

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE

ATOMIC SAFETY AND LICENSING BOARD



In the Matter of)
PENNSYLVANIA POWER & LIGHT COMPANY)
and)
ALLEGHENY ELECTRIC COOPERATIVE, INC.)
(Susquehanna Steam Electric Station,)
Units 1 and 2))

Docket Nos. 50-387
50-388

AFFIDAVIT OF WILLIAM F. HECHT
IN SUPPORT OF APPLICANTS' ANSWER
TO NRC STAFF'S MOTION FOR
SUMMARY DISPOSITION OF CONTENTION 4



County of Lehigh)
: SS
Commonwealth of Pennsylvania)

William F. Hecht, being duly sworn according to law,
deposes and says as follows:

1. I am Manager-System Planning for Pennsylvania Power & Light Company ("PP&L") and give this Affidavit in support of Applicants' Answer to NRC Staff's Motion for Summary Disposition of Contention 4. A summary of my professional qualifications and experience is included in Exhibit "A" to this Affidavit, a document entitled "Applicants' Testimony of William F. Hecht on Contention 4a and 4b", dated September 15, 1981.

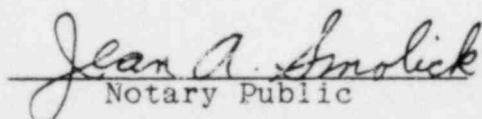
2. I have reviewed the Affidavit of Sidney E. Feld, dated September 1, 1981, and the Statement of Material Facts As To

DS03
5
1/1

Which There Is No Genuine Issue to Be Heard, both of which were attached to the NRC Staff Motion for Summary Disposition of Contention 4, dated September 2, 1981. Both Mr. Feld's Affidavit and the Statement of Material Facts establish that the operation of the Susquehanna units will result in substantial economic savings based upon the differential fuel costs. My analysis, set forth in Exhibit "A" hereto, presents a detailed system cost analysis of the effects of operating the Susquehanna units as compared with the effects of abandoning them. My analysis shows that the NRC Staff's analysis very conservatively underestimates the likely benefits of operating the Susquehanna units, even though PP&L's reserve margins in the 1980's will be greater than that required to maintain minimum system reliability.

William F. Hecht

Sworn to and subscribed
before me this 22nd day
of September, 1981.


Notary Public

JEAN A. SMOLICK, Notary Public
Allentown, Lehigh County, Pa.
My Commission Expires May 14, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

| | | |
|--------------------------------------|---|--------------------|
| In the Matter of |) | |
| |) | |
| PENNSYLVANIA POWER & LIGHT COMPANY |) | |
| |) | |
| and |) | Docket Nos. 50-387 |
| |) | 50-388 |
| ALLEGHENY ELECTRIC COOPERATIVE, INC. |) | |
| |) | |
| (Susquehanna Steam Electric Station, |) | |
| Units 1 and 2) |) | |

APPLICANTS' TESTIMONY OF
WILLIAM F. HECHT
ON CONTENTION 4a AND 4b

September 15, 1981

D JPE
8109230536

EXHIBIT "A" To
AFFIDAVIT OF WILLIAM F. HECHT

DIRECT TESTIMONY
OF WILLIAM F. HECHT

Q. Will you please state your full name, business address, educational and professional background, and employment background.

A. William F. Hecht, Two North Ninth Street, Allentown, Pennsylvania. I am employed by Pennsylvania Power and Light Company (PP&L) as Manager - System Planning. In this position I am responsible for the planning of PP&L's electric supply system. My responsibilities include performing economic analysis of total and marginal system costs for generating capacity additions. I am also responsible for analysis required to support licensing, rate making and other regulatory matters associated with the economic and reliability benefits of the Susquehanna Steam Electric Station to PP&L and the Pennsylvania-New Jersey-Maryland Interconnection. I also oversee analytical work concerning bulk power contracts between PP&L and other utilities and the power system analysis of effects of load management applications on the power system.

I graduated from Lehigh University in 1964, with a Bachelor of Science Degree in Electrical Engineering. I received a Master of Science Degree in Electrical Engineering from Lehigh University in 1970. From 1973 through 1975, I was an Adjunct Professor in the

Electrical Engineering Department at Lehigh University. I am a Registered Professional Engineer in the Commonwealth of Pennsylvania.

I was employed by PP&L in 1964 as an Engineer in the System Planning Department. I progressed to Project Engineer and later to Senior Project Engineer in the System Planning Department. I became Executive Director of the Corporate Energy Planning Council in August 1976, and was appointed Manager - System Planning in May, 1978.

Q. Mr. Hecht, would you please present your testimony.

INTRODUCTION

I am here to testify on Contention 4, parts a & b, which read as follow:

"The Susquehanna facility (or, at least, Unit 2 thereof) is not needed; and, as a result, the cost-benefit balance is tilted against authorization of operating licenses (or, at least, a license for Unit 2), for the following reasons:

"a. Information supplied in the Applicants' ER shows that, in the very low growth rate scenario the entire output of both units will be available for sale outside the service area of the Applicants as the units come on line (ER, Table 1.1-15).

"b. The electric capacity of the lead Applicant in 1977 was 40% greater than customer demands from existing facilities. Latest projections of energy use and requirements during the next 30 years for the Applicants' service area, the period equal to the projected plant's 'useful life,' show that the Applicants can meet the needs of their customers through existing facilities and sources."

I will first give brief responses to these contentions. The balance of my testimony will explain in detail the need for energy and capacity from the Susquehanna Steam Electric Station (Susquehanna) as related to these contentions.

The statement in Contention 4a, that "the entire output of both units will be available for sale outside the service area" is not accurate. Susquehanna will have the lowest operating costs (other than hydroelectric) of any generating facility on the PP&L system. Electric energy generated by Susquehanna will displace energy generated by other plants using more costly fuels such as oil and coal, and will be retained for PP&L's own customers. The more costly PP&L generation that is then available will displace other even more costly generation on the Pennsylvania-New Jersey-Maryland Interconnection (PJM) to which PP&L belongs.

As to contention 4b, PP&L agrees that with Susquehanna, its generating reserves for several years will be higher than it is obligated to have in

order to meet minimum system reliability standards. Reserve margin is, however, only one of many criteria that should be considered in analyzing the appropriateness of new capacity. Factors such as diversity of fuel sources, conservation of oil, and overall economics are also basic to such an analysis. To conclude a unit is or is not needed based solely on one criterion, such as system reliability, without regard to the other factors, is incorrect. Operation of Susquehanna is desirable because it provides significant operating cost savings and fuel diversity benefits, it conserves substantial quantities of oil, and it provides a supplemental margin of service reliability for unexpected contingencies.

I will now address contention 4a in detail.

In order to fully understand how Susquehanna fits into PP&L's energy picture, it is first necessary to understand how PP&L relates to the PJM Interconnection of which PP&L is a member.

The PJM Interconnection operates on a "one company" philosophy with free-flowing transmission ties among all member companies. Under the "one company" concept, the most economic generation available among all members is operated first regardless of the individual company's customers' demand (load). Each company retains for its system its own lowest cost generation, but makes available for sale other, more costly generation which it does not need at that time, and which may be lower in cost than other

companies have at their disposal. As a result, an individual member company's generation usually will not match that company's load, although absent any sales or purchases outside PJM, the sum of the member companies' generation will, of course, match the sum of the member companies' loads. If a company cannot generate energy at a cost less than that available on the Interconnection, it will then purchase energy and capacity it requires from the Interconnection.

When Susquehanna is placed in service, PP&L will credit the energy generated by these units to its customers. As a result, PP&L will have less need for energy generated by other more expensive PP&L units (coal and oil) to satisfy its customer load. In addition the available energy from these other PP&L units can be used to replace other, still more costly generation on PJM. Both the buyer(s) (other PJM companies) and PP&L benefit in this case since the savings that result are shared equally between the buyer(s) and PP&L. PP&L's share of these savings directly benefits its customers because such savings are not retained by the company but are passed directly to them.

Therefore it is my conclusion, based on the testimony presented above, that Susquehanna's output will be credited to PP&L for its customers and that PP&L customers will benefit because of the displacement of other, more costly generation, which otherwise would have been used to supply the load requirements.

I will now address contention 4b in detail.

There are many criteria that must be factored into an evaluation of the benefits of new capacity. The reserve margin is but one of these criteria. Another major criterion is economics. Fuel diversity and reduction of oil dependency are other important concerns. To judge whether capacity is needed based solely on any one criterion is not prudent planning.

Since contention 4b focuses on the issue of reserves, I will first address this concern. Then I will discuss the other criteria involved in the analysis.

Reserves

On a utility system, the reserve margin is that capacity in excess of the peak load. Reserves are necessary because at the time the peak load occurs on the system, some generating units may be under repair or otherwise unable to produce the amount of electricity needed to meet the customers' demands. Also, the actual peak could be in excess of that predicted or at a different time than predicted, and it is necessary to plan for such a possibility.

With Susquehanna, PP&L's reserve margin in the 1980's will be greater than that required to maintain minimum system reliability. As part of its PJM

responsibilities, PP&L must maintain a reserve margin of about 10% over its winter peak. By the late 1990's, as PJM tends towards winter peaking (based on PJM forecasts), this requirement is projected to increase to nearly 20%. PP&L's reserve requirement has been lower than other utilities within PJM because of the fact that PP&L's peak load is in the winter, whereas PJM's overall peak is in the summer. Also, PP&L has been given credit for its good unit performance record, which is better than the average for PJM.

Addressing contention 4b specifically, Chart 1 (attached) shows PP&L's projected capacity through 1992 if Susquehanna's capacity were not available. Also shown are PP&L's projected loads and its PJM reserve margin obligations.

As described in the testimony of Mr. McNair on Load Forecasting, PP&L forecasts a compound annual peak load growth rate of approximately 2½% (1977-1995). With this 2½% load growth, PP&L would require additional major capacity additions by the mid-1980's if Susquehanna were not allowed to operate. With construction lead times of 10-12 years for new base load generation, PP&L would not be able to meet its reserve margin obligation to PJM in the mid-1980's unless relatively high operating cost units, such as oil- or gas-fired combustion turbines, were added. Certainly the 30 year figure cited in contention 4b is not correct under this case.

To illustrate how PP&L's required reserve margin is affected by a 1 percentile variation in the forecast, these requirements are shown on the same chart. A 1 percentile per year increase above PP&L's forecast would result in a much faster reduction in the reserve margin requiring capacity additions before the mid-1980's. A 1 percentile decrease would result in a situation where additional capacity would be needed by about 1990.

Susquehanna's impact on PP&L's reserve margin can readily be seen by comparing chart #1 to chart #2. Chart #2 is identical to #1, except that Susquehanna's capacity is added. As can be seen, PP&L's reserve margin situation will benefit substantially by placing Susquehanna in service.

Fuel Diversity

The discussion of reserve generating capacity has centered around the issue of reliability, and it is for reliability purposes that reserve margin requirements are generally determined. Reliability can also be enhanced by diversifying the methods and fuel sources that a utility uses to generate electricity. This is another criterion used to evaluate capacity additions.

Every fuel source is subject to natural or man-made disruptions. For example, a utility relying solely on coal is extremely vulnerable to a coal miners' strike. A utility relying mostly on oil is vulnerable to embargoes or other supply problems. Therefore a diverse mix of fuel sources is desirable to reduce the risk of over-reliance on any one fuel.

PP&L's mix of generating capacity by fuel sources is currently about 63% coal, 33% oil, and 4% hydro. The addition of Susquehanna will result in a mix of about 49% coal, 26% oil, 22% nuclear, and 3% hydro. Thus, with Susquehanna in service, the PP&L system will be made more reliable due to the increased fuel diversity these nuclear units provide.

Economics

The benefits of power from Susquehanna can be further established through its economics. Because this analysis is somewhat complex, I would first like to give a general overview of the economic impact of Susquehanna, then go into detailed analysis.

Susquehanna Costs and Savings

Utilities, as any other business, must recover through revenues those costs associated with providing service. These revenue requirements include operation and maintenance expenses, taxes, recovery of the cost of property investment through depreciation, and a fair rate of return to investors for money provided to finance construction of facilities. Under the "cost of service principle", a utility is permitted to recover the total revenue requirements of providing electric service.

Certain revenue requirements are expected to increase when the Susquehanna units are placed in service. These fall into two general categories:

- o Capital-related costs - depreciation, return on investment and taxes

- o Operating & maintenance costs - wages, material, contract engineering & labor etc., to operate and maintain the units

These increased costs are expected to be partially offset by lower fuel costs and the benefits of increased sales of energy to other members of PJM. The fuel cost for electricity used by PP&L's customers will be less with Susquehanna. Also, the company will be able to sell more energy from its coal and oil-fired stations to other utilities in PJM, with the savings from the sales directly benefitting PP&L's customers, as described in my contention 4a response.

Capital-Related Costs

Essentially, capital-related costs are the revenues required to: (1) recover the cost of the plant through depreciation; (2) compensate investors for the use of the money used to finance the construction of the plant--called return on investment; and (3) pay income and other taxes.

In this analysis, the capital-related costs of Susquehanna are based on the following assumptions:

- o Book depreciation - straight line method
 - 30-year, 5 month life for Unit 1
 - 29-year, 5 month life for Unit 2
- o Tax depreciation - 10-year tax life using the accelerated
 - cost recovery system established in the
 - Economic Recovery Act of 1981, and nor-
 - malization of income taxes
- o Rate of Return - 12.25 percent cost of capital
- o Taxes - tax laws and rates in effect after
 - enactment of the Economic Recovery Act of
 - 1981
 - investment tax credit amortized over the
 - book life of the plant

Depreciation represents recovery of the original cost of the plant investment over the life of the facility. For a fixed dollar investment, the annual book depreciation cost remains the same each year.

For this analysis, 30 year-5 month and 29 year-5 month economic lives for unit 1 and unit 2, respectively, are used. Current NRC regulations provide that the operating licenses will expire 40 years after issuance of the construction permits. In Susquehanna's case this would mean (assuming no extension) that both units would shut down in 2013, even though their useful lives may be longer. This conservative assumption will result in a lower value for Susquehanna than if the plant were assumed to operate longer and the fixed costs spread over more years.

Rate of return represents the amount required to compensate investors for the money they provide to finance construction of the units.

Taxes include federal income taxes and state taxes on income, capital stock, utility realty and gross receipts.

The following analyses combine all the above capital-related costs into one rate which is applied to each unit's in-service cost. This is called the carrying charge.

Depreciation expense is a fairly constant amount after both units are in-service. For a fixed dollar investment in utility plant, the return on investment declines over the life of the facility as the initial investment is reduced through depreciation. After Susquehanna is placed in service, the return component is projected to decrease as more of the plant is depreciated. Taxes generally track the return on the equity investment in the plant. Deductions of accumulated deferred Income Tax from plant investments also influence the capital related costs. After both units are in service, the total annual capital related cost is expected to decrease to the end of the units' economic lives.

After Susquehanna is placed in service, PP&L expects there will have to be certain capital additions or modifications necessary to improve station performance or meet future regulatory requirements. When placed in service, these additions will be recovered through a carrying charge, similar to that used for the original plant.

Operating and Maintenance Costs (exclusive of fuel)

The operating and maintenance costs include such items as:

- o Wages and employee benefits
- o Material and supplies
- o Work performed by outside contractors
- o Rentals
- o Insurance

Also included in this category of expense are:

- o Carrying charges on nuclear fuel in the reactor
- o Plant decommissioning costs

Excluded from this category is direct nuclear fuel expense, which is included in the fuel and interchange costs.

Operation and maintenance of Susquehanna will require personnel, replacement parts, maintenance work by specialized outside contractors, rental of equipment, and insurance. These costs are expected to increase because of inflation during the life of the units. An annual cost escalation rate of 10% in the early years, declining to 9% in the later years, is reflected in the operating & maintenance costs used in this analysis.

Certain costs unique to nuclear generating units are also included in the general category of operating and maintenance costs. When nuclear fuel is placed in the reactor, it remains there for a period of time. The cost of the portion of nuclear fuel not yet used to generate electricity is treated the same as utility plant for ratemaking purposes. A return on invested capital used to finance the investment in nuclear fuel in the reactor and related taxes is included in the operating costs component.

At the end of the useful life of Susquehanna, certain expenditures will be required in order to decommission the plant.

Separate testimony on contention 9 indicates an expected plant decommissioning cost of about \$191 million (1980\$). Of that amount, about \$153 million is required for decommissioning the radioactive portion of the plant. This analysis assumes that PP&L will establish a sinking fund during the plant's life to accumulate this latter cost. This way, these costs will be recovered from the customers who benefit from the power generated by the plant.

Assuming that costs will rise at about 8% a year (in the long term) and a conservative 7% long term yield on its sinking fund, the average total annual charge for decommissioning costs is expected to be about \$18.5 million.

Fuel Costs and Interchange Revenues

Part of the benefit to PP&L's customers from the low-cost nuclear generation of the Susquehanna units can be described as follows.

If Susquehanna were not placed in service, PP&L would be forced to rely on increasing amounts of very expensive oil-fired generation, and increasing amounts of energy purchased from other PJM utilities, most of which is oil-fired. With Susquehanna, PP&L will have low cost nuclear generation available instead of oil. The savings of nuclear fuel over oil are expected to be substantial.

In addition to the fuel cost savings described above, PP&L's customers are expected to benefit from the sale of energy by PP&L to other utilities as described in my response to contention 4a. Generation from PP&L's coal and oil-fired stations is expected to replace more expensive oil-fired generation of other companies within the PJM. Under the PJM split savings pricing arrangement, 50 percent of the total fuel-cost savings from these sales directly benefit PP&L's customers. The remaining 50 percent savings will benefit the purchasing companies' customers.

Thus, the total savings in energy costs to PP&L's customers because of Susquehanna include the direct fuel savings from using the lowest cost nuclear and fossil units to serve PP&L's load and 50 percent of the savings from additional interchange power sales.

Net Revenues Required From Customers

The additional net revenues required from PP&L's customers due to operation of Susquehanna can be determined by combining the increased capital-related and operating costs with the changes in PP&L's total fuel and interchange charges. These projections of costs which PP&L would expect to recover are referred to as the "base case" in the remainder of my testimony.

These revenue requirements can then be compared to those required if Susquehanna were abandoned as a result of not receiving operating licenses, to determine the net value of Susquehanna to PP&L's customers. A discussion of the abandonment scenario follows in the detailed analysis.

Detailed Analysis

The material that follows provides a detailed economic analysis that shows Susquehanna is economically beneficial over a broad range of assumptions.

As stated before, PP&L forecasts a compound annual peak load growth rate of approximately 2½% per year through 1995. In order to have a high probability of "capturing" the eventual actual peak load, PP&L brackets its load forecast with a ±1% band. Because the load growth assumption is important in the economic evaluation, PP&L performed the following analyses based on an annual load growth rate of 3½% per year, or what is

referred to hereafter as the high load growth, and a growth rate of $1\frac{1}{2}\%$ per year, or the low load growth. These 1 percentile variations from the company's $2\frac{1}{2}\%$ load growth forecast were examined to show the effect of load growth variations on the economic impact of Susquehanna.

In these analyses, I will be referring to the value of Susquehanna. Value is defined as the net economic benefit to PP&L customers that results from placing the plant in service versus abandonment of the facility. This value is determined in the first analysis presented by quantifying the total cost of service that would result in the base case and if Susquehanna were abandoned. Subsequent analyses will show the changes to the net value resulting from varying other assumptions of that analysis.

To determine the value of Susquehanna, it is necessary to examine the difference in PP&L's revenue requirements with the plant in-service, and if Susquehanna were abandoned.

It is assumed that if Susquehanna's operating license were denied, all work would cease on both units by November 1982. It is further assumed that unit 1 would be 100% complete. PP&L's total investment in the plant at that point, less salvageable equipment, plus cancellation costs, would amount to about \$2.6 billion. Added onto this would be PP&L's investment in nuclear fuel, which is about \$300 million after salvage and cancellation costs. To conservatively understate the abandonment costs, I have assumed, for this analysis, that the recovery of the abandonment cost of Susquehanna from customers would occur over a 30 year period.

I will now quantitatively discuss each of the revenue requirement components in the base case and how each is expected to be affected by abandonment of Susquehanna.

Carrying Charge

Table 1 shows the carrying charges for the Susquehanna plant in the first ten years of its operation. Line 1 represents the base case with assumptions stated on pages 10 & 11. PP&L's cost for unit 1 is expected to be \$1.735 billion, and for unit 2 is \$1.415 billion.

Again to conservatively understate the cost of abandonment of Susquehanna in these analyses, it has been assumed that the abandonment loss would eliminate all Federal and state income tax liabilities as soon as possible. As a result the abandonment case carrying charge is lower than the carrying charge for the base case during the first eight years, as shown on line 2. After the eighth year the abandonment case carrying charge increases above the base case because at that time all tax benefits arising from the abandonment loss would have been flowed through to customers.

Line 3 shows the difference between the two revenue requirements for the first ten years of Susquehanna's operation. In this period, PP&L's revenue requirement would decrease by about \$450 million if the plant were abandoned, with a January 1982 present worth of about \$250 million.

Operation & Maintenance

Table 2 lists the various operation and maintenance (O&M) costs, as I described earlier.

The direct O&M costs (line 1) do not uniformly increase in time. This is because the O&M costs are sensitive to whether one or both units are scheduled for maintenance during that year.

The decommissioning cost (line 2) reflects those annual payments into a sinking fund necessary to accumulate the funds described in PP&L's response to contention 9.

The indirect fuel cost (line 3), is the carrying charge on the fuel in the core.

In the 10 year period 1983-1992, Susquehanna's total operation and maintenance costs are projected to be about \$1.6 billion, with a January 1982 present worth of about \$680 million. If Susquehanna were abandoned, these expenses would not be incurred.

Capital Additions

Table 3 shows the projected annual value of capital additions to Susquehanna, as well as the associated carrying charge. On average, about

\$25 million of additional capital equipment and modifications for each unit are expected to be placed in service during each of the first nine years of operation, after unit 1 is placed in-service. PP&L's share of these costs is about \$45 million. A carrying charge rate was applied to the capital cost of these additions just as it was to the plant itself to derive revenue requirements. This carrying charge results in approximately \$8 million a year increase in revenue requirements for every year in this period in which there are expected to be capital additions.

If the plant were abandoned, none of these additions would be installed, thus these revenues would not be required.

Fuel Costs and Interchange Revenues

Tables 4 and 5 show changes in PP&L's fuel costs and interchange revenues that would result from abandonment under the low load growth and high load growth scenarios, respectively.

Fuel Costs - represent the total cost of fuel consumed by all of PP&L's units to meet both PP&L's customer needs and PJM sales. Also reflected are the firm contract arrangements between PP&L and other parties.

Net Interchange Revenues - represent the net amount received by PP&L as a result of sales and purchases between PP&L and PJM. These receipts include both revenues to cover the cost of the fuel consumed and the split-savings margin, as described earlier in my testimony.

If Susquehanna were abandoned, PP&L's fuel costs would increase primarily due to increased reliance on high cost oil. Also, PP&L's revenues from sales of energy to PJM would be substantially less. The combined effect of these two changes in costs would be to significantly increase PP&L's total operating costs.

Table 4 shows that under the low load growth conditions, without Susquehanna, PP&L's revenue requirement for fuel and interchange costs would increase by about \$9.2 billion in the ten year period. Table 5 shows that under the high load growth condition, PP&L's revenue requirement for fuel and interchange costs would increase by about \$11.6 billion. The January 1982 present worths of these figures are \$3.8 billion and \$4.7 billion, respectively.

Totals

Tables 6 and 7 summarize the total revenue requirements under the base case and abandonment case, for both low and high load growth scenarios. Line 11 shows the annual value of Susquehanna to PP&L. If Susquehanna were abandoned, PP&L's revenue requirements between 1983 and 1992 would be \$6.8 billion (low growth) to \$9.2 billion (high growth) higher than if the plant were to be placed in-service as scheduled. The January 1982 present worths of these values range from \$2.7 billion to \$3.6 billion.

These values assume that both units would be abandoned. If unit 1 should be licensed, but not unit 2 - and unit 2 thus abandoned - the value of Susquehanna would be approximately half of the figures cited above.

Beyond 10 Years

PP&L can, with reasonable certainty, project the total revenue requirements in the first 10 years of operation of Susquehanna. Beyond this initial 10 year period, these projections become less certain. However, definite trends can be seen that will qualitatively show how Susquehanna will remain economically attractive throughout its life.

The carrying charge on the initial plant can be reasonably projected over the life of the plant. In the period beyond 1992, the total annual carrying charge for the base case will continue to decrease, as more of the plant is depreciated. As discussed previously, after the eighth year the abandonment case carrying charge is greater than that of the base case. This relationship continues through the remainder of the 30 year period.

Capital additions will probably continue throughout the life of the plant in response to regulatory requirements. As noted earlier, these costs are expected to add only a small amount to overall capital related charges.

Operation and maintenance costs, exclusive of fuel, will continue to escalate, at an assumed rate averaging 9% per year.

Nuclear fuel costs are projected to escalate no faster than fossil fuels, thus the operating savings will tend to increase at that same rate.

In summary, beyond 1992 PP&L projects the carrying cost on the initial plant will decline, operating and maintenance costs and capital additions will increase, and operating savings will continue to increase. Overall it is expected that PP&L's customers will experience even greater benefits in the future than anticipated for the first 10 years of operation.

PJM Benefits

Other PJM utilities also benefit economically from Susquehanna's operation. As I described in my response to contention 4a, the energy from Susquehanna will result in the displacement of high cost oil-fired energy elsewhere on the PJM system by relatively inexpensive PP&L coal- and oil-fired energy. These savings result in reduced fuel and interchange costs for these other PJM companies.

For the period 1983 to 1992, other PJM utilities will save between \$2 billion and \$3 billion, depending on PP&L's load growth.

Effects of a Delay

If Susquehanna is not placed in service as scheduled, PP&L's revenue requirements will increase above those required for the base case and thus the value of the plant will decrease.

Tables 8 through 13 show the differences in the appropriate cost components between the base case and one year delay case. As can be seen on tables 8, 9, and 10, over the 10-year period the carrying charge and O&M costs increase. Table 11 shows a decrease in the capital additions. Tables 12 and 13, for the low and high growth rates respectively, show that a delay will reduce fuel and interchange benefits to PP&L's customers.

Tables 14 and 15 summarize the changes in PP&L's revenue requirement due to a year's delay. As can be seen on line 11 of these tables, about \$800 million additional revenue in the ten year period 1983-92 would be required for either high or low load growth rates. However, Susquehanna's value is still about \$6.0 billion to \$8.4 billion in the ten year period, with a present worth of about \$2.4 billion to \$3.4 billion.

Effects of Capacity Factor Variations

The economic benefits of Susquehanna can be shown to exist even under a wide range of capacity factors. For this analysis, PP&L used both a pessimistic lifetime capacity factor of 50%, and an optimistic factor of 80%. The only cost that would be significantly affected by this change in capacity factor would be fuel costs and interchange revenues. Carrying charges, capital additions, and operating and maintenance (excluding fuel) would remain approximately the same.

Tables 16 and 17 show the effect of a 50% lifetime capacity factor upon the fuel costs and interchange revenues, assuming low and high load growth rates, respectively. This pessimistic forecast of Susquehanna's capacity factor results in a decrease in the plant's value. In the first 10 years of operation, the value decreases between about \$1.9 billion and \$2.4 billion. However, the net value of the plant in this same time period remains substantial, between \$4.9 billion and \$6.8 billion, or present worth values of \$2.0 billion and \$2.7 billion.

If we were to assume an optimistic 80% lifetime capacity factor, the value of Susquehanna increases between \$1.3 billion and \$1.6 billion, with the net value at between \$8.1 billion and \$10.9 billion. The present worth of these values are \$3.3 billion and \$4.4 billion. Tables 18 and 19 show this in detail.

Summary

Table 20 summarizes the value of Susquehanna to PP&L, and the effects of changes of certain key assumptions, as described above. Under all of these changes and conditions examined, which assumed both pessimistic and optimistic conditions and assumptions, Susquehanna is a net economic benefit to PP&L and its customers. Most importantly, this benefit begins to accrue from the date of the plant's commercial operation.

Effects On Oil Usage

As I described earlier, Susquehanna will reduce both PP&L and PJM use of fuel oil, both residual oil used in steam boilers, and the higher priced distillate oil used in combustion turbines and diesel engines. Table 21 summarizes how much oil is displaced during the first 10 years of Susquehanna's operation. This oil will directly or indirectly reduce this nation's requirements for imports of oil from overseas, barrel for barrel, by about 120 million barrels of oil. Susquehanna will, therefore, serve to meet important national energy goals.

Conclusions

I have shown that Susquehanna meets the criteria for determining whether additional capacity is justified. From the study described in my testimony, I conclude that:

1. Susquehanna will be economically beneficial to PP&L and its rate-payers
2. Susquehanna will provide an extra measure of reliability to the PP&L and PJM system
3. Susquehanna will displace expensive and politically insecure imported oil.

Q. Mr. Hecht, does this conclude your testimony?

A. Yes, it does.

PW:cvc

22/H

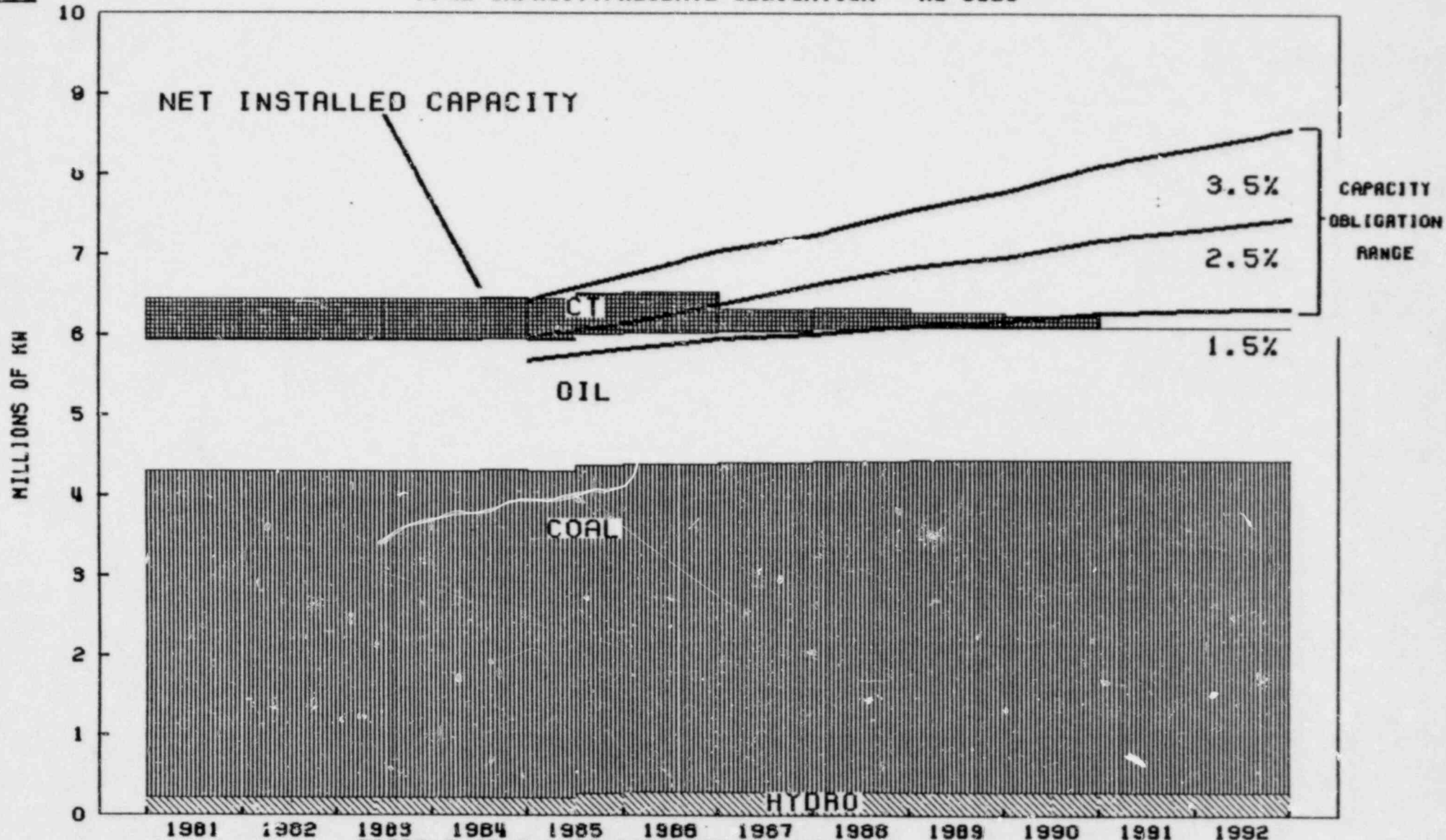
CHARTS AND TABLES IN
SUPPORT OF
DIRECT TESTIMONY OF WILLIAM F. HECHT
Contentions 4a, 4b

RESERVE CHARTS

CHART I

PP&L

PP&L CAPACITY/RESERVE OBLIGATION - NO 9929

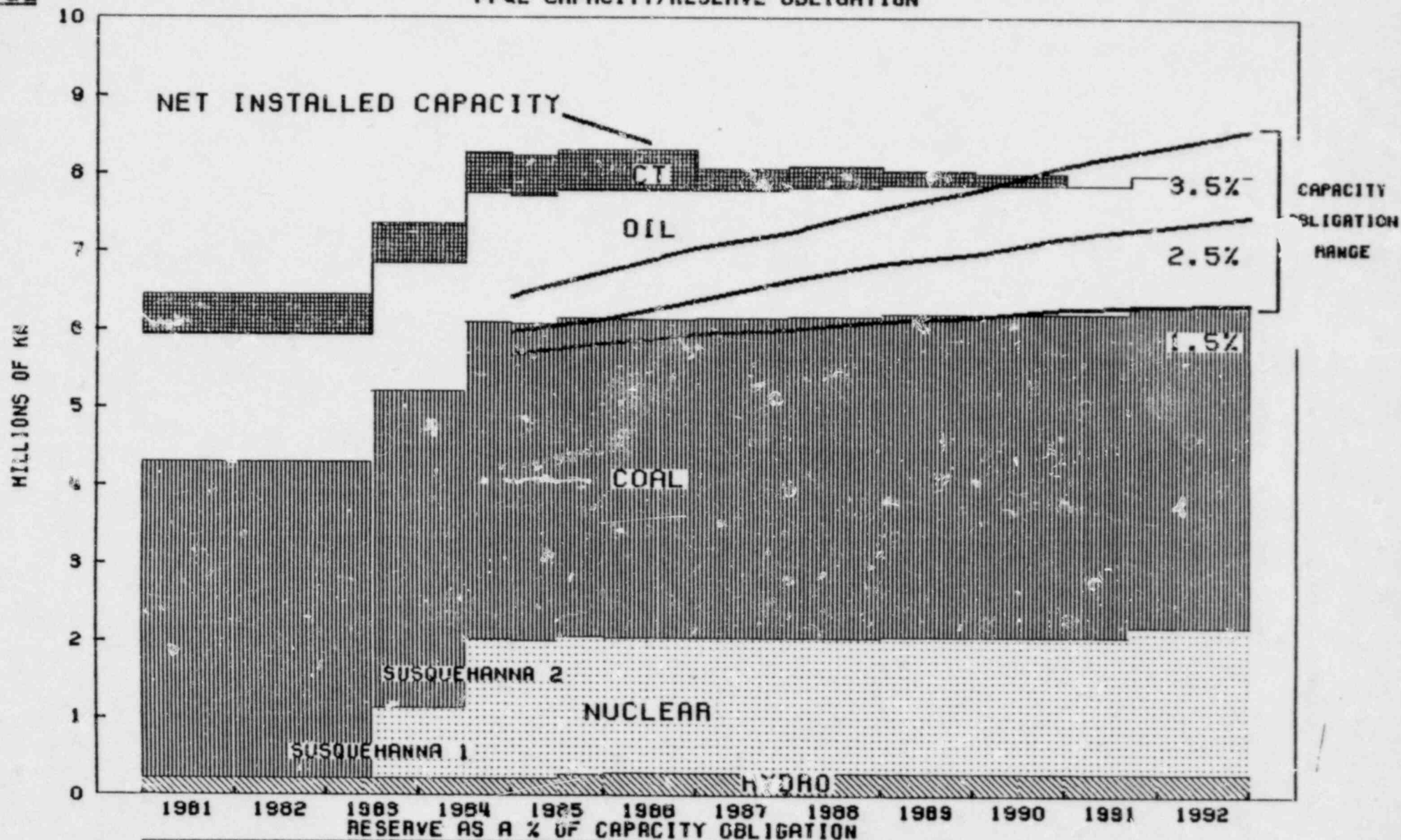


| RESERVE AS A % OF CAPACITY OBLIGATION | | | | | | | | | | | | |
|---------------------------------------|------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| CAPACITY | 3.5% | 14 | 19 | 18 | 0 | - 4 | - 8 | -13 | -16 | -20 | -23 | -27 |
| OBLIGATION | 2.5% | 14 | 19 | 18 | 7 | 6 | 2 | - 5 | - 8 | -10 | -13 | -17 |
| | 1.5% | 14 | 19 | 18 | 12 | 11 | 0 | 5 | 2 | 0 | 1 | 0 |

CHART II

PP&L

PP&L CAPACITY/RESERVE OBLIGATION



| | | | | | | | | | | | | | |
|------------|------|----|----|----|----|----|----|----|----|----|-----|-----|-----|
| CAPACITY | 3.5% | 14 | 19 | 34 | 28 | 23 | 18 | 11 | 7 | 3 | - 1 | - 4 | - 7 |
| OBLIGATION | 2.5% | 14 | 19 | 34 | 38 | 35 | 30 | 21 | 18 | 15 | 11 | 9 | 7 |
| RANGE | 1.5% | 11 | 10 | 21 | 15 | 12 | 20 | 24 | 20 | 20 | 20 | 20 | 20 |

BASE CASE

VS.

ABANDONMENT CASE

TABLE 1
SUSQUEHANNA ECONOMIC TESTIMONY
PP&L CARRYING CHARGES FOR OWNERSHIP SHARE
BASE VS. ABANDONMENT CASES
(MILLIONS OF CURRENT DOLLARS)

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----|-------------------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------------|--------------|
| 1. | BASE CASE | \$ 211 | 579 | 713 | 670 | 631 | 594 | 558 | 523 | 500 | 487 | 5466 |
| 2. | ABANDONMENT CASE | <u>489</u> | <u>476</u> | <u>463</u> | <u>450</u> | <u>471</u> | <u>457</u> | <u>443</u> | <u>456</u> | <u>660</u> | <u>639</u> | <u>5004</u> |
| 3. | DIFFERENCE | 278 | -103 | -250 | -220 | -160 | -137 | -115 | - 67 | 160 | 152 | - 462 |
| 4. | PRESENT WORTH (1982 \$) | <u>221</u> | <u>- 73</u> | <u>-157</u> | <u>-123</u> | <u>- 80</u> | <u>- 61</u> | <u>- 46</u> | <u>- 24</u> | <u>50</u> | <u>43</u> | <u>- 250</u> |

TABLE 2
SUSQUEHANNA ECONOMIC TESTIMONY
PP&L OPERATION & MAINTENANCE COSTS FOR OWNERSHIP SHARE
BASE CASE
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----------------------------|-----------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|------------|
| 1. OPERATION & MAINTENANCE | \$ 26 | 71 | 110 | 139 | 149 | 142 | 155 | 192 | 188 | 214 | 1386 |
| 2. DECOMMISSIONING | 5 | 13 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 19 | 163 |
| 3. INDIRECT FUEL | <u>1</u> | <u>- 2</u> | <u>- 7</u> | <u>- 5</u> | <u>- 3</u> | <u>2</u> | <u>4</u> | <u>6</u> | <u>9</u> | <u>10</u> | <u>17</u> |
| 4. TOTAL | 32 | 82 | 121 | 152 | 164 | 162 | 177 | 216 | 215 | 243 | 1566 |
| 5. PRESENT WORTH (1982 \$) | <u>25</u> | <u>58</u> | <u>76</u> | <u>85</u> | <u>82</u> | <u>72</u> | <u>70</u> | <u>76</u> | <u>68</u> | <u>68</u> | <u>681</u> |

TABLE 3
SUSQUEHANNA ECONOMIC TESTIMONY
PP&L CAPITAL ADDITIONS FOR OWNERSHIP SHARE
BASE CASE
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|------|------|------|------|------|------|------|------|------|-------|
| 1. IN SERVICE COST OF ADDITIONS | \$ 0 * | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | |
| 2. CUMULATIVE COST OF ADDITIONS | 0 | 45 | 90 | 135 | 180 | 225 | 270 | 315 | 360 | 405 | |
| 3. CARRYING CHARGE | 0 | 0 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 360 |
| 4. PRESENT WORTH (1982 \$) | 0 | 6 | 10 | 13 | 16 | 18 | 19 | 20 | 20 | 20 | 142 |

* THERE WILL BE NO CAPITAL ADDITIONS ACCOUNTED FOR SEPARATELY UNTIL AFTER UNIT 1 IS IN SERVICE.

TABLE 4
SUSQUEHANNA ECONOMIC TESTIMONY
FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. ABANDONMENT CASES
LOW LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| BASE CASE: | | | | | | | | | | | |
| 1. PP&L TOTAL FUEL COST | \$ 892 | 1066 | 1149 | 1297 | 1329 | 1581 | 1853 | 2057 | 2291 | 2600 | 16115 |
| 2. PP&L NET INTERCHANGE REVENUE | -619 | -980 | -1048 | -1262 | -1300 | -1531 | -1886 | -2043 | -2065 | -2553 | -15287 |
| 3. TOTAL | 273 | 86 | 101 | 35 | 29 | 50 | - 33 | 14 | 226 | 47 | 828 |
| ABANDONMENT CASE: | | | | | | | | | | | |
| 4. PP&L TOTAL FUEL COST | 851 | 1000 | 1142 | 1293 | 1377 | 1629 | 1895 | 2131 | 2315 | 2649 | 16280 |
| 5. PP&L NET INTERCHANGE REVENUE | -430 | -503 | -559 | -641 | -543 | -669 | -727 | -754 | -658 | -773 | -6254 |
| 6. TOTAL | 421 | 497 | 583 | 652 | 834 | 960 | 1168 | 1377 | 1657 | 1876 | 10026 |
| DIFFERENCES: | | | | | | | | | | | |
| 7. PP&L TOTAL FUEL COST | - 41 | - 66 | - 7 | - 4 | 48 | 48 | 42 | 74 | 24 | 49 | 165 |
| 8. PP&L NET INTERCHANGE REVENUE | 189 | 478 | 489 | 622 | 757 | 862 | 1159 | 1289 | 1407 | 1781 | 9033 |
| 9. TOTAL | 148 | 412 | 482 | 618 | 805 | 910 | 1201 | 1363 | 1431 | 1830 | 9198 |
| 10. PRESENT WORTH (1982 \$) | 117 | 291 | 304 | 347 | 402 | 405 | 476 | 482 | 451 | 513 | 3789 |

TABLE 5
SUSQUEHANNA ECONOMIC TESTIMONY
FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. ABANDONMENT CASES
HIGH LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|------|------|------|------|------|-------|------|------|------|-------|
| BASE CASE: | | | | | | | | | | | |
| 1. PP&L TOTAL FUEL COST | \$ 924 | 1098 | 1207 | 1343 | 1404 | 1673 | 1971 | 2224 | 2463 | 2785 | 17092 |
| 2. PP&L NET INTERCHANGE REVENUE | -478 | -802 | -787 | -886 | -866 | -879 | -1002 | -977 | -592 | -779 | -8048 |
| 3. TOTAL | 446 | 296 | 420 | 457 | 538 | 794 | 969 | 1247 | 1871 | 2006 | 9044 |
| ABANDONMENT CASE: | | | | | | | | | | | |
| 4. PP&L TOTAL FUEL COST | 879 | 1028 | 1187 | 1342 | 1440 | 1709 | 2003 | 2232 | 2468 | 2801 | 17089 |
| 5. PP&L NET INTERCHANGE REVENUE | -265 | -258 | -188 | -129 | 101 | 211 | 420 | 797 | 1262 | 1651 | 3602 |
| 6. TOTAL | 614 | 770 | 999 | 1213 | 1541 | 1920 | 2423 | 3029 | 3730 | 4452 | 20691 |
| DIFFERENCES: | | | | | | | | | | | |
| 7. PP&L TOTAL FUEL COST | - 45 | - 70 | - 20 | - 1 | 36 | 36 | 22 | 8 | 5 | 16 | - 3 |
| 8. PP&L NET INTERCHANGE REVENUE | 213 | 543 | 599 | 757 | 966 | 1090 | 1422 | 1773 | 1853 | 2429 | 11650 |
| 9. TOTAL | 168 | 473 | 579 | 756 | 1002 | 1126 | 1454 | 1781 | 1858 | 2445 | 11647 |
| 10. PRESENT WORTH (1982 \$) | 133 | 334 | 365 | 424 | 501 | 501 | 577 | 629 | 585 | 686 | 4736 |

TABLE 6
SUSQUEHANNA ECONOMIC TESTIMONY
SUMMARY OF TOTAL NET REVENUE REQUIREMENTS
ESTABLISHING VALUE OF SUSQUEHANNA
BASE VS. ABANDONMENT CASES
LOW LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|-------------------|--------------------------------------|--------|------|------|------|------|------|------|------|------|------|-------|
| BASE CASE: | | | | | | | | | | | | |
| 1. | CARRYING CHARGES (TABLE 1) | \$ 211 | 579 | 713 | 670 | 631 | 594 | 558 | 523 | 500 | 487 | 5466 |
| 2. | OPERATION & MAINTENANCE (TABLE 2) | 32 | 82 | 121 | 152 | 164 | 162 | 177 | 216 | 215 | 243 | 1566 |
| 3. | CAPITAL ADDITIONS (TABLE 3) | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 360 |
| 4. | NET FUEL & INTERCHANGE (TABLE 4) | 273 | 86 | 101 | 35 | 29 | 50 | - 33 | 14 | 226 | 47 | 828 |
| 5. | TOTAL | 516 | 755 | 951 | 881 | 856 | 846 | 750 | 809 | 1005 | 849 | 8220 |
| ABANDONMENT CASE: | | | | | | | | | | | | |
| 6. | CARRYING CHARGES (TABLE 1) | 489 | 476 | 463 | 450 | 471 | 457 | 443 | 456 | 660 | 639 | 5004 |
| 7. | OPERATION & MAINTENANCE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8. | CAPITAL ADDITIONS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9. | NET FUEL & INTERCHANGE (TABLE 4) | 421 | 497 | 583 | 652 | 834 | 960 | 1168 | 1377 | 1657 | 1876 | 10026 |
| 10. | TOTAL | 910 | 973 | 1046 | 1102 | 1305 | 1417 | 1611 | 1833 | 2317 | 2515 | 15030 |
| 11. | VALUE OF SUSQUEHANNA (DIFFERENCE) | 394 | 218 | 95 | 221 | 449 | 571 | 861 | 1024 | 1312 | 1666 | 6810 |
| 12. | PRESENT WORTH (1982 \$) | 313 | 154 | 60 | 124 | 224 | 254 | 342 | 362 | 413 | 467 | 2713 |

TABLE 7
SUSQUEHANNA ECONOMIC TESTIMONY
SUMMARY OF TOTAL NET REVENUE REQUIREMENTS
ESTABLISHING VALUE OF SUSQUEHANNA
BASE VS. ABANDONMENT CASES
HIGH LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|-------------------|--------------------------------------|--------|------|------|------|------|------|------|------|------|------|-------|
| BASE CASE: | | | | | | | | | | | | |
| 1. | CARRYING CHARGES (TABLE 1) | \$ 211 | 579 | 713 | 670 | 631 | 594 | 558 | 523 | 500 | 487 | 5467 |
| 2. | OPERATION & MAINTENANCE (TABLE 2) | 32 | 82 | 121 | 152 | 164 | 162 | 177 | 216 | 215 | 243 | 1566 |
| 3. | CAPITAL ADDITIONS (TABLE 3) | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 360 |
| 4. | NET FUEL & INTERCHANGE (TABLE 5) | 446 | 296 | 420 | 457 | 538 | 794 | 969 | 1247 | 1871 | 2006 | 9044 |
| 5. | TOTAL | 689 | 965 | 1270 | 1303 | 1365 | 1590 | 1752 | 2042 | 2650 | 2800 | 16436 |
| ABANDONMENT CASE: | | | | | | | | | | | | |
| 6. | CARRYING CHARGES (TABLE 1) | 489 | 476 | 463 | 450 | 471 | 457 | 443 | 456 | 660 | 639 | 5004 |
| 7. | OPERATION & MAINTENANCE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8. | CAPITAL ADDITIONS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9. | NET FUEL & INTERCHANGE (TABLE 5) | 614 | 770 | 999 | 1213 | 1541 | 1920 | 2423 | 3029 | 3730 | 4452 | 20691 |
| 10. | TOTAL | 1103 | 1246 | 1462 | 1663 | 2012 | 2377 | 2866 | 3485 | 4390 | 5091 | 25695 |
| 11. | VALUE OF SUSQUEHANNA (DIFFERENCE) | 414 | 281 | 192 | 360 | 647 | 787 | 1114 | 1463 | 1740 | 2283 | 9259 |
| 12. | PRESENT WORTH (1982 \$) | 329 | 199 | 121 | 201 | 323 | 350 | 442 | 510 | 548 | 640 | 3663 |

BASE CASE

VS.

YEAR DELAY CASE

TABLE 8
SUSQUEHANNA ECONOMIC TESTIMONY
PP&L CARRYING CHARGES FOR OWNERSHIP SHARE
BASE VS. ONE YEAR DELAY CASES
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----------------------------|--------|------|------|------|------|------|------|------|------|------|-------|
| 1. BASE CASE | \$ 211 | 579 | 713 | 670 | 631 | 594 | 558 | 523 | 500 | 487 | 5466 |
| 2. ONE YEAR DELAY CASE * | 0 | 238 | 651 | 802 | 754 | 711 | 670 | 628 | 602 | 589 | 5645 |
| 3. DIFFERENCE | -211 | -341 | - 6. | 132 | 123 | 117 | 112 | 105 | 102 | 102 | 179 |
| 4. PRESENT WORTH (1982 \$) | -167 | -241 | - 39 | 74 | 61 | 52 | 44 | 37 | 32 | 29 | - 118 |

* 90% OF UNIT COSTS: UNIT 1 \$ 1957
UNIT 2 1589
TOTAL \$ 3555

TABLE 9
SUSQUEHANNA ECONOMIC TESTIMONY
PP&L OPERATION & MAINTENANCE COSTS FOR OWNERSHIP SHARE
ONE YEAR DELAY CASE
(BILLIONS OF CURRENT DOLLARS)

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----|-------------------------|----------|-----------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|------------|
| 1. | OPERATION & MAINTENANCE | \$ 0 | 32 | 88 | 134 | 169 | 181 | 172 | 188 | 239 | 238 | 1441 |
| 2. | DECOMMISSIONING | 0 | 5 | 14 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 153 |
| 3. | INDIRECT FUEL | <u>0</u> | <u>1</u> | <u>- 1</u> | <u>- 7</u> | <u>- 5</u> | <u>2</u> | <u>2</u> | <u>3</u> | <u>6</u> | <u>2</u> | <u>3</u> |
| 4. | TOTAL | 0 | 38 | 101 | 146 | 183 | 202 | 193 | 210 | 264 | 259 | 1597 |
| 5. | PRESENT WORTH (1982 \$) | <u>0</u> | <u>27</u> | <u>64</u> | <u>82</u> | <u>91</u> | <u>90</u> | <u>77</u> | <u>74</u> | <u>83</u> | <u>73</u> | <u>660</u> |

TABLE 10
 SUSQUEHANNA ECONOMIC TESTIMONY
 PP&L OPERATION & MAINTENANCE COSTS FOR OWNERSHIP SHARE
 BASE VS. ONE YEAR DELAY CASES
 (MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----------------------------|-------------|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|-------------|
| 1. BASE CASE | \$ 32 | 82 | 121 | 152 | 164 | 162 | 177 | 216 | 215 | 243 | 1566 |
| 2. ONE YEAR DELAY CASE | <u>0</u> | <u>38</u> | <u>101</u> | <u>146</u> | <u>183</u> | <u>202</u> | <u>193</u> | <u>210</u> | <u>264</u> | <u>259</u> | <u>1597</u> |
| 3. DIFFERENCE | - 32 | - 44 | - 20 | - 6 | 19 | 40 | 16 | - 6 | 49 | 16 | 31 |
| 4. PRESENT WORTH (1982 \$) | <u>- 25</u> | <u>- 31</u> | <u>- 13</u> | <u>- 3</u> | <u>9</u> | <u>18</u> | <u>6</u> | <u>- 2</u> | <u>15</u> | <u>4</u> | <u>- 21</u> |

TABLE 11
 SUSQUEHANNA ECONOMIC TESTIMONY
 PP&L CAPITAL ADDITIONS FOR OWNERSHIP SHARE
 CARRYING CHARGES
 BASE VS. ONE YEAR DELAY CASES
 (MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----------------------------|----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|
| 1. BASE CASE | \$ 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 360 |
| 2. ONE YEAR DELAY CASE | <u>0</u> | <u>0</u> | <u>8</u> | <u>16</u> | <u>24</u> | <u>32</u> | <u>40</u> | <u>48</u> | <u>56</u> | <u>64</u> | <u>288</u> |
| 3. DIFFERENCE | 0 | - 8 | - 8 | - 8 | - 8 | - 8 | - 3 | - 8 | - 8 | - 8 | - 72 |
| 4. PRESENT WORTH (1982 \$) | <u>0</u> | <u>- 6</u> | <u>- 5</u> | <u>- 4</u> | <u>- 4</u> | <u>- 4</u> | <u>- 3</u> | <u>- 3</u> | <u>- 3</u> | <u>- 2</u> | <u>- 34</u> |

TABLE 12
SUSQUEHANNA ECONOMIC TESTIMONY
NET FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. ONE YEAR DELAY CASES
LOW LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----------------------|------------------------------|--------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| BASE CASE: | | | | | | | | | | | | |
| 1. | PP&L TOTAL FUEL COST | \$ 892 | 1066 | 1149 | 1297 | 1329 | 1581 | 1853 | 2057 | 2291 | 2600 | 16115 |
| 2. | PP&L NET INTERCHANGE REVENUE | -619 | -980 | -1048 | -1262 | -1300 | -1531 | -1886 | -2043 | -2065 | -2553 | -15287 |
| 3. | TOTAL | 273 | 86 | 101 | 35 | 29 | 50 | - 33 | 14 | 226 | 47 | 828 |
| ONE YEAR DELAY CASE: | | | | | | | | | | | | |
| 4. | PP&L TOTAL FUEL COST | 851 | 1057 | 1222 | 1296 | 1357 | 1589 | 1855 | 2055 | 2263 | 2619 | 16164 |
| 5. | PP&L NET INTERCHANGE REVENUE | -430 | -728 | -1122 | -1176 | -1218 | -1643 | -1768 | -2042 | -2200 | -2402 | -14731 |
| 6. | TOTAL | 421 | 329 | 100 | 118 | 139 | - 54 | 87 | 13 | 63 | 217 | 1433 |
| DIFFERENCES: | | | | | | | | | | | | |
| 7. | PP&L TOTAL FUEL COST | - 41 | - 9 | 73 | - 1 | 28 | 8 | 2 | - 2 | - 28 | 19 | 49 |
| 8. | PP&L NET INTERCHANGE REVENUE | 189 | 253 | - 75 | 85 | 81 | -112 | 119 | 1 | -136 | 152 | 556 |
| 9. | TOTAL | 148 | 244 | - 2 | 84 | 109 | -104 | 121 | - 1 | -164 | 171 | 605 |
| 10. | PRESENT WORTH (1982 \$) | 117 | 173 | - 1 | 47 | 54 | - 46 | 48 | 0 | - 52 | 48 | 388 |

TABLE 13
SUSQUEHANNA ECONOMIC TESTIMONY
NET FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. ONE YEAR DELAY CASES
HIGH LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|------|------|------|------|-------|-------|------|------|------|-------|
| BASE CASE: | | | | | | | | | | | |
| 1. PP&L TOTAL FUEL COST | \$ 724 | 1098 | 1207 | 1343 | 1404 | 1673 | 1971 | 2224 | 2463 | 2785 | 17092 |
| 2. PP&L NET INTERCHANGE REVENUE | -478 | -802 | -787 | -886 | -866 | -879 | -1002 | -977 | -592 | -779 | -8048 |
| 3. TOTAL | 446 | 296 | 420 | 457 | 538 | 794 | 969 | 1247 | 1871 | 2006 | 9044 |
| ONE YEAR DELAY CASE: | | | | | | | | | | | |
| 4. PP&L TOTAL FUEL COST | 879 | 1090 | 1281 | 1360 | 1422 | 1677 | 1973 | 2223 | 2440 | 2789 | 17134 |
| 5. PP&L NET INTERCHANGE REVENUE | -264 | -527 | -859 | -809 | -721 | -1024 | -875 | -977 | -797 | -572 | -7425 |
| 6. TOTAL | 615 | 563 | 422 | 551 | 701 | 653 | 1098 | 1246 | 1643 | 2217 | 9709 |
| DIFFERENCES: | | | | | | | | | | | |
| 7. PP&L TOTAL FUEL COST | - 45 | - 8 | 74 | 17 | 18 | 4 | 2 | - 1 | - 23 | 4 | 42 |
| 8. PP&L NET INTERCHANGE REVENUE | 214 | 275 | - 72 | 77 | 145 | -145 | 127 | 0 | -205 | 207 | 623 |
| 9. TOTAL | 169 | 267 | 2 | 94 | 163 | -141 | 129 | - 1 | -228 | 211 | 665 |
| 10. PRESENT WORTH (1982 \$) | 134 | 189 | 1 | 53 | 81 | - 63 | 51 | 0 | - 72 | 59 | 434 |

TABLE 14
SUSQUEHANNA ECONOMIC TESTIMONY
SUMMARY OF TOTAL NET REVENUE REQUIREMENTS
ESTABLISHING EFFECT OF ONE YEAR DELAY OF SUSQUEHANNA
BASE VS. ONE YEAR DELAY CASES
LOW LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----------------------|---------------------------------------|-------------|-------------|-------------|-------------|-------------|------------|------------|------------|-------------|-------------|-------------|
| BASE CASE: | | | | | | | | | | | | |
| 1. | CARRYING CHARGES (TABLE 8) | \$ 211 | 579 | 713 | 670 | 631 | 594 | 550 | 523 | 500 | 487 | 5466 |
| 2. | OPERATION & MAINTENANCE (TABLE 10) | 32 | 82 | 121 | 152 | 164 | 162 | 177 | 216 | 215 | 243 | 1566 |
| 3. | CAPITAL ADDITIONS (TABLE 11) | 0 | 0 | 16 | 24 | 32 | 40 | 50 | 56 | 64 | 72 | 360 |
| 4. | NET FUEL & INTERCHANGE (TABLE 12) | 273 | 86 | 101 | 35 | 29 | 50 | - 33 | 14 | 226 | 47 | 828 |
| 5. | TOTAL | <u>516</u> | <u>755</u> | <u>951</u> | <u>881</u> | <u>856</u> | <u>846</u> | <u>750</u> | <u>809</u> | <u>1005</u> | <u>849</u> | <u>8220</u> |
| ONE YEAR DELAY CASE: | | | | | | | | | | | | |
| 6. | CARRYING CHARGES | 0 | 238 | 651 | 802 | 754 | 711 | 670 | 628 | 602 | 589 | 5645 |
| 7. | OPERATION & MAINTENANCE | 0 | 38 | 101 | 146 | 183 | 202 | 193 | 210 | 264 | 259 | 1597 |
| 4. | CAPITAL ADDITIONS | 0 | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 288 |
| 9. | NET FUEL & INTERCHANGE (TABLE 12) | 421 | 329 | 100 | 118 | 139 | - 54 | 87 | 13 | 63 | 217 | 1433 |
| 10. | TOTAL | <u>421</u> | <u>605</u> | <u>860</u> | <u>1082</u> | <u>1100</u> | <u>891</u> | <u>900</u> | <u>899</u> | <u>985</u> | <u>1129</u> | <u>8963</u> |
| 11. | DIFFERENCE | - 95 | -150 | - 91 | 201 | 244 | 45 | 240 | 90 | - 20 | 280 | 743 |
| 12. | PRESENT WORTH (1982 \$) | <u>- 75</u> | <u>-106</u> | <u>- 57</u> | <u>113</u> | <u>122</u> | <u>20</u> | <u>95</u> | <u>32</u> | <u>- 6</u> | <u>79</u> | <u>217</u> |

TABLE 15
SUSQUEHANNA ECONOMIC TESTIMONY
SUMMARY OF TOTAL NET REVENUE REQUIREMENTS
ESTABLISHING EFFECT OF ONE YEAR DELAY OF SUSQUEHANNA
BASE VS. ONE YEAR DELAY CASES
HIGH LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|----------------------|---------------------------------------|--------|------|------|------|------|------|------|------|------|------|-------|
| BASE CASE: | | | | | | | | | | | | |
| 1. | CARRYING CHARGES (TABLE 8) | \$ 211 | 579 | 713 | 676 | 631 | 594 | 558 | 523 | 500 | 487 | 5466 |
| 2. | OPERATION & MAINTENANCE (TABLE 10) | 32 | 82 | 121 | 152 | 164 | 162 | 177 | 216 | 215 | 243 | 1566 |
| 3. | CAPITAL ADDITIONS (TABLE 11) | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 360 |
| 4. | NET FUEL & INTERCHANGE (TABLE 13) | 446 | 296 | 420 | 457 | 538 | 794 | 969 | 1247 | 1871 | 2006 | 9044 |
| 5. | TOTAL | 689 | 965 | 1270 | 1303 | 1365 | 1590 | 1752 | 2042 | 2650 | 2808 | 16436 |
| ONE YEAR DELAY CASE: | | | | | | | | | | | | |
| 6. | CARRYING CHARGES | 0 | 238 | 651 | 802 | 754 | 711 | 670 | 628 | 602 | 589 | 5645 |
| 7. | OPERATION & MAINTENANCE | 0 | 38 | 101 | 146 | 181 | 202 | 195 | 210 | 264 | 259 | 1597 |
| 8. | CAPITAL ADDITIONS | 0 | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 288 |
| 9. | NET FUEL & INTERCHANGE (TABLE 13) | 615 | 563 | 422 | 551 | 701 | 653 | 1098 | 1246 | 1643 | 2217 | 9709 |
| 10. | TOTAL | 615 | 839 | 1182 | 1515 | 1662 | 1598 | 2001 | 2132 | 2565 | 3129 | 17239 |
| 11. | DIFFERENCE | - 74 | -126 | - 88 | 212 | 297 | 8 | 249 | 90 | - 85 | 321 | 803 |
| 12. | PRESENT WORTH (1982 \$) | - 59 | - 89 | - 55 | 118 | 148 | 4 | 99 | 32 | - 26 | 90 | 262 |

CAPACITY FACTOR

SENSITIVITY CASE

TABLE 16
SUSQUEHANNA ECONOMIC TESTIMONY
NET FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. LOW CAPACITY FACTOR CASES
LOW LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| BASE CASE: | | | | | | | | | | | |
| 1. PP&L TOTAL FUEL COST | \$ 892 | 1066 | 1149 | 1297 | 1329 | 1581 | 1853 | 2057 | 2291 | 2600 | 16115 |
| 2. PP&L NET INTERCHANGE REVENUE | -619 | -980 | -1048 | -1262 | -1300 | -1531 | -1886 | -2043 | -2065 | -2553 | -15287 |
| 3. TOTAL | 273 | 86 | 101 | 35 | 29 | 50 | - 33 | 14 | 226 | 47 | 828 |
| LOW CAPACITY FACTOR CASE: | | | | | | | | | | | |
| 4. PP&L TOTAL FUEL COST | 894 | 1065 | 1150 | 1298 | 1339 | 1590 | 1868 | 2072 | 2299 | 2608 | 16183 |
| 5. PP&L NET INTERCHANGE REVENUE | -596 | -882 | -1066 | -1215 | -1112 | -1391 | -1576 | -1698 | -1842 | -2096 | -13476 |
| 6. TOTAL | 298 | 183 | 84 | 83 | 227 | 199 | 292 | 374 | 457 | 510 | 2707 |
| DIFFERENCES: | | | | | | | | | | | |
| 7. PP&L TOTAL FUEL COST | 2 | - 1 | 1 | 1 | 10 | 9 | 15 | 15 | 8 | 8 | 68 |
| 8. PP&L NET INTERCHANGE REVENUE | 23 | 99 | - 18 | 47 | 188 | 139 | 310 | 344 | 223 | 456 | 1811 |
| 9. TOTAL | 25 | 98 | - 17 | 48 | 198 | 148 | 325 | 359 | 231 | 464 | 1879 |
| 10. PRESENT WORTH (1982 \$) | 20 | 69 | - 11 | 27 | 99 | 66 | 129 | 127 | 73 | 130 | 729 |

TABLE 17
SUSQUEHANNA ECONOMIC TESTIMONY
NET FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. LOW CAPACITY FACTOR CASES
HIGH LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|------|------|------|------|------|-------|------|-------|------|-------|
| BASE CASE: | | | | | | | | | | | |
| 1. PP&L TOTAL FUEL COST | \$ 924 | 1098 | 1207 | 1343 | 1404 | 1673 | 1971 | 2224 | 2463 | 2785 | 17092 |
| 2. PP&L NET INTERCHANGE REVENUE | -478 | -802 | -787 | -686 | -866 | -879 | -1002 | -977 | -1142 | -779 | -8048 |
| 3. TOTAL | 446 | 296 | 420 | 457 | 538 | 794 | 969 | 1247 | 1871 | 2006 | 9044 |
| LOW CAPACITY FACTOR CASE: | | | | | | | | | | | |
| 4. PP&L TOTAL FUEL COST | 924 | 1096 | 1208 | 1344 | 1413 | 1680 | 1979 | 2237 | 2455 | 2805 | 17140 |
| 5. PP&L NET INTERCHANGE REVENUE | -454 | -691 | -802 | -827 | -618 | -709 | -604 | -530 | -286 | -1 | -5702 |
| 6. TOTAL | 470 | 405 | 406 | 517 | 795 | 971 | 1375 | 1707 | 2169 | 2624 | 11438 |
| DIFFERENCES: | | | | | | | | | | | |
| 7. PP&L TOTAL FUEL COST | 0 | - 2 | 1 | 1 | 9 | 7 | 8 | 13 | - 8 | 20 | 49 |
| 8. PP&L NET INTERCHANGE REVENUE | 24 | 111 | - 15 | 59 | 248 | 170 | 398 | 447 | 306 | 598 | 2346 |
| 9. TOTAL | 24 | 109 | - 14 | 60 | 257 | 177 | 406 | 460 | 298 | 618 | 2394 |
| 10. PRESENT WORTH (1982 \$) | 19 | 77 | - 9 | 34 | 128 | 79 | 161 | 163 | 94 | 173 | 919 |

TABLE 18
SUSQUEHANNA ECONOMIC TESTIMONY
NET FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. HIGH CAPACITY FACTOR CASES
LOW LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| BASE CASE: | | | | | | | | | | | |
| 1. PP&L TOTAL FUEL COST | \$ 892 | 1066 | 1149 | 1297 | 1329 | 1581 | 1653 | 2057 | 2291 | 2600 | 16115 |
| 2. PP&L NET INTERCHANGE REVENUE | -619 | -990 | -1048 | -1262 | -1300 | -1531 | -1886 | -2043 | -2065 | -2553 | -15287 |
| 3. TOTAL | 273 | 86 | 101 | 35 | 29 | 50 | - 33 | 14 | 226 | 47 | 828 |
| HIGH CAPACITY FACTOR CASE: | | | | | | | | | | | |
| 4. PP&L TOTAL FUEL COST | 891 | 1067 | 1147 | 1291 | 1327 | 1575 | 1649 | 2053 | 2283 | 2595 | 16077 |
| 5. PP&L NET INTERCHANGE REVENUE | -643 | -1044 | -1215 | -1428 | -1368 | -1704 | -1983 | -2140 | -2335 | -2729 | -16589 |
| 6. TOTAL | 248 | 23 | - 68 | -137 | -41 | -129 | -134 | - 87 | - 52 | -134 | - 512 |
| DIFFERENCES: | | | | | | | | | | | |
| 7. PP&L TOTAL FUEL COST | - 1 | 1 | - 2 | - 6 | - 2 | - 6 | - 4 | - 4 | - 8 | - 5 | - 38 |
| 8. PP&L NET INTERCHANGE REVENUE | - 24 | - 63 | -167 | -166 | - 68 | -171 | - 97 | - 98 | -271 | -176 | -1302 |
| 9. TOTAL | - 25 | - 63 | -169 | -172 | - 70 | -179 | -101 | -102 | -279 | -181 | -1340 |
| 10. PRESENT WORTH (1982 \$) | - 20 | - 45 | -106 | - 97 | - 35 | - 80 | - 40 | - 36 | - 88 | - 51 | - 598 |

TABLE 19
SUSQUEHANNA ECONOMIC TESTIMONY
NET FUEL COSTS AND INTERCHANGE REVENUES - TEN YEAR ANALYSIS
BASE VS. HIGH CAPACITY FACTOR CASES
HIGH LOAD GROWTH
(MILLIONS OF CURRENT DOLLARS)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | TOTAL |
|---------------------------------|--------|------|------|-------|------|-------|-------|-------|------|-------|-------|
| BASE CASE: | | | | | | | | | | | |
| 1. PP&L TOTAL FUEL COST | \$ 924 | 1098 | 1207 | 1343 | 1404 | 1673 | 1971 | 2224 | 2463 | 2785 | 17092 |
| 2. PP&L NET INTERCHANGE REVENUE | -478 | -802 | -787 | -886 | -866 | -879 | -1002 | -977 | -592 | -779 | -8048 |
| 3. TOTAL | 446 | 296 | 420 | 457 | 538 | 794 | 969 | 1247 | 1871 | 2006 | 9044 |
| HIGH CAPACITY FACTOR CASE: | | | | | | | | | | | |
| 4. PP&L TOTAL FUEL COST | 923 | 1101 | 1207 | 1340 | 1400 | 1666 | 1967 | 2222 | 2452 | 2799 | 17076 |
| 5. PP&L NET INTERCHANGE REVENUE | -505 | -872 | -988 | -1074 | -947 | -1093 | -1134 | -1098 | -964 | -1005 | -9681 |
| 6. TOTAL | 418 | 229 | 219 | 266 | 453 | 573 | 833 | 1124 | 1488 | 1793 | 7396 |
| DIFFERENCES: | | | | | | | | | | | |
| 7. PP&L TOTAL FUEL COST | - 1 | 3 | 0 | - 3 | - 4 | - 7 | - 4 | - 2 | - 11 | 14 | - 15 |
| 8. PP&L NET INTERCHANGE REVENUE | - 26 | - 70 | -201 | -189 | - 81 | -214 | -132 | -121 | -372 | -228 | -1634 |
| 9. TOTAL | - 27 | - 67 | -201 | -192 | - 85 | -221 | -136 | -123 | -383 | -214 | -1649 |
| 10. PRESENT WORTH (1982 \$) | - 21 | - 47 | -127 | -108 | - 40 | - 98 | - 54 | - 43 | -121 | - 60 | - 722 |

SUMMARIES

TABLE 20
 SUSQUEHANNA ECONOMIC TESTIMONY
 TOTAL CUMULATIVE
 NET VALUE OF SUSQUEHANNA TO PP&L
 FOR THE TEN YEAR PERIOD
 1983 - 1992
 (MILLIONS OF CURRENT DOLLARS)

| | | <u>LOW LOAD GROWTH</u> | <u>HIGH LOAD GROWTH</u> |
|----|---------------------------|------------------------|-------------------------|
| 1. | BASE CASE | \$ 6810 | 9259 |
| 2. | ONE YEAR DELAY CASE | 6067 | 8456 |
| 3. | LOW CAPACITY FACTOR CASE | 4931 | 6865 |
| 4. | HIGH CAPACITY FACTOR CASE | 8150 | 10908 |

TABLE 21
 SUSQUEHANNA ECONOMIC TESTIMONY
 TOTAL CUMULATIVE
 DISPLACEMENT OF OIL BY SUSQUEHANNA
 FOR THE TEN YEAR PERIOD
 1983 - 1992
 (MILLIONS OF BARRELS)

| | | <u>#2 DISTILLATE OIL</u> | <u>#6 RESIDUAL OIL</u> | <u>TOTAL</u> |
|----|----------------------|--------------------------|------------------------|--------------|
| 1. | PP&L | \$ 2 | 18 | 20 |
| 2. | PJM (EXCLUDING PP&L) | 35 | 65 | 100 |
| 3. | TOTAL | 37 | 83 | 120 |

OIL DISPLACEMENT INSENSITIVE TO PP&L LOAD GROWTH.