937,992,544			1,596,024,122	1,596,024,122	1,596,024,122	1,596,024,122

3-YEAR AVERAGE 1,596,024,122 0.812 1,296,058,912 1,296,058,912 1,296,058,912 1,296,058,912

5-YEAR AVERAGE 1,596,024,122 0.999 1,594,427,218 1,594,427,218 1,594,427,218 1,594,427,218

O.C. ACCRUAL RATE = 3.62% FCT. AMOUNT = 3,627,687

YEAR	ORIGINAL COST	INDEX	TREND FACTOR	ORIGINAL COST	TRENDED COST	ESTIMATED FUTURE RETIREMENTS	BOOK RESERVE
TOTAL	937,992,544			1,596,024,122	1,596,024,122	1,596,024,122	1,596,024,122

ORIGINAL COST 937,992,544 ORIGINAL TREND 1,596,024,122 ESTIMATED FUTURE RETIREMENTS 1,596,024,122 BOOK RESERVE 1,596,024,122

CALCULATED ACCRUALS

ORIGINAL COST	AVG. SERVICE LIFE	AVG. REMAINING LIFE	CALCULATED ACCRUAL RATE	CALCULATED ACCRUAL AMOUNT
937,992,544	0.0	0.0	0.00	0

PROPERTY GROUP SURVIVOR CURVE 0 FCT. NET SALVAGE PCT. 0 ORIGINAL LIFE 0.0 REMAINING LIFE 0.0 ACCRUAL RATE 0.00

ATTACHMENT V23a
3 OF 5

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 322.00 REACTOR PLANT EQUIPMENT - PEACH BOTTOM

ORIGINAL AND THEORETICAL DEPRECIATION AS OF MAY 31, 1980

INDEX SOURCE: GANNETT FLEMING ORIGINAL COST AND RELATED DEPRECIATION STUDIES - 12-31-79

SURVIVOR CURVE: IOWA 70-R2 NET SALVAGE: 0 PCT.

PROBABLE RETIREMENT YEAR: 2014

| ORIGINAL COST TABULATED | | |

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 322.00 TURBOGENERATOR UNITS-EACH BOTTOM

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE:: GANNETT AND FLEMING T-T- 80-22: NET SALVAGE:: 0 PCT.

SURVIVOR CURVE:: IOWA PROBABLE FUTURE RETIREMENT YEARS:: 2014

| | CALCULATED RESERVE | | |

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 325.00 MISC PWR PLT EQUIP PEACH BOTTOM

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

INDEX SOURCE:. GANNETT AND FLEMING 3-77 SURVIVOR CURVE:. IOWA 80R2.5 NET SALVAGE:. 0 PCT.

PROBABLE FUTURE RETIREMENT YEAR:. 2014

YEAR	ORIGINAL COST	INDEX 6323	TREND FACTOR	TRENDED ORIGINAL COST		AGE YEARS	RESERVE RATIO	CALCULATED RESERVE ORIGINAL COST	CALCULATED RESERVE TRENDED ORIGINAL COST
1967	44,314	654	2.532	112,203	45.1	12.75	0.2721	12,058	30,530
1973	3,916	1086	1.525	5,972	39.8	6.75	0.1648	646	985
1974	10,218,227	1195	1.386	14,678,678	38.8	5.75	0.1532	1,563,414	2,007,472
1975	1,111,110	1323	1.252	1,391,666	37.8	4.75	0.1319	146,556	183,583
1976	4,685	1413	1.173	5,490	37.0	3.75	0.0988	463	543
1977	68,812	1498	1.105	76,158	36.1	2.75	0.0754	5,188	5,743
1978	441	1602	1.034	463	35.1	1.75	0.0487	21	22
1978	42,553	1602	1.034	44,000	35.1	1.75	0.0487	2,072	2,143
1979	735,000	1656	1.000	735,000	34.2	0.75	0.0215	15,803	15,803
1980	592,000	1656	1.000	592,000	33.6	0.13	0.0037	550	550
2001 BASE		1656	1.000						
TOTAL	13,824,657			15,167,929				1,551,870	2,136,065
3-YEAR AVERAGE		1585	0.957	14,774,194					2,063,344
2-YEAR AVERAGE		1498	0.993	14,172,377					1,951,237

A.F. ACCRUAL RATE = 3.41 PCT., AMOUNT = 309,794

Attachment V23a
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ATTACHMENT V.3.L
10 FS

ATTACHMENT V 23.b
2 OF 5

PHILADELPHIA ELECTRIC CO. - EFFECTIVE

ATTACHMENT V 3 of 5

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 322-16 TURBOGENERATOR UNIT 5 AGED ON ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1990

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1990

INDEX SOURCE: NOT TRENDED

SURVIVOR CURVE: IOWA 80-R2; NET SALVAGE: 0 PCT.

PROBABLE FUTURE RETIREMENT YEAR: 2017

YEAR	ORIGINAL COST	INDEX	TRENDED COST	CALCULATED RESERVE	FUTURE ACCRUALS
1974	5,040,622	1.000	5,040,622	4,111,946	928,676
1975	0	1.000	0	0	0
1976	0	1.000	0	0	0
1977	0	1.000	0	0	0
1978	0	1.000	0	0	0
1979	0	1.000	0	0	0
1980	0	1.000	0	0	0
1981	0	1.000	0	0	0
1982	0	1.000	0	0	0
1983	0	1.000	0	0	0
1984	0	1.000	0	0	0
1985	0	1.000	0	0	0
1986	0	1.000	0	0	0
1987	0	1.000	0	0	0
1988	0	1.000	0	0	0
1989	0	1.000	0	0	0
1990	0	1.000	0	0	0
TOTALS	5,040,622		5,040,622	4,111,946	928,676

	ORIGINAL COST	TRENDED COST	CALCULATED RESERVE	FUTURE ACCRUALS
5-YEAR AVERAGE	1,008,124	1,008,124	822,389	185,735
3-YEAR AVERAGE	1,680,207	1,680,207	1,370,649	309,558
1-YEAR AVERAGE	5,040,622	5,040,622	4,111,946	928,676

0.0% ACCRUAL RATE = 4.491 FCR, AMORT. PERIOD = 22.3 YEARS

MOORE BUSINESS FORMS, INC. PRINTED IN U.S.A.

Appendix V 23.2

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PHILADELPHIA ELECTRIC CO. - PEACH BOTTOM ATOMIC POWER STATION UNIT 3

ACCOUNT 324.16 SALEM NO. 1 ACCESSORY ELEC. EQUIP.

ORIGINAL AND TRENDED ORIGINAL COST AND RELATED DEPRECIATION AS OF MAR 31, 1980

SOUTHERN CALIFORNIA EDISON COMPANY

PROBABLE RETIREMENT YEAR ANALYSIS

INDEX SOURCES: GNP IMPLICIT PRICE DEFLATORS FOR GNP - FIXED INVESTMENT

MAY 1980

YEAR	ORIGINAL COST INDEX	TRENDED INDEX	FACTOR	PROBABLE RETIREMENTS	TRENDED COST	AGE	YEARS	RATIO	ORIGINAL COST	TRENDED COST
1974	1.000	1.000	1.000	0.0%	0	6	6.0	0.9994	1,999,972	1,999,972
1975	1.000	1.000	1.000	0.0%	0	5	5.0	0.9994	1,999,972	1,999,972
1976	1.000	1.000	1.000	0.0%	0	4	4.0	0.9994	1,999,972	1,999,972
1977	1.000	1.000	1.000	0.0%	0	3	3.0	0.9994	1,999,972	1,999,972
1978	1.000	1.000	1.000	0.0%	0	2	2.0	0.9994	1,999,972	1,999,972
1979	1.000	1.000	1.000	0.0%	0	1	1.0	0.9994	1,999,972	1,999,972
1980	1.000	1.000	1.000	0.0%	0	0	0.0	0.9994	1,999,972	1,999,972
1-YEAR AVERAGE										
5-YEAR AVERAGE										

PCT 0 ACCUMULATED DEPRECIATION AS OF MAR 31, 1980 1,999,972

ORIGINAL COST 1,999,972

ACCUMULATED DEPRECIATION RATIO 0.9994

NET SALVAGE -20%

PROBABLE RETIREMENT YEAR 2011

REMAINING LIFE 31.0

ANNUAL ACCRUAL RATE 3.2%

ANNUAL ACCRUAL AMOUNT 63,999

MODERN BUSINESS FORMS, INC. Printed in U.S.A. 27

ATTACHMENT V-23.2
SOFS

MOORE BUSINESS FORMS, INC.

PRINTED IN U.S.A.

PHILADELPHIA ELECTRIC CO. - ELECTRIC

ACCOUNT 355.00 POLES AND FIXTURES

ORIGINAL AND DEPRECIATION RESERVE ON A UNIT BASIS FOR MAY 31, 1990

PROJECTED UNITS AND DEPRECIATION AS OF MAY 31, 1990

INDEX SOURCE: NOT TRENDED

	ORIGINAL COST	INDEX TO TREND	TREND FACTOR	TRENDED ORIGINAL COST	AGE	YEARS	RESERVE PCT	RESERVE	UNDEPRECIATED TRENDED COST
1977	61,745,113	1.000	1.000	61,745,113	13.0	13.0	0.4600	28,402,752	33,342,361
1978	34,691,741	1.000	1.000	34,691,741	12.0	12.0	0.4400	15,264,366	19,427,375
1979	37,479,234	1.000	1.000	37,479,234	11.0	11.0	0.4200	15,741,278	21,737,956
1980	41,941,410	1.000	1.000	41,941,410	10.0	10.0	0.4000	16,776,564	25,164,846
1981	47,970,412	1.000	1.000	47,970,412	9.0	9.0	0.3800	18,228,757	29,741,655
1982	41,203,063	1.000	1.000	41,203,063	8.0	8.0	0.3600	14,833,103	26,369,960
1983	47,178,470	1.000	1.000	47,178,470	7.0	7.0	0.3400	16,040,680	31,137,790
1984	61,719,141	1.000	1.000	61,719,141	6.0	6.0	0.3200	19,750,125	41,969,016
1985	67,237,000	1.000	1.000	67,237,000	5.0	5.0	0.3000	20,171,100	47,065,900
1986	71,691,234	1.000	1.000	71,691,234	4.0	4.0	0.2800	20,073,545	51,617,689
1987	79,881,239	1.000	1.000	79,881,239	3.0	3.0	0.2600	20,769,122	59,112,117
1988	84,691,238	1.000	1.000	84,691,238	2.0	2.0	0.2400	20,325,897	64,365,341
1989	91,691,238	1.000	1.000	91,691,238	1.0	1.0	0.2200	20,172,072	71,519,166
1990	98,691,238	1.000	1.000	98,691,238	0.0	0.0	0.2000	19,738,248	78,952,990

3-YEAR AVERAGE 1.000

5-YEAR AVERAGE 1.000

TOTAL TRENDED ORIGINAL COST 1,000,000,000

ORIGINAL COST INDEX TREND FACTOR TRENDED ORIGINAL COST 1,000,000,000

AGE YEARS RESERVE PCT RESERVE UNDEPRECIATED TRENDED COST

AVERAGE SERVICE LIFE 38.0 0.4000 400,000,000 600,000,000

ACCUMULATED DEPRECIATION RESERVE

ORIGINAL COST 1,000,000,000

ACCUMULATED DEPRECIATION RESERVE 400,000,000

UNDEPRECIATED TRENDED COST 600,000,000

ORIGINAL COST 1,000,000,000

ACCUMULATED DEPRECIATION RESERVE 400,000,000

UNDEPRECIATED TRENDED COST 600,000,000

Appendix F

A Utility Makes Conservation Work

By JAMES J. KILPATRICK

PORTLAND, ORE. — It sounds like one of those dizzy theories from the Blue Eagle School of Screwball Economics, but in the Pacific Power & Light Company some hard-headed guys are making it work: They are acquiring energy by not consuming it.

Let me run that by you again. The company is deeply committed to a program predicated upon not selling its own product. Every kilowatt hour saved, in its book, is a profit earned. Less is more. This is energy conservation put to practical work.

For the record, Pacific Power serves 600,000 customers in the great Northwest. At one time, 15 or 20 years ago, virtually all of its power was hydroelectric power, generated from the rivers that tumble out of the Cascade Mountains on their way to the sea. As the area has grown, steam plants have taken over 75 percent of the total load. For the foreseeable future new power needs must be met by new coal-burning plants--and new coal-burning plants cost a fortune.

THE CONVENTIONAL approach to meeting power needs is to generate more power. The management of Pacific Power had a better idea: Reduce the need. A year ago the company won approval for an innovative Zero Interest Financing Program in Oregon, Washington, Montana and Idaho. District managers took aim on 104,000 homeowners with all-electric space heating. Typically, the individual homeowner was consuming 10,000 kilowatt hours a year to heat his house. Could that demand be reduced to 5,500 or 7,500 KWH?

In Oregon alone, company analysts found that 40,000 homes could benefit from floor insulation, 33,000 from ceiling insulation and 48,000 from the installation of storm windows and doors. Not all those prospects could be sold, of course, but if incentives could be devised to pull even 65 or 70 percent of them into the program, significant savings would result.

Pacific Power began to offer eligible homeowners a deal they could hardly refuse: loans with no interest and no repayment schedule. In the past year, 4,600 loans have been made, averaging $1,354. They become a lien on the property, to be repaid when the property is sold or inherited. As the program has gained momentum, completions have reached a level of 100 houses every week. Over the next five years the company realistically expects to see 60,000 homes insulated, weather-stripped, or storm-windowed. At that point the company will not be generating and selling 300 million kilowatt hours a year that it otherwise might have sold.

AND THE COMPANY figures it will be much better off. By treating the loans as a resource, the loans become part of the company's rate base; the company is entitled to earn a reasonable return on the investment. It costs 14 mills to save a kilowatt hour by conservation; it costs 56 mills to generate a kilowatt hour in a new steam plant. The program isn't of sufficient magnitude to replace an actual plant, but it will postpone the time when new plants must be put on the line. Meanwhile, the participating consumers benefit and the company prospers.

Six other utilities in the Pacific Northwest are now offering similar programs. The Tennessee Valley Authority makes term loans for the same purposes. And while the specific approach won't work everywhere, it makes a certain crazy sense out here in the land of cheap power.

A few critics have voiced reservations. Non-participating customers are hard put to understand how the company's $1,300 loan to a neighbor could be part of a system-wide rate base. California and Wyoming commissions have refused to go along. Even though company engineers check completed jobs before payment is made to the insulation contractors, complaints have been heard of shoddy workmanship. On the whole, however, the program has gone modestly but well. For those who have been skeptical about "energy conservation," the Northwestern companies are providing a profitable answer: It works.

Trial Staff Exhibit No. DLB-1-A
Witness: D. L. Birx

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

Philadelphia Electric Company

Docket No. R-79060865

Exhibit to Accompany the

Direct Testimony

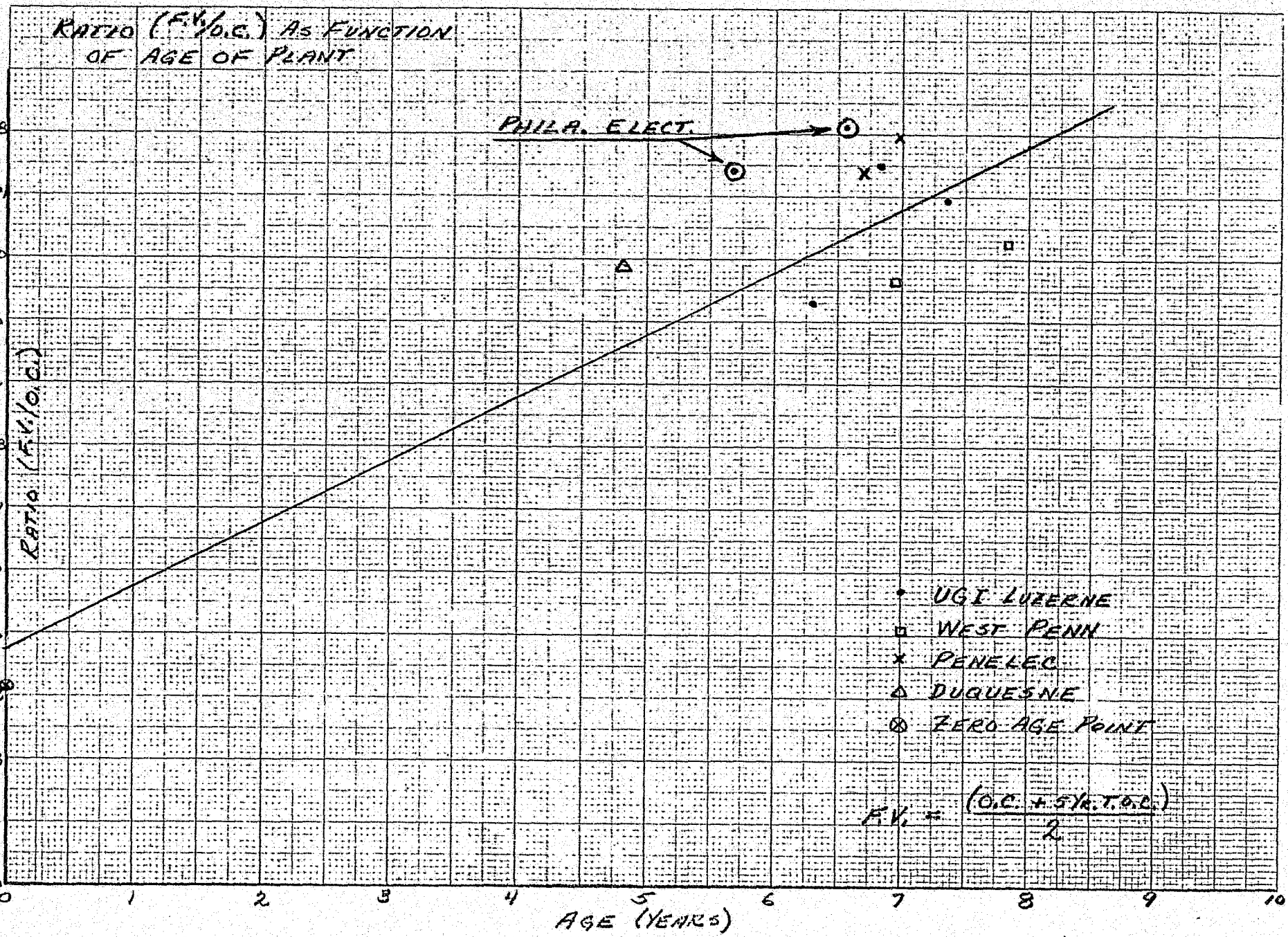
of

Donald L. Birx

Concerning

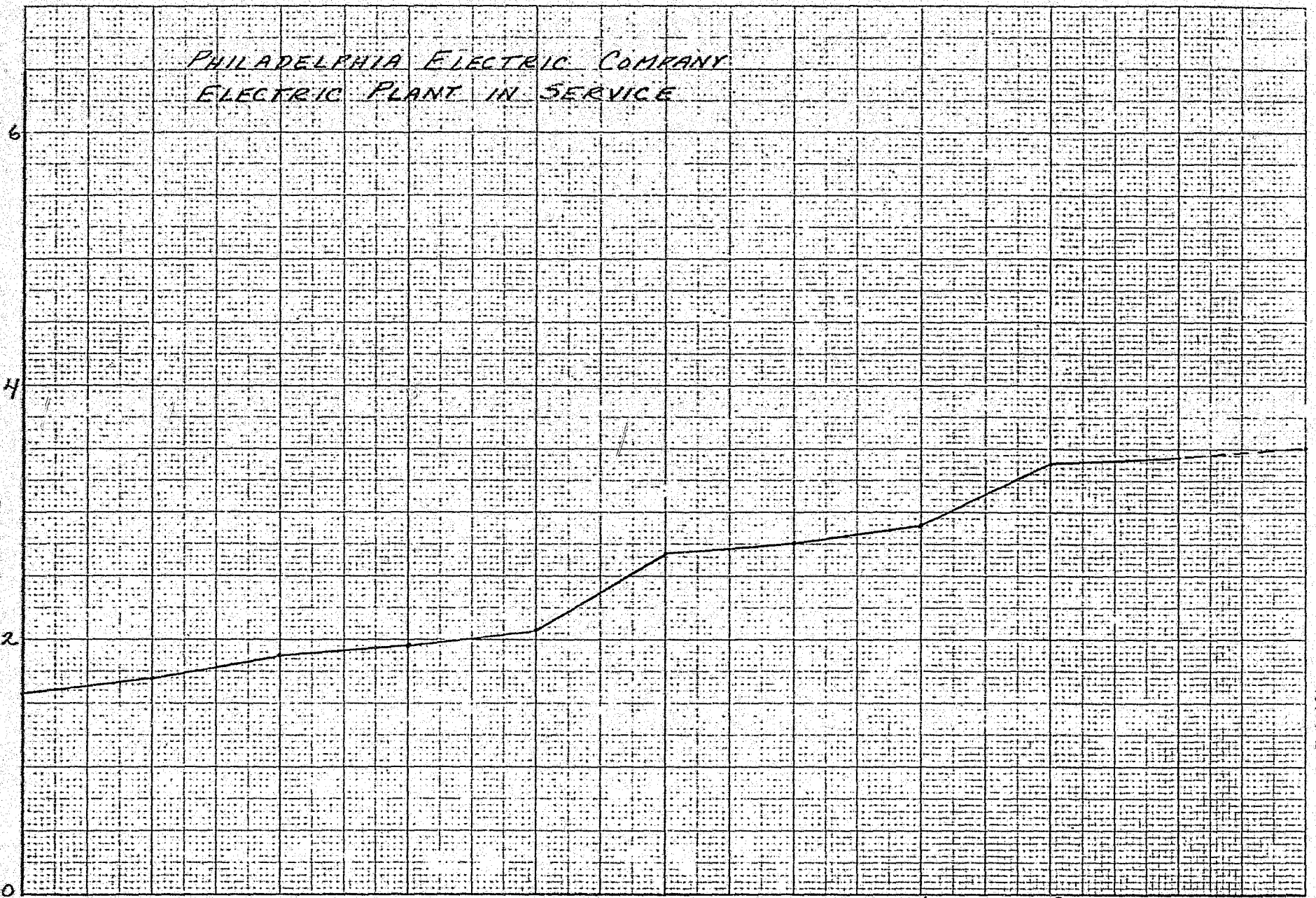
Valuation

"PRECISE" TRADE MARK 10452-20 20X20 TO 1 INCH
B. K ELLIOTT company



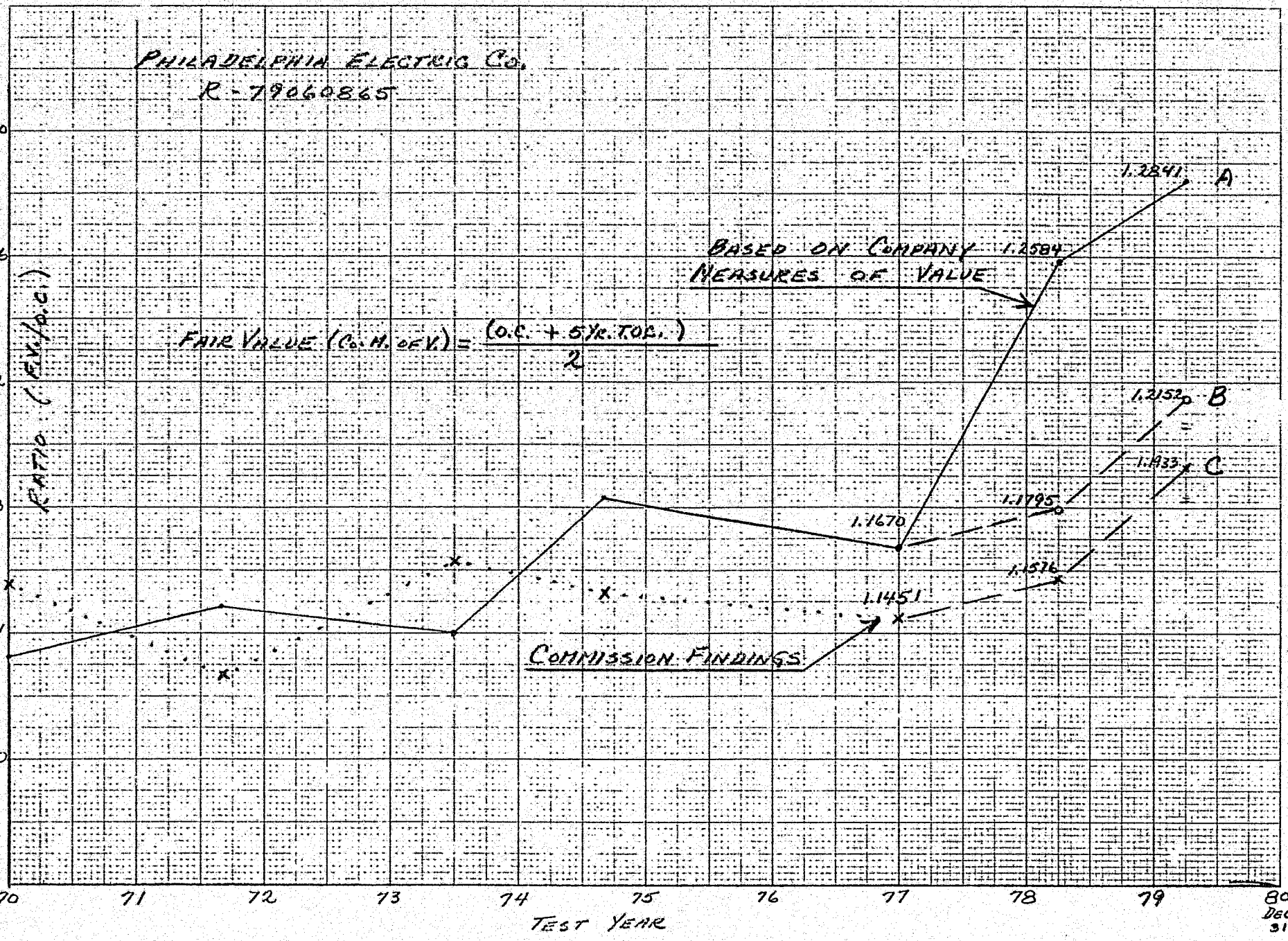
SCHEDULE 1
WITNESS: R.L. BIEX

"PRECISE" TRADE MARK 10452-20 20 X 20 TO 1 INCH
E K ELLIOTT company



SCHEDULE 2
WITNESS: D.L. BUCK
DEC01

"PRECISE" TRADE MARK 10452 - 20 20 X 20 TO 1 INCH B. K. ELLIOTT company



SCHEDULE 3
WITNESS: D.L. BIRX
DEC 31

Schedule 4

Philadelphia Electric Company
Fair Value Calculations
($000)

Method 1: Ratio Based on Company Data
F.V. = 1.2152 x 2,390,604 = 2,905,062

Method 2: Ratio Based on Commission Findings
F.V. = 1.1933 x 2,390,599 = 2,852,708

Method 3: Trending C.E. to 5-Yr. Average

	Staff Recommended Capital Structure		
Debt & Preferred	65%	x 2,390,604	= 1,553,893
Common Equity	35%	x 3,815,477	= 1,335,417
		F.V.	= 2,889,310
		R	= 1.2086

Method 4: Trending C.E. to Spot

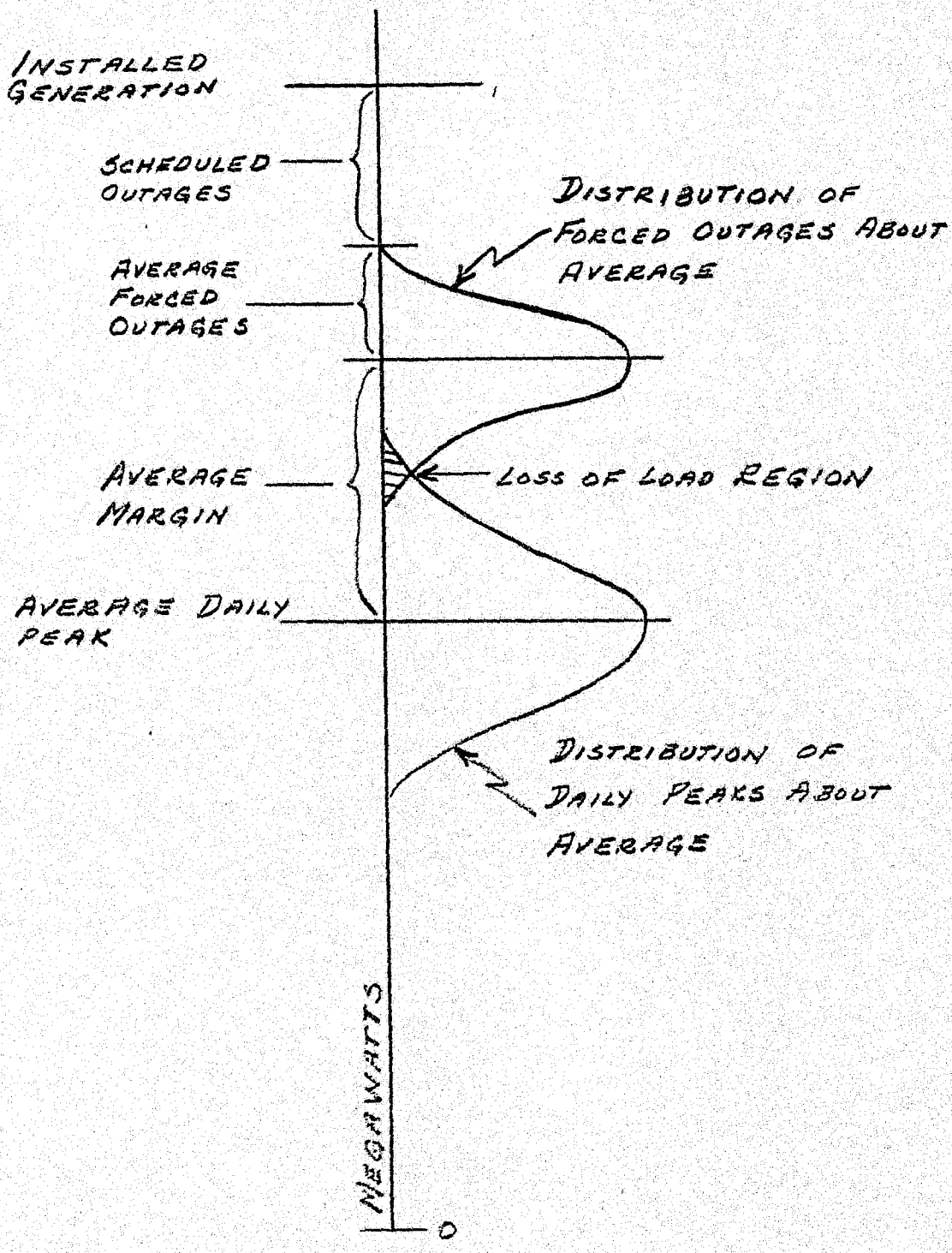
	Staff Recommended Capital Structure		
Debt & Preferred	65%	x 2,390,604	= 1,553,893
Common Equity	35%	x 4,165,634	= 1,457,971
		F.V.	= 3,011,864
		R	= 1.2599

Average Methods 1-4

F.V. = 2,914,736 R = 1.2192

Method 5: Trending Old--Adding New Plant at O.C.

O.C. @ R.I.D. 438		= 2,488,824
Depreciation:		
Annual Accrual	101,249	
$\frac{27}{12}$ x 101,249 = 227,810		
Less Depreciation		(227,810)
		2,261,014
Staff adj. O.C. @ R.I.D. 865		2,390,604
Difference = New Plant		129,590
Trended Old Plant = 1.1933 x 2,261,014		= 2,698,068
Fair Value (New Plant + Trended Old)		= 2,827,658
	R	= 1.1828



CAPACITY & LOAD RELATIONSHIP

Schedule 6
Witness: D. L. Birx

EXCESS CAPACITY ADJUSTMENT

Plant	Capacity	Net Orig. Cost
Eddystone 3 & 4	760 MW	$224,775,000
Muddy Run	880 MW	$ 70,702,000
Croydon	392 MW	$ 48,920,000
	2,032 MW	$344,397,000

$$\text{Average \$/MW} = \frac{344,397,000}{2,032} = \$169,487$$

$$\text{O.C. Adjustment} = 500 \text{ MW} \times \$169,487 = \$84,743,356$$

MEASURES OF VALUE

COMPANY CLAIM

Mar. 31, 1980

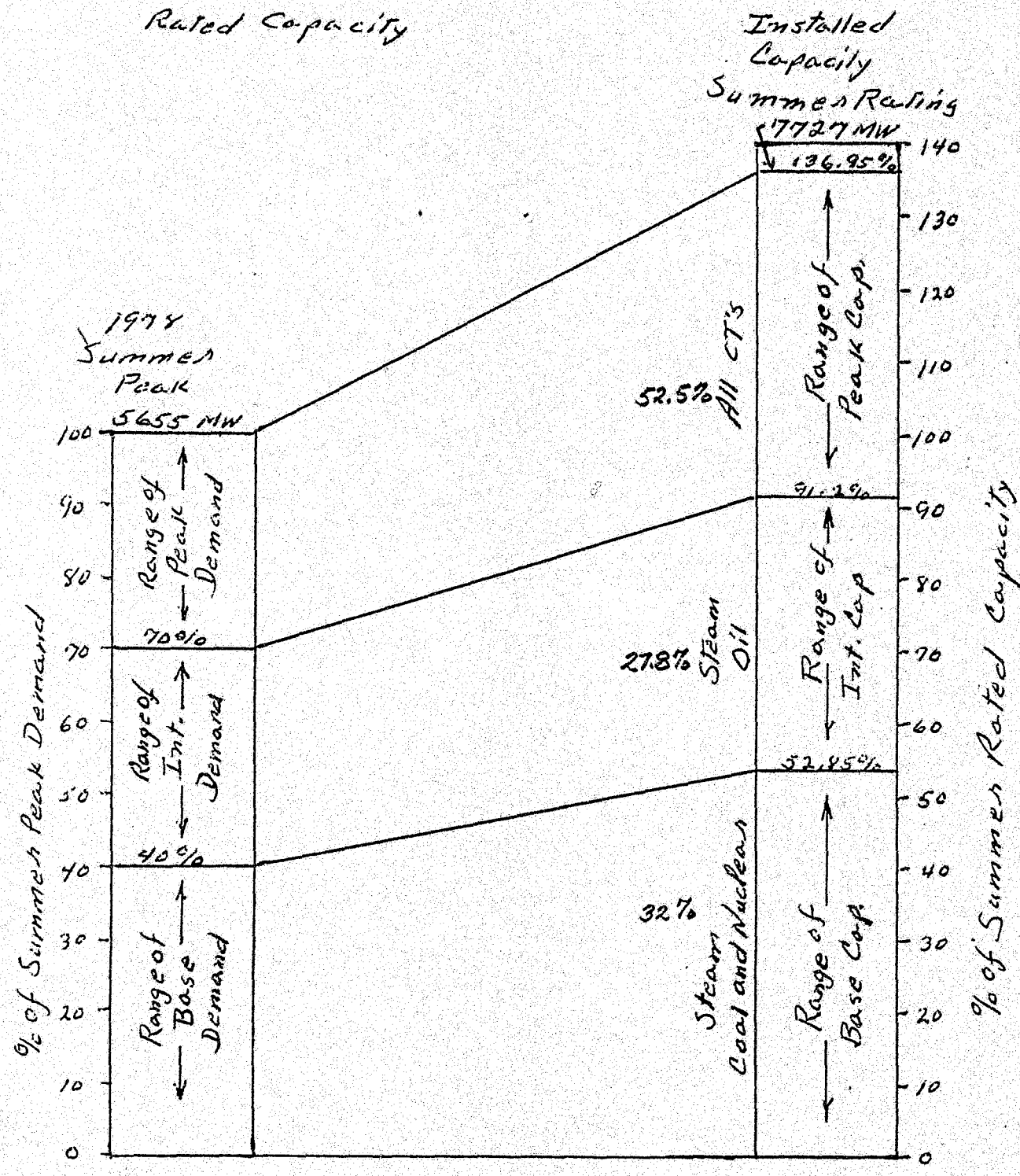
	O.C.	SPOT	3-Yr.	5-Yr.
Eddystone 3 & 4	224,7751	290,112	279,279	
Muddy Run	70,702	161,162	154,435	
Croydon	48,920	71,719	68,683	
	344,397	522,993	502,397	

ADJUSTMENT FOR 500 MW EXCESS

(84,743) (128,689) (123,621) (117,653) (Est.)

SCHEDULE 7
WITNESS: D.L. BIRX

PEC. - 1978
Summer Peak Demand
vs. Installed Summer
Rated Capacity



R. 79060865

Trial Staff Statement No. HJH-1
Witness: Harry J. Hagan, Jr.

HS. 12-4-79
E. Holbert - J. O'Hara

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PHILADELPHIA ELECTRIC COMPANY

Docket No. R-79060865

DOCKETED
DEC 3 1979

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PUBLIC UTILITY
COMMISSION

DOCUMENT
FOLDER

Direct Testimony

of

Harry Joseph Hagan, Jr.

Concerning:

Plant Held for Future Use

Q. Would you please state your name and business address?

A. Harry J. Hagan, Jr. My business address is P. O. Box 3265, Harrisburg, Pennsylvania 17120.

Q. By whom are you employed and in what capacity?

A. I am employed by the Pennsylvania Public Utility Commission as a Public Utility Engineer in the Engineering Section of the Electric Division of the Bureau of Rates.

Q. What is your educational and professional background?

A. See Appendix A.

Q. What is the subject of your testimony?

A. My testimony concerns respondent's claim for Plant Held for Future Use in measures of value. I recommend a $2,338,000 reduction at all measures of value.

Q. What is the basis for your recommended reduction to the measures of value?

A. Please refer to Table "A" which is attached hereto (page No.). Table "A" summarizes those projects which should be eliminated from respondent's claimed measures of value. To facilitate matters I will enumerate the reasons for this reduction to measures of value by functional group. Information referred to in this discussion is summarized in Table "B".

1. Production

This property consists entirely of the Fulton generating site amounting to $357,000. This property was first claimed in 1972 (R.ID.. 295) with a "Construction expected to start" date of 1980.

On page 120 of the transcript Mr. Hill stated that the company has indefinitely delayed or canceled the Fulton project. In addition, on page 121 of the transcript Mr. Hill further stated that "there has been no drawings or engineering done in the way of constructing or construction on this site". It is important to note that for Property to be included in account 105 there must be a definite plan for its use.[1] Since the project has been canceled, there obviously is not a definite plan for use. Therefore, I recommend the disallowance of the cost of this site from measures of value.

2. Transmission

Included in this functional group are the costs of various plots of land bought for future substations, lines and the expansion of present stations and lines. The property in this group was included in account 105 for the years ranging from 1961 thru 1973. Respondent's claim in this proceeding is comprised of property initially claimed: 1) at R.I.D. 29; 2) at R.I.D. 129, 3) at R.I.D. 295, 4) R.I.D. 438, 5) in the current proceeding.

The largest single parcel of property is the land for the 500 KV line Bradford--New-linville Transmission line in the amount of $1,253,000 (Phila. Elec. Exh. II DPS-2, C-23) On pages 122 and 123 of the transcript, Mr. Hill explained the reasons why the company wants to construct the line but he could not say when the line would be in service. At R.I.D. 29 respondent initially included this plant in its claim for plant held for future use, with a construction expected to start date of 1976. In the current proceeding respondent has revised the date it expects to start construction on this line to 1988. Clearly, the respondent does not have a definite plan for using this land, let alone a firm in service date. Respondent has changed the in service dates for the remaining parcels of land in this group at least once and in some instances more than once. In fact, some parcels of land were originally included in account 105 in 1961 and claimed in rate cases as far back as R.I.D. 29 which had a test year ending 31 August

---

[1] Uniform System of Accounts Account 105

1972. For these reasons the costs of these parcels of land should be excluded at all measures of value.

3. Distribution

The majority of this property was first claimed in the rate proceeding at R.I.D. 438. The test year at R.I.D. 438 was for the 12 months ending 31 December 1977. Six parcels of land claimed in the current proceeding were first claimed at R.I.D. 295 with a test year ending 31 August 1975.

Every tract of land claimed in this functional group has had its in service date changed once and in one instance three times. Such changes belie the existence of a definite plan for use of this land. A definite plan for use is required for the inclusion in account 105. In addition, the filing requirements 52 Pa. Code Section 53.53 I-A-14 required the respondent to supply the expected date of use for each item claimed, not the date construction is expected to start. Neither of these requirements have been met by the respondent. Respondent's continuously changing estimated construction expected to start dates for these portions of its claim create considerable doubt that respondent has a definite plan for utilization of this property. For these reasons the cost of these parcels of land should be excluded at all measures of value.

Q. Does this conclude your testimony?

A. Yes.

TABLE A
(000 omitted)

Functional group	Company claim	Recommended reduction
Production	357	(357)
Transmission	2,811	(1,758)
Distribution	223	(223)
	3,391	(2,338) (1)

(1) Recommended reduction of $2,338,000 from all measures of value.

TABLE B

Plant Held for Future Use

Location of Property	Date Originally Acquired	Date Originally Included in Account 105	Rate Case First Claimed	Date Construction Expected to Start				
				R-865	RID 438	RID 295	RID 129	RID 29
Production								
Land for Future Generation Stations								
Fulton Site, Lancaster Co., PA	1972	1972	R.I.D. 295	1988	N.C.	1980		
Total Production								
Transmission								
Land for Future Substations and Lines								
Cromby--N. Wales Line	1960-1961	1961	RID 438	1982	1980			
220 kV Line New Hope--Buckingham	1968	1969	RID 29	1983	1980	1980	1980	1980
Cromby--Plymouth Meeting Line	1922-1943	1966	RID 438	1982	1980			
200 kV R/W Adj. to Waneeta Sub.	1973	1973	RID 29	1983	1980	1982		
500 kV Line Bradford--Newlinville	1972	1972	RID 29	1988	N.C.	1984	1978	1976
Limerick Substation Site	1967	1972	RID 865	1982				
Land for Expansion of Pres. Sta. & Lines								
Barbadoes--Cromby Line	1971	1971	RID 295	1982	1980	1978		
Peach Bottom--Newlinville Line	1963-1964	1972	*RID 865	1988				
Peach Bottom--Whitpain Line	1964-1970	1972	*RID 865	1985				
Total Transmission								
Distribution								
Land for Future Substations								
Hays Substation	1961	1961	RID 295	1982	1978	1978		
Woodside Substation	1957	1957	RID 295	1982	1978	1978		
High Substation	1974	1975	RID 295	1984	1980	1980		
Phillips Substation	1963	1963	RID 295	1984	1980	1980		
Land for Expansion of Pres. Stations								
Willis Substation	1961	1974	RID 438	1982	1978			
Hagys Substation	1963	1974	RID 438	1984	1978			
Bacton Substation	1960	1974	RID 438	1982	1978			
Salford Substation	1959	1974	RID 438	1984	1978			
Acorn Substation	1971	1974	RID 438	1982	1978			

N.C. = No Claim

*recommend inclusion in measures of value

TABLE B

Plant Held for Future Use (continued)

	Date Originally Acquired	Date Originally Included in Account 105	Rate Case First Claimed	Date Construction Expected to Start			
				R-865	RID 438	RID 295	RID 129
Land for Expansion of Pres. Stations							
Oaks Substation 33-4kV	1953	1974	RID 438	1982	1978		
Moser Substation	1952	1974	RID 438	1987	1985		
Oaks Substation 33 kV	1954	1974	RID 438	1987	1985		
Matthews Substation	1969	1974	RID 438	1982	1978		
Creek Substation	1968	1974	RID 438	1983	1979		
Bootjack Substation	1956	1957	RID 295	1984	1980	1980	
Landenberg Substation	1969	1974	RID 438	1983	1979		
Diltown Substation	1968	1974	RID 438	1981	1977		
Fgggs Substation	1956	1974	RID 438	1983	1979		
Boyd Substation	1960	1974	RID 438	1982	1978		
Highland Substation	1966	1974	RID 438	1981	1977		
Byers Substation	1967	1974	RID 438	1981	1977		
Ship Substation	1969	1974	RID 438	1982	1978		
Page Substation	1960	1974	RID 438	1982	1978		
Pocopson Substation	1970	1974	RID 438	1981	1977		
Crest Substation	1961	1974	RID 438	1981	1977		
Tanguy Substation	1971	1974	RID 438	1984	1980		
Pennsbury Substation	1973	1974	RID 438	1981	1977		
Montgomery Substation	1960	1968	RID 438	1981	1977		
Folly Substation	1954	1974	RID 438	1981	1977		
Kellers Substation	1956	1974	RID 438	1983	1979		
Aque Substation	1960	1974	RID 438	1981	1977		
Wright Substation	1963	1974	RID 438	1983	1979		
Piper Substation 1974	1959	1974	RID 438	1981	1978		
Turk Substation	1965	1974	RID 438	1982	1978		
Canal Substation	1962	1974	RID 438	1981	1977		
Woodburne Substation	1958	1974	RID 295	1984	1987	1985	
Broadale Substation	1972	1974	RID 438	1981	1977		
Worth Substation	1960	1973	RID 438	1984	1980		
Rickerts Substation	1973	1974	RID 438	1981	1977		

Test Year; R.I.D. 29 31 Aug. 1972 R.I.D. 295 31 Aug. 1975 R.I.D. 865 31 March 1980
R.I.D. 129 31 Oct. 1973 R.I.D. 438 31 Dec. 1977

Educational and Professional Background

Q. What is your educational background?

A. I graduated with honors from Mount Saint Marys College in 1975 with a Bachelor of Science Degree in Finance and Economics

Q. Have you attended any conferences, seminars, etc. related to public utility valuation?

A. I have attended the following:

June 1977 "Public Utility Accounting and Finance"
Gordon F. Heim
Coopers and Lybrand

August 1977 "First Annual Education Energy Seminar"
Eugene F. Carter
Met Ed/GPU

September 1979 NRC Workshop on Decommissioning
Nuclear Regulatory Commission
Columbia, South Carolina

October 1979 Depreciation Program II
Depreciation Programs Inc.
Kalamazoo, Michigan

Q. Prior to your employment with the Commission, what has been your work experience?

A. Upon separation from the U. S. Navy in 1971 I entered the construction trade as an Ironworker apprentice and pipefitter.

Throughout college and shortly thereafter I practiced my trade in New York, Connecticut, Pennsylvania, Maryland and Washington, D. C.

From August 1975 to June 1977 I was employed by Grove Manufacturing Co., a division of Walter Kidde Corp. in the planning and analysis department. My duties included planning and forecasting sales and manufacturing costs for the division. This forecasting and planning involved domestic operations

and international subsidiaries. My work also involved acquisition analyses, other studies, and special projects in which I reported directly to the president and/or executive committee of the Company.

Q. Describe your responsibilities for the Pennsylvania Public Utility Commission.

A. In June 1977 I began working for the Pennsylvania Public Utility Commission. I was initially assigned to the Finance Division, Rate of Return Section. My work entailed financial analyses of public utilities as well as other publicly held corporations. These analyses included the evaluation of capital structure, the cost of common equity, and the cost of long term debt. In this capacity I worked on the rate increase requests of York Water Company, Philadelphia Suburban Water Company, Mid-Penn Telelphone Company, Arco Pipeline Company and other utilities.

Following my reassignment to the Electric Section of the Energy Division (currently the Engineering Section of the Electric Division) I have assisted other engineers in the preparation of testimony which was subsequently presented in rate case proceedings.

I have assisted in making analyses regarding load shedding procedures for electric utilities, the relationship between pressure, temperatures, and the service life of boilers. I have also worked on specific projects related to rate proceedings for the following utilities: UGI Corporation (R-78030572) Pennsylvania Electric Company (R-78040599), Metropolitan Edison Company (R-78060626), West Penn Power (R-78100685), Duquesne Light & Power Co. (R-79010740) as well as steam heat rate proceedings.

Q. Have you testified in prior rate proceedings?

A. Yes. I have testified in West Penn Power at R.I.D. 78100685 concerning Plant Held for Future Use.

R 79060865

Trial Staff Statement No. GFM-1
Witness: G. F. Markovci

Hbg 12-5-79

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PHILADELPHIA ELECTRIC COMPANY

Docket No. R-79060865

DOCUMENT FOLDER

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DEC 3 1979

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SECRETARY'S OFFICE
PUBLIC UTILITY
COMMISSION

Direct Testimony

of

George F. Markovci

Concerning:

Cash Working Capital

Summary

The following adjustments to Respondent's Cash Working Capital Requirement (Exhibit DPS-2, page C-25) of $52,276,000 are recommended:

Semi-Annual Interest Payments	$27,071,000
Preferred Dividend Payments	3,121,000
Cash Required to Finance O&M Expenses	25,368,000
Total Adjustments to Cash Working Capital	$55,560,000

Q. State your name and the name and address of your employer.

A. George F. Markovci. I am employed by the Pennsylvania Public Utility Commission, P. O. Box 3265, Harrisburg, Pennsylvania 17120.

Q. What is your position with the Pennsylvania Public Utility Commission and how long have you held this position?

A. I am an Analyst for the Energy Division - Electric Finance Section, Bureau of Rates and I have held this position since October 1977. Prior to that I was employed as an Analyst for the Financial Section - Bureau of Rates and Research from February 1976 to October 1977.

Q. What is your educational and professional background?

A. See Appendix A.

Q. What is the purpose of your testimony in this case?

A. My testimony is intended to recommend the following necessary downward adjustments to Respondent's Cash Working Capital Requirement (Exhibit DPS-2, page C-25)

Semi-Annual Interest Payments	$27,071,000
Preferred Dividend Payments	3,121,000
Cash Requirement to Finance O&M Expenses	25,368,000
Total Adjustments to Cash Working Capital	$55,560,000

Q. Please comment on your reasons for disagreeing with the Company's methodology used to determine the cash working capital requirement?

A. The purpose of a cash working capital allowance is to allow the equity holder a fair return on funds required by a utility to conduct normal opera-

tions and to cover any gap between cash expenditures required for the production and delivery of service and the collection of revenues associated with these services.

The rates paid by PECO customers include a revenue requirement to service debt and preferred obligations. These rates are collected on a continuous basis throughout the year. In the case of bonds, the interest is paid semi-annually and preferred dividends are paid quarterly. If revenues collected from customers but not yet paid to bondholders and preferred stockholders are not recognized as a source of working capital contributed by the rate payer and correspondingly offset against the cash working capital requirement, the equity holders will earn on capital not supplied by them and receive a supplemental return or windfall profit. PECO recognizes this principal in its revenue-expense lag study for tax revenues received in advance of payment. There is no valid basis for ignoring the same principal and application to funds collected to service debt and preferred instruments.

I believe that an adjustment should be made on the basis that the mid-point of semi-annual interest payments and quarterly preferred dividend payments are proper in determining the adjustment to cash working capital requirement for debt service and preferred obligations.

Q. Have you prepared an exhibit outlining the Staff's position in regard to your adjustments to the cash working capital requirement for semi-annual interest payments and quarterly preferred dividend payments for the test year March 31, 1980?

A. Yes, I have attached Trial Staff Exhibit No.'s GFM-1A and 1B: Exhibit No.

GFM-1A supports a downward adjustment in cash working capital of $27,071,000 for semi-annual interest payments. Exhibit No. GFM-1B indicates a downward adjustment of $3,121,000 for quarterly preferred dividend payments. The total downward adjustment for debt service and preferred obligations is $30,192,000 and should be applied as a reduction to the Cash Working Capital Requirement.

Q. Please comment on your reasons for disagreeing with the Company's treatment of arriving at the Cash Requirement of $71,876,000 to finance Operation and Maintenance Expenses (Exh. DPS-2, Page C-25).

A. The Company was selective in arriving at its Average Lag in Receipt of Revenues of 57 days. Respondent has used a combination of a lag methodology and a balance sheet approach to determine this requirement of 57 days. PECO's claim is based on 15 days from the mid-point of the month, four days for bill preparation and 38 days for the time average bill is outstanding (Exh. DPS-1, page C-25A).

Witness Rimmerman (TR-403) characterized the 38-day period for the average time bill is outstanding as strictly a lag in receipt of payment. Staff does not agree with this statement. The method of arriving at the 38-day period was the result of the sum of twelve monthly total accounts receivable balances divided by the sum of twelve average daily revenue balances for the twelve months ended March 31, 1979 (TR-378). Staff characterizes this as a the balance sheet approach as this method utilizes twelve "snapshot" pictures of the Company's balances at the end of each month of the test year.

I believe that a Revenue Lag Day study should be made utilizing Total

Electric Revenues for the test period. The lag day study should include both Electric Revenues by Rate Classes and Other Operating Revenues, including late payment penalties.

Q. Have you prepared a Revenue Lag Day Study for the test period?

A. Yes, attached is Trial Staff Exhibit GFM-1C (Three Sheets).

Q. Do you have any additional comments to make on Trial Staff Exhibit GFM-1C?

A. Yes. The source of Total Revenue and resultant Revenues Dollar Days utilized was Exhibit DPS-1, Page A-5, which is the historic test year ended March 31, 1979. I could not use the future test year revenues as the Company information regarding a breakdown of forfeited discounts for the future test year was not available (TR-1, Q. and A. 15).

I, also could have assumed the mid-point of the 54-calendar days after due date when a delinquent account is referred to an outside collection agency or becomes delinquent (Footnotes D, E. & F). I did not use the mid-point of 54-calendar days or 27 days in the interest of conservatism.

Q. How did you make your revenue lag study as outlined on Trial Staff Exhibit GFM-1C?

A. First, I took the electric revenues received by each individual rate class and multiplied it by the lag days indicated and explained on Footnotes A, B and C which resulted in revenue dollar days for each individual rate class. This resulted in a Total Revenue of $1,196,846,493 and Revenue Dollar Days $49,094,581,519 for the test period.

Then the Other Operating Revenues excluding late payment penalties were lagged in the same manner to arrive at Total Electric Operating Revenues of $1,208,836,493 and Revenue Dollar Days of $49,456,279,519 which resulted in 41 days revenue lag before application of Late Payment Penalties. The 30 and 57-lag days used for Other Operating Revenue items were conservatively estimated in the absence of specific information.

The 95-lag days used for late penalty payments are explained in Footnotes D, E and F. The principle involved to arrive at penalty revenue dollars was to capitalize the associated penalties at an annual or monthly interest rate to derive the revenues associated with these late penalty payments. This was then multiplied times the 95-lag days to arrive at the Revenue Dollar Days of $5,014,765,000 associated with late penalty payments.

The overall result was $1,213,526,493 of Total Revenue divided by $54,471,044,519 Revenue Dollar Days which resulted in an overall 45 dollar days revenue lag.

The difference between the Company's Dollar Days Revenue Lag of 57 days and Staff's 45 days results in an reduction of 12 days to Respondent's claim for cash required to finance O&M expenses. This results in a cash working capital requirement of $46,508,000 (22 days @ $2,114,000). A $25,368,000 reduction (12 days x $2,114,000) to Respondent's cash working capital claim of $71,876,000 to finance O&M expenses is recommended.

Trial Staff Statement No. GFM-1
Witness: George F. Markovci

Appendix A

Educational and Professional Background

I graduated in February 1950 with a B.A. degree from Pennsylvania State University, majoring in Commerce and Finance. After graduation, I was employed by the Blue Mountain Consolidated Water Co. of Nazareth, Pa. (1950-1965). I was hired as an accountant, promoted to office manager and ultimately to Manager. Served as Manager for an eight-year period. In 1965, I was employed by General Waterworks Management and Service Corporation as Division Accountant of their Delaware Division. My duties included supervision of office personnel and formulation of office and accounting procedures for seven operating utility companies in Delaware, Pennsylvania and Maryland. I was transferred in June of 1966 to Pennsylvania Utilities Investment Corporation as their Controller and Assistant Secretary-Treasurer. My duties consisted of preparation of consolidated financial reports, operating budgets, cash flow and other financial reports for the parent and four operating steam heat utilities. I served in this capacity until June of 1967 when I entered the public accounting profession. I remained in public accounting until February 1970. During this time I was employed by the firms of Timpson, Boyle and Wolverton of Oakland, California and J. D. Yerger Company of Reading, Pennsylvania. In February 1970, I was hired as Accounting Manager of the Birdsboro Corporation, Birdsboro, Pa. I became Treasurer of Barbey Electronics of Reading, Pennsylvania in April 1971 and served in this capacity until December 1973 when I accepted the position of Controller with Herr & Company of Lancaster, Pennsylvania and remained in that capacity until

Trial Staff Statement No. GFM-1
Witness: George F. Markovci

Appendix A

Educational and Professional Background (continued)

May 1975 when I became the accountant for the Reading Area Community College. I served as their accountant until February 1976 when I joined the staff of the Pennsylvania Public Utility Commission.

Trial Staff Exhibit No. GFM-1A
Witness: George F. Markovci

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PHILADELPHIA ELECTRIC COMPANY

Docket No. R-79060865

Exhibit to Accompany The

Direct Testimony

of

George F. Markovci

Concerning:

Cash Working Capital

PHILADELPHIA ELECTRIC COMPANY

Commission Staff Adjustment to Cash Working Capital Requirement for Semi-Annual Interest Payments for Year Ended March 31, 1980

Exh. DPS-2 Page A-2	Net Electric Plant--3/31/80	$2,501,021,000
Attachment II-A-1A	1979 Budget Capitalization Ratio Long-Term Debt	52.1%
Exh. DPS-2 Page D-9	Amount of Net Electric Plant Allocated to Long Term Debt ($2,501,021,000 x 52.1%)	$1,303,032,000
Exh. DPS-2 B-19	Pro Forma Long Term Interest Charges Allocable to Electric (Embedded Debt Cost of 8.31% x $1,303,032,000 Electric Plant)	$108,282,000
	Semi-Annual Interest Payments $108,282,000 ÷ 2 payments	$54,141,000
	Staff Assumes Mid-Point of Semi-Annual Long Term Debt Payments of $54,141,000	2
	Staff recommended adjustment to cash working capital requirement for long term interest payments	$27,071,000

Trial Staff Exhibit No. GFM-1B
Witness: George F. Markovci

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PHILADELPHIA ELECTRIC COMPANY

Docket No. R-79060865

Exhibit to Accompany The

Direct Testimony

of

George F. Markovci

Concerning:

Cash Working Capital

PHILADELPHIA ELECTRIC COMPANY

Commission Staff Adjustment to Cash Working Capital Requirement for Preferred Dividend Payments for Year Ended March 31, 1980

Exh. DPS-2 Page A-2	Net Electric Plant--3/31/80	$2,501,021,000
Attachment II-A-1A	1979 Budget Capitalization Ratio Preferred Stock	12.8%
	Amount of Net Electric Plant Financed by Preferred Stock (12.8% x $2,501,021,000)	$320,130,688
Exh. DPS-2 Page B-20	Embedded Cost of Preferred Stock	7.80%
	Amount of Preferred Stock Dividends Allocated to Electric Plant (7.80% x $320,130,688)	$24,970,194
	Average Quarterly Dividend Payments Allocated to Electric Plant ($24,970,194 ÷ 4 Quarterly Payments).	$6,242,549
Staff assumes Mid-Point of Quarterly Preferred Dividend Payments of $6,242,549		2
Staff recommended adjustment to cash working capital requirement for quarterly preferred dividend payments		$3,121,000

Trial Staff Exhibit No. GFM-1C
Witness: George F. Markovci

PENNSYLVANIA PUBLIC UTILITY COMMISSION

V.

PHILADELPHIA ELECTRIC COMPANY

Docket No. R-79060865

Exhibit to Accompany The

Direct Testimony

of

George F. Markovci

Concerning:

Cash Working Capital

PHILADELPHIA ELECTRIC COMPANY
Revenue Lag Days as Adjusted by
Staff for Cash Working Capital Requirement

Source: Exh. DPS-1 Page A-5 Rate Class	Total Revenue $	Lag Days	Footnotes (See Sheet 2)	Revenue Dollar Days $
R	374,629,897	41.75	A	15,640,798,200
RH	35,195,566	41.75	A	1,469,414,881
WH	16,533,696	41.75	A	690,281,808
POL	1,273,058	41.75	A	53,150,172
GLP	3,746,394	41.75	A	156,411,950
GS-W/O Dem Meas	9,932,955	41.75	A	414,700,871
GS-W/Dem Meas	159,836,954	41.75	A	6,673,192,829
PD-(Incl. Riders)	111,769,354	40.25	B	4,498,716,498
HT-(Incl. Rider)	459,667,987	40.25	B	18,501,636,477
SLP	6,827,538	40.25	B	274,808,404
SLS	8,708,949	40.25	B	350,535,197
MLP	5,735,737	40.25	B	230,863,414
FLP	942,257	61.25	C	57,713,241
TL	1,759,628	40.25	B	70,825,027
BLI	3,213	40.25	B	129,323
Trans Rental Rider	283,310	40.25	B	11,403,227
Total Elec Tariff 25	1,196,846,493			49,094,581,519
Other Operating Revenues: (Excluding Late Payment Penalties)				
Interdepartmental Sales	2,059,000	30		61,770,000
Miscellaneous Service Revenues	74,000	57		4,218,000
Rent from Electric Property	3,450,000	30		103,500,000
Interdepartmental Rents	2,402,000	30		72,060,000
Other Electric Revenue	4,005,000	30		120,150,000
Total Electric Operating Revenues Before Application of Late Payment Penalties	1,208,836,493	41 days		49,456,279,519
Late Payment Penalties				
1½% Finance Charges	3,658,000	95	D	2,316,765,000
3% Late Payment Charges	792,000	95	E	2,508,000,000
1% Finance Charges	240,000	95	F	190,000,000
Total Forfeited Discounts	4,690,000			5,014,765,000
TOTAL ELECTRIC OPERATING REVENUES	1,213,526,493	45 days		54,471,044,519

	Dollar Days Company	Dollar Days Staff
Average Lag in Receipt of Revenues	57	45
Average Lag in Payment of Expenses	23	23
Average Lag in Days Between Receipt of Revenues & Payment of Operating Expenses	34	22

Company Requirement (Exh. DPS-2, Page C-25) $2,114 x 34 days	71,876,000
Staff Recommendation (Exh. GFM-1C) $2,114 x 22 days	46,508,000
Staff Reduction to O&M Expenses for Cash Working Capital Requirement	25,368,000

PHILADELPHIA ELECTRIC COMPANY

Footnotes to Sheet One

Footnote A

30.50 days for an average billing month $\frac{(26 + 35)}{2}$ (A)

15.25 mid-point of average billing month $\frac{(30.5)}{2}$

4.00 days for bill preparation
20.00 days to due date of billing
2.50 mid-point of five-day remittance period for payment by mail before late payment charge is imposed.

41.75 Lag Days for Rate Classes R, RH, WH, POL, GLP & GS

Footnote B

15.25 mid-point of average billing month
4.00 days for bill preparation
15.00 business days to expiration of net payment period
6.00 days for conversion to calendar days

40.25 Lag Days for all other Rate Classes except Rate FLP

Footnote C

15.25 mid-point of average billing month
4.00 days for bill preparation
30.00 business days to expiration of net payment period
12.00 days for conversion to calendar days

61.25 Lag Days for Rate Class FLP

Footnote D

Source: (TR-1, Q and A.15-TR 410-MWR)
$3,658,000 of 1¼% penalties capitalized at a 15% annual interest rate would result in $24,387,000 of late revenues associated with the 1¼% penalties

Lag Days

41 lag days resulting from Total Electric Operating Revenues before application of late payment penalties (Sheet 1 of 3)
54 calendar days after due date referred to outside collection agency. (TR-1, Q and A.8, TR 377-MWR)

95 Lag Days for Late Payment Penalties

PHILADELPHIA ELECTRIC COMPANY

Footnotes to Sheet One (continued)

Footnote D (continued)
95 Lag Days times $24,387,000 late penalty revenue would result in $2,316,765,000 of Revenue Dollar Days.

Footnote E
Source: (Supplied by Mr. Jerry O'Neill, PECO Rate Department on 10/29/79).

$792,000 of 3% late payment charges capitalized at the 3% monthly one-time charge would result in $26,400,000 of late revenues associated with this charge.

95 Lag Days (see Footnote D) times $26,400,000 late penalty revenues would result in $2,508,000,000 of Revenue Dollar Days.

Footnote F
Source: (Supplied by Mr. Jerry O'Neill, PECO Rate Department on 10/29/79).

$240,000 of 1% Finance Charges capitalized at a 12% annual interest rate would result in $2,000,000 of late penalty revenues associated with this charge.

95 Lag Days (see Footnote D) times $2,000,000 of late penalty revenues would result in $190,000,000 of Revenue Dollar Days.

Reference: (A) 52 Pa. Code, Chapter 56, Standards and Billing Practices for Residential Utility Service, Section 56.2.

R-7906085
HJH-1A
HSS-12-5-79
D. Hollis

PHILADELPHIA ELECTRIC COMPANY
2301 MARKET STREET
P.O. BOX 8699
PHILADELPHIA, PA. 19101
(215) 841-4000

DOCUMENT FOLDER

JOSEPH F. PAQUETTE, JR., VICE PRESIDENT
FINANCE AND ACCOUNTING DEPARTMENT

June 18, 1979

DOCKETED
DEC 3 1979

RECEIVED
'79 DEC 6 AM 10:16
DELAWARE PUBLIC UTILITY COMMISSION
SECRETARY'S OFFICE

Mr. Lorin H. Drennan, Jr.
Chief Accountant
Office of Accounting and Finance
825 North Capital Street
Washington, D.C. 20426

Dear Mr. Drennan:

In accordance with the Federal Energy Regulatory Commission Uniform System of Accounts instructions for Account 105, Electric Plant Held for Future Use, we are requesting approval to transfer the following properties to Account 121, Nonutility Property.

Property Description	Date Originally included In Account 105	Amount
Land acquired for expansion of Tacony Substation	1974	$102,859.00
Land acquired for expansion of Overbrook Substation	1962	497,631.55
Land acquired for expansion of Elmwood Substation	1974	89,137.39
Land acquired for expansion of Lombard Substation	1974	110,298.26
Land acquired for expansion of Packer Substation	1974	204,887.69
Land acquired for the Planned Torresdale Area Substation	1972	261,933.84
Land acquired for the Planned Chestnut Hill Area Substation	1973	153,089.22
Land acquired for the Planned Bustleton Area Substation	1973	120,278.40
Subtotal		$1,540,115.35

The above properties were ...ired for expansion to existing substa-...r for new locations. Lower growth rates have eliminated the need for ...use or delayed it far into the unpredictable future.

The Pennsylvania Public Utility Commission has taken the position to allow in rate base only that Future Use Property that will be used within ten years of a test year.

Because of that restriction, the above properties were never in rate base (FERC or Pa.P.U.C.). We therefore request an exception to Order Number 420 and seek your approval to record any future gain or loss on the sale of these properties to Account 421.

Approval is also requested to transfer the following land properties to Account 121. These too, are no longer needed or appropriate for future Company service operations. These properties were included in rate base and any gain or loss from their disposition will be accounted for in accordance with the instructions in Paragraph D of Account 105.

Property Descriptions	Date Originally included In Account 105	Amount
Land acquired for expansion of Byberry Substation	1974	$4,758.21
Land acquired for expansion of Morton Substation	1974	6,761.50
Land acquired for expansion of Saville Substation	1974	18,980.76
Land acquired for expansion of Parrish Substation	1974	25,363.88
Land acquired for expansion of MacDade Substation	1974	19,618.30
Land acquired for expansion of Foxchase Substation	1974	250,984.20
Land acquired for expansion of Neshaminy Substation		9,559.87
Land acquired for a proposed transmission line for Eddystone to Philadelphia	1968	150,740.69
Subtotal		$486,767.41
Total amount to be transferred		$2,026,882.76

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79 DEC 6 AM 10:16
PUBLIC UTILITY COMMISSION
CHIEF CLERK'S OFFICE

Sincerely,

R-7906086 PECO Exh 5 Rebuttal of Bird
PECO Exh. 5
Co. 12-5-79
E. Holbert

V-1

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SECRETARY'S OFFICE
PUBLIC UTILITY
COMMISSION

Q. 1. With regard to pages 8-9, lines 23-27 and 1-2, please identify and provide a copy of any document(s) which support your declaration that NRC is not requiring conformity with latest constructional rules as a requirement for relicensing. . . ."

A. 1. Information cited was obtained in telephone conversation with V. P. Lee, V. P. in charge of nuclear plants for Commonwealth Edison. Attached is copy of letter listing the requirements of NRC pertaining to the start-up of Dresden Unit 1.

Q. 2. With regard to page 9, lines 3-10 of your testimony, please identify any written document(s) or other information which support your statement that "General Electric Company has a test reactor (GETR) which has operated for over 20 years with a much higher neutron flux density than is permitted in any commercial reactor." Please provide copies of any documents so identified.

A. 2. Information cited was obtained in telephone conversation with Lynn Wallis, Consultant, General Electric Nuclear Division, San Jose, California.

Q. 3. With regard to page 7, lines 1 through 25 of your testimony, in which you cite inspections of modern plants and discussions with design engineers and officials of the NRC as the basis for your conclusion that the life span of a nuclear plant is fifty years or more, please identify the following:

a. The name and the position of each NRC official with whom you have had the discussions referred to and the date of those discussions.

b. The location of all of the "modern plants" to which you refer.

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C
DOCUMENT
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In addition, please identify the utility that owns each plant and the age of each plant.

c. The name and position of each design engineer with whom you have had the discussions referred to and the approximate dates of those discussions.

A. 3. a. Telephone contacts were made on August 21, 1978 with the following NRC personnel:

Ed Case, Deputy Director
Martin Walsh
Bob Bernero

b. Plants inspected:

Limerick - Philadelphia Electric

Peach Bottom - Philadelphia Electric

Susquehanna - PP&L

Both Limerick and Susquehanna are under construction. Peach Bottom has been in service 5 years.

c. See A.2.

On July 5, 1978 at time of visit to Limerick we asked a Bechtel Engineer (unidentified) how long he thought the reactor portion of the plant would last. His reply was, "at least 60 years".

Mr. W. D. Garland, Depreciation Manager, GPU Service Corporation, testified (Penelec R.I.D. 599) that the reactor vessel is designed to more stringent requirements and could effectively outlast all the other equipment in the plant. (TR 1711)

Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

September 27, 1978

NOV 2 1978

Mr. Donald L. Birx
Pennsylvania Public
Utilities Commission
P.O. Box 3265
Harrisburg, Pennsylvania 17120

Dear Mr. Birx:

In accordance with our conversation on September 22, I have collected some information on the recommissioning of Dresden Unit 1.

We have been ordered by the NRC, or we have committed ourselves, to complete the following items prior to the startup of Dresden Unit 1:

1. High Pressure Coolant Injection System (HPCI)
2. Upgrade of the Reactor Protection System (RPS)
3. Inservice Inspection (ISI)
4. Post surveillance program following the chemical cleaning and replacement or repair of any damaged components

For further information on the philosophy and costs involved with chemical cleaning, I have enclosed a speech written and delivered to NARUC by Ralph Heumann, Comptroller at Edison.

I have not located a generic study on the life expectancy and deterioration causes of reactor pressure vessels. I will continue my search and send this information to you when possible.

Please do not hesitate to contact this department for any further information.

Sincerely,

Leslie A. Bowen

Leslie A. Bowen
Staff Assistant
Office of V.P. Lee

Q. 4. Please identify any other non-written data upon which you have relied for your conclusion.

A. 4. See attached documents and notes of telephone conversations.

Q. 5. Please identify all written documents, including but not limited to documents prepared by the NRC, utilities, commissions, and the Pennsylvania Public Utilities Commission Staff, upon which you rely or of which you are aware that support your conclusion that a nuclear plant has a life span of fifty years.

A. 5. See attached documents and notes of telephone conversations.

Q. 6. On page 15 of your testimony, line 19 et seq., you cite testimony of Mr. E. Newton, Jr. in the Penelec Rate Case (R.I.D. 599). We have checked with the General Public Utilities Service Corporation or have been advised that Mr. Newton's testimony is not found on pages 336-42 as you have indicated. Please provide the correct transcript pages for Mr. Newton's testimony. Alternatively, please provide a copy of the testimony of Mr. Newton upon which you rely.

A. 6. Reference is in error. Correct reference should be Metropolitan Edison R.I.D. 626 (TR 336-42).

Design criteria a primary requirement

Good example of change (N.Y.) processing plant. – closed down permanently.

Standards established

Depends upon changing state of heavy metals.

Decision based on next today's criteria –

would be unique plant

to be visited to present day standards (25)

40 yrs

ISOTOPES

---

much experience in desalination

Not set for fuel yrs at till

radiation for disposal to continue

Continue to see right – Contamination

until all, or entirely eliminated

depended on future of reactor used.

can control eventually.

Lynn Wallis 405-935-1179

Consultant with G.E

Assistance Center 935-1147 operating end of two

40 yrs. – fossil experience

Nuclear reduction of vessel. shielding effective.

some have not experienced deterioration. not 25 yrs

(LC)

Can reach GEFR higher neutron flux – no problems

Efficiency – no decrease in efficiency except for

maintenance of pumps valves.

Canadian, British, French

recent 40 years also.

Extraction time 6 yr. in

Commonwealth Edison 312-555-1212

294-4321

Gordon R. Corey M. Bankey Exec V.P.

Keeon La V.P.

Byron Lee V.P. in charge of nuclear plants.

Byron: Unit 1 to be licensed 1977
1980
17
15
32

End of Oct. expires

Have license - not in Commonwealth latest ECCS emergency equipment

high pressure cooling injection

NRC - not yet up'd mod. for earthquake but standard met.

Aux. power system to be added —

Fire at at Brown's Ferry

License was indefinite

Unit 2 was interim license Extension of licensing a possibility.

Cable Indep. Studies show probab. life shorter accur.

Vessel test 30-40 yrs.

will send any material he can find in these areas.

List of Threatened Plants

8/21/78

Martin Kalish NEC 301-492-7203

31 species with
no assurance that plant could be delisted.
- no removal for big pr. ventor.
some regulations in place - in last 30 + years.
yes need one on keeping up.
most of important things taken care of delisting if plant list may be best if
done before they could
possibly be removed

Bob Barnes Accommodations
Ed Case Deputy director. - 492-7726
to call.

Not much change in constituency permits Valley or timber vs. or a plateau.
No reason to keep up with regulations
during anti-program for delist plants.

Don't encourage time of delist more plants.
Timber.
Timber relieving is a possibility.

Hopefully a recommended procedure will come out this year
for determining -

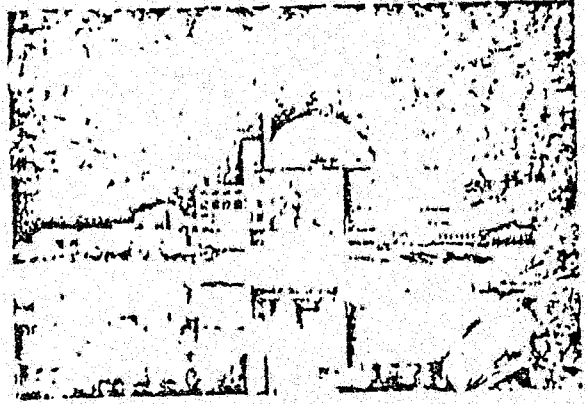
Decommissioning

Electric power plants, like cars, planes, appliances or buildings, eventually grow too old to continue operating. The time comes when maintenance and service costs become too high, major mechanical components near the end of their useful life, or "newer models" appear that are more economical to operate. Continued use may not be practical and the facility or equipment needs to be retired.

In the case of a nuclear power plant, the Federal government, through the U.S. Nuclear Regulatory Commission (NRC), requires that the builder identify "retirement" options and costs before a nuclear plant is allowed to be built. Once this and many other safety and environmental reviews are completed, a nuclear power plant is licensed for a 40-year period.

After expiration of the operating license, several options are available for a nuclear power plant. These are:

- Seek a new operating license from the NRC so that the nuclear plant may continue to operate;
- Seek to "repower" the station – that is, build a new nuclear or fossil-fueled steam generator to replace the "old" portion of the station; or
- Retire and decommission the entire nuclear power plant, terminating all operations with no long-term risk to the public.



The Yankee Rowe nuclear plant in Rowe, Massachusetts is the oldest of the seven nuclear plants in New England. In operation since 1960, Yankee Rowe will probably be the first New England nuclear plant to be decommissioned.

Three Options Available

There are now three major nuclear power plant decommissioning options available, as well as combinations of the three. In all decommissioning options, the nuclear fuel and waste is removed from the power plant. In decommissioning a nuclear power facility, a utility must weigh the short and long-term costs for each alternative, as well as the possible future uses for the reactor site. The NRC considers the following decommissioning alternatives acceptable:

1. *Mothballing* – Mothballing a nuclear facility consists of placing it in protective storage. Most of the equipment is left intact, except all fuel assemblies and radioactive liquids are removed and radioactive surfaces are cleaned or left inaccessible. Environmental surveillance, radiation monitoring and security programs isolate the facility from the public. Though this alternative has the lowest initial cost, the ongoing expenses are significant.
2. *Encapsulation* – In-place encapsulation of a nuclear facility consists of removing or cleaning most interior plant structures. All the remaining radioactive components are sealed in concrete and all access is blocked via concrete or welded barriers. Ongoing costs include a surveillance system, but security or maintenance services are not required.
3. *Complete dismantling and removal* – This alternative requires that all radioactive materials be removed from the site and shipped to government-approved waste disposal sites. With the dismantling option, a utility also removes all structures to below the surface. The site is graded, landscaped and left unsupervised and non-radioactive – available for other productive uses. This option is the most expensive, but eliminates the ongoing security and maintenance service expenses.

As a practical matter, most utilities faced with decommissioning a nuclear power plant may choose a combination of these approaches, if relicensing or repowering are not sought.

OA-501 . 12-67 COMMONWEALTH OF PENNSYLVANIA

September 14, 1977

SUBJECT: Re: Nuclear Regulatory Commission's Licensing

TO: Michael P. Kerrigan, Assistant Counsel-Rates Division
Law Bureau

FROM: John A. Levin, Assistant Counsel-Rates Division
Law Bureau

Question Presented: Duquesne Light and other utilities are claiming for rate purposes that the proper measure for depreciation lives of nuclear reactors is the "estimated useful life" used by the Nuclear Regulatory Commission in determining the duration of a license issued in connection with its supervisory powers under the Atomic Energy Act of 1954 (P.L. 703, 68 Stat. 921, 42U.S.C. §2011) as amended by the Energy Reorganization Act of 1974 (P.L. 93-438; 88 Stat. 1233, 42 U.S.C. §5801, §5841 (f)).

The claim is necessarily advantageous to utilities, since the NRC'S "estimated useful life" may be shorter than engineering lives determined by this Commission. A shorter period of depreciation means a faster annual write off, and consequently a greater annual charge to expenses. By accelerating depreciation the utility may hope to avoid some of the effects of inflation. The sooner the original cost is recovered through depreciation expense, the less impact inflation will have upon depreciation charges in later years. Additionally the utility will have a greater amount of capital to work with under shorter depreciation lives, since annual charges will be greater. This will tend to improve its cash flow position during the years of depreciation. Since most utilities have current plans for future expansion of nuclear generating capacity, short depreciation lives that are desirable for the utilities' point of view.

The question here presented is whether there is anything under federal legislation or regulations which mandates use of the federal "estimated useful life" for regulatory purposes. It may be answered in the negative.

Discussion

The Atomic Energy Act of 1954 set national policy for the peaceful use of atomic energy. With memories of Hiroshima and Nagasaki still fresh, and the threat of Armageddon lurking in the future, the promotion of peaceful uses of nuclear fission seemed a way to turn the new-found ability to split the atom into a technology that did not menace mankind quite as much. See the Atomic Energy Act of 1954, Section 1, 42 U.S.C. §2011.

Accordingly, the Atomic Energy Act of 1954 was enacted to promote the peaceful uses of atomic energy through research, development and marketing of nuclear fission (and advanced nuclear techniques which were not immediately feasible: e.g. fusion) for medical, industrial and energy purposes. There was considerable debate in Congress as to who would be the purveyor of the new technology, private industry or government. Private industry was the winner. However, because of the hazardous nature of the heavy actinide metals used in fission and the potential for conversion to weapons, the Atomic Energy Commission was created to license, monitor and regulate peacetime use of nuclear energy. Atomic Energy Act of 1954 Section 1, 42 U.S.C. §2201, as amended. The Commission was not created to regulate the generation, sale or transmission of electric power, and thus did not preempt any of the power of the states to exercise authority in that area. The Atomic Energy Act of 1954, Section 1, (68 Stat. 960), as amended by P.L. 89-135, (79 Stat. 551), 42 U.S.C. §2018 states:

> "Nothing in this chapter shall be construed to affect the authority of any federal, state or local agency with respect to the generation, sale or transmission of electric power produced through the use of nuclear facilities licensed by the Commission: (provided, that this section shall not be deemed to confer upon any federal state or local agency any authority to regulate, control, or restrict any activities of the Commission)".

Material within the brackets was added by 1965 amendment in light of Maun vs. U.S. 347 F. 2d 970 (1965). In Maun, several communities sought to force the Atomic Energy Commission to comply with local requirements that high tension power lines be placed underground. The AEC was constructing a high tension line to an experimental facility and claimed governmental immunity from local interference. It sought to go ahead with construction until enjoined by the federal court on the basis of 42 U.S.C. §2018. The amendment cited above sought to prevent local interference with the AEC

above sought to prevent local interference with the AEC action. However, where AEC action is outside its assigned function of licensing, regulating or developing nuclear energy, the provisions of 42 U.S.C. §2018 would not shield it. New Hampshire v. AEC 406 F. 2d 170 (1969) held the AEC's refusal to consider the thermal effects of the Vermont Yankee Nuclear plant upon the Connecticut River was proper. The AEC, it was held, was confined to scrutiny of and protection against hazards from radiation. The states were left to consider and regulate nonradiological hazards in a manner not inconsistent with the federal policy. The exact scope of state power is an unresolved question as it pertains to direct state interference with nuclear development on the basis of nonradiogical hazards. Even as to radiogical hazards, it may be contended that the Tenth Amendment of the United States Constitution preserves to the state's a residuum of police power. Accord, Marshall v. Consumers Power 237 N. W. 2d 266, 65 Mich. App. 237 (1975). The instant question involves no such interference with the Nuclear Regulatory Commission's functions at all. Instead, a utility has advanced the proposition that a licensing period determined under a federal standard is res judicate upon the Pennsylvania Commission for rate making purposes. Such an assertion is without foundation in law or common sense and must be rejected.

The licensing period for nuclear facilities is statutorily derived from the Atomic Energy Act of 1954, 68 Stat. 936, 42 U.S.C. 2133 (c):

> "Each such license shall be issued for a specified period, as determined by the Commission, depending on the type of activity of the license but not exceeding 40 years, and may be renewed upon the the expiration of such period"

This revision was resisted somewhat by the utilities at Congressional hearings, where it was claimed that the 40 year term did not represent the actual life span of future reactors. E. H. Dixon, chairman of the Committee on Atomic Power of the Edison Electric Institute and president of Middle South Utilities Inc., testified in a 1954 hearing before the Joint Committee on Atomic Energy considering the Atomic Energy Act of 1954, and particularly the above cited provision:

> "Representative Holifield. I am talking about the legislative pattern, sir, which we could not reverse. If the AEC makes a contract with a private power company for a period of a license of 25 years in which they agree to buy the byproducts or in which they agreed to do the necessary laboratory work

on special materials, which they furnish, either selling them or leasing them to the licensee, do you think that injustice to the power companies that the AEC could abrogate that contract?

Mr. Dixon. Oh, no, sir; I may have missed the point of your question. I certainly think that that is unthinkable that it would be abrogated. My only thought was that after 10 years of that period we would find a better way for the issuance of the next 10 licenses. I think it is a revolting thought that a company would start on a big expensive program and be pulled up short halfway down the line.

Representative Holifield. It would set the pattern as far as those contracts were concerned.

Mr. Dixon. I think those contracts would be set.

Representative Holifield. In this rapidly changing technology if those reactors were found to be obsolete at the end of a 10-year period, the private companies would be stuck with it and it would be up to the companies to of course stand the loss which would result because of its obsolescence would it not?

Mr. Dixon. In my experience in this business, obsolescence does not work exactly that way. It is different.

Representative Holifield. But you are in an established business, you are using established machinery and a established method of producing BTUs; this is a new industry which is not yet been set in its ways, you might say.

Mr. Dixon. I do not think it is as new as all that. This is a fuel and we have had great experience in burning coal, oil, gas, and lignite, and this would represent a fraction of our business.

The boiler plant is normally about a third of your power plant installation cost. Now let us take your example of ten companies and ten contracts. Presumably these contracts will be relatively a minor part of their whole business. Technologies continue to advance with orthodox fuels in the power business. And we have newer methods today in our equipment. But what actually happens in a large power business is that you use your most

efficient machines, and as new technology comes along the new machines will replace the old ones for purposes of serving our baseload. But your old ones are extremely useful over their full life, perhaps not 24 hours a day, but they do have a place in our economic scale. There is seldom a point where there is a change overnight.

We have machines that are forty years old. The kilowatts they make are just as good as the kilowatts that the new machines make. They just cost more to produce and are very valuable for what we call peaking. So the obsolescence question does not frighten us very much. It would be divided among a number of companies and in those companies it would be a relatively minor part, initially, of their total of generating facilities.

Representative Holifield. Do you believe that the investors, then, could take care of an obsolescence of the magnitude that runs into $40 or $50 million in machines, which might be on a 20-year amortization schedule basis but would become obsolescence in five or ten years? Do you think that the investors would be able to absorb that all right in your different companies?

Mr. Dixon. No, sir, I don't think that it is something that should be borne entirely by the investors. You have touched on a number points I have made. I think that the period is too short, for one thing. If atomic power is to be competitive with standard orthodox fuels, the need for amortizing facilities over 20 or 25 years puts an undue price burden on that product. These reactions may work fifty years, we don't know.

Representative Holifield. I believe fifty years is a normal amortization period in the utility industry for certain types of machinery, is it not?

Mr. Dixon. Forty to 50 years, depending on the type of equipment. Some transmission lines seem to last forever. But forty years is the normal period for amortizing or depreciating a generating unit.

Representative Holifield. From a private investor's standpoint, you would propose stepping up the 25 year period to the normal amortization time period of 40 years?

Mr. Dixon. Either that or have a provision where, if you observe the provisions of your license, you

could count absolutely in a renewal of your license. Our financing is done on a longer term than twenty or twenty-five years.

Representative Holifield. I recognize the validity of that point. Certainly the renewal of the license should be based on the need of the community and the compliance of the company, rather than on the arbitrary whim of the Commission.

Mr. Dixon. That is my point sir."

Proposed Amendments to the Atomic Energy Act of 1946, Hearings on S. 3323 and H.R. 8862 before the Joint Subcommittee on Atomic Energy, 83rd Cong., 2nd Session (1954) (statement of E. M. Dixon).

That the section of the act restricting license periods was not intended to reflect depreciation economics was borne out in questioning of Lewis L. Strauss, chairman of the Atomic Energy Commission before the Joint Committee on Atomic Energy in the June, 1954 hearings:

"Representative Durham. Yes; but that forty year contract is renewable without you licensing them again.

Mr. Strauss. No; it is not renewable at the option of the licensee. It is renewable by agreement but not at the option of the private company.

Representative Durham. But you are bound by agreement to renew it; are you not?

Mr. Strauss. No sir.

Chairman Cole. The Commission may renew it.

Representative Durham. May

Representative Hinshaw. Incidentally in that connection, Admiral Strauss, my attention has been called to the fact that a good many of these utility properties are financed on a 50-year basis rather than a 40-year basis and the question whether or not this number should be made fifty instead of forty. Now I do not know the details on this; perhaps the testimony that you have before you or your own knowledge will lead you to some understanding of that sort, but I think that the subject is worth consideration and recommendation by the Commission as whether or not we should change it from forty to fifty.

Mr. Strauss. Mr. Hinshaw, my long experience in the banking business gives me this much right to speak. The fashion in the maturity of bonds changes as often as the interest rate. Not for the same reasons. But occasionally it is possible to sell very much longer securities than others because investors prefer them. It really has a minimum amount of bearing in the actual depreciation of the property after 40 years are past whether it is 40 or 50.

Representative Hinshaw. Of course, most of these public utilities operate under some sort of franchise, either local or state, and if they are interstate, why, they operate under a certificate, I guess, from the Federal Power Commission. What is the general term time or renewal time required of these certificates of public convenience and necessity? Is it 40 years 25 years, or 50 years?

Mr. Strauss. I do not know the answer, but I would be glad to provide you that information, and I am anxious to find out for myself.

Representative Hinshaw. If one of these things is constructed, one of these reactors is constructed which would have the depreciated life of more or less, either one, than the life of the franchise, then presumbly the person who takes over the franchise under the terms of the franchise or in the case of renewal the company itself, would.
Whoever would take it over under some proceedings would be required to pay for it and operate the facilities; is that right?

Mr. Strauss. I would think so. I'm not sure that I followed you all the way in your reasoning.

Representative Hinshaw. I changed my place in the middle of it. What I mean is that there is a definite depreciation life for these reactors which would have to be setup on the books of the company?

Mr. Strauss. That is right.

Representative Hinshaw. Presumably it is very close to the actual life of the instrument itself?

Mr. Strauss. That is right, and that depreciates, it would show in the rate.

Representative Hinshaw. Anytime during the life

of the franchise the company could erect one of these reactors whether it would be five years from the end of the franchise or 25 years or 50. At any time they could erect it?

Mr. Strauss. I would think so unless there were provisions to the contrary.

Representative Hinshaw. I was just asking whether there usually are provisions under the franchise that would enable the company to sell the reactor and equipment to someone else in the event the franchise was not renewed.

Mr. Strauss. I never thought about it. Certainly they could not sell to a purchaser who was not also an approved licensee, potential licensee, of the Commission, but that is an avenue I would like to explore and also because Commissioner Campbell has had long experience in the investment business I would like to ask him whether I have testified to anything in the last minute or two pertaining to this subject to which he might take exception.

Mr. Campbell. I think it is generally acknowledged that the financing now of public utilities, 40 years, is a very reasonable time. I think you could take the New York Times, for example, this morning, and you will find the maturities are running anywhere from 30 to 40 years, sometimes less. I think 50 years is probably the rare occasion nowadays."

Proposed amendments the Atomic Energy Act of 1946, hearings, on S. 3323 H.R. 8862 before the Joint Committee on Atomic Energy, 83rd Cong., 2nd Session (1954) (statement of Lewis L. Strauss)

Clearly, in view of somewhat equivocal nature of the licensing provided for in the act, it is neither a rational basis, nor a reliable indicator of the proper depreciation life for a of the licensed nuclear facility. Note that by the terms of 42 U.S.C. §2133 (c) the license may be extended by the Commission.

The Nuclear Regulatory Commission has provided through regulation the effective period for licensing the operation of nuclear facilities. A question has been raised concerning the effect of the issuance of a "construction permit" on the effective period of a license issued under the Atomic Energy Act. Apparently the issuance of a construction permit will start the 40 year period as

Section 185 of the act, 68 Stat. 955, 43 USC §2235 states:

> "for all other purposes of this chapter, a construction permit is deemed to be a license."

The Nuclear Regulatory Commission's regulation on license periods reads:

> "Each license will be issued for a fixed period of time to be specified in the license but in no case to exceed forty years from the date of issuance. Where the operation of a facility is involved, the Commission will issue the license for the term requested by the applicant or for the estimated useful life of the facility, if the Commission determines that the estimated useful life is less than the term requested. Where construction of a facility is involved, the Commission may specify in the construction permit the period for which license will be issued, if approved pursuant §50.56. Licenses may be renewed by the Commission upon the expiration of the period." 10 CFR §50.51 (1977)

The regulations, in effectuating §103 (c) of the act, 42 USC 2133 (c) states the general rule that the applicant for a license may request a term of no longer than 40 years, as long as that term is less the useful life of the facility as determined by the Commission. The license may be renewed upon expiration.

Thus the Commission may determine that the useful life of a facility is shorter than the requested period and restrict the term of a license to that period. Reported decisions and regulations of the predecessor-AEC and present NRC shed no light upon standards used by the Commission in determining estimated useful life. Note that in its licensing application, the lead utility constructing Three Mile Island requested a license term of forty years, the maximum provided for by statute. Conversations with staff of the Nuclear Regulatory Commission indicate that the Commission generally grants licenses for the full forty year period and has not yet considered the issue of renewals.

However, leaving aside the criteria used by the NRC in "estimating useful lives", the statutory scheme militates against use of NRC lives for PUC purposes, however determined.

Section 185 of the act, 68 Stat. 955, 42 USC §2235 provides for the issuance of construction permits to a person applying for license to build and operate a nuclear utilization facility.

In recent years, with environmental requirements of the National Environmental Policy Act of 1969 and the Federal Clean Air and Water Act Amendments, as well as frequent challenges to the licensing process by opponents of nuclear power, construction periods may last as long as ten years in some instances. Since a construction permit is the same as a license for purposes of computing the effective terms, the operating period of a plant will certainly be shorter than the initial term of the license and in some case may be substantially less than the term of the license. Depreciation accounting is intended to charge off the consumption of an asset over its useful life. The useful life obviously begins after construction is complete. To use the NRC license term to measure such useful life is to depend upon chance, since there is no evidence that the NRC gives licenses for any period other than 40 years for power plants.

Since nuclear power generation is still a new technology, it may be asserted that new developments may render present technology obsolete within a shorter period of time than is now envisioned. Conversely, there is some indication that major components of a nuclear plant (ie; cooling towers, environmental safeguards, electrical systems) will remain useful for a very period. It has been suggested by Joseph Cento of the NRC Law Department that recent overhauls of nuclear plants seem to indicate that overhauls of reactor cores may be possible and economically feasible. If this proves to be the case, not only would the NRC license term be an inaccurate measure of proper depreciation lives it would be an incorrect one.

The utility's position is all the more striking in view of express language of both the act and the regulations that permit license renewals at the discretion of the NRC. See, Testimony of Louis L. Strauss before the Joint Committee on Atomic Energy, supra.

Conclusion: There is nothing in the Atomic Energy Act, as amended, which permits the NRC to prescribe depreciation lives for rate-making purposes in state proceedings. There is also no reason in law or in common sense which requires the Commission to accept, as a conclusive upon it, the determination by the NRC of a license term, particularly where such term is renewable, is not determined according to accepted principles of depreciation economics, and is based upon different policy considerations as evidenced by legislative history.

JL:e