Exhibit JC-500

Jersey Central Power & Light Company

Docket No. 804-285

TESTIMONY OF MARVIN RABER

POTENTIAL CONVERSION OF TMI-2 AND FORKED RIVER NUCLEAR FACILITIES TO COAL FIRED PLANTS

My name is Marvin Raber. I am employed by GPU Service Corporation (hereafter referred to as "Service Corp" or "GPUSC") located at 100 Interpace Parkway, Parsippany, New Jersey as Manager of Forecasting and Supply Planning.

In its rate order, in Docket #795-427 (Phase 2) dated April 1, 1980 the New Jersey Board of Public Utilities (hereafter referred to as the "BPU" or the "Board") requested that Jersey Central Power & Light Company (hereafter referred to as "Jersey Central" or the "Company") "in its forthcoming base rate application prepare a detailed submission on the rate impact of placing in service nuclear power facilities now under construction as compared to the impact of similar capacity coal fired facilities". This request was extended to cover not only the nuclear plant under construction at Forked River, but also the possible conversion of TMI-2 to coal firing.

My testimony today will address the following issues:

1. TMI-2 disposition options and the studies conducted by GPU leading to the conclusion that recovery as a nuclear unit is the best option.
2. Applicability of the TMI-2 conversion studies and results to the question of converting Forked River to coal firing.
3. Feasibility of constructing a coal plant at Forked River.
4. Comparative prospects for coal plants at other New Jersey sites.
5. Customer cost implications of replacing the Forked River Nuclear Plant with equivalent coal capacity in New Jersey.

Before addressing these issues, let me briefly discuss the time frame in which Jersey Central really needs the capacity represented by its share of TMI-2 and the Forked River Nuclear Plant. Exhibit JC-501, which is based on Jersey Central's May, 1980 Load and Capacity Forecast, illustrates Jersey Central's capacity situation through the 1980's and 1990's. This chart shows Jersey Central's total capacity obligation based on the GPU and PJM contract agreements and based on the latest available long term load forecast. This forecast embodies a continuation of existing load management and conservation programs. The potential impact of GPU's recently announced energy conservation and load management Master Plan on Jersey Central's total capacity obligation is also indicated on that chart. This exhibit also shows Jersey Central's projected installed capacity on a year by year basis, with the TMI units and all new additions shown discretely. This chart assumes that all capacity retirements are deferred until the early 1990's. The "firm purchase" indicated on the chart corresponds to construction of the underwater DC cable to Ontario Hydro and the purchase for a period of 7 years of 1000 MW of capacity and equivalent energy.

Assuming that retirements can indeed be deferred, and that the Ontario Hydro tie will be completed as planned, Jersey Central's need for additional capacity in the late 1980's will be determined by the availability of TMI-2 and by success in the Master Plan. Given the present uncertainties in load growth and in the return to service of TMI-2, it would be prudent to have additional capacity in the planning stages for service in the late 1980's. As we move into the early 1990's, the need for new capacity becomes more certain. Even if the arrangements with Ontario Hydro that are now under negotiation were completed, we cannot, at this point in time count on a continuation of the availability of energy from Ontario Hydro beyond 1991. New capacity, at least equivalent in magnitude to the Forked River Nuclear Plant, must be planned for that time frame.

From a Jersey Central customer's standpoint, it might be economically beneficial to complete the Forked River project as a nuclear plant. The Forked River Nuclear Plant would offer the following advantages relative to alternatives:

1. It would be permanent capacity, available to serve our customers for 30-40 years, rather than a temporary purchase such as the one now being arranged with Ontario Hydro.
2. It would be located in New Jersey, near the load to be served, and thereby avoid transmission system reliability concerns associated with importing energy from generating stations far from load centers.
3. Optimistically, the nuclear plant could be completed as early as 1986, sooner than any alternative base load generating facility.
4. If the Forked River Nuclear Plant could be completed by late 1986, the total cost of energy from this plant would be about the same as energy obtained from Ontario Hydro during the 1987-1991 period. Thereafter, it is expected that the total cost of energy would be lower than energy from Ontario

Hydro, which is expected to escalate in proportion to the escalation of the cost of coal, or from a coal plant built to replace Ontario Hydro energy.

5. Compared to coal plants completed on the same schedule as the Forked River Nuclear Plant in the late 1980's or early 1990's, the average cost of electricity for the first ten years of operation would be about 20% less for the Forked River Nuclear Plant, even with significant capital cost and operation and maintenance cost allowances for the nuclear plant to cover prospective regulatory changes, lessons learned from TMI, etc.

Because the present financial, regulatory, and political climate will make construction of a nuclear plant in the decade of the 1980's difficult, and because we have no absolute assurance that TMI-2 can be returned to service in the 1980's, the company has explored alternatives. Realistically, the only other option for new generation in the time frame of the 1980's and early 1990's would be coal. Consequently, the question of converting TMI-2 to a coal fired facility or replacing it with coal capacity constructed elsewhere, has been addressed in considerable detail. The question of substituting coal capacity for the Forked River Nuclear Plant has also been considered.

CONVERSION OF TMI-2

GPU has completed a thorough investigation into the feasibility of converting TMI-2 to fossil fuel. The investigation considered various design alternatives, three different fuels, regulatory or licensing feasibility, and an economic evaluation of cost to the customer. The conclusion was that the conversion of TMI-2 to fossil fuel is technically feasible but would have associated with it reliability risks, regulatory approval difficulties, and increased costs to the customer. As a result of our evaluations, we have made the following decisions:

1. To continue the cleanup of TMI-2 as expeditiously as possible within technical, regulatory and "good neighbor" constraints.
2. To make no commitments at this time to convert TMI-2, since our evaluations to date lead us to conclude that rehabilitation as a nuclear unit is by far the most preferable course, and that decommissioning coupled with development of new capacity elsewhere is also preferable to conversion. For the time being, we plan to keep open the option of new coal capacity at sites other than TMI by maintaining the Seward 7 coal plant project on a 1987 in-service schedule and by exploring the prospects of constructing the same kind of plant in New Jersey. Our

restore or replace TMI-2 until the fuel is removed, now targeted for 1983.

The results of the TMI-2 disposition options study that lead to these conclusions are described in some detail in Exhibit JC-502 Section II and in Exhibit JC-503 "Three Mile Island #2 Major Commitment Review."

In mid-1979, TMI-2 was in the early stages of a cleanup program. Although there were, and are, no known technical factors that preclude successful decontamination and eventual return to service as a nuclear unit, GPU recognized that there were many uncertainties concerning an eventual return to service. In addition to commissioning a study by the Bechtel Corporation of the cost and schedule for decontamination and reactivation, GPU, for planning purposes, undertook a study of the three possible courses of action regarding TMI-2:

1. Returning it to service as a nuclear unit.
2. Converting it to a fossil-fired steam supply system with firing on Pennsylvania bituminous coal or alternatively with firing on natural gas for an initial five year period followed by firing on Pennsylvania bituminous coal.
3. Not reactivating this unit and replacing it with other capacity such as new coal-fired units at other sites.

In August of 1979, GPU commissioned Gilbert Associates, Inc. to perform a feasibility study on the conversion option and to develop detailed information on the cost of such a conversion should it prove to be feasible. A report describing the results of a Phase I scoping effort was issued in October of 1979. A detailed report concluding the Phase II preliminary design effort providing a technical feasibility evaluation and plant cost estimates was published in February of 1980. This evaluation of the TMI-2 coal conversion options involved three separate efforts:

1. Detailed technical studies and preliminary design of the conversion of TMI-2 to a fossil-fired plant, as conducted by Gilbert Associates, Inc.
2. A fuel supply evaluation including an analysis of the possibility of using anthracite coal.
3. An economic assessment.

In addition, the overall effort drew upon work that had already been completed, including the Bechtel study of the TMI-2 cleanup and rehabilitation and previous studies concerning the cost and performance of Seward 7. The major findings of the Major Commitment Review were:

1. Present and future needs for supplying our customers' demand for electricity require the restoration or replacement of TMI-2.
2. No known technical factors have been identified which could foreclose restoring TMI-2 to service. However, the technical feasibility of restoration

will not be known with confidence until after a first hand inspection has been made inside the reactor building and the pressure vessel.

3. The alternatives evaluated by GPU are:

	Capital Cost as Incurred	Earliest Startup
a) Restore TMI-2 (880 MW) & build 472 MW Coal Plant*	$ 100 Million $ 645 Million	1/1/84 1/1/87
b) Convert TMI-2 to a Coal-fired plant (1352 MW)	$1377 Million	1/1/87
c) Convert TMI-2 to a gas-fired plant (1375 MW), run for 5 years, then convert to coal (1352 MW)	$1658 Million	10/1/86
d) Replace TMI-2 with two offsite coal plants (1352 MW)	$1846 Million	1/1/87

*The 472 MW coal plant size was selected for consistency with the other options. In fact, a 625 MW plant would be built. The cost used is the same as for a 625 MW plant on a $/KW basis.

The preceding cases were designed to achieve uniform capacity levels and supply the same annual quantities of electricity for 1984-1996.

4. The average estimated cost of electricity supplied, either by generation or purchases of electricity, under each of the four alternative cases for 1984-96 are:

		¢/KWH
a)	Restore plus coal	7.60
b)	Convert-Coal	11.15
c)	Convert-Gas/Coal	10.60
d)	Replace-Offsite Coal	11.25

Using the restore option as a benchmark, the <u>average monthly cost penalty</u> to a typical residential customer (500 KWH's/month usage) over the 13 year period would be:

	Jersey Central	Met-Ed	Penelec
Convert-Coal	$1.60	$5.04	$1.89
Convert-Gas/Coal	1.34	4.23	1.58
Replace-Offsite Coal	1.65	5.19	1.94

The actual monthly penalty is less in early years and grows with time, continuing past the 1996 end-date used in this evaluation.

5. The earliest and least expensive option from both the customers' and corporation's viewpoint is restoring TMI-2 to service. There is a large margin for error in meeting cost and schedule targets before the benefits of this option would be eliminated. For the restore option to have the same average cost of electricity as the nearest competitor (gas/coal), the following conditions would be necessary:
   a) TMI-2 restored 1/1/84; Cost overrun - $1250 Million
   b) TMI-2 restoration delayed to 1/1/87; cost overrun - $1100 Million

The economic arguments in favor of restoring TMI-2 to nuclear service appear compelling, even in light of present on-going evaluations of the cost and schedule for cleanup and recovery. While the other options, conversion or decommissioning coupled with new coal capacity built elsewhere, have comparable economic consequences, the risks and uncertainties associated with these two alternatives are not comparable. The conversion options have a number of issues not shared by the off-site coal alternative which could undermine their practicality. These include operational and reliability risks for the converted plant relative to plants initially designed and built to operate on coal. The best design developed by Gilbert Associates, Inc. requires the coordinated operation of two steam supplies, three turbine-generator sets, and associated equipment. This is far more complex than the coordinated operation of one steam supply and one turbine generator. While some systems are redundant and offer the prospect of half load operation in the event of equipment failure, other systems, such as the existing turbine generator set, cannot practically be made redundant. If this 1352 MW unit were built, and it were to trip off the line, it would be the largest single unit loss in PJM and would represent the loss of capacity equivalent to more than 15 percent of the forecast GPU summer peak load in 1990. An extended forced outage would produce a need to purchase huge quantities of replacement energy.

A large measure of regulatory support for the conversion would be required. This support includes resolution of any TMI-1 interface security issues with the Nuclear Regulatory Commission, the reversal of the Federal Energy Regulatory Commission designation of part of Three Mile Island as a recreational area, the selection and approval of a site for disposal of ash and sludge produced during coal combustion, resolution of air quality matters with EPA and the PA DER (TMI is in close proximity to the Harrisburg Air Basin which is classified as a nonattainment area for particulate matter), the need for a waiver by the Federal Aviation Administration to allow construction of a tall smokestack (TMI is in close proximity to the Harrisburg Airport), and rate relief to attract the capital to finance a $1.4 billion project. Adverse rulings or delay would rapidly increase project and replacement energy costs.

GPU has attempted to resolve one of these regulatory approvals, one which appeared to be rather straightforward. On February 22, 1980, GPU filed a notice of proposed construction or alteration (FAA form no. 745-1) to obtain approval for construction of the smokestack required by a coal fired power plant. The proposed stack height was 650 feet above ground. In an acknowledgement dated March 31, 1980, the FAA advised "Proposed construction would exceed FAA obstruction standards and further aeronautical study is necessary to determine whether it would be a hazard to air navigation. Pending completion of any further study, it is presumed that construction would be a hazard to air navigation." The acknowledgement further stated "if the proposed structure were reduced to a height to not exceed 390 feet above ground level, it would not exceed Part 77 obstruction standards." While this need not be the last word on the subject, it does indicate the uphill battle GPU expects it would face in obtaining regulatory approval to convert TMI-2 to coal.

In summary, there are a number of risks associated with the conversion of TMI-2 to a fossil-fueled unit. These include increased costs to the customer, difficulties in financing a $1.4 billion project, increased forced outage rate, decreased system reliability with 1352 MW in one unit, and potential regulatory agency opposition, among others. After weighing these risks, the costs, and the uncertainties associated with each option, GPU has concluded that the best approach from the viewpoint of both customers and stockholders is to restore TMI-2 to service as a nuclear plant. While the cost and schedule assumptions are generally optimistic for each alternative and recent information suggests that restoration will cost appreciably more and take longer than originally assumed, the overwhelming economic advantage of restoration is such that the study conclusion should not change even if the cost and schedule estimates for restoration increase significantly.

Conversion of Forked River Nuclear Plant to Coal

Assuming that the construction of coal-fired capacity on the Forked River site is feasible from a regulatory standpoint, and desirable from customer, company and regulatory standpoints, the question arises as to whether it would be preferable to "convert" the Forked River Nuclear Plant to coal-firing or to construct on the site one or more coal plants designed from scratch. In the case of TMI-2, it was concluded that the construction of comparable coal capacity at other sites was preferable to converting the nuclear unit to coal-firing capability. The principal factors supporting this conclusion were:

a) the economic advantage of conversion vis-a-vis offsite coal was small, well within the possible margin for uncertainty in capital cost estimates;

b) while costs are similar, the risks and uncertainties are not. There is considerable uncertainty in meeting the cost and schedule targets and achieving reliable operation for this "first of a kind" plant; and

c) the selection of the offsite coal option was supported by an additional strategic advantage. If difficulties in financing and/or constructing two coal plants were to arise, at least one plant might be completed on schedule. Financing limitations or construction problems would force the delay of <u>all</u> of the capacity represented by the conversion option if that were the selected approach.

Each of these points also applies to Forked River conversion, but to an even greater degree. First, the TMI-2 conversion could have taken advantage of about $290 million worth of equipment already in place and potentially useful to a coal plant, namely, the turbine-generator, cooling towers, switchyard and transmission lines. Unlike TMI-2, the only major piece of existing plant equipment (this excludes the site itself, earthworks, foundations, environmental and geo-technical studies, etc) that would be of use in a converted Forked River plant is the turbine-generator. Given the unique design features required in a converted unit, there is a good chance that there would be a capital cost <u>penalty</u> associated with conversion of Forked River relative to starting from scratch.

Second, a converted unit at Forked River which used a design concept similar to the TMI-2 converted plant would have a capacity of 1700-1800 MW. The cost and schedule uncertainties for this unit would be as great as, or greater than, those applicable to TMI-2 conversion, and the consequences of not achieving reliable operation would be even more severe.

Finally, the converted Forked River plant would be the equivalent of nearly three 625 MW coal plants. The implications of encountering financing or construction difficulties in building the converted unit, as compared to building two or three coal plants, would be more drastic than in the TMI-2 conversion case due to the nearly 30% higher capacity level for a converted Forked River plant. Financial and reliability uncertainties argue against putting so many "capacity eggs" in the converted Forked River "basket".

If the Forked River unit is not to be completed as a nuclear plant, a prudent alternative would be to utilize the site, if possible, for one or more coal units designed and constructed from scratch. The land is already owned by Jersey Central. Much of the environmental data collected in support of the nuclear plant would be applicable to the coal plant.

It may also be possible to utilize existing nuclear plant foundation work for a coal plant. Any existing equipment at Forked River, exclusive of the turbine generator, which is of potential use in a coal plant would be utilized, if cost justified.

We have concluded, therefore, that "conversion" of Forked River to coal firing using the existing nuclear turbine-generator is not a prudent course to follow. However, "conversion" in the sense of substituting one or more coal fired plants for the nuclear plant at the Forked River site merits further consideration if completion of the nuclear plant is deemed impracticable.

New Coal Plant at the Forked River Site

GPU is studying the feasibility of constructing a coal plant at the Forked River site. These studies are still in progress. For the purpose of these studies, we are examining the feasibility of constructing one or more 625 megawatt coal fired plants similar to the Seward 7 plant now planned for western Pennsylvania.

Tentatively, it is technically feasible to construct a coal fired generating station at the Forked River site. Questions of feasibility center about the extent and acceptability of environmental impacts and ability to license a coal plant in a timely manner at this particular site. There are also questions regarding the suitability of the Forked River site relative to alternative locations throughout New Jersey. The key issues are discussed in some detail in Exhibit JC-502. The following are items of major concern which might adversely affect the ability of Jersey Central to construct a coal plant at Forked River.

1. New Jersey air quality regulations. New Jersey's current sulfur dioxide emission rate standard of 0.3 pounds of SO_2/MBTU is approximately twice as stringent as the 0.6 pounds SC_2/MBTU that must be consistently achieved at other planned GPU generating stations using coal qualities typical of western Pennsylvania coal. The capital cost and operation and maintenance cost implications of flue gas desulfurization systems designed to meet the more stringent New Jersey standards are not clear at this time. The risk implications of constructing a plant to meet these stringent standards and later discovering that the plant cannot do so with the consistency needed to achieve the desired capacity factors are sizable.
2. Ambient air quality and prevention of significant deterioration. Plume dispersion modeling studies are needed to verify that emissions from a coal plant at Forked River will not exceed available PSD increments.
3. Coal transportation. At present, there is neither an obvious economic choice of transportation mode, nor an associated choice of route to the Forked River site for coal delivery. Rail and barge are the two most logical choices, although truck and slurry pipeline

might also be considered. Logical existing rail routes to Forked River are in generally poor condition and would require considerable rehabilitation. In addition, there are numerous grade crossings to be dealt with and the prospect of adverse noise impact from one or more unit trains passing through reasonably populated areas each day. By the same token, delivery of coal by barge in the relatively shallow and recreationally sensitive Barnegat Bay area also presents difficulties.

4. Coastal Area Facilities Review Act (CAFRA). In general terms, CAFRA discourages construction of industrial facilities in New Jersey's coastal zone. It must be demonstrated pursuant to CAFRA that the proposed site is best for the project, that a need for the project exists, and that the type of fuel to be used is in accord with government guidelines.
5. Pinelands preservation. It is likely that a coal fired station at Forked River would have certain ancillary facilities such as transmission, rail and waste disposal areas located within the pinelands. Evolving regulations concerning development within the pinelands could have a significant impact on the viability of a coal plant at Forked River.

6. Lacey Township zoning ordinance. In light of Lacey Township's current zoning ordinance, it is highly unlikely that we can rely on the current Forked River Site Plan approval for construction of a coal-fired generating station. Under the current zoning ordinance, even the Oyster Creek nuclear plant is designated as a non-conforming use. At the present time, the Oyster Creek and Forked River properties are zoned industrial, but generation of electricity is a specifically excluded use. In order to build a coal station at Forked River or anywhere in Lacey Township, Jersey Central would need a "use variance" from the Lacey Township Board of Adjustment.
7. Salt drift. Anticipated salt drift from the Forked River nuclear plants proposed 550 foot evaporative cooling tower would require a variance from NJ DEP's particulate emission standards, which has recently been denied. Although a 625 megawatt coal fired unit cooling tower would have a heat rejection rate about one fourth of that expected from the nuclear plant tower, the salt drift issue may remain a problem. It is expected that the state's current 30 pound per hour standard for particulate matter should be attainable using a cooling tower with state of the art drift eliminators. This remains to be demonstrated, however.

These and other issues continue to be addressed in GPU's ongoing studies of the possibility of building a coal plant at Forked River.

Coal Plants at Other N.J. Site

If Jersey Central was to proceed with a coal plant program, it would be necessary to determine whether the Forked River site offers advantages over other prospective sites for the first or possibly second coal plant in New Jersey. The company is also in the process of conducting an investigation of locational alternatives to the Forked River site. Such a study is required by both the National Environmental Policy Act and by New Jersey's Coastal Areas Facility Review Act. A brief description of these studies is presented in Exhibit JC-502. Thus far, these studies indicate that Forked River appears to be the most suitable location for a coal-fired plant of all the Jersey Central owned sites in New Jersey and it appears to be as good as or better than most non-owned candidate sites identified to date. The advantages of Forked River include:

1. The site is currently owned, which minimizes lead time and therefore costs.
2. There exists a possibility of achieving savings by utilizing existing facilities and substructures, and the results of previous environmental and geotechnical studies.

3. The site appears to require minimal civil work compared to alternative locations. If this is confirmed, lower cost and shorter construction schedules should be realized.
4. Transmission facilities can be in service by the time the unit goes into service.
5. The Forked River site is located in the generation deficient Jersey Central system, at a location where another major generating station has long since been planned and whose presence has been assumed in evolutionary studies of the PJM transmission systems.
6. Since it is sited immediately adjacent to the Oyster Creek station, a coal fired unit at Forked River could take advantage of the intake canal and the "industrial look" of the area.
7. Labor force availability should be a positive site selection factor.

Customer Cost Impacts

We have also studied the potential rate impacts of replacing the Forked River nuclear plant with a coal fired plant. Exhibit JC-502 presents a preliminary economic comparison of nuclear and coal plants at Forked River. As shown in that exhibit, the electricity costs for the nuclear plant are about 20% lower than the values for coal plants over the first ten years of plant life. Over that ten year period, a typical residential customer who used 500 kilowatt hours per month, would pay an average of about $4 per month more if coal plants were constructed rather than the Forked River Nuclear Plant. While the Forked River Nuclear Plant appears to have an economic and schedule advantage over constructing coal plants on the same site, the cost estimates that lead to this conclusion are preliminary and somewhat speculative in nature. The risks and uncertainties associated with each of these options, particularly the regulatory risks, are significant to the point of potentially jeopardizing the feasibility of either approach.

In choosing between a nuclear plant and one or more coal plants at Forked River, an evaluation of the relative risks may overshadow economic differences of the magnitude indicated in present studies. It is to these issues of feasibility and risk that we are directing further study and efforts. The end result of this work will be recommendations concerning the nature and timing of new capacity to service Jersey Central's customers and the commitments required to support this new capacity. It is our opinion that the initial and subsequent commitments to completing the Forked River Nuclear project were sound business decisions, supported by the need for base load capacity in New Jersey, and the apparent economic advantage of nuclear power vis-a-vis coal at the time these decisions were made. It is equally clear that conditions have been drastically altered, in the aftermath of the accident at TMI, which greatly increases the uncertainties, risks, and potential costs for completing the project at a time when Jersey Central's financial resources are limited and not conducive to large scale risk taking. Unless there is a clear sentiment, especially at the state level, in favor of completing the nuclear plant at Forked River, we feel it would be inappropriate to continue with the project.

Conclusions

The extensive studies that we have conducted lead us to the following conclusions, which we believe merit the support of the N.J. BPU.

1. Depending on load growth patterns, the impact of GPU's load management and energy conservation Master Plan, the return of TMI-2 to service, success in negotiating a major energy purchase agreement with Ontario Hydro, and success in completing the underwater DC tie, Jersey Central's need for new base load capacity may be deferred until 1991-1992. At the present time, there is no prudent basis for counting on longer deferrals. It would be prudent to maintain an option for new capacity in the late 1980's.

2. While it is technically feasible to convert TMI-2 to coal, economic and risk considerations make this the least desirable option. Return to service as a nuclear unit is most desirable economically, even allowing for a large margin of uncertainty in the estimated cost of doing so. Replacement by new coal capacity is economically indifferent from conversion, and far preferable from the standpoints of financial and plant performance risks. GPU's present course of action, which is to proceed with the TMI-2 cleanup, keep open the offsite coal options, and defer final decisions regarding restoration vs. replacement until equipment inspections are completed, is the most prudent.

3. The TMI-2 conversion study results tell us that the risk/benefit balance of converting the Forked River Nuclear Plant to coal, using the nuclear turbine-generator, is far worse than that of the conversion of TMI-2. If completion of the nuclear plant is deemed impracticable, then it appears that constructing one or more new coal plants at the Forked River site may be the best course of action. This is subject to verification of regulatory feasibility and further economic evaluation. If coal fired capacity is to be substituted for the Forked River Nuclear Plant, then

the Forked River site appears to offer schedule and cost advantages over other sites. This too is subject to further verification.

4. From a Jersey Central customer economics standpoint, it might be beneficial to complete the Forked River Nuclear plant, because this unit would provide needed base load capacity within the State of New Jersey, and it would provide energy at costs estimated to be about 20% below those for coal fired energy. For example, a typical residential customer who uses 500 KWH per month would pay an average of about $4 per month more over the first 10 years of plant life if coal plants were substituted for the Forked River Nuclear Plant. The cost differential would be expected to increase as time goes on. However, cost and approval uncertainties are such that unless there is a clear sentiment, especially at the state level, supporting the completion of the Forked River Nuclear Plant, we do not think it would be apropriate to continue with the project. Rather, our resources would be better directed toward constructing coal fired capacity in New Jersey.

I would like to make one final point before concluding this testimony. The analysis of options .or TMI-2 makes no mention of how the <u>total</u> investment is to be recovered in the conversion option cases or the replace option case. The conversion cases, however, does include the cost of the capital which could be utilized for the converted facility. This treatment is utilized because it is appropriate for economic studies and should not be construed in any way as a comment on the proper method to use in recouping the balance of the investment in the facility.

This concludes my prepared testimony on this matter.

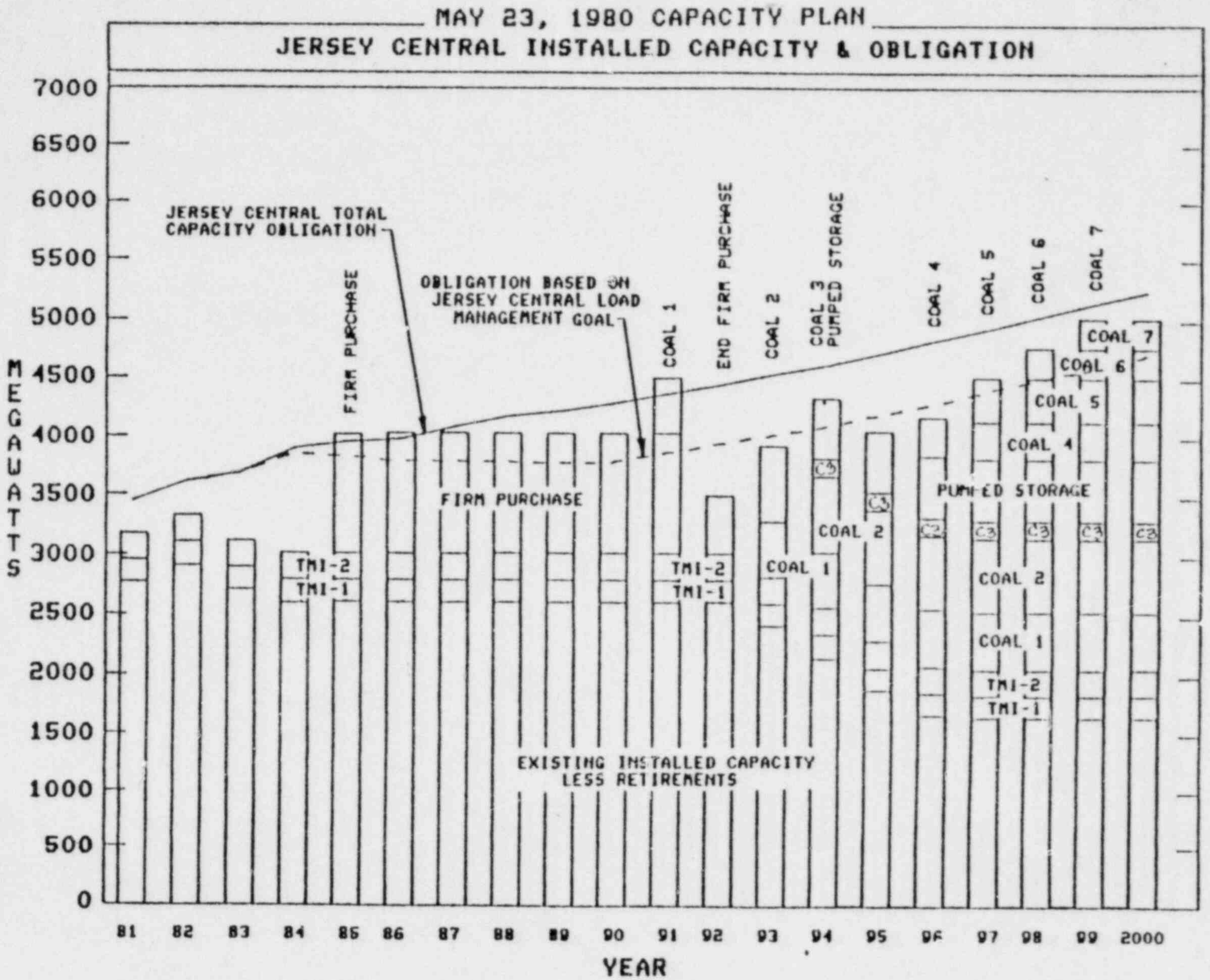

Exhibit JC-501
Witness: M. Raber

Exhibit JC-502

POTENTIAL CONVERSION OF TMI-2 AND FORKED RIVER NUCLEAR FACILITIES TO COAL-FIRED PLANTS

I. INTRODUCTION

In its Rate Order in Docket No. 795-427 (Phase II) dated April 1, 1980, the N.J. BPU requested that Jersey Central "in its forthcoming base rate application prepare a detailed submission on the rate impact of placing in service nuclear power facilities now under construction as compared to the impact of similar capacity coalfired facilities." This request was extended to cover not only the nuclear plant under construction at Forked River, but also the possible conversion of TMI-2 to a coal fired facility.

In response to the N.J. BPU request, this exhibit addresses the impacts of completing (Forked River) or restoring (TMI-2) the nuclear facilities, converting them to coal-fired units, or replacing them with new coal plants. TMI-2 will be considered first, since extensive studies have been performed on the TMI-2 disposition options. The results of these studies, including potential rate impacts, will be summarized, based on a more detailed evaluation which is also being provided as Exhibit JC-503, "Three Mile Island #2 Major Commitment Review."

The balance of the material will concern the disposition of Forked River plant. First, the applicability of the results of the TMI-2 study to the Forked River situation will be briefly considered. This will be followed by a status report on the efforts now underway to determine the feasibility and desirability of building coal plants at Forked River and other sites in New Jersey. Finally, some preliminary cost and rate implications will be presented on the completion of the Forked River plant or its replacement with coal-fired capacity.

II. TMI-2 DISPOSITION OPTIONS

Several consultants were commissioned to investigate the various options available concerning the disposition of TMI-2. The Bechtel Corp., in June, 1979, completed a preliminary assessment of the potential cost and schedule for decontaminating and restoring the unit to service. Gilbert Associates, Inc. completed their evaluation of converting TMI-2 to a fossil-fired plant in February, 1980. While the latter study was underway, GPU personnel evaluated the acceleration of coal-fired plants already planned for construction in western Pennsylvania in the mid-1930's and beyond.

These investigations provided the framework for a comparative analysis of the three basic options available concerning TMI-2, namely, restoring, conversion to fossil-firing, and replacement with coal plants at other sites. The recently completed comparison, Three Mile Island #2 Major Commitment Review (June 2, 1980), is provided as Exhibit JC-503 and contains summaries of the Bechtel and Gilbert studies.

The disposition options considered for TMI-2 were:

a) decontamination and restoration as an 880 MW nuclear unit;

b) conversion to a 1352 MW coal-fired plant, with topping turbines added to the existing plant to take advantage of the higher energy content steam produced in coal-fired boilers. A variation of this option which involved gas-firing for the first 5 years of operation with subsequent conversion to coal was also considered; and

(c) replacement of TMI-2 by accelerating the Seward 7 and Coho 1 625 MW coal plants that were planned for construction in western Pennsylvania with in-service dates of 1987 and 1989.

The assumptions used throughout the analysis were generally optimistic with regard to meeting cost and schedule targets. Therefore, variations on these assumptions were also analyzed.

The economic comparison among alternatives is displayed in two ways:

1. comparison of electricity costs (¢/KWH) from the specific plants involved, without regard for differences in total capacity, for a period of 10 years following the projected in-service date.

2. comparison of electricity costs on a consistent capacity and energy basis, between 1/1/84 and 12/31/96.

Plant Costs

Table II-1 summarizes the earliest startup dates and net cash flows associated with each of the options. In each case, a major financial commitment to the selected alternative would be required in 1981. The decontamination and restoration of TMI-2 was estimated by Bechtel Corp. to cost about $400 million, including replacement of the fuel. Anticipated insurance disbursements of $300 million reduced the net project cost to $100 million for a 1984 startup.

The cost of converting TMI-2 to a coal-fired plant was estimated to be $1365 million. The converted plant would take advantage of about $290 million worth of existing equipment which is also useful to the coal plant; i.e., turbine-generator, cooling towers, switchyard, and transmission lines. The replacement value of the existing equipment would be considerably higher, since these investments represent pre-1979 costs. For example, the total useful investment in the converted plant would total $1655 million ($1224/KW) as contrasted with an estimate of $1707 million ($1366/KW) for 1250 MW of new coal capacity in western Pennsylvania. This highlights the potential investment advantage of conversion vis-a-vis starting from scratch.

The gas/coal conversion option has a total capital cost estimate of $1640 million. While higher in cost than going directly to coal-firing, this option has two potential advantages. First, initial firing with gas permits the deferral of coal-related investment to the 1987-1991 time frame, though at the price of added escalation (8% per year). This would significantly reduce the new term financing burden for building the converted unit. Second, the capacity factor anticipated during gas-firing is 85%, versus the 58% assumed for coal and nuclear plants. Thus, a greater amount of electricity would be produced during the first 5 years, further reducing the need to purchase replacement power.

Electricity Costs and Rate Impacts

The estimated cost of electricity produced by these alternate plants over the first 10 years of operation is given in Table II-2. The average cost of electricity that would be generated by the restored 880 MW nuclear plant over the first ten years of operation (1984-93) is estimated to be roughly half the values for the non-nuclear options (1250 to 1375 MW; 1987-96). These values assume complete recovery of the $710 million original TMI-2 investment in the restore case, recovery of $290 million of the original plant cost for the conversion options, and no recovery of TMI-2 investment for the offsite coal option. As shown, an additional $1450- $1700 million could be spent on restoration before electricity costs from the restored plant reach the levels for electricity produced by the converted plant or new offsite coal plants.

While the individual plant comparisons capture the differences in the costs of producing electricity in each plant arrangement, the impacts of schedule, capacity, and replacement power differences among the alternatives are not reflected in the values. In order to overcome this deficiency, the bases for comparison of alternatives were broadened to achieve consistency, so that ultimate capacity levels and annual electricity supply for 1984 through 1996 were the same in all cases:

a) Case 1 (Restore) - in addition to the return to service of the 880 MW reactor on 1/1/84, a 472 MW coal plant was added in 1/1/87, the earliest possible date, so that capacity installed reached the 1352 MW level of the coal conversion case. (This does not mean that a 472 MW coal plant would actually be built but, instead, places all options on a consistent capacity basis.)

b) Case 2 (Coal Conversion) - no change in capacity level and timing was made; however, purchases of replacement power equal to the output of Case 1 in 1984-6 were included;

c) Case 3 (Gas/Coal Conversion) - same as Case 2, except the additional electricity generated during gas firing, in excess of the amount the coal conversion case would produce, is "sold"; and

d) Case 4 (Replace-Offsite Coal) - the two 625 MW coal plants were increased in size to 676 MW each so that total installed capacity equaled 1352 MW. As in Cases 2 and 3, replacement power was purchased in 1984-6.

The replacement power requirements and assumed costs for replacement power are summarized in Table D-7, Appendix D of Exhibit JC-503. The values for purchased power costs and credits are projections based on the operating characteristics and surplus power availability of the entire Pennsylvnia-New Jersey-Maryland Interconnection (PJM).

These costs are expected to increase sharply during 1984-1996 as a consequence of escalating oil prices and the reduction and eventual elimination of PJM's present excess capacity condition.

The average cost of electricity for each case is broken down by major contributing components in Table II-3. The capital costs of the coal units in Cases 1 and 4 were calculated using the updated $/KW cost given for Seward 7 and Coho 1 earlier, namely, $1366/KW.

The estimated electricity costs resulting from this analysis differ from the individual plant values previously calculated. The 7.60¢/Kwh cost for Case 1 is higher than the 5.55¢/Kwh value cited earlier because of the contribution of the relatively more expensive 472 MW coal unit. On the other hand, the results for Cases 2-4 are lower since replacement power costs in 1984-6 are less than the cost of coal-fired energy production from 1987 on, bringing the average for the 13 year period down. Even with these modifications, Case 1 retains a sizable economic advantage over the other options. This advantage would grow with time since a smaller proportion of the nuclear costs (fuel, O&M) are prone to escalation.

Using Case 1 (restore) as a benchmark, Table II-4 summarizes the average potential cost penalties incurred by a typical residential Jersey Central customer (500 Kwh monthly usage; no electric heat or hot water) over the 1984-1996 period if Case 1 were not pursued, based on Jersey Central's 25% ownership of TMI-2. The effects of a three year delay in restoring TMI-2 to service and a 1 1/2 year slippage in startup of the converted coal plant are also shown, in each case yielding a penalty of 10¢ per month for each year of delay.

The extra costs for not selecting Case 1 range from $1.35 to $1.75 a month. This would amount to $210 to $275 over the thirteen year period, and would continue to increase after 1996. (While averages are used here for convenience, the year by year penalties grow with time.) Since the penalty would apply to each KWH of sales, the additional costs which all customers of Jersey Central would pay over the thirteen year period would equal nearly $750 million for Case 2 and over $810 million if the converted plant were delayed 1 1/2 years.

There is a large margin for error in meeting cost and schedule targets for restoring TMI-2 to service as a nuclear unit before a break-even cost condition is reached. This is evident in Table II-5, where the required increase in investment for restoring TMI-2 before reaching the electricity costs of the other options is given. When compared to the next least costly option (Gas/Coal Conversion), a \$1250 million increase could be absorbed by Case 1 before the customer penalty reaches the Case 3 level. Even if the unit were delayed three years, the increase which would yield \$1.35/month penalty is \$1150 million. These values contain no allowance for delays or cost increases in the converted plant.

In summary, the economic comparison overwhelmingly favors restoring TMI-2 as a nuclear plant. The non-nuclear options have comparable (to each other) costs, with the gas/coal conversion option having a modest advantage over the others. The large economic advantage of refurbishing TMI-2 allows considerable margin for error in meeting cost and schedule targets for restoring the unit, with the additional advantage of keeping new investment requirements to a minimum. Even though recent information sugges , that the cost and schedule assumptions presented here for restoration are overly optimistic, the changes expected from updating these assumptions should not change the conclusion favoring restoration of TMI-2.

Conclusions

The principal findings of the TMI-2 Major Commitment Review are:

1) A significant financial commitment to the convert or replace options would be needed in 1981, if the schedules assumed here are to be met.

2) The decision on the restart of TMI-1, expected in 1981, will help to establish whether restoring TMI-2 is a feasible option. If the undamaged TMI-1 is not allowed to restart, then assuming TMI-2 can be restored and allowed to operate is unrealistic. The TMI-1 licensing process now underway will help define the technical changes that would be required for TMI-2. It also provides a forum for airing the views of GPU, Federal, State and local governments, and the public on this controversial issue.

3) The need to restore or replace TMI-2 is clear, given present and future demand for electricity. Ideally, GPU should keep at least two of the options on track while awaiting the outcome of the TMI-1 licensing hearings. However, GPU's current financial condition may preclude this approach.

4) While no technical factors have been identified which would foreclose restoring TMI-2 to service, the technical feasibility of this option will not be known with confidence until after a first hand inspection has been made inside the reactor building and the pressure vessel. Initial indications of conditions within the reactor building are promising.

5) The earliest implementable and least expensive option from the viewpoint of our customers (electricity costs) and the corporation (investment) is restoring TMI-2 to service. When compared to the alternatives, there is a large margin for error in meeting cost and schedule targets before the benefits of this option would be eliminated.

6) All the non-nuclear alternatives have comparable (to each other) economic consequences. While costs are similar, the risks and uncertainties are not. The conversion options have a number of issues, not shared by the offsite coal alternative, which could undermine their practicability. Also, the reliability of operation for a converted

unit is a major unknown, since it would be a "first of a kind."

In light of these considerations, the following strategy has been adopted as the course of action which best fulfills GPU's responsibilities to Jersey Central's customers and GPU's stockholders:

a) Commit to restoring TMI-2 to service as the best option, even with its considerable risks and uncertainties. This commitment would be reinforced by a favorable decision on restarting TMI-1. Under these circumstances, the primary condition which would reverse this commitment is if restoration were found to be technically infeasible after first hand inspection within the containment building. For the time being, this commitment involves nothing beyond what is needed for cleanup, which would have to be conducted in any event.

b) If TMI-1 is not allowed to restart <u>or</u> restoring TMI-2 is found to be impractical for other reasons, then redirect GPU's resources, to the extent possible, to building offsite coal plants to replace TMI-2 (and TMI-1, if necessary) as the next best course of action. Continue with the cleanup and decontamination of TMI-2. At the same time, retain the conversion option for possible future use.

The selection of the offsite coal option as the second best choice is supported by an additional strategic advantage. If difficulties in financing both plants arise, at least one plant might be completed on schedule. Financing limitations would force the delay of <ins>all</ins> of the capacity represented by the conversion option if that were the selected approach.

TABLE II-1

SUMMARY OF CASH FLOWS* ($MILLIONS)
(incl. AFDC, where applicable)

	Fix TMI-2	Convert TMI-2 Coal	Convert TMI-2 Gas/Coal	Replace TMI-2 (Seward 7, Coho 1)	
1979	0	0	0	12	('79+prior yrs)
1980	0	5	5	6	
1981	70	26	19	80	
1982	15	90	56	146	
1983	10	237	141	268	
1984	5	377	233	410	
1985	0	358	207	530	
1986	0	272	172	210	
1987	0	0	6	45	
1988	0	0	25	0	
1989	0	0	92	0	
1990	0	0	451	0	
1991	0	0	233	0	
TOTAL	100	1356	1640 (833 for gas portion)	1707	
Difference From Fix	--	1265	1540	1607	
MW	880	1352	1375 (gas-fired) 1352 (coal-fired)	1250	
Earliest Startup	1/1/84	1/1/87	10/1/86	1/1/87	

* All cases exclude the costs for cleanup and decontamination, which are common to each and covered by insurance. The conversion options do not include the $12 million cost of the ash and sludge disposal site.

TABLE II-2

ALTERNATE PLANT ELECTRICITY COSTS

	CASE 1 (Restore) 880MW 1/84	CASE 2 (Convert-Coal) 1352MW 1/87	CASE 3 (Convert-Gas/Coal) 1375/1352MW 10/86 1/92	CASE 4 (Replace-Offsite Coal) 1250MW 1/87
Average Cost in ¢/Kwh over first 10 years	5.55	11.90	11.10	12.05
Levelized Cost in ¢/Kwh over first 10 years	5.60	11.55	10.25	11.75
Change Required in Capital Investment of "Restore" Option Before Electricity Cost is Equivalent to Alternative	--	$1450-1700 Million	$1150-1450 Million	$1500-1700 Million

Note:

1) Costs include recovery of capital with interest and earnings, taxes, fuel and O&M costs. The composite cost of money used for present valuing is 13%.

2) The value for Case 1 includes recovery of original $710 million investment plus $100 million needed to restore. The conversion cases include recovery of $290 million of the TMI-2 investment, the value of the portions of the original plant that would be used in converted facility.

3) Capacity factor equal to 0.58 for all cases, except during gas-firing phase of Case 3 when a value of 0.85 is assumed.

4) For the capital investment changes, the higher value is based on average cost while the lower value is the levelized result.

TABLE II-3

COMPONENT COST SUMMARY (¢/KWH)
(1984-1996)

	CASE 1*	CASE 2	CASE 3	CASE 4
1984-86 Purchase Power Cost	0	1.20	0.95	1.20
1987-91 Purchase Power Cost (Credit)	0	0	(1.90)	0
Capital Recovery, Taxes, and Inventory costs	4.30	4.40	4.40	4.90
Fuel	2.15	4.00	6.15	3.80
O&M	1.15	1.55	1.00	1.35
Total Average Cost	7.60	11.15	10.60	11.25
Levelized Cost	7.15	10.30	9.45	10.50

* The contributions to the total average cost of 7.60¢/Kwh arising from from the 472 MW coal plant are:

1.70 for capital, etc.;
1.35 for fuel; and
0.50 for O&M.

NOTE: All four cases achieve an ultimate capacity of 1352MW.

TABLE II-4

AVERAGE INCREASE IN JERSEY CENTRAL TYPICAL RESIDENTIAL CUSTOMER'S MONTHLY ELECTRIC BILL (1984-1996)
(500 KWH's used per month)

Case 1,	1/1/84 Return	Base
1A,	1/1/87 Return	$0.31
Case 2,	1/1/87 Startup	$1.60
2A,	6/1/88 Startup	$1.75
Case 3,	10/1/86 Startup	$1.34
Case 4,	1/1/87 Startup	$1.65

TABLE II-5

CONDITIONS FOR ELECTRICITY COST EQUIVALENCE
(Case 1 versus alternatives)

	CASE 2 (Convert-Coal)	CASE 3 (Convert-Gas/Coal)	CASE 4 (Replace-Offsite Coal)
Change required in Capital Investment of "Restored" option before electricity cost is equivalent to alternative			
Base - Restore TMI-2 1/1/84	$1500 Million	$1250 MIllion	$1550 Million
Restoration Delayed to 1/1/87	$1400 Million	$1150 Million	$1450 Million

III. APPLICABILITY OF TMI-2 CONVERSION STUDY TO FORKED RIVER

Assuming that the construction of coal-fired capacity on the Forked River site is feasible from a regulatory standpoint and desirable from customer, company, and regulatory standpoints, the question arises as to whether it would be preferable to "convert" the Forked River nuclear plant to coal-firing or construct, on the site, one or more coal plants from scratch. In the case of TMI-2, it was concluded that the construction of comparable coal capacity at other sites was preferable to converting the nuclear unit to coal-firing capability. The principal factors supporting this conclusion were:

a) the economic advantage of conversion vis-a-vis offsite coal was small, well within the possible margin for variance in capital cost estimates;

b) while costs are similar, the risks and uncertainties are not. There is considerable uncertainty in meeting the cost and schedule targets and achieving reliable operation for this "first of a kind" plant; and

c) the selection of the offsite coal option was supported by an additional strategic advantage. If difficulties in financing and/or constructing two coal plants were to arise, at least one plant might be completed on schedule. Financing limitations or construction problems would force the delay of <u>all</u> of the capacity represented by the conversion option if that were the selected approach.

Each of these points would also apply to Forked River conversion, but to an even greater degree. First, the TMI-2 conversion could have taken advantage of about $290 million worth of equipment already in place and potentially useful to a coal plant, namely, the turbine-generator, cooling towers, switchyard and transmission lines. Unlike TMI-2, the only major piece of existing plant equipment that would be of use in a converted Forked River plant is the turbine-generator. Given the unique design features required in a converted unit, there is a good chance that there would be a capital cost <u>penalty</u> associated with conversion of Forked River over starting from scratch.

Second, a converted unit at Forked River which used a design concept similar to the TMI-2 converted plant would have a capacity of 1700-1800 MW. The cost and schedule uncertainties for this unit would be as great as or greater than those applicable to TMI-2 conversion, and the consequences of not achieving reliable operation would be even more severe.

Finally, the converted Forked River plant would be the equivalent of nearly three 625 MW coal plants. The implications of encountering financing or construction difficulties in converting the unit, as compared to building two or three coal plants, would be more drastic than in the TMI-2 conversion case due to the nearly 30% higher capacity level for a converted Forked River plant. Financial and reliability uncertainties argue against putting so many "capacity eggs" in the converted Forked River "basket".

In conclusion, if the Forked River unit is not to be completed as a nuclear plant, a prudent alternative would be to utilize the site, if possible, for one or more coal units designed and constructed from scratch. Property east and west of U.S. Route 9 is already owned by Jersey Central. Disposition of this property to non-utility use would not be in the best interest of maintaining low population densities in the vicinity of Oyster Creek Nuclear Station. Much of the environmental data and generating investigations collected and performed in support of the Forked River Nuclear Plant would be applicable to a coal plant. These include studies of aquatic and terrestrial ecology, foundation investigations, groundwater studies, and meteorological data collection. In addition, the existence of these completed efforts should minimize the time required for performing studies in support of a coal-fired electric generating station and allow an earlier in-service date. Any existing equipment at Forked River, exclusive of the turbine-generator, which is of potential use in a coal plant would be utilized if cost-justified. In light of these considerations, the balance of this exhibit will address the construction of coal plants from scratch at the Forked River site and other sites, rather than literally converting the Forked River unit to coal-firing.

IV. FEASIBILITY OF CONSTRUCTING A COAL-FIRED ELECTRIC GENERATING STATION AT THE FORKED RIVER SITE AND OTHER NEW JERSEY SITES

On behalf of Jersey Central Power & Light Company, GPU Service Corporation is investigating the possible placement of one or more coal-fired electric generating units at the Forked River site. Conceptual in nature, these investigations assume that the coal-fired unit(s) would be constructed in lieu of the Forked River Nuclear Station (FRNS) and each unit would be nominally rated at 625 MW (net).

Initial study of the Forked River site's capability of supporting a coal-fired station centered on a comparison of Forked River and another JCP&L-owned site, Union Beach. The results, although not conclusively demonstrating feasibility, clearly demonstrated Forked River's superiority over this particular alternative location on the bases of station layout, site development costs, and various environmental concerns.

Residuals of the initial site comparison study include questions of site viability in and of itself, and site viability and suitability with respect to alternative locations throughout New Jersey. The following discussion addresses some of the major questions currently being investigated.

Fuel Transportation

GPU Service Corporation has not identified an economical, reliable, and environmentally preferred mode of coal transportation to the Forked River site. Candidate modes under investigation include barge, truck, and rail. We are more concerned, within reasonable economic constraints, with identifying an acceptable route rather than an acceptable mode. Concerns include:

1) Barging - Icing of Barnegat Bay; poor reliability during bad weather; possibility of adverse impacts on tourism and recreation on Barnegat Bay.
2) Trucking - few alternative routes available; truck traffic, particularly when frequency of delivery is considered, may adversely affect tourism and recreation.
3) Railroads - rail spur from Toms River to the site is in a state of disrepair and much of the track has been removed; this section of rail spur has many grade crossing that would require upgrading with electronic controls.

N.J. DEP Sulfur in Coal Standards

GPU Service Corporation is currently investigating whether it is possible to consistently achieve the New Jersey sulfur emission rate standard of 0.30 lbs. SO_2/MBtu input (N.J.A.C. 7:27-10), without grossly and adversely affecting station performance as well as capital and operating costs. For comparison purposes, Federal New Source Performance Standards require an emission reduction, from raw coal sulfur content, of 70% to 90% and a sulfur emission rate not to exceed 1.2 lbs. SO_2/MBtu heat input. Coal qualities currently under consideration for use at other planned GPU generating stations require that an emission rate of 0.60 lbs. SO_2/MBtu be consistently achieved under these Federal standards.

Land Use

Aside from addressing Coastal Area Facilities Review Act (CAFRA) requirements, additional site suitability issues include the station's possible effects on the nearby Pinelands, identification of acceptable candidate sites for solid waste disposal (combustion byproducts), and selection of acceptable sites or routes associated with the preferred fuel transportation mode.

Ambient Air Quality and Local Meteorology

A cursory evaluation indicates that ambient air quality for regulated pollutants is at levels well below federal and state standards in the vicinity of the site. However, local meteorology, notably wind persistence, appears to be such that SO_2 emissions from a hypothetical 625 MW coal-fired station, designed and constructed to Federal New Source Performance Standards, could violate Federal Prevention of Significant Deterioration (PSD) air quality regulations. Plume dispersion modeling studies are needed to clarify this situation.

Miscellaneous Environmental Concerns

Other issues to be addressed include: salt drift, its possible affects on flora, fauna, and neighboring land uses, and means to minimize drift by state-of-the-art cooling tower designs; potential synergistic effects of SO_2 and salt drift on the Pinelands and other neighboring land uses; and other possible impacts on terrestrial and aquatic resources due to station construction and operation.

Schedules

Because there have been no large coal plants licensed in New Jersey since the present Federal and State regulations began to evolve in 1970 (the last

N.J. coal plant to be placed in commercial operation is the 620 MWe Hudson 2 plant, in 1968), present estimates of licensing schedules are necessarily uncertain. However, since the Forked River site benefits from Jersey Central ownership, previous site development activities associated with the Forked River Nuclear Plant, and other facilities in place or planned, it is judged that a coal-fired unit at Forked River could be in service within approximately eight (8) years from the time a decision to proceed with the project is made. Achievement of this schedule is contingent upon timely resolution of the above-mentioned technical and environmental issues, as well as contingent upon timely federal and state regulatory review and approval of various permit applications. Major equipment procurement, construction, and testing could be completed within five (5) years of the date all necessary regulatory approvals of the project are received.

For comparison purposes, installation of coal capacity at other potential Ne Jersey sites, including those partially owned by Jersey Central, could require ten (10) or more years of lead time to commercial operation. The extended lead time for other sites may be necessitated by site acquisition schedules, need for extensive environmental studies of the site and ancillary facilities, and need for planning, permitting and constructing new transmission lines. This longer schedule also assumes timely action by federal and state regulatory agencies.

Alternative Sites

An investigation of locational alternatives to the Forked River site is currently being performed as required by the National Environmental Policy Act and as required by New Jersey's Coastal Area Facility Review Act (CAFRA). Under CAFRA, electric generating stations in New Jersey's Coastal Zone are deemed "conditionally acceptable" (N.J.A.C. 7:7E-8.32) and an applicant for a CAFRA permit must demonstrate "a consideration, evaluation, and comparison... of alternative sites with the coastal zone and inland." In particular, Jersey Central is also reviewing the potential for installing coal-fired capacity at other owned sites which include:

- Gilbert Station, located in Holland Township, Hunterdon County;
- H. C. Thuerk site, located in Hopewell Township, Mercer County;
- Sayreville Station, located in Sayreville Borough, Middlesex County;
- E. H. Werner Station, located in South Amboy Borough, Middlesex County; and

- Union Beach site, located in Union Beach Borough, Monmouth County.

Because of physical limitations apparent at Thuerk, Sayreville, and Werner, it is doubtful that a replicate 625 MW coal-fired electric generating station could be constructed at these sites. Because of its limited potential for coal-fired station development and Jersey Central's need to conserve cash, the Thuerk site may be sold in the near future. The GPU System Site Selection Study described below, which was begun in 1978, provides a more comprehensive but still preliminary basis for judging locational alternatives.

GPU System Site Selection Study

GPU Service Corporation, on behalf of Jersey Central Power & Light Company, Metropolitan Edison Company, and Pennsylvania Electric Company, is performing a site selection study to establish a "site bank" which can be used to support current and future capacity installation plans, particularly with respect to coal-fired units.

The primary goal of the study is to identify a bank of at least 15 screened, graded, publicly defensible, environmentally and economically viable sites for coal-fired electric generating stations dispersed within or adjacent to GPU's service territories in the

State of New Jersey and the Commonwealth of Pennsylvania. Corollaries to this goal have required that a phased investigation be undertaken to develop the basis for siting decisions that are environmentally and economically prudent and to provide rigorous documentation of the legally required site selection effort.

Within the first phase of the study, elegible siting regions were identified by eliminating areas that: are generally committed to other than power plant use; are environmentally inappropriate; or would present extraordinary permitting or licensing difficulty. Land uses that were eliminated from further consideration for coal-fired stations included most wetlands, Pennsylvania State Gamelands, national and state forests and parks, wildlife refuges, and most urban areas.

The second phase of the investigation considered discretionary siting criteria that, when properly applied, would lead to the selection of a heirachy of candidate siting areas that would be environmentally suitable and economically viable from a customer perspective. Determination of environmental suitability was based on the broad issues of recreational sensitivity, agricultural soils productivity, and aquatic resources sensitivity. Economic viability was assessed by means of a revenue requirement analysis of base plant costs, fuel and its transportation, water supply, air quality control strategies, and transmission planning considerations. All environmental and economic evaluations of candidate siting areas were effected with the aid of computerized mapping techniques.

Initially, 92 potential sites within the candidate areas were identified and studied to various levels of detail. Twenty-five of these potential sites are located in New Jersey. Successive stages of the program, involving increasingly thorough evaluation of sites that met the screening criteria of previous stages, have been completed to the point where 15 candidate sites have been identified. Nine of these are in New Jersey.

Site Specific Costs

The results of the GPU System Site Selection Study's candidate area evaluation reasonably bounded the range of required revenues between the most and least expensive areas. Expressed in 1989 revenue requirement dollars, this range is approximately $1.5 billion, or about 30% of the total lifetime revenue requirements for a 625 MW coal-fired plant.

The preliminary economic evaluations were based on the assumptions of (1) construction and operation of a 625 MW coal-fired unit (a replicate of Pennsylvania Electric Company's Homer City Unit-3), (2) operating with a capacity factor of 0.65 for forty years and, (3) beginning commercial operation in 1989. The sensitivity of assumptions used in the revenue requirement evaluations were not tested.

The candidate area evaluation performed for the site study generally demonstrated an economic preference for Pennsylvania sites. This preference resulted from the estimated cost impact of satisfying the New Jersey sulfur dioxide emission standard of 0.30 lbs./MBtu fired. This standard was artifically relaxed to federal levels, with concomitant cost reductions, in order to ensure retention of some New Jersey sites throughout the stagewise screening process. Refinement of all cost data is planned for subsequent phases of the site study.

V. PRELIMINARY ECONOMIC COMPARISON OF LOCATING NUCLEAR AND COAL PLANTS AT FORKED RIVER

This section will compare preliminary estimates of electricity costs and relative rate impacts for completing the Forked River Nuclear Station or replacing it with comparable coal capacity on the Forked River site. The presentation will parallel the comparison of TMI-2 alternatives summarized earlier; however, the Forked River options have not been analyzed as extensively as in the case of TMI-2. As explained in the previous section, efforts are underway to determine the feasibility of locating one or more 625 MW coal plants at the site. If feasibility is established, detailed capital cost estimates for the coal plant(s) will have to be developed. The cost estimate for the Forked River Nuclear Station will also have to be revised in future studies to reflect modifications in regulatory requirements and in-service date. Thus, the following comparison, while illustrative, is preliminary in nature, utilizing "ballpark" estimates that will be refined over the coming months.

Plant Costs

Prior to the accident at TMI, the Forked River Nuclear Station was estimated to cost $1156 million, including AFC, and was scheduled for commercial operation in December, 1983. Since all construction efforts at the site were suspended in April, 1979, the startup date must slip and the total capital cost for the plant will necessarily increase. Table V-1 portrays the estimated impacts of delays in the startup date on the Forked River Nuclear Station cost estimate. First, the original estimate (no delay) was modified to be consistent with recent changes in the method and rates used for calculating AFC, increasing the total cost to $1270 million. Then, the effects of startup delays ranging from two years, the minimum expected slippage, to six years were calculated, including:

a) escalation at a 14% annual rate for the first two years of delay and 8% per year thereafter;
b) additional AFC arising from the delays, as determined using the current method and rates; and
c) other costs associated with maintaining the site and equipment already delivered.

These modifications yielded capital costs ranging from just under $1.6 billion for a two year slippage to over $2.2 billion for a six year delay.

In addition to these changes, the regulatory requirements which the plant must fulfill will be substantially altered. It is not possible at this time to accurately estimate the impacts of these changes since all the modifications arising from TMI have yet to be established by the Nuclear Regulatory Commission. For estimating the cost of electricity produced by the Forked River Nuclear Station, it has been assumed that the total capital cost will increase by an additional 20% (or $300 to $450 million). This estimate is speculative and could be significantly different from the actual impact, once regulatory revisions are defined.

The total project cost of coal plants located at Forked River is equally uncertain. Assuming feasibility, a number of unresolved issues could influence the total cost -- pollution control requirements, coal transportation facilities, and ash and sludge disposal sites, among others. For this comparison, it is assumed that the capital cost of two 625 MW coal plants built at Forked River is the same as the estimates for Seward 7/Coho 1 used in the TMI-2 alternatives study, namely, $1707 million for a January, 1987 in-service date for both units. While the earliest date that coal capacity could be in place at Forked River is judged to be eight years (mid-1988 startup assuming a mid 1980 commitment), this timing constraint was relaxed for the purpose of this comparison, and cost estimates for various startup dates were obtained by applying an 8% escalation rate to the above cost estimate. Though there are cost savings in using the Forked River location due to present ownership by Jersey Central and previous site work, the assumed capital cost for coal plants could be optimistic (low) because of the scrubbers needed to meet current New Jersey requirements.

Electricity Costs and Rate Impacts

On the basis of the capital cost estimates and adjustments in fuel and operating costs, the average cost of electricity produced by Forked River nuclear and coal plants over the first ten years of operation was estimated for in-service dates ranging from January, 1986 through January, 1990. The estimates are given in Table V-2. The nuclear values include adjustments in the original Forked River operating cost estimates for escalation plus an additional 10% increase in O&M costs to cover potential operating modifications arising from TMI. The coal estimates are based on the 12.05¢/Kwh value used for Seward 7/Coho 1 (1/87) in the TMI-2 study, as adjusted for escalation where applicable. While the earliest startup date for coal capacity would be in 1988, the values for earlier in-service dates are provided for context.

As shown, the electricity costs for the nuclear plant are about 20% lower than the values for coal plants. These differences would allow increases of $835 to $1040 million in the nuclear capital cost estimate, depending on the assumed in-service date, before reaching the electricity cost levels for coal. The consequences of these hypothetical differences to JCP&L's customers are summarized in Table V-3. Over the same ten year period, the electricity cost differences would yield extra costs to all JCP&L customers of $1.4 to $1.8 billion, based on the output of 1120 MW of capacity at a 58% capacity factor. A typical residential customer who used 500 Kwh's a month would pay an average of $3.90 to $4.40 a month more over the ten years. (In actuality, the initial monthly penalty would be smaller and would continue to increase over the ten year period and thereafter due to the proportionally larger fraction of coal-derived electricity costs which are subject to continuing escalation.)

In conclusion, the Forked River nuclear plant appears to have an economic and schedule advantage over constructing coal plants on the site. While the estimates supporting this conclusion are preliminary and somewhat speculative, the general conclusion should continue to hold even after site specific cost estimates have been developed. However, the risks and uncertainties associated with each option are significant, potentially jeopardizing the feasibility of either approach. It is this issue of feasibility to which Jersey Central is directing its efforts.

TABLE V-1

EFFECT OF DELAYS ON FORKED RIVER COST ESTIMATE
(millions of dollars, as incurred)

	Assumed Delay in In-Service Date				
	Two Years	Three Years	Four Years	Five Years	Six Years
NO DELAY ESTIMATE (12/83)	1270	1270	1270	1270	1270
ADDITIONAL COSTS DUE TO DELAY					
Escalation	137	194	259	326	399
Additional AFC	152	230	315	409	513
Other Costs	18	25	31	38	45
Sub-Total	307	449	605	773	957
COST ESTIMATE, WITH DELAY	1577	1719	1875	2043	2227

1. Construction effort ceases in April, 1979, and resumes after the assumed delay period.

2. Original Forked River cost estimate (no delay) increased from $1156 million to $1270 million to reflect revisions in AFC (rates and calculation methodology).

3. Other Costs, which have been kept to minimal levels, include additional AE and owner's costs, site demobilization costs, insurance premiums, and security and site maintenance.

4. Escalation calculated at 14%/year for first two years of delay and 8%/year thereafter.

TABLE V-2

ELECTRICITY COST ESTIMATES FOR NUCLEAR AND COAL PLANTS AT FORKED RIVER

	Assumed Delay in In-Service Date				
	Two Years (1/86)	Three Years (1/87)	Four Years (1/88)	Five Years (1/89)	Six Years (1/90)
AVERAGE ELECTRICITY COST FOR FIRST TEN YEARS OF OPERATION (¢/Kwh)					
Forked River, Nuclear	8.70	9.45	10.25	11.15	12.0
Comparable Coal	11.15	12.05	13.00	14.05	15.20
ALLOWABLE INCREASE IN NUCLEAR CAPITAL COST FOR BREAKEVEN WITH COAL ELECTRICITY COST ($ Millions)	835	880	930	985	1040

1. All plants assumed to have 58% capacity factor.

2. Forked River nuclear costs based on revised capital cost estimates (increased by an additional 20% to cover prospective regulatory changes, lessons learned from TMI, etc.) and assumed 10% increase in O&M due to potential operational changes arising from TMI.

3. Coal costs derived from estimate used for Seward 7/Coho 1 (1/87), as adjusted by 8% escalation where applicable.

TABLE V-3

HYPOTHETICAL RATE IMPACTS OF
SELECTING COAL OVER NUCLEAR AT FORKED RIVER

	Assumed In-Service Date				
	1/86	1/87	1/88	1/89	1/90
TOTAL EXTRA COSTS TO ALL JCP&L CUSTOMERS OVER A TEN YEAR PERIOD ($ Billions)	1.4	1.5	1.6	1.7	1.8
AVERAGE INCREASE IN TYPICAL JCP&L RESIDENTIAL CUSTOMER'S MONTHLY BILL OVER A TEN YEAR PERIOD (500 Kwh's per month)	$3.90	$4.00	$4.15	$4.25	$4.40

1. Total extra costs were developed by applying the difference between coal and nuclear electricity costs to the production from an 1120 MW plant (58% capacity factor) over ten years.

2. Customer impacts were derived by multiplying (total extra costs divided by total JCP&L projected sales over the ten year period) by (500 Kwh's).