FERC-0050

Power Pooling in the Northeast Region

Prepared by the
Northeast Regional Task Force

For the
FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF ELECTRIC POWER REGULATION
WASHINGTON, DC 20426

February 1981

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

FOREWORD

This report is one of five regional reports prepared by task forces as part of the Federal Energy Regulatory Commission (FERC) power pooling study under the provisions of Section 205(b) of PL 95-617, the Public Utility Regulatory Policies Act of 1978 (PURPA). The act directs the Commission to conduct a study of power pooling and report its findings to the President and Congress. The purpose of the study is to examine "the opportunities for (a) conservation of energy, (b) optimization in the efficiency of use of facilities and resources, and (c) increased reliability through power pooling arrangements."

The regional task forces were formed after consultation with industry and regulatory representatives. Each member of the five regional task forces served primarily as an individual, contributing personal knowledge and interpretations, and provided information on industry activities and problems on the basis of this expertise. While there is basic agreement among the members on the report content in general, there is not necessarily total agreement on all comments or interpretations of events. Where practicable, the differences in views have been reflected in the text.

The regional reports reflect the work of the task forces in addressing the characteristics and problems of coordinated electric power operations in each region. The purpose of the task forces was to assist in developing a regionally specific factual understanding of the development, status, problems, plans, benefits, costs, industry and regulatory views, and other significant aspects of power pooling in the region.

In addition to the regional task force reports, which are primarily descriptive, a separate report is being submitted to the President and the Congress containing an overall assessment of the status of power pooling in the United States by the electric utility industry. This assessment and report is based in part on the reports and proceedings of the task forces.

NORTHEAST REGION TASK FORCE

John W. Boston	Executive Vice President and Director of Power Operations, Power Authority of the State of New York
John F. English	Senior Vice President, System Operations, Power Authority of the State of New York, Representing John W. Boston
James D. Hebson*	Regional Engineer, New York Regional Office, Federal Energy Regulatory Commission
Wilmer S. Kleinbach	Manager, Pennsylvania-New Jersey-Maryland Interconnection
David L. Mohre	Director, Power Supply and Engineering, Allegheny Electric Cooperative, Inc., Replacing Joseph A. Zullo
Philip C. Otness	General Manager, Massachusetts Municipal Wholesale Electric Company
Jack H. Roskoz	Vice President, Electric Operations, New York State Electric & Gas Corporation
Marquis Seidel	Economist, Pennsylvania Public Utility Commission
William Shaffer	Staff Engineer, New York State Public Service Commission, Representing Charles A. Zielinski
James R. Smith	Director, NEPLAN, New England Power Pool
Robert deR. Stein	Manager, Power Supply Planning, Massachusetts Municipal Wholesale Electric Company, Representing Philip C. Otness
Jack R. Templeton	Manager, Energy Systems and Interconnections, Potomac Electric Power Company
Paul N. Tethrow	Assistant General Manager, Allegheny Electric Cooperative, Inc., Representing Joseph A. Zullo

---

*Task Force Chairman

Robert C. Young	Superintendent, Burlington Electric Department
Charles A. Zielinski	Chairman, New York State Public Service Commission
Joseph A. Zullo	Staff Engineer, Allegheny Electric Cooperative, Inc.

CONTENTS

EXECUTIVE SUMMARY

The Northeast Region includes that part of the Northeast Power Coordination Council (NPCC) that lies within the United States and the Mid-Atlantic Area Council (MAAC), two of nine Regional Reliability Councils of the National Electric Reliability Council (NERC). The Northeast Region includes three of the most highly integrated power pools in the country: the New England Power Pool (NEPOOL) and the New York Power Pool (NYPP), which make up the United States portion of NPCC, and the Pennsylvania-New Jersey-Maryland Interconnection (PJM), which covers the same area as MAAC. The areas served by the members of these pools include New England, New York, New Jersey, Delaware, large sections of Pennsylvania and Maryland, a very small part of Virginia, and all of the District of Columbia.

These three pools include as members virtually all Class A and B investor-owned utilities in the Northeast Region. NEPOOL contains 4 holding companies representing 14 electric utilities; a Vermont group representing 5 investor-owned systems, 2 cooperative and 13 municipal systems; and individual memberships of 8 investor-owned and 27 municipal systems. NYPP contains the 7 major investor-owned utilities and the Power Authority of the State of New York (PASNY). PJM contains 8 signatory member systems plus 3 other utilities that participate through separate agreements with particular signatory members. Signatories include the 3 subsidiaries that make up the only holding company in the pool.

As of the end of 1979, the aggregate installed generating capacity in the Northeast Region available to meet peakloads amounted to approximately 97,600 megawatts (MW), or about 17 percent of the total in the United States. Of this amount, NEPOOL had approximately 21,100 MW, NYPP about 31,500, and PJM about 45,000. The bulk power transmission network serving the northeast consists of over 11,000 circuit miles of transmission lines, 230 kV and above. The principal extra-high voltage (EHV) level in NEPOOL and NYPP is 345 kV with about 1500 and 2100 circuit miles in each, respectively. There are smaller amounts of 230-kV lines in both pools. NYPP also has in service the beginnings of a 765-kV system. PJM has extensive 500- and 230-kV networks of about 1300 and 4300 circuit miles, respectively. In addition, PJM has a small amount of 345-kV transmission lines. NEPOOL and NYPP are interconnected at 345 and 230 kV, and NYPP and PJM at 500, 345, and 230 kV.

In addition to strong interpool ties, the three pools are heavily interconnected with neighboring systems in the United States and Canada. In PJM, there is especially heavy east-west transmission of power and energy generated at mine-mouth plants in western Pennsylvania to load centers in the east. In NYPP, the heaviest transmission is in a north-south direction between downstate and upstate New York because of the seasonal diversity between the two areas, the cost differential between the low-sulphur oil required in the downstate region and the high-sulphur oil and coal used in the upstate region, and the need to locate generating capacity outside of metropolitan New York City.

Each of the three power pools in the Northeast Region operates under a formal agreement containing provisions dealing with organization, planning, operation, reserve sharing, and rates. Partly because of greater diversity in the size and ownership characteristics of its members, the NEPOOL Agreement is much more comprehensive and complex than either of the other two. All three agreements provide for a committee structure that includes an executive or management committee that determines policy and directs the activities of the other committees established under the agreement.

Planning committees are responsible for coordinating the planning of bulk power supply facilities. These committees consider the expansion plans of individual pool members and develop coordinated plans for additional generating capacity and transmission facilities, as well as interconnections with neighboring systems and pools. Both NEPOOL and NYPP have separate planning staffs that develop pool load forecasts, evaluate alternative plans, and make recommendations to their respective planning committees.

Each of the three pools in the Northeast Region is operated as a single control area with free-flowing interties among members. The pools have operating committees that direct the activities of pool control centers and establish rules and practices that may be necessary for the coordination of the operations of members. Each is centrally dispatched in the sense that all major generating and transmission resources available to each pool are scheduled and monitored so as to meet overall pool requirements in accordance with reliability and economy criteria regardless of company boundaries.

The three pooling agreements contain a series of provisions relating to rates and capacity responsibility of the members. The capacity responsibility is determined similarly in the three pools. Generating capacity costs are shared in accordance with similar principles in all three pools, although the details vary.

Transmission services and rates are treated somewhat differently in the three pools. The PJM Agreement assesses no transmission charges for intrapool transactions. However, several agreements provide for jointly planned and jointly owned transmission and contain investment equalization payment arrangements. Under the terms of the NYPP Agreement, there are no specific charges for transmission; however, a portion of the savings from economy capability and economy energy transactions is paid to the member systems that supply most of the transmission service. The NEPOOL Agreement provides for transmission as a pool service, and the provisions dealing with transmission service are complex. A pool-wide transmission use rate is established each year for pool transmission facilities of 230 kV and higher.

Economy energy is priced on a split-savings principle in both PJM and NYPP, although there are differences of detail. Other types of transactions among pool members are priced at rates set forth in the respective agreements. NEPOOL allocates pool savings in another manner.

Practically all of the load in the Northeast Region is carried by bulk power facilities that are fully coordinated in the three power pools. Coordination of daily operations between PJM and NYPP and between NYPP and NEPOOL is provided in separate pool-to-pool agreements. By means of these arrangements, the central pool dispatching offices deal directly with each other, significantly simplifying transactions, and substantially improving regional response to emergencies. This approach is an important step beyond the bilateral transactions still used by power pool members in some parts of the country for transactions with members of other pools.

The main thrust of the three power pools in the region is to achieve maximum practicable economies consistent with reliability standards through coordinated development and operation of the bulk power facilities of its members. The two councils, NPCC and MAAC, were formed to augment bulk power system reliability, through a review of individual utility member generation and transmission plans to ensure compliance with council reliability criteria.

The operation of each of the three pools in the Northeast Region, the full coordination of daily operation, and innovative contractual arrangements to obtain and provide energy to and from systems north, south, and west of the region have enabled the members of each pool to maximize conservation of oil.

Blank

CHAPTER 1
INTRODUCTION

Because of the diverse nature of electric power systems, many varieties of pooling and many interpretations of the term "power pool" exist. In this report, electric utility system refers to an electric utility under a single authority, either an investor-owned, business-managed corporation, or a publicly owned governmental agency. A system may be one or, in the case of a holding company, more than one electric utility.

In this report, power pool refers to an amalgamation of two or more utility systems striving for the maximum practical benefits from coordinated planning and operation of their interconnected bulk power supply facilities. Each pool has evolved with similar basic characteristics. Differences between pools reflect, among other things, each pool's unique development, industry structure, and experience.

Power pooling has been actively pursued in the Northeast Region since the 1920's. A comparison of Figures 1 and 2 (1949 and 1979, respectively) shows the expansion of electric bulk transmission facilities resulting, at least in part, from pooling activity in the region. Table 1 presents electric power characteristics of the three formal power pools in the Northeast Region and the appendix presents detailed information on utilities in the region.

Pool operations are continuously monitored, reviewed, and modified to achieve more reliable and economic results. Operations planning and control have achieved effective regional coordination in the operation of generating and transmission facilities of the participating systems. This coordination has enhanced reliability and improved economies in system operation and reserve capacity use.

Central control centers for each pool enhance the reliability of the region's bulk power supply by deploying operating reserves throughout the region at all times, by coordinating facility maintenance on a poolwide basis, and by designing and implementing procedures to deal with various contingencies and emergencies on a poolwide basis.

The electric utility industry in the northeast has a long record of cooperation between and among systems, both in planning and operations. Interconnections have increased since the mid-1920's; three major interconnected pooling networks now cover the 12 States and the District of Columbia, which are considered in this report. The key to this reliable bulk power system has been the coordinated development and operation of these networks. Coordination has contributed to availability of adequate generating capacity and the increased ability of systems to support others during emergencies.

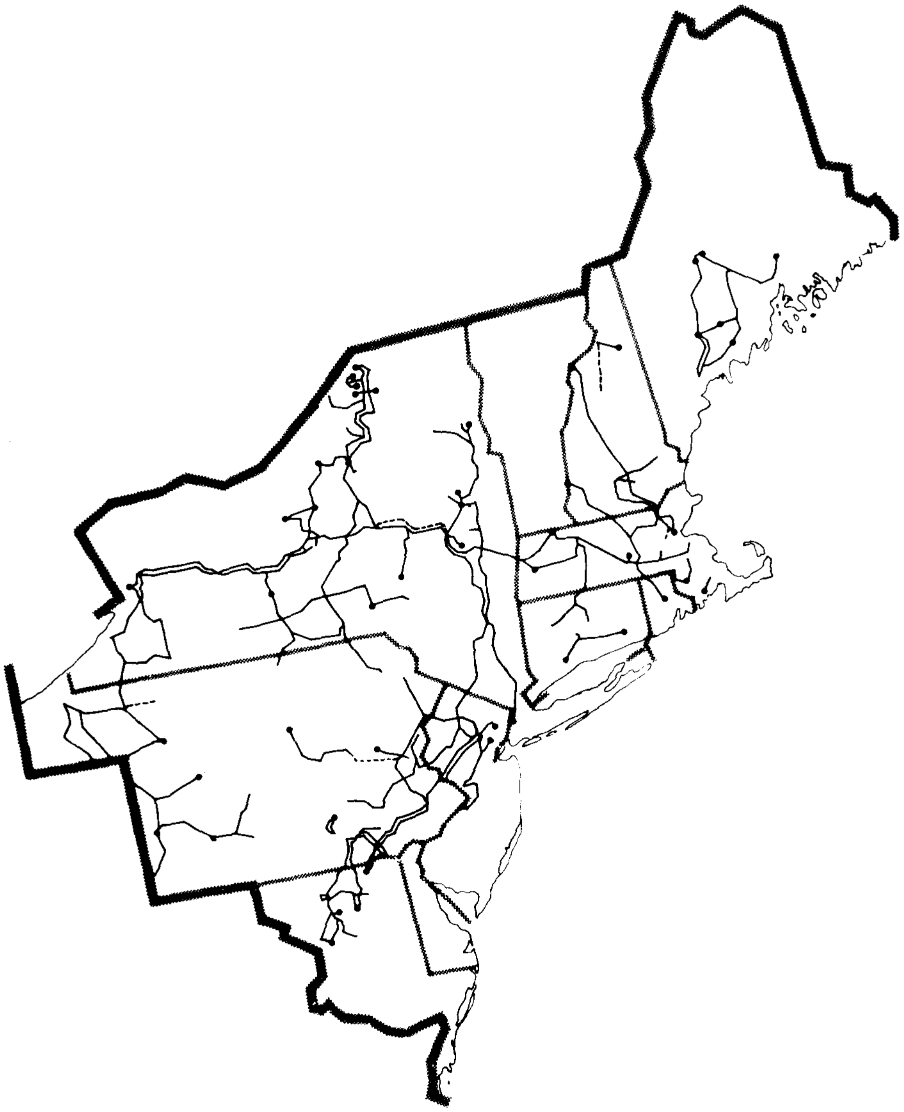


FIGURE 1--Bulk Power Transmission Network in 1949

Substantial economies have been obtained by producing power from lower cost generation to displace high cost generation. Mutual support during such major emergencies as the oil embargo, the coal strike, and natural disturbances has reduced the adverse impact of such events.

The Northeast Region encompasses the entire electric utility industry--investor-owned and publicly owned. Through its two reliability councils, the Northeast Power Coordinating Council (NPCC) and the Mid-Atlantic Area Council (MAAC), the region has an administrative mechanism to provide the overview and leadership to ensure the reliability and adequacy of the bulk power supply.

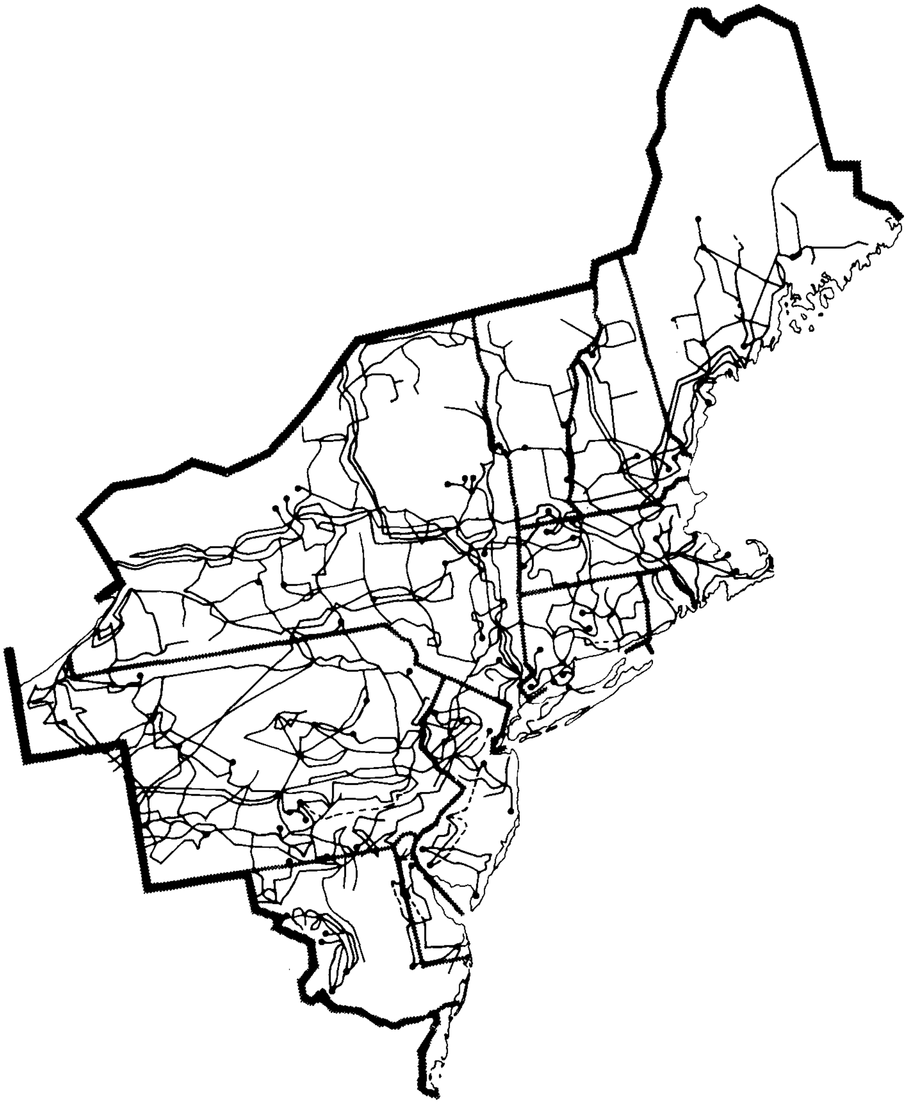


FIGURE 2--Bulk Power Transmission Network in 1979

Coordination in the Northeast Region can be improved mainly by strengthening intraregional ties to facilitate transfers of power in response to economic opportunities and emergency situations and by increasing interregional ties and transactions to the north and south-southwest. Operations can be improved in the areas of automatic generation control, voltage control, unit commitment, and maintenance scheduling.

In the Northeast Region, the goal for the foreseeable future is not to seek one "monolithic," fully coordinated pool, which would be unmanageable, but to promote increased coordination within areas of viable size and closer coordination with neighboring pools.

The Northeast Region is located within the District of Columbia and 12 States: the six New England States, New York, New Jersey,

TABLE 1--Electric Power Characteristics of Systems in the Northeast Region

Name	State	Code	Installed Capacity 1979 (MW)[1]	Peakload 1979 (MW)[1]	Major Interconnections (230 kV and Above)	Purchases Power From[2]
New England Power Pool	Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut	NEPOOL	21,919	15,278	New Brunswick Electric Power Commission, New York Power Pool	Southern Canada, PASNY, New Brunswick Electric Power Commission
New York Power Pool	New York, New Jersey, Pennsylvania	NYPP	29,697	20,406	Hydro Quebec, New England Power Pool, PJM Interconnection	Hydro Quebec, Southern Canada
Pennsylvania-New Jersey-Maryland Interconnection	Pennsylvania, New Jersey, Maryland, Delaware, Virginia, District of Columbia	PJM	44,701	31,654	New York Power Pool, Cleveland Electric Illuminating Co., Virginia Electric & Power Co., Allegheny Power System	PASNY, Allegheny Power System

[1] Source: Tables 11, 15, and 21 of this report.
[2] Source: Appendix A of this report.

Delaware, about 75 percent of Pennsylvania, 60 percent of Maryland, and approximately 1 percent of Virginia. The population in 1970 was more than 50 million, and the land area was approximately 160,000 square miles. The area was served by 246 utility systems, of which 95 are privately owned. One hundred thirty-two municipal systems, 16 cooperatives, and three State agencies make up the public segment.

The Northeast Region encompasses the area of responsibility of NPCC (U.S. portion) and MAAC. These councils are two of the nine area councils that make up the National Electric Reliability Council (NERC), formed by the electric utility industry in 1968 and incorporated in 1974. NERC's stated purpose is to augment the reliability and adequacy of bulk power supply of the electric utility systems in North America. The nine regional councils represent essentially all of the electric utility systems in the United States and the Canadian systems in Ontario, British Columbia, Manitoba, Alberta, and New Brunswick.

The governing body of NERC is the Board of Trustees, which consists of two representatives from each regional council, plus such additional members as necessary to include at least two representatives from each segment of the electric utility industry: investor-owned, Federal, Rural Electric Cooperative, and municipal/State. Meetings of the Board of Trustees are attended by observers from the United States Government and the Government of Canada.

Serving the NERC Board of Trustees are the technical steering committee, the engineering committee (formerly the technical advisory committee) and the operating committee (formerly the North American Power Systems Interconnection Committee).

The two councils, NPCC and MAAC, were formed to augment further the planning for bulk power system reliability. The main thrust of the three power pools in the region is to achieve maximum practicable economies consistent with reliability standards through coordinated development and operation of the bulk power facilities of its members.

REGIONAL ORGANIZATION--NPCC

NPCC, which commenced operation on January 19, 1966, consists of 21 full member systems (Table 2) that supply approximately 98 percent of all the electricity generated in New England, New York, and New Brunswick and Ontario, Canada. The systems in the United States portions of NPCC, in 1979, had a total summer generating capability of approximately 50,428 MW. Table 3 provides a statistical description of NPCC.

Four distinct planning and operating entities exist within the NPCC region. NPCC member systems in New England are also members of NEPOOL, and systems in New York are members of NYPP. New Brunswick Electric Power Commission and Ontario Hydro are single entities serving their respective provinces in Canada.

Membership in NPCC is available to electric systems ". . . which by virtue of generating or transmission capacity, or concentration

TABLE 2--Members of NPCC and Locations of Executive Offices

Member Systems	Executive Offices
Boston Edison Co.	Boston, Mass.
Burlington Electric Dept.	Burlington, Vt.
Central Hudson Gas & Electric Corp.	Poughkeepsie, N.Y.
Central Maine Power Co.	Augusta, Me.
Central Vermont Public Service Corp.	Rutland, Vt.
Consolidated Edison of New York Inc.	New York, N.Y.
Eastern Utilities Associates	Boston, Mass.
Green Mountain Power Corp.	Burlington, Vt.
Long Island Lighting Co.	Mineola, N.Y.
New Brunswick Electric Power Commission*	Fredericton, N.B., Canada
New England Electric System	Westboro, Mass.
New England Gas & Electric Association	Cambridge, Mass.
New York State Electric & Gas Corp.	Binghamton, N.Y.
Niagara Mohawk Power Corp.	Syracuse, N.Y.
Northeast Utilities	Hartford, Conn.
Ontario Hydro*	Toronto, Ont., Canada
Orange and Rockland Utilities, Inc.	Pearl River, N.Y.
Power Authority of the State of New York	New York, N.Y.
Public Service Co. of New Hampshire	Manchester, N.H.
Rochester Gas & Electric Corp.	Rochester, N.Y.
United Illuminating Co.	New Haven, Conn.

*Not included in statistical data.
Source: NERC Annual Report, 1978

of load, can have a substantial effect on the service reliability of the Northeast interconnection." The council's Memorandum of Agreement also allows for nonvoting associate membership classification.

REGIONAL ORGANIZATION--MAAC

A portion of the present MAAC system, operating on a "one-system" basis under the long existing Pennsylvania-New Jersey Agreement (1927), expanded in 1956 to become the Pennsylvania-New Jersey-Maryland Interconnection (PJM). Eight companies are now signatories to the agreement and three other companies are included in the fully coordinated operation of the pool.

In 1967, PJM member companies and their associates signed a service-reliability compact known as the Mid-Atlantic Area Coordination Agreement (MAAC). It calls for planned additions or changes in major existing facilities to be submitted to the MAAC

TABLE 3--NPCC Statistical Data (U.S. Portion Only)

Population served	30,100,000
Number of customers	10,700,000
Area served (square miles)	111,000
Includes: Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York	
Maximum peakload (August 1979)	34,743 MW
Maximum annual energy requirements (1979)	201,708,000 MWh

Net installed summer capability as of 12/31/79:

	MW	Percent
Steam, coal	3,974.00	7.9
Steam, oil	25,428.57	50.4
Steam, nuclear	7,922.47	15.7
Combustion turbine	4,988.47	9.9
Conventional hydroelectric	5,299.12	10.5
Pumped storage	2,632.60	5.2
Combined cycle	183.00	0.4
Total	50,428.23	100.0

Installed transmission circuit miles as of 12/31/79:
765 kV - 251*
500 kV - 5
345 kV - 3,644
230 kV - 1,547

Total energy requirements, 1979	Percent
Steam, coal	10.9
Steam, oil	41.2
Steam, gas	3.3
Steam, nuclear	22.3
Combustion turbines and diesels	0.3
Hydroelectric, conventional	15.5
Hydroelectric, pumped storage	0.2
Net purchases	6.3

	Number
NPCC external connection points	36
Interpool connection points	12
NYPP - Ontario Hydro	4
NYPP - NEPOOL	7
NEPOOL - New Brunswick	1
NYPP - MAAC PJM	12

*96 miles is presently operated at 345 kV.

Sources: Director of NEPOOL Planning; NYPP "15-112" Report, 1980; FPC Form 1-M, Power Authority, 1978, 1979; NPCC April 1980; DOE/EIA 0044 (78)

Executive Board for review by its Area Coordinating Committee, which determines whether the plans meet established standards of service reliability.

In addition to meeting the PJM obligations, all members, as members of MAAC, must meet MAAC reliability criteria, which were subsequently adopted as PJM's own reliability criteria.

Membership in MAAC is available to "any other electric system which (1) is directly connected with and is operated in parallel with the bulk electric supply system of one or more of the signatories, and (2) significantly affects the reliability of the bulk electric supply systems of the signatories." The MAAC Agreement also provides for nonvoting participation by systems not eligible to become signatories under the above membership requirements.

Because for all practical purposes PJM and MAAC are synonymous, the acronyms are used interchangeably in this report. Table 4 lists members and associates of the MAAC Regional Council, and Table 5 provides the latest statistical data available.

TABLE 4--Members and Associate Members of MAAC

Members

Atlantic City Electric Co.
Baltimore Gas and Electric Co.
Delmarva Power & Light Co.
Jersey Central Power & Light Co.*
Metropolitan Edison Co.*
Pennsylvania Electric Co.*
Pennsylvania Power & Light Co.
Philadelphia Electric Co.
Potomac Electric Power Co.
Public Service Electric and Gas Co.
UGI Corp.

Associates

Allegheny Electric Cooperative Corp.
Dover (Del.) Municipal Utility
Easton (Md.) Utility Commission
Southern Maryland Electric Cooperative Corp.
Vineland (NJ) Municipal Utility

---

*Subsidiaries of General Public Utilities Corporation.

Source: MAAC ERA-411 Report, April 1979

TABLE 5--MAAC-PJM Statistical Data

Population served	20,400,000
Number of customers	7,500,000
Area served (square miles)	48,700
Includes: Delaware, the District of Columbia, 97 percent of New Jersey, 75 percent of Pennsylvania, 60 percent of Maryland, and 1 percent of Virginia	
Maximum peakload (July 1980)	34,420 MW
Maximum annual energy requirements (1979)	172,540,000 MWh

Net installed summer capability as of 12/31/79:

	MW	Percent
Steam, coal	13,724	30.5
Steam, oil	12,122	26.9
Steam, coal/oil	1,753	3.9
Steam, nuclear	7,076	15.7
Combustion turbine and diesel	7,496	16.7
Combined cycle	452	1.0
Conventional hydroelectric	956	2.1
Pumped storage hydroelectric	1,280	2.8
Transfers	180	0.4
Total	45,039	100.0

Installed transmission circuit miles as of 12/31/79:
500 kV - 1,263
345 kV - 160
230 kV - 4,400

Total energy requirements, 1979	Percent
Steam, coal	47.6
Steam, oil	19.9
Steam, nuclear	18.2
Combustion turbines and diesels	4.3
Hydroelectric, conventional	2.5
Hydroelectric, pumped storage	1.1
Net purchases	6.4

	Number
Intersystem connection points	53
Interpool connection points	
New York Power Pool	12
The Cleveland Electric Illuminating Co.	1
Allegheny Power System	13
Virginia Electric and Power Co.	1
Total interpool	27

Sources: FPC Forms 12, 1978; MAAC April 1980

Blank

CHAPTER 2
ELECTRIC COORDINATION IN THE NORTHEAST REGION

TRANSMISSION NETWORK

The highly interconnected transmission system in the Northeast Region forms the basic framework that integrates the generating capacity and the bulk power transmission supply system. A strong and well-balanced transmission network is the key to reliability. The existing networks have the operating flexibility to provide reliable and economic bulk power. They can accommodate a wide range of power-flow patterns and a wide variety of emergency conditions, such as lightning storms, hurricanes, operating mishaps, and mechanical failures, without uncontrolled cascading trip-outs in large portions of the network. The transmission pattern is largely determined by the location and dispatch of generation, the location of load centers with relation to generating stations, the availability of network components for operation, and the scheduling of power transfer between and among the utility systems in the northeast network.

The transmission networks in the northeast reflect the economic growth and the technical constraints created by the demands for electric energy and the availability of resources. The present extensive transmission system has resulted in:

1. The existing high level of bulk supply reliability.
2. A reduction in cost of electricity through the realization of economies of scale and through the most economical generation.
3. A reduction in generation reserve requirements through the utilization of load and outage diversity among systems.
4. Mutual assistance among power suppliers to meet shortages during emergency conditions.

The two coordinating councils in the northeast, NPCC and MAAC, are highly interconnected. Five 115-kV lines, three 230-kV lines, four 345-kV lines, and one 500-kV line connect the two councils. The United States members of NPCC are interconnected with the Canadian members of NPCC and Quebec to the north. MAAC is interconnected with ECAR to the west and SERC (Virginia-Carolinas Subregion, VACAR) to the south.

Emergency transfer capability is defined by NERC as the total amount of power (above the net contracted purchases and sales) that can be scheduled, with an assurance of adequate system reliability, for interregional or multiregional transfers over the transmission network for periods up to several days, based on the most limiting of the following:

a) All transmission loadings initially within long-time emergency ratings and all voltages initially within acceptable limits.
b) The bulk power system capable of absorbing the initial power swings and remaining stable upon the loss of any single transmission circuit, transformer, or generating unit.
c) All transmission loadings within their respective short-time emergency ratings and voltages within emergency limits after the initial power swings following the disturbance, but before system adjustments are made. (In the event of a permanent outage of facility, transfer schedules may need to be revised.)

Figure 3 shows the emergency transfer capabilities between NPCC, MAAC, and neighboring council areas in 1978 and those anticipated for 1982 and 1988.

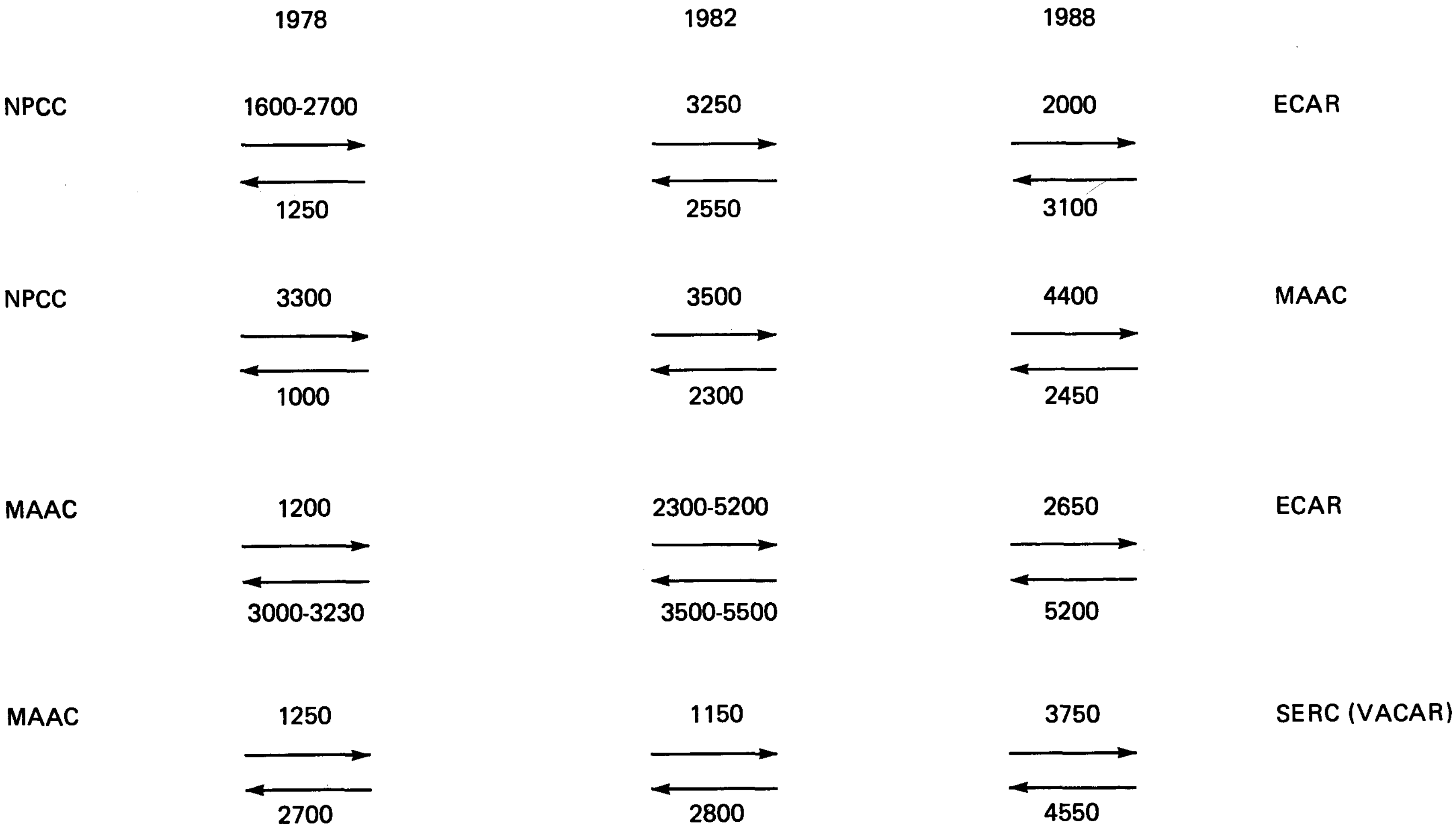
The inherent strength of this transfer capability has been demonstrated during a number of serious emergency conditions. A recent test was the 111-day coal strike during the winter of 1977-78. During this period, approximately 3.2 billion kilowatt-hours were transferred into ECAR, TVA (Tennessee Valley Authority), and MAIN from the Northeast Region.

As of December 31, 1979 there were approximately 5900 circuit miles of 230-kV, 3800 circuit miles of 345-kV, 1500 circuit miles of 500-kV, and at least 200 circuit miles of 765-kV lines operating in the Northeast Region. By 1989, total existing, under-construction, committed, and planned transmission in the region is expected to total approximately 5900 circuit miles of 230-kV, 5000 circuit miles of 345-kV, 2000 circuit miles of 500-kV, and 300 circuit miles of 765-kV lines.

This transmission expansion includes many new interconnections between individual utilities. These lines, if constructed, would provide intraregional and interregional transfer capabilities as shown in Figure 3.

Delays in the siting and approval for construction of new transmission facilities may result in future systems not having the necessary transmission capability and flexibility. This could have a serious impact on future bulk power supply reliability. In the northeast, the reduced operating flexibility of the transmission network will necessitate increased use of oil to maintain system reliability. In addition, the lack of transmission alternatives will greatly reduce the ability of the region to provide assistance to and receive assistance from neighboring areas during fuel emergencies.

Many critical transmission lines in the region have been delayed due to the inability to secure timely regulatory approval. In many cases, the approval process is delayed because of localized opposition based on land-use conflicts or situations in which opponents do not want the transmission project in their area,



NOTE: The arrow indicates the direction of the power flow and the adjacent number the magnitude of the power flow. Two adjacent numbers are annual minimum and maximum power flows.

SOURCE: 8th Annual Review of Overall Reliability and Adequacy of the North American Bulk Power Systems, August 1978 NERC.

FIGURE 3--Emergency Transfer Capabilities (MW)

regardless of the overall necessity. Once the need for a project has been ascertained, the approval process should establish an acceptable route for the transmission line as quickly as possible.

CONTROL AREAS AND CENTRAL DISPATCH

Use of generating units by utilities in an interconnected system dispersed throughout a region allows utilities to minimize their capacity requirements by lowering their reserve capacity requirements. The joint use of generating units requires utilities to integrate their transmission networks. Close, hourly coordination is required to take full advantage of joint generating facilities. The method by which interconnected utilities manage and coordinate the supply of electric power within their service area is known as the control area concept.

A control area may be for a single system or, by arrangements between utilities, may encompass more than one system. Within a control area, the generation is managed so that changes in load requirements are met by the area's own generation resources while prearranged levels of power interchanges with adjoining control areas are maintained. This is accomplished by the application of a system of controls such that when net flows over the interarea tielines go off schedule, changes are made in area generation to restore them to the scheduled levels. If the area control center is equipped with a system that controls the economic selection of generation at the same time that it regulates tielines, maximum operating economy of available equipment is realized. This optimization often occurs when the control area coincides with an individual utility system, but it is not always achieved when the control area covers more than one system, except in formal power pools or holding companies. The operating coordination accomplished through the application of the control area concept to multiple systems can range from that achieved by a formal power pool to that obtained by simple bilateral interconnection agreements between two systems.

The nine Regional Reliability Councils provide another important coordinating mechanism. Formed in the late 1960's, with membership open to all utilities, the Councils provide a forum for review and discussion of individual utility plans and operating practices. They encourage voluntary member actions to harmonize plans and improve operating coordination. Although the focus of the Councils' activities is on technical coordination and does not include economic coordination as such, effective technical coordination is a prerequisite for economic coordination. Consequently, the Council's work is often the basis for expanded economic coordination.

The control area concept of coordination was formally endorsed in the early 1960's by the North American Power Systems Interconnection Committee (NAPSIC). The following 10 principles that define the major responsibilities and requirements of the utility systems in a control area are excerpted from the NAPSIC Operating Manual, June 1979 revision:

1. Each control area shall provide sufficient capacity to carry its expected load at 60 Hz with provision for adequate reserve and regulating margin.
2. Each control area shall provide accurate and reliable automatic tieline bias control as a means of continuously balancing its generation against its load, so that the net loading of its tielines agrees with the scheduled net interchange, plus or minus its frequency bias obligation.
3. Each control area operating in parallel with other control areas shall have its frequency bias set equal to its area frequency response characteristic.
4. All interconnections shall be equipped with tieline telemetering to the appropriate Power Control Centers for inclusion in the area control schemes. Common measuring equipment should be used by both parties.
5. All interconnections shall be equipped with kilowatt-hour metering, with readings obtained hourly at the Power Control Center as a means of continually monitoring control area regulating performance and effecting prompt corrective action.
6. Coordination of changes in scheduled power deliveries between control areas is essential for proper frequency control so as not to burden other control areas or systems.
7. In the event that a system is deficient in either generating or transmitting capability, that system has the responsibility of bringing load and generation into balance within emergency limits.
8. Whenever practicable, generating units should be operated in such a way that governors are free to respond to changes in system frequency.
9. Operating instructions and procedures should be established by each system to cover its operation under emergency conditions, including the loss of communications.
10. For high degree of service reliability under normal and emergency operations, it is essential that adequate and reliable communications be provided within a system, between systems, and between control areas.

NEPOOL

The operating arm of NEPOOL is the New England Power Exchange (NEPEX). Using computers and a complex communications network, NEPEX controls and dispatches the major generating units using the pool transmission network in New England. This ensures that power is always produced by the most efficient units available and at the lowest possible cost. By continuously monitoring New England's generation and transmission system, NEPEX is also able to direct a unified response by all utilities to any critical situation.

NEPEX has a master computer control center in West Springfield, Massachusetts, four regional satellite centers, and a communication network for remote control of most generating units in the region. The four satellite control centers are located in Southington, Connecticut; Westboro, Massachusetts; Manchester, New Hampshire; and Augusta, Maine. Figure 4 shows the location of NEPEX control centers.

Each day NEPEX commits units to meet the anticipated loads through a daily forecast program. This program meets the estimated requirements by dovetailing the hydroelectric, pumped storage, nuclear, and conventional thermal generation into a commitment schedule that requires minimum fuel expenditures and other variable costs. Capital costs are not considered in this daily commitment.

The one-system commitment schedule is updated and administered on a minute-to-minute basis using conventional economic dispatch and automatic generation control programs. The single-system dispatch results in numerous transactions of various types among NEPOOL participants.

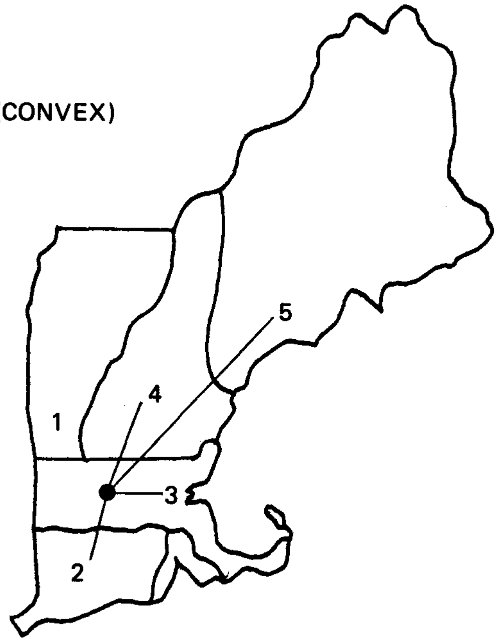
1 MASTER CONTROL CENTER
West Springfield, Massachusetts.

2 CONNECTICUT VALLEY ELECTRIC EXCHANGE (CONVEX)
Southington, Connecticut. Controls power in Connecticut and western Massachusetts.

3 RHODE ISLAND–EASTERN MASSACHUSETTS–VERMONT ENERGY CONTROL (REMVEC)
Westboro, Massachusetts. Controls power in Rhode Island, eastern Massachusetts and Vermont.

4 NEW HAMPSHIRE CONTROL CENTER
Manchester, New Hampshire. Controls power in most of New Hampshire.

5 MAINE POWER EXCHANGE
Augusta, Maine. Controls power in most of Maine.



SOURCE: "Electric Utility Industry in New England," 1977.

FIGURE 4--NEPEX Satellite Control Centers

NEPOOL exchanges power with its neighbors on a single-system basis. It has interconnection agreements with the New York Power Pool and New Brunswick. These contracts are for economy, emergency, and supplemental service and are generally considered to be short term. Longer term contracts are typically worked out several years in advance and benefit both parties. For instance, Vermont has a long-term purchase contract with the Power Authority of the State of New York for 150 MW from its St. Lawrence project, and Maine Electric Power Company has a contract for 400 MW from New Brunswick. Because of the long leadtimes, long-term contracts can be incorporated into NEPOOL's power supply planning many years ahead.

Central dispatch involves two kinds of continuous transactions among participants: exchange of energy and operating reserves through NEPEX, and transfer of these resources over Pool Transmission Facilities (PTF) owned by the individual participants.

To account for the economic flows associated with the continuous interchanges of energy and reserves, NEPEX has established a complex set of billing procedures that involve two major steps:

1. Each participant's system is dispatched on paper to determine how that participant would have met its load with only its own resources, without NEPEX. The difference between this dispatch and the actual generation represents deliveries to or receipts from NEPEX.
2. The participant then makes payments to or receives payments from NEPEX for these deliveries or receipts according to the decremental or incremental costs associated with the difference in level of output (plus adjustments in certain cases) for each unit. The difference between NEPEX receipts and payments is savings, which are distributed to participants based on their share of total NEPEX transactions.

These billing procedures are equitable and are based on the same economic principle as the dispatching rules--namely, that the costs are incremental/decremental costs. The billing procedures also encourage each participant to optimize its own system and to engage in mutually beneficial transactions with other participants.

For the power pool to be effective, the participants must have access to each other's transmission facilities. At minimum, a participant must have access to the network to receive hour-to-hour services through NEPEX and to transfer to its own system its joint participation interests in generating units approved by NEPOOL. For these purposes, NEPOOL generally provides participants unrestricted access to pool transmission facilities (PTF).

Under the PTF billing procedures, transmission rates in general do not vary with transmission distances. Thus, a participant can make use of a generating unit to meet its capacity requirements and not be penalized for location. The rates also reflect uniformity in cost determination. This is important for efficient and effective power pooling because if each participant were to bring a unique set of cost data to bear on the billing calculations, the pool would be plagued with controversy and administrative complexity. Finally, these cost-based rates reflect the principle of proportional sharing of total PTF costs. That is, users pay for their transmission-facility use into a PTF fund. At the end of each month, the fund is distributed to participants in proportion to their share of total PTF costs. These PTF rates and billing procedures facilitate pool operations and encourage joint ownership of units by ensuring the partners access to transmission facilities, on predetermined terms, to transfer energy to their systems.

NEPEX coordinates its activities with other power pools in the northeastern United States and Canada, allowing an exchange of power and reserve capacity to enhance reliability and operating efficiency while minimizing plant investment. For example, during the extremely cold winter of 1976-77 and the coal strike of 1978, the New England utilities, through NEPEX, were able to export energy to pools that were unable to meet their loads.

NYPP

The NYPP Power Control Center near Schenectady, New York, which went into service in February 1970, coordinates the operation of NYPP throughout the State. NYPP performs economic dispatch on an hourly basis by coordinating all economy transactions, within New York and with external systems, to maximize savings. It also coordinates emergency capability and energy transactions, as required, at the lowest cost available. Pool members dispatch their respective generating units according to hourly transaction schedules developed by NYPP.

NYPP members have signed an interconnection agreement with the members of the Pennsylvania-New Jersey-Maryland (PJM) Interconnection. There are also agreements between NYPP and NEPOOL and an agreement between the NYPP and Ontario Hydro. These allow for the most economic operation of the Northeast Region.

The NYPP agreement enables the pool to operate with computer-directed economic dispatch executed on a real-time basis. The bulk power supply system within New York State operates as a single system while maintaining the corporate identity of each member company. Additional savings are realized through this approach for the following reasons.

1. The real-time dispatch is able to take advantage of the member systems' load diversity within each hour.
2. The automated coordination of transactions of eight pool members and three neighboring pools reduces limitations due to time constraints restricting manual transactions.
3. Generalized approaches and approximations, such as pricing energy in blocks, have been replaced by computerized algorithms and methods.
4. The real-time dispatch permits the economic allocation of operating reserves among member systems to meet total pool requirements.
5. The dispatching of resources is economically enhanced by pooling.

The implementation of pool economic dispatch required both computer hardware and software and modifications in operating procedures and contractual language. These changes were implemented at the Power Pool Control Center and at the members' control centers.

A preliminary step toward achieving maximum economy of operation is the development of an optimum schedule. All resources within New York State are scheduled to meet overall pool requirements in accordance with economy and reliability criteria, regardless of company boundaries. More savings may be realized through the real-time dispatch as the scheduling process becomes more effective. Pool scheduling will ultimately be done by a computer program known as Unit Commitment, which will be executed daily by NYPP and updated as required. Member systems will input information on supply load, fixed schedules, unit availability, and local operating constraints. The program will then examine the overall production cost alternatives for each day and produce an optimum schedule.

Because implementation of Unit Commitment lags behind the remainder of the pool dispatch package, it has been necessary for the member systems to continue to schedule unit availability individually.

Each hour NYPP personnel undertake a detailed analysis of the next hour, using a computer program known as Interchange Evaluation. The pool dispatcher can update the schedule in the event of changes in operating conditions, then evaluate any potential purchases and/or sales between NYPP and external parties. Then a final schedule of external transactions for the hour is developed.

Each hour is divided into intervals with a dispatch calculation being performed once during each interval. The normal interval is 5 minutes. Each dispatch determines the most economic loading point for every dispatchable generator regardless of company boundaries. Checks are made to avoid exceeding transmission line ratings or generator limits, and required NYPP reserve levels are maintained. The calculated base points (economic dispatch load points) for each dispatchable unit and desired net interchange are transmitted to each member's control center.

An Automatic Generation Control Program is run every 6 seconds and determines the pool control error. From this quantity, Satellite Control errors are computed for each member system, recognizing participation factors and generator limitations, then transmitted via computer to member companies. These signals can be automatically introduced into generation control equipment at each member's control center.

Billing is done once each dispatch interval using a reconstruction technique that determines net interchange levels for all member companies and the degree of participation by each member company in the interchange transactions. Production cost data are determined at this time. At the close of each hour, preliminary billing data are summarized and reported to each member company.

As compensation for the use of bulk power system facilities, currently 9.2 percent of all savings from economy transactions is retained in a transmission fund that is distributed monthly to Con Edison (21 percent), Niagara Mohawk (74 percent), and New York State Electric and Gas (5 percent). This provision effectively results in "free flowing ties" with respect to economic dispatch.

All internal and external purchases and sales, with the exception of firm contracts, take place between companies and NYPP. All external transactions, except firm contracts, are between NYPP and neighboring pools. All data associated with billing are determined by NYPP, which produces, in addition to the hourly billing data, daily and monthly billing reports. Such reports include all data required by the member companies, including fuel adjustment clause data. Bills rendered by NYPP are final, but are subject to adjustment in succeeding months, if appropriate.

PJM

The coordinated operation of PJM begins with the advance scheduling of both generator and transmission planned outages. The Interconnection Office prepares composite schedules for maintenance of generation and transmission facilities from schedules prepared by the individual companies as follows:

1. Generator Maintenance. A schedule by weeks is prepared each month for a future period. In December through April, a schedule is prepared through September of the coming summer. In May, a schedule is issued for the next 29 months--through September, 2 years hence. In June through October, a schedule is issued through September of the next year and, in November, a schedule is issued through September, 2 years hence.
2. Transmission. A schedule by days is prepared each month for the next 2 months. A schedule by days is prepared every 3 months for the next 6 months. A schedule by days is prepared annually for the next 24 months.

Maintenance scheduling is coordinated to minimize production and maintenance costs while maintaining an acceptable level of risk. Development and review of the maintenance schedules includes evaluation of scheduling alternatives by a production costing computer program and computer assessment of the weekly risk, determined on a probabilistic basis.

A benefit to the PJM systems is the creation of an operating reserve for the pool as a whole instead of individual operating reserves of the 11 PJM systems. Operating reserve is generating capability in excess of forecast system peakload. It is available within 30 minutes to provide for adequate tieline regulation in the event of load variations or equipment failure and, under certain conditions, area protection. The operating reserve is divided into primary and secondary reserves.

Primary reserve is the generation capability in excess of system load that is synchronized to the system or on standby and ready for immediate startup and that is capable of being loaded within 10 minutes to provide for adequate tieline regulation in the event of load variations or equipment failure. Primary reserve is subdivided into spinning reserve and quick-start reserve. Spinning reserve is that portion of primary reserve synchronized to the system. Quick-start reserve is any remaining portion of primary reserve, adjusted by a factor to allow for the probability of failure of equipment to start. The pumping load of pumped storage hydroelectric plants, when counted as primary reserve, is considered to fall within the spinning category.

Secondary reserve is the generating capability in excess of system load that is either synchronized to the system or on standby and ready for startup and that is capable of being loaded within 10 to 30 minutes of the occurrence of a contingency.

Reserve objectives are established by the PJM Operating Committee. An operating reserve objective, a primary reserve objective, and a spinning reserve objective are in effect at all times. Operating reserve objectives are determined by combining the effects of load deviation from forecast, probability of equipment forced outages during the scheduling period, probability of equipment return from outages during the scheduling period, probability of equipment starting failure, and variance in risk from the mix of available units.

The precise values of the objectives depend on season, day of the week, time of day, PJM load level, and the number of large units (greater than 950 MW) operating. The following discussion concerns objectives calculated for the summer of 1978 and demonstrates the typical magnitude of reserve objectives in the PJM system. For low large-unit availability and load levels from 22,000 to 34,000 MW, the objectives range from 2100 to 2900 MW for weekday mornings and from 1800 to 2400 MW for weekday afternoons. High large-unit availability usually increases reserves by approximately 100 to 150 MW at all levels. The evening objectives are generally commensurate with those of morning. Objectives for weekends are generally 400 to 600 MW higher because of the higher probability of load deviations from forecast.

To schedule and operate PJM on a daily basis, the individual systems provide their estimates of the peakloads for various periods in the day and the operating capacity required for their local area protection. The Interconnection Office combines the estimates into a total pool estimate and schedules sufficient operating reserve to protect PJM. A vital part of the scheduling procedure involves the scheduling of operating capacity and energy with neighboring pools and systems. After the capacity has been scheduled for reliable and economical generation, incremental loading schedules are prepared and made available to the interconnection dispatcher for economically loading the generation.

Using the standard tieline frequency bias, control signals are developed at the PJM Control Center near Valley Forge, Pennsylvania by a large-scale, digital computer that compares the prearranged tieline schedules with actual flows. Every 3.5 seconds, a new area requirement signal is developed, and approximately every 15 seconds a new incremental cost, or Lambda signal, is dispatched to the remote computers for the automatic loading of approximately 60 percent of the installed capability of the pool, which is under automatic control. Supplemental generation that may be needed is also loaded economically, but manually, by the interconnection dispatcher from incremental loading schedules. The result is the most economic generation of power for the total pool load requirements plus the scheduled interchange of power with the adjacent pools or systems.

To provide the interconnection dispatcher and the PJM system dispatchers with accurate current information concerning the bulk power transmission system, considerable information is transmitted to the PJM Control Center, where the transmission network security is extensively monitored. Economically dispatched generation is permitted only as long as first contingency transmission limits are not exceeded. When these limits are exceeded, then, generation may be dispatched uneconomically to provide the desired degree of reliability. Through a series of computer applications the bulk power system is monitored, and simulation studies are made to indicate immediate or forthcoming anticipated operating restrictions in the operation of the bulk power transmission system of PJM.

Recognizing the importance of maintaining the integrity of the bulk power system and the power supply to the customers of the PJM systems, an extensive notification and emergency plan has been in use for some time. The plan deals with shortages in available operating capacity to meet customer demand and includes both short-range and long-range plans to accommodate such shortages. In recent years, PJM has observed the need for a plan to cope with energy shortages. The plan recognizes problems in energy supply that could result from oil embargos, coal strikes, nuclear moratoriums, governmental edicts, or natural disasters. Plans for operating capacity deficiencies and energy deficiencies are constantly reviewed and, if necessary, updated. When necessary, they are reviewed with appropriate governmental agencies to ensure their implementation in case of shortages.

The coordinated operation of PJM requires an extensive communications system to link the PJM Control Center with the member companies' control centers. Because the communications are vital, redundancy in these facilities is provided. Because of the importance of the computers to the monitoring of the bulk power transmission system, redundancy in computer power is also provided. In addition, the power supply to the PJM Control Center and to the control centers of the PJM member companies is installed with backup in case of failure of the normal supply. PJM is cooperating with NYPP and NEPOOL to extend communication links and computer ties over a larger region to improve regional monitoring.

In summary, the PJM operation under the one-system concept attempts to provide a high degree of reliability through the coordination of the systems. The most economical dispatch of generation takes place within the pool and with neighboring pools and systems. Under the one-system concept all systems are obligated to take emergency steps to cope with either a deficiency in operating capacity, a serious bulk power transmission loading condition, or a deficiency in available energy resources to produce electrical energy to supply the loads of all systems. Regardless of the development of a critical situation on a portion of the pool and to the extent possible, all systems will share in maintaining the integrity of the pool operation.

The success of PJM in such operating circumstances can be related to the availability of emergency procedures and to the coordination of the procedures by the interconnection dispatchers. At their direction, PJM member companies will take steps, including curtailment of load or load dumping, if the condition is critical. The success of PJM can also be attributed to its long experience in operating under the one-system concept. Although this concept may be burdensome to some member companies, over the long run each member company receives greater assistance than it is required to return.

The accounting for PJM transactions begins with the installed capacity determination of the requirement for the pool and the determination of the member companies' obligation to the total installed requirement of the pool. Sufficient generating capacity is planned to ensure that in each year the probability of load exceeding the available generating capacity shall not be greater on the average than 1 day in 10 years.

Among the factors considered in calculating the probability are the characteristics of the load, the probability of error in load forecast, the scheduled maintenance requirements for generating units, the forced outage rates of generating units, limited energy capacity, the effects of transmission interconnections with other pools, and network transfer capability within PJM. Each member is obligated to meet its share of the total pool requirement, which recognizes the variation of several of the aforementioned components among the PJM member companies. Installed capacity may either be arranged through others within the pool or obtained through commitments with systems outside the pool. If a PJM member company is deficient in meeting its obligation, it must pay at rates that are filed with the Federal Energy Regulatory Commission (FERC). Before the fact, commitments must be made and, based on an after-the-fact analysis, adjustments may be made in the obligations of the PJM member companies.

Because of the installed capacity accounting, only two types of transactions take place within PJM: economy transactions based on a split-of-savings between cost and replacement values, and noneconomy transactions that result when a member company does not have a replacement value to be applied in the accounting. The economy transactions are accounted for on a split-saving basis, with half the savings accruing to the selling companies, and half accruing to the buying companies. In the case of the noneconomy power, the receiver pays cost plus 10 percent for such power received.

Under the terms of PJM's agreements with NYPP, the Cleveland Electric Illuminating Company, Allegheny Power System, and Virginia Electric and Power Company, the PJM Interconnection office acts for the PJM systems in scheduling interchange transactions with these neighboring systems and in accounting for all resulting transactions. Rate schedules covering interchange with these neighboring systems that have been filed or will soon be filed include

- Economy operating capacity and energy
- Emergency operating capacity and energy
- Nonreplacement energy
- Inadvertent interchange
- Short-term power
- Conservation energy

Unlike PJM's internal minute-to-minute economic energy dispatch under the "free-flowing" tie basis, PJM schedules energy interchange on a scheduled hourly basis with its neighboring systems. The accounting for the interchange with neighboring systems also takes place on a scheduled basis.

RELIABILITY COUNCILS

NORTHEAST POWER COORDINATING COUNCIL

The purpose of the Northeast Power Coordinating Council (NPCC) is to improve the reliability and efficiency of the member systems through improved coordination in system design and operating procedures.

One step in reaching this objective is the development of criteria to be used in the design and operation of the major systems. Definitions of several terms used in the following paragraphs are listed at the end of this section. More rigid criteria will be applied in some segments of the Council area because of local considerations. The basic criteria are not necessarily applicable to those elements of the individual members' systems that are not major parts of the interconnected transmission network. The transmission criteria are applicable either to the areas (New Brunswick, New England, New York, or Ontario) or to the entire Council grid in its relations with neighboring pools.

An interconnected power system should be designed and operated so that the loss of a major portion of the system would not result in a system failure during a reasonably foreseeable contingency or combination of contingencies. NPCC requires that the interconnected power systems be designed and operated to meet specific contingencies. Loss of small portions of the system may be tolerated, provided the overall interconnected power system is not jeopardized. NPCC has set criteria for design and operation of its interconnected power system. The NPCC areas are analyzed under both normal and emergency operations, and for the most severe load and generating conditions expected.

Generating Capacity

Generating capacity will be installed and located so that, after due allowance for the factors listed below, the expected frequency of insufficient generation (including contract purchases) to cover NPCC load, as determined on an annual (power year) basis, should not exceed one occurrence in 10 years.

1. The possibility that load forecasts may be exceeded as a result of weather variations.
2. Immature and mature equivalent forced outage rates, for partial and full outages, differ for generating units of various sizes and types.
3. Seasonal adjustment of generation capability is necessary.
4. Proper maintenance is required.
5. The reliability of interconnections with systems that are not NPCC participants may differ.
6. Other factors may be considered from time to time.

For planning purposes, the assumed equivalent forced outage rate of a generating unit connected to the transmission network by a radial transmission line will be increased to reflect the estimated transmission line forced outage rate if significant. Potential power transfers from outside New England that are considered in determining the New England capacity requirements must not exceed the firm emergency interpool transmission transfer capabilities.

Area Transmission Requirements

The power system should be designed with sufficient transmission capacity to serve area loads and operated so that the design objectives are fulfilled.

<u>Normal Transfers (Stability Conditions)</u>--Stability of the interconnected power systems during normal operations is to be maintained during and after the most severe of the conditions listed below:

1. A permanent three-phase fault on any generator, transmission circuit, transformer, or bus section, cleared in normal time with due regard to reclosing facilities.
2. Simultaneous permanent phase to ground faults on different phases of each of two adjacent transmission circuits on a multiple transmission circuit tower, cleared in normal time, with due regard to reclosing facilities.

3. A permanent phase to ground fault on any generator, transmission circuit, transformer, or bus section with delayed clearing and with due regard to reclosing facilities. This delayed clearing could be due to circuit breaker, relay system, or signal channel malfunction.
4. Loss of any element without a fault.
5. A permanent phase to ground fault on a circuit breaker, cleared in normal time, and with due regard to reclosing facilities.

Transfers of power from one area to another, as well as within areas, should be considered in the design of the transmission network.

Operating capabilities shall be adhered to for normal and emergency transfers. These capabilities will be based on the facilities in service at the time of the transfers. In determining the emergency transfer capabilities discussed below, a less conservative margin is justified.

Emergency Transfer (Stability Conditions)--Stability of the interconnected systems during an emergency transfer condition is to be maintained during and after the most severe conditions listed below. System conditions may be adjusted before the outaged element is tested.

1. A permanent three-phase fault on any generator, transmission circuit, transformer, or bus section, cleared in normal time, and with due regard to reclosing facilities.
2. Loss of any system element.

Possible but Improbable Contingencies--Studies are conducted to determine the effect of the following contingencies on system performance, and plans are developed to minimize the spread of any interruption that might result.

1. Loss of the entire capability of a generating station.
2. Loss of all lines emanating from a generating station, switching station, or substation.
3. Loss of all transmission circuits on a common right-of-way.
4. Permanent three-phase fault on any generator, transmission circuit, transformer, or bus section, with delayed clearing, and with due regard to reclosing facilities. This delayed clearing could be due to circuit breaker, relay system, or signal channel malfunction.
5. The sudden dropping of a large load or major load center.
6. The effect of severe power swings arising from disturbances outside the Council's interconnected systems.

List of Definitions--NPCC

1. Area--An area is either New Brunswick, New England, New York, or Ontario.

2. Emergency--An emergency is assumed to exist in an area if firm load may have dropped because of insufficient power in that area. Emergency transfers are appropriate under such conditions.
3. Applicable Emergency Limits--These limits depend on the duration of the occurrence, and on the policy of the various member systems of NPCC regarding loss of life to equipment or voltage limitation. Short time emergency limits are those that can be applied for at least 10 minutes. The limiting condition for voltages is that voltages at key locations should not drop below that level required for suitable system stability, and should not adversely affect the operation of the interconnected systems. The limiting condition for equipment loadings should be such that cascading will not occur because of operation of protective devices on the failure of facilities.
4. Ten-Minute Reserve--Ten-Minute Reserve is that portion of unused generating capacity that is synchronized to the system and is fully available within 10 minutes, plus that portion of capacity being used to pump reversible hydroelectric units and to serve interruptible loads.
5. With Due Regard to Reclosing Facilities--This phrase means that recognition will be given to the type of reclosing, manual or automatic, and to the time protective schemes.
6. Element--An element is a generator, transmission circuit, transformer, circuit breaker, or bus section.

MID-ATLANTIC AREA COORDINATION AGREEMENT

The Mid-Atlantic Area Coordination Agreement (MAAC) was formulated to provide a mechanism to augment further bulk power system planning and reliability. MAAC reviews and determines the effects upon the reliability of the area bulk power system of additions, modifications, or removals of generating and bulk transmission facilities planned by the individual member companies in accordance with established criteria.

The Agreement states that sufficient generating capability is to be installed to ensure that in each year, the probability of occurrence of loss of load is not greater on the average than one day in 10 years. Among the factors considered in the calculation of the probability are the characteristics of the loads, deviations in load forecasts, scheduled maintenance requirements for generating units, forced outage rates of generating units, limited energy capacity, effects of transmission interconnections with other pools, and network transfer capability within MAAC.

The bulk transmission system is to be capable of operation at all load levels without instability, cascading, or interruption of load when the following contingencies occur:

1. The loss of any single generating unit, transmission line, transformer, or bus in addition to normal scheduled outages of bulk electric supply system facilities without exceeding the

applicable emergency rating of any facility. After the outage, the system must be capable of readjustment so that all equipment (in the MAAC and neighboring systems) can be loaded within normal ratings.

2. After the outage and system readjustment specified above, the subsequent outage of any remaining generator or line will not result in the short time emergency rating of any facility being exceeded. After this outage, the system must be capable of readjustment so that all remaining equipment can be loaded within applicable emergency ratings for the probable duration of the outage.
3. The loss of any double circuit line, or a combination of facilities resulting from a line fault and stuck breaker, in addition to normal scheduled generator outages, will not result in the short time emergency rating of any facility being exceeded. After the outage, the system must be capable of readjustment so that all equipment can be loaded within applicable emergency ratings for the probable duration of the outage.

In determining the bulk transmission requirements, similar contingencies in neighboring systems and their effect on the MAAC shall be considered.

Sufficient capacity, with adequate controls, is planned for each system to supply the reactive load and loss requirements to maintain acceptable emergency transmission voltage profiles during all the above contingencies. The system is designed so that stability is maintained without loss of load during and after the following types of faults at the most critical location at all load levels.

1. A three-phase fault with normal clearing time.
2. Single-phase to ground fault with a stuck breaker or other cause for delayed clearing.

MAAC recognizes that to anticipate or test for all contingencies on the present and future system is impossible. As a result, tests of "less probable contingencies" are used. These tests are prescribed not on the basis of a high level of probability, but rather to provide a severe enough test of the system's strength to cover all disturbances that could occur in day-to-day operating. Examples of less probable contingencies to be studied follow:

1. Sudden loss of the entire capability of any station, for any reason.
2. Outage of the most critical transmission line on any interconnected system as the result of a three-phase fault immediately following (i.e., before readjustment) the tripping of another critical line on the same, or on an adjacent system.
3. The sudden loss of all lines of one voltage emanating from a substation.
4. The sudden loss of all lines on a single right-of-way.

5. The sudden dropping of a large load or a major load center.
6. The occurrence of a multiphase fault with delayed clearing.

The amounts of power to be interchanged within MAAC areas and between MAAC and neighboring systems are to be planned so that applicable ratings and stability, voltage, and relay limitations are not exceeded.

INTERAREA ARRANGEMENTS

The ECAR, MAAC, NPCC, and VACAR (subregion of SERC) coordination areas established the Joint Interarea Review Committees (JIRC) to carry out the intent of two coordination agreements in the areas of reliability and adequacy. JIRC has two working committees, the MAAC-ECAR-NPCC Study Committee (MEN) and the VACAR-ECAR-MAAC Study Committee (VEM), which conduct studies to determine the adequacy and limits of interarea power transfers as affected by interarea and intraarea conditions. In carrying out their assignments, MEN and VEM perform the following:

1. Determine interregional transfer capabilities.
2. Determine transregional transfer capabilities as limited by ECAR, MAAC, NPCC, or VACAR facilities.
3. Examine the ability of the interregional system network to withstand severe contingencies without experiencing widespread cascading outages.

Studies are based on the most up-to-date plans of the individual systems considering the load level most critical to system performance. Transfer capability is defined as the maximum amount of power that can be reliably transferred from one area to another such that

1. With all transmission facilities in service, system stability limits will be observed, facility loadings will be within appropriate long-time ratings, and voltage levels will be within acceptable limits.
2. The interconnected system can support the initial power swing resulting from the sudden loss of any one circuit, transformer, or generating unit.
3. After the loss of any circuit, transformer, or generating unit, the appropriate short-time rating will not be exceeded on any facility, and voltage levels will be within acceptable limits.

The operating studies are conducted each year for the summer peak season and again for the winter peak season. A 5-year planning study is conducted every other year, followed in the next year by a 10-year planning study. If weaknesses are uncovered in the bulk power network, the problem is referred to the affected system(s) for corrective action.

To assess the reliability of the interregional bulk power transmission system as measured by its ability to avoid cascading outages over a widespread area, the effects of very severe contingencies similar to those previously discussed are considered.

INTERREGIONAL ENERGY EXCHANGES

Table 6 shows the results of MAAC and NPCC energy interchanges in 1978 and 1979. The internal energy interchanges are those made among the members of the pools. External interchanges are made between pool members and non-pool members. Energy interchanges between the United States and Canadian members of NPCC are considered to be external for the purpose of this study. Table 6 shows that the bulk of the interchanges in both MAAC and NPCC are made internally.

The high degree of coordination between Coordinating Councils, pools, and individual companies is quite evident in the northeast, extending even to the joint planning and ownership of generating facilities. Almost 33 percent of the generating facilities are jointly owned. Table 7 indicates the jointly owned units in the region.

The trend in the northeast to jointly construct new capacity is expected to increase. New jointly owned generating units, including those scheduled, authorized, or planned, total approximately 17,800 MW. More than 80 percent of this capacity is expected to be nuclear. Table 8 shows jointly owned capacity additions with anticipated ownership shares and expected dates of installation.

TABLE 6--Estimated Annual Energy Interchanges by MAAC and NPCC (Billion kWh)

Energy Interchanged	1978	1979
MAAC		
Internal	28.5	30.2
External	9.0	9.6
NPCC (U.S. portion)		
Internal*	80.4	87.5
External	11.3	19.2

*Energy interchanges between U.S. and non-U.S. portions of NPCC were considered to be external interchanges.

Sources: Department of Energy Power Supply Statements for 1978 and 1979

TABLE 7--Generating Units with Joint Ownership in the Northeast Region

		Capability (MW)		Percent Ownership[b]											
Station Name and Unit No.	Fuel[a]	Summer	Winter	CACO	MOEL	WEME	HAEL	COLP	UNIC	HOGE	FIGE	NATT	LITT		
NEPOOL															
Canal #2	O	580	584	50.00	50.00										
Millstone #1	N	654	660			19.00	28.00	53.00							
Millstone #2	N	810	812			19.00	28.00	53.00							
New Haven Harbor #1	O	447	447						93.71	1.12	4.50	0.45	0.22		
Northfield Mountain #1	PS	250	250			19.00	28.00	53.00							
Northfield Mountain #2	PS	250	250			19.00	28.00	53.00							
Northfield Mountain #3	PS	250	250			19.00	28.00	53.00							
Northfield Mountain #4	PS	250	250			19.00	28.00	53.00							
				BAHE	BOEC	CEMP	CEVP	GRMP	MAPS	MMWE	MOEL	NEBC	PSNH	NEEP	
Wyman #4[c]	O	600	600	8.33	5.89	59.15	1.78	1.14	3.35	3.67	1.96	1.43	3.14	9.27	
				COEN	ORRU	NIMP	CEHG	BEIC							
NYPP															
Bowline Point #1	O	602	602	66.67	33.33										
Bowline Point #2	O	600	600	66.67	33.33										
Roseton #1	O	600	600	40.00		30.00	30.00								
Roseton #2	O	600	600	40.00		30.00	30.00								
Beebee Island #1, #2	H	8	8			85.94		14.06							
				PSEG	PHEC	PEPL	BAGE	POEP	ATCE	DEPL	UGIC	PEEC	MEEC	JECP	NEYE[d]
PJM															
Conemaugh #1	C	850	850	22.50	20.72	11.39	10.56	9.72	3.83	3.72	1.11		16.45		
Conemaugh #2	C	850	850	22.50	20.72	11.39	10.56	9.72	3.83	3.72	1.11		16.45		
Conemaugh Diesel A,B,C,D	O	11	11	22.50	20.72	11.39	10.56	9.72	3.83	3.72	1.11		16.45		
Homer City #1	C	618	618									50.00			50.00
Homer City #2	C	618	618									50.00			50.00
Homer City #3	C	652	652									50.00			50.00
Homer City Diesel #s 4,5,6	O	6	6									50.00			50.00
Keystone #1	C	840	850	22.84	20.99	12.34	20.99		2.47	3.70				16.67	
Keystone #2	C	840	850	22.84	20.99	12.34	20.99		2.47	3.70				16.67	
Keystone Diesel #s 3,4,5,6	O	11	11	22.84	20.99	12.34	20.99		2.47	3.70				16.67	
Peach Bottom #2	N	1,051	1,055	42.49	42.49				7.51	7.51					
Peach Bottom #3	N	1,035	1,035	42.49	42.49				7.51	7.51					
Salem #1	N	1,090	1,090	42.59	42.59				7.41	7.41					
Salem GT 3	O	38	48	42.59	42.59				7.41	7.41					
Seneca #1[e]	PS	175	175									20.00			
Seneca #2[e]	PS	175	175									20.00			
Seneca #3[e]	PS	30	30									20.00			
Three Mile Island #1	N	776	800									25.00	50.00	25.00	
Three Mile Island #2	N	880	906									25.00	50.00	25.00	
Yards Creek #1[f]	PS	130	130	50.00										50.00	
Yards Creek #2[f]	PS	130	130	50.00										50.00	
Yards Creek #3[f]	PS	130	130	50.00										50.00	

[a] O = Oil, N = Nuclear, H = Hydroelectric, C = Coal, PS = Pumped Storage
[b] See Appendix for codes.
[c] 0.88 percent owned by 3 additional utilities.
[d] Located in NYPP.
[e] 80 percent owned by Cleveland Electric Illuminating Co. (ECAR).
[f] Limited to a total output of 330 MW.

TABLE 8--Generating Unit Additions with Joint Ownership Scheduled for the Northeast Region

Station Name and Unit Number	Fuel	Capability (MW)	Expected Installation Date	Anticipated Ownership Shares, Percent*				
Oswego 6	Oil	850.0	Feb 1980	NIMP=76.0	ROGE= 24.0			
Salem 2	Nuclear	1114.0	Nov 1980	PSEG=42.6	PHEC= 42.6	ATCE= 7.4	DEPL= 7.4	
Susquehanna 1	Nuclear	1050.0	Jan 1982	PEPL=90.0	ALEC= 10.0			
Susquehanna 2	Nuclear	945.0	Jan 1983	PEPL=90.0	ALEC= 10.0			
Seabrook 1	Nuclear	1150.0	Apr 1983	COLP= 4.6	UNIC= 20.0	PSNH=50.0	NEEP=10.1	Other=15.3
Hope Creek 1	Nuclear	1067.0	Sep 1984	PSEG=95.0	ATCE= 5.0			
Chace Hill	Hydro	10.6	Nov 1984	BULI=50.0	GRMP= 50.0			
Pilgrim 2	Nuclear	1150.0	Dec 1985	BOEC=60.0	Other=40.0			
Millstone 3	Nuclear	1150.0	May 1986	COLP=38.2	HAEL= 20.2	WEME=13.7	NEEP=10.8	Other=17.2
Hope Creek 2	Nuclear	1067.0	Sep 1986	PSEG=95.0	ATCE= 5.0			
Nine Mile Pt 2	Nuclear	1080.0	- 1986	NIMP=41.1	LOIL= 18.0	NEYE=18.0	ROGE=14.0	CEHG= 9.0
Dickerson 4	Coal	800.0	May 1987	POEP=50.0	Other=50.0			
Sears Island	Coal	568.0	Nov 1987	CEMP=80.8	Other=19.2			
Jamesport 1	Coal	800.0	May 1989	LOIL=50.0	NEYE= 50.0			
Scottsville	Coal	625.0	May 1990	PEEC=60.0	JECP= 20.0	MEEC=20.0		
Pumped Storage	-	850.0	May 1992	JECP=50.0	NEEC= 40.0	PEEC=10.0		
Wehrum 1	Coal	625.0	May 1994	PEEC=40.0	JECP= 40.0	MEEC=20.0		
Portland 5	Coal	625.0	May 1996	PEEC=40.0	JECP= 40.0	MEEC=20.0		

*See Appendix for codes.

Sources: MAAC April 1980; NPCC Form 411-1980. NPCC has indicated that the Sterling 1 Nuclear Plant shown in its Form 411-1980 for service in May 1988 has been cancelled.

CHAPTER 3
POWER POOLING

NEW ENGLAND POWER POOL

At first, small powerplants in New England served local areas. As loads increased, technological gains in generation and transmission justified larger powerplants. Electric companies then began interconnecting and pooling their power resources.

The first formal pool in New England was the Connecticut Valley Power Exchange (CVPE) in 1925 involving the Hartford Electric Company, Western Massachusetts Electric Company, and New England Power Company. In 1964, CONVEX, the Connecticut Valley Exchange, was formed to provide pooling of the resources of the private companies in Connecticut. The next development was NEPOOL, the New England Power Pool, in 1971. NEPOOL now controls 99.6 percent of all generation in New England.

NEPOOL is a cooperative arrangement among New England utilities that has been evolving over a substantial period of time. As early as 1920, joint ownership of plants was initiated by three New England utilities. In 1954, 10 New England electric utilities formed the Yankee Atomic Company to construct a 175-MW nuclear plant, which began operation in 1960 at Rowe, Massachusetts. Similar joint ventures were formed to construct three additional nuclear powerplants--Connecticut Yankee, Maine Yankee, and Vermont Yankee.

The 1965 northeast blackout, prodding by the Federal Power Commission (FPC), and the considerable coordination experience of the New England utilities culminated in a 1966 proposal by the nine largest New England utilities (Boston Edison Company, Central Maine Power Company, Central Vermont Public Service Corporation, Eastern Utilities Associates, New England Electric System, New England Gas and Electric Association, Northeast Utilities, Public Service Company of New Hampshire, and United Illuminating Company) to form NEPOOL. In 1966, steps were taken to develop a power pooling agreement and a central dispatch operation, the New England Power Exchange (NEPEX). The agreement was drafted during 1967 and revised in 1968 by the NEPOOL Drafting Committee, which included representatives of small investor-owned systems, publicly owned systems, and the nine originating utilities. NEPEX became operational on June 1, 1970. The NEPOOL Agreement was signed on September 1, 1971 and became effective November 1st. It has been amended several times since.

NEPOOL's territory extends over the six New England States and embraces virtually all of their electric utilities. The territory is characterized by a diverse demography ranging from metropolitan centers to nearly uninhabited woodlands. The urban centers align with the Boston-New York axis through Connecticut, Rhode Island, and Massachusetts. Away from this axis, population declines rapidly and in northern New Hampshire and northern Maine reaches almost zero. The utilities in NEPOOL cover all of New England except five municipals in Connecticut, the area served by Maine Public Service Company (which is not a pool member) and Nantucket Island, which is served by an isolated utility. Table 9 lists the members of NEPOOL as of January 1, 1980.

Princeton Electric Light Department and Pascoag Fire District joined NEPOOL late in 1978. The Massachusetts Municipal Wholesale Electric Company is also a participant, but has no load and is not involved in the billing.

ORGANIZATIONAL STRUCTURE AND OBJECTIVES

NEPOOL is organized into Management, Executive, Operations, and Planning committees. Members are selected from the participants according to provisions of the Agreement. (See Figure 5 for an organizational chart of NEPOOL and Table 10 for the composition, voting procedures, and major activities of the committees.) The New England Power Exchange (NEPEX) is under the Operations Committee and New England Power Planning (NEPLAN) is under the Planning Committee.

The objectives of NEPOOL are to provide New England with a bulk power supply that meets appropriate reliability standards, to provide this power supply in the most economical manner, and to provide for the equitable sharing of the associated costs and benefits among the participants. The specific economic goals are to reduce capacity requirements by sharing reserves and by interchanging power or reserves among systems that peak at different times; to achieve economies of scale in generation and transmission facilities; and to reduce system operating costs through central dispatching by using those units with the lowest marginal (largely fuel) costs.

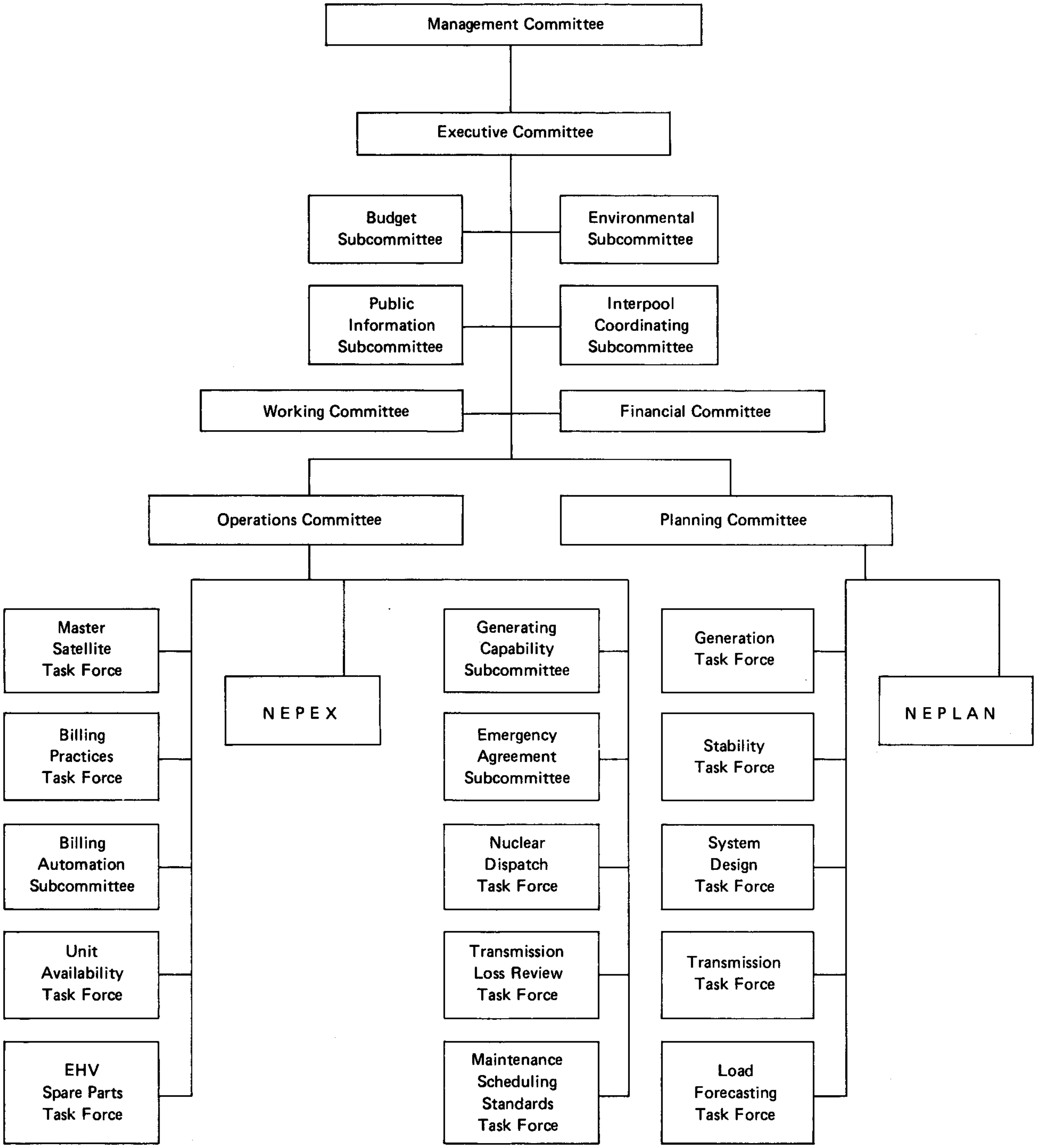
To accomplish its objectives, NEPOOL has four major functions:

1. Long-range planning. Because planning decisions probably have the greater impact on future electricity costs, NEPLAN provides joint planning of generation and transmission facilities and produces a regional load forecast.
2. Coordination of participants' plans. NEPOOL must have an overview role in individual participants' planning to ensure consistency with pool objectives and to protect the collective interests of the pool.
3. Operations planning and control. The hourly, daily, and monthly scheduling and operation of the power facilities of the individual utilities must be centralized for maximum

TABLE 9--Stand-Alone NEPOOL Participants as of January 1, 1980

Participant	Acronym	Beginning of Participation Period
Ashburnham Municipal Light Plant	AMLP	3/1/76
Bangor Hydro-Electric Co.	BHE	6/1/70
Boston Edison Co.	BE	6/1/70
Boylston Municipal Light Dept.	BMLD	11/1/77
Braintree Electric Light Dept.*	BELD	6/1/70
Central Maine Power Co.	CMP	6/1/70
Chicopee Municipal Lighting Plant	CMLD	11/1/77
Danvers Electric Dept.	DED	5/1/76
Eastern Utilities Associates	EUA	6/1/70
Fitchburg Gas and Electric Light Co.	FG&E	6/1/70
Georgetown Municipal Light Dept.	GMLD	12/1/76
Groton Electric Light Dept.	GELD	10/1/77
Hingham Municipal Lighting Plant	HMLP	1/1/76
Holden Municipal Light Dept.	HMLD	12/1/75
Holyoke Gas and Electric Dept.	HG&E	6/1/70
Hudson Light and Power Dept.	HL&P	5/1/77
Hull Municipal Lighting Plant	HLLP	10/1/77
Ipswich Municipal Light Dept.	IMLD	12/1/76
Littleton Electric Light and Water Dept.	LEL&WD	11/1/75
Mansfield Municipal Electric Dept.	MMED	12/1/75
Marblehead Municipal Light Dept.	MMLD	11/1/75
Middleborough Gas and Light Dept.	MG&LD	1/1/76
Middleton Municipal Light Dept.	MILD	12/1/76
New England Gas and Electric Assoc.	NEGEA	6/1/70
New England Power Company	NEP	6/1/70
Newport Electric Corp.	NEC	11/1/75
North Attleborough Electric Dept.	NAED	11/1/75
Northeast Utilities	NU	6/1/70
Pascoag Fire District	PFD	12/1/78
Paxton Municipal Light Dept.	PMLD	10/1/77
Peabody Municipal Light Plant	PMLP	11/1/75
Princeton Electric Light Department	PELD	10/1/78
Public Service Company of New Hampshire	PSNH	6/1/70
Reading Municipal Light Department	RMLD	11/1/76
Shrewsbury Electric Light Plant	SELP	11/1/75
South Hadley Electric Light Dept.	SHEL	11/1/77
Sterling Municipal Electric Light Dept.	SMED	10/1/77
Taunton Municipal Light Dept.	TMLD	12/1/75
Templeton Municipal Lighting Plant	TTMLP	1/1/76
United Illuminating Co.	UI	6/1/70
Vermont Electric Power Co., Inc.	VELCO	6/1/70
Wakefield Municipal Light Dept.	WMLD	11/1/75
West Boylston Municipal Lighting Plant	WBMLP	5/1/76
Westfield Gas and Electric Light Dept.	WG&ED	6/1/76

*Did not participate from 1/31/73 to 3/31/76.
Source: Director of NEPLAN



SOURCE: Director of NEPLAN

FIGURE 5--NEPOOL Organization

TABLE 10--Composition, Voting, and Activities of NEPOOL Committees

Committee	Composition	Voting	Activities
Management	One representative per participant	Based on annual peaks Affirmation requires 75-percent vote 15-percent vote by two or more participants can block action	Administer, enforce, and interpret provisions of agreement Establish standards of reliability for bulk power supply Provide for central dispatch facilities Establish generating capability objectives Adopt pool expansion plan Elect 11-member Executive Committee
Executive	11 members elected from and by the Management Committee	One vote per member Affirmation requires the greater of six, or two-thirds present Any participant appeal suspends action until the Management Committee acts	Substantially the same as Management Committee, except for appeal provision
Planning	One member for each participant whose annual peak is 3 percent of sum of all annual peaks One additional representation for each full 10 above original 10 percent of total peak One member for group of investor-owned participants One member for group of municipals and cooperatives	Substantive issues are not resolved by vote, but minority reports are permitted	Recommend reliability standards to Management Committee Prepare load forecasts Study and evaluate, through NEPLAN, alternative expansion plans and power purchase/sale plans
Operating	Elected in same manner as Planning Committee members	One vote each Two-thirds of those present required for affirmative vote Any participant appeal suspends action until the Management Committee acts	Schedule and coordinate, through NEPEX, day-to-day operations of the bulk power supply, including the provision of operating reserves Establish operating reserve dispatch procedure, maintenance schedules Establish the generating capacity of each unit in the system Administer billing procedures

Source: Director of NEPLAN

effectiveness, and the pool organization must develop the technological, decision-making, and administrative procedures to operate the system economically and reliably.

4. Pricing and billing procedures. Under the Agreement, transactions involving energy and reserve exchanges and the use of transmission facilities occur continually among NEPOOL participants. NEPOOL establishes and administers pricing and billing procedures for these transactions.

These four functions also serve as a basis for determining how effectively NEPOOL achieves its objectives. The NEPOOL staffs are augmented by personnel from the individual systems who serve on task forces, subcommittees, and working groups. The organization plans of NEPEX and NEPLAN are shown in Figures 6 and 7, respectively.

AREA CHARACTERISTICS

Load

NEPOOL is a winter peaking pool, reflecting the region's climate and northern latitude. Summers are warm and sometimes humid; winters are often harsh. On a typical winter weekday, the demand for electricity rises sharply from a low about 4 a.m. to a daily peak at 6 p.m. The load is cyclic during the day, rising from the 4 a.m. low to a morning peak at 10 a.m., with a slight decline during midday and then an abrupt rise to the 6 p.m. peak. The peak demand is about 80 percent above the minimum at 4 a.m. The demand falls rapidly from the 6 p.m. peak to the low of the following day.

The summer pattern is somewhat smoother with a longer period of peak demand that occurs from about 11 a.m. until 3 p.m. with a peak occurring either at 2 or 3 p.m. The low point is at about 5 a.m.

The winter peak for the calendar year usually occurs in December. However, the actual winter seasonal peak can occur in December, January, or February. The annual summer peak occurs at any time from June through September. Actual peak demand for 1970-1979 is shown in Table 11.

Future load growth in New England is expected to be modest, averaging 2.7 percent per year in energy and 2.6 percent per year in peak demand from 1979-80 through 1989-90.

Generation

The capacity mix in New England consists of hydroelectric, nuclear, coal-fired, diesel, and gas turbine capacity. The pattern of customers' habits tends to be regular, and the rise and fall in demand is somewhat predictable. The selection of the generating unit type to meet customer demand is based on the type of load the unit will serve and the availability, cost, and special characteristics of each fuel. A baseload unit must operate almost

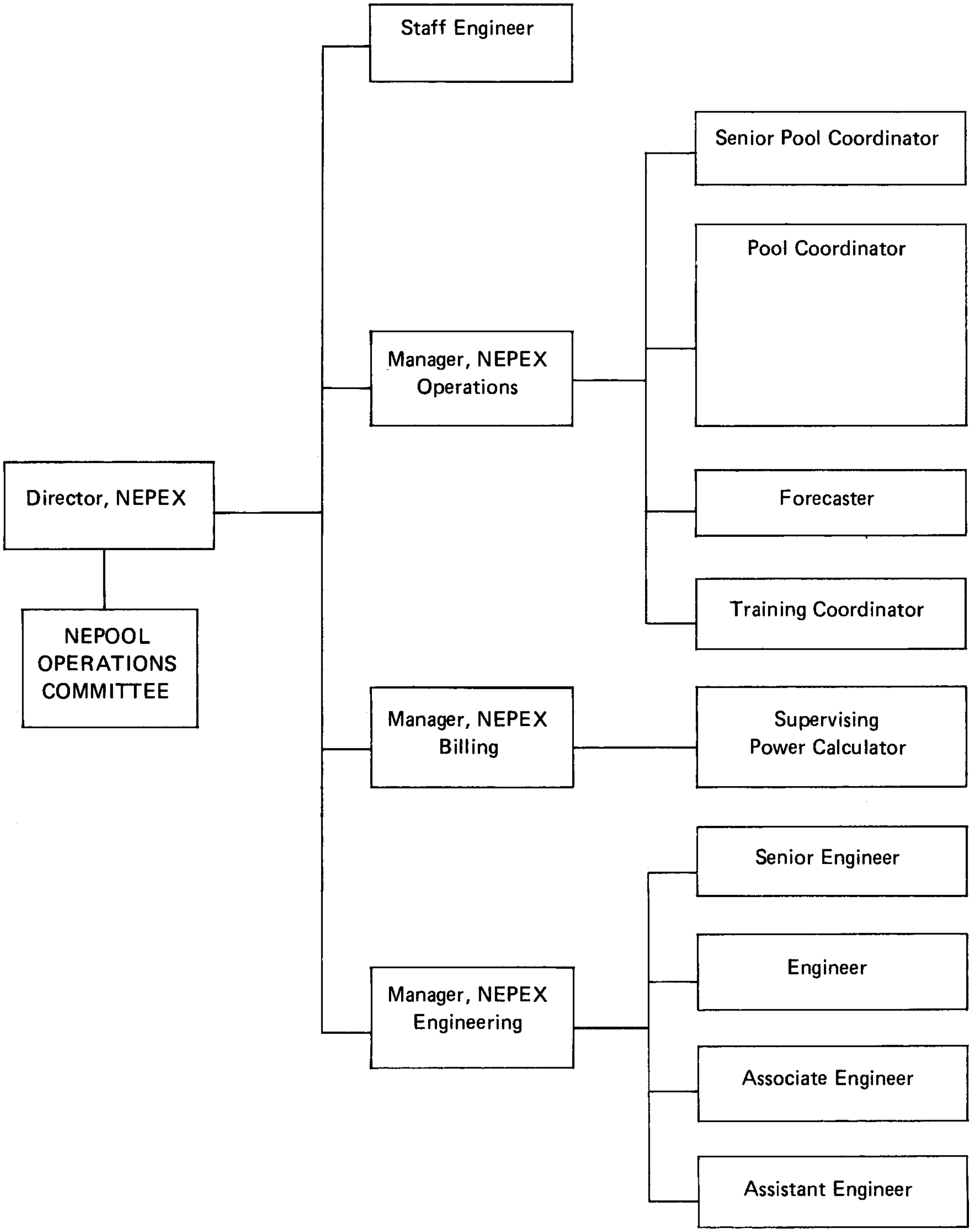
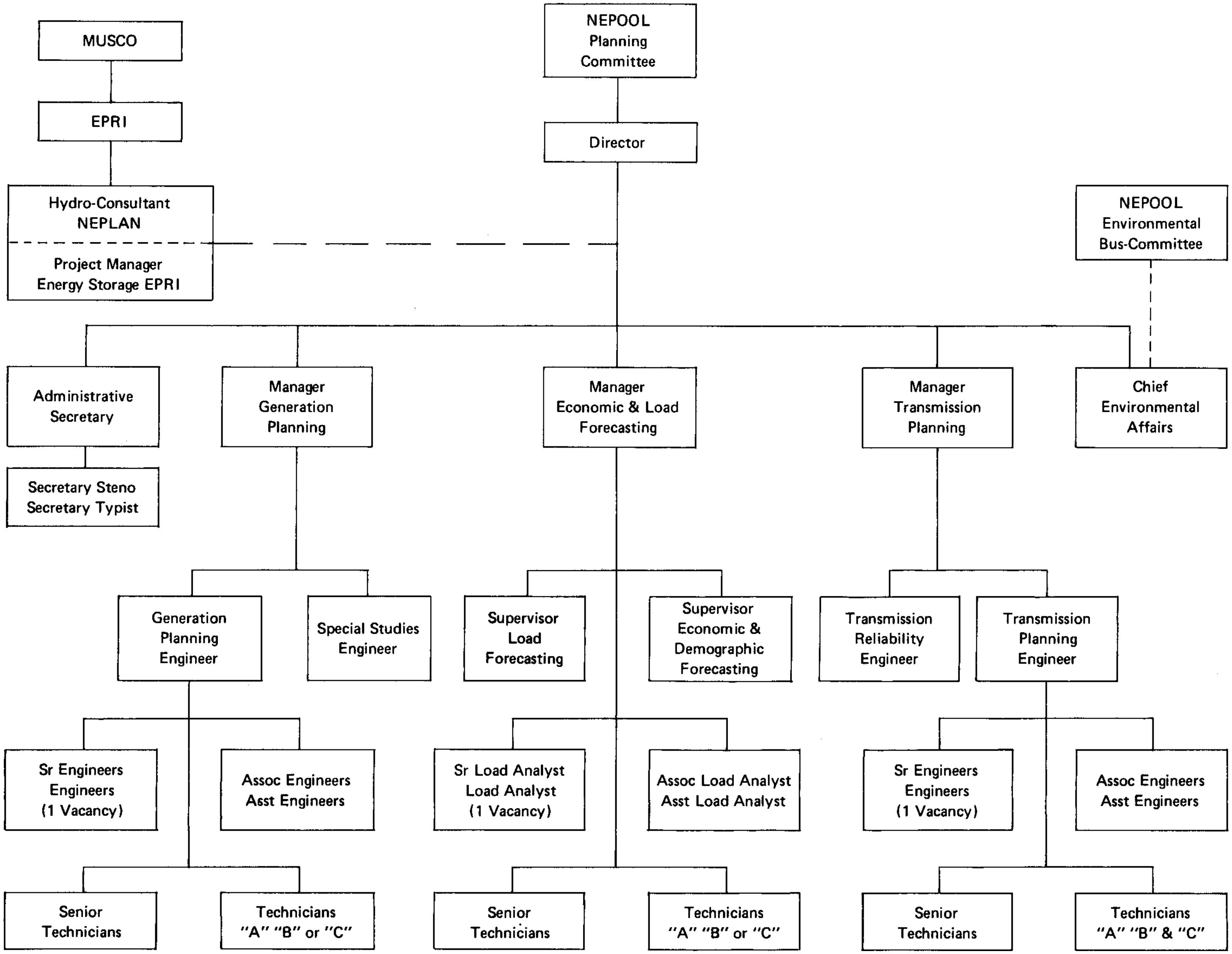


FIGURE 6--NEPEX Organization



Source: Director of NEPLAN

FIGURE 7--NEPLAN Organization

TABLE 11--NEPOOL Power Requirements and Resources

Year	Energy (GWH)	Annual Peak Demand[1] (MW)	Peak Month	Net Capability at Time of Peak Demand[2] (MW)
1970	62,005	11,656	Dec.	13,151
1971	64,990	12,057	Dec.	13,924
1972	70,523	13,450	Jan. 1973	17,137
1973	74,367	12,832	Jan. 1974	17,409
1974	72,875	12,833	Jan. 1975	18,998
1975	73,102	13,903	Jan. 1976	19,931
1976	77,908	14,694	Dec.	21,091
1977	79,734	14,822	Dec.	20,790
1978	82,505	15,072	Feb. 1979	21,198
1979	83,958	15,278	Dec.	21,916
Projected				
1980	86,219	16,110		21,977
1984	93,475	17,390		23,692
1989	107,297	20,040		27,166
1994		23,370		29,520
1999		28,060		35,070

Projected Net Capability Additions

	Hydroelectric	Nuclear	Coal	Other	Total
1980 through 1989					
Percent	1.1	83.6	15.3	0	100.0
Megawatts	62	4,162	844	0	5,518
1990 through 1999					
Percent	0	43.4	56.6	0	100.0
Megawatts	0	3,430	4,474	0	7,904

---

[1] Seasonal peak demand. Since New England is expected to peak in winter, these peaks may occur in January or February of the following year. Peak excludes interruptible demand.

[2] Includes all scheduled imports and exports.

Source: NPCC--Data on Coordinated Regional Bulk Power Supply Programs, filed each year in response to FPC Order 383, Docket R-362, now ERA-411; FPC Forms 12 and 12E-2 constantly to handle the continuous day and night demand. An intermediate-load unit handles the heavy and fluctuating daytime demand of homes, schools, offices, and industry. These units are called "cyclers" and can be brought on and off daily. Peaking units handle the rapid upsurges of demand such as occur between 5 and 6 p.m. in the winter, during mid-afternoon in the summer, and during system emergencies. It is uneconomical for one kind of unit to handle the entire electric energy demand.

A nuclear generating unit is more expensive to build, primarily because of high-quality equipment and elaborate safety systems, but is the least expensive to operate. It is, therefore, an ideal choice for a baseload unit. Its round-the-clock operation supplies continuous power for the constant portion of consumer requirements. It is also a natural partner for pumped-storage generation. A pumped storage unit uses low-cost, offpeak power to pump water into an upper reservoir during periods of low consumer use. The water is released during periods of high demand to generate electricity.

Despite increasing reliance on nuclear generation, fossil-fueled steam-electric generation continues to supply the largest part of New England's energy requirements. (See Table 12.) During 1979, such plants supplied 54 percent of the region's utility generation, down from 77 percent in 1972.

Gas turbine and internal combustion generation furnish the smallest portion of the region's energy. During 1977, these units supplied less than 1 percent of the generation. Like pumped-storage and most hydroelectric units, they are used to meet peakload requirements and system emergencies.

The only significant addition to generating capability since 1975 was the 600-MW Wyman No. 4 unit of Central Maine Power Company in late 1978. Reserves continued to be more than adequate because of the loss of approximately 4500 MW of expected load growth because of conservation efforts, load management, and the softening of the economy. Capability figures for December 31st of 1978 and 1979 are given in Table 12. No additional nuclear generation capability other than uprating of existing units is expected before 1983. Therefore, the share of energy requirements for residual oil can be expected to increase.

Table 11 summarizes the scheduled capacity additions for the next 10 years, mostly nuclear units. Table 11 also summarizes scheduled capacity additions for New England's power supply in the 1990-1999 period, mostly coal-fired units. New England plans to install units with capability totaling more than 13,000 MW over the next 20 years.

Generating capacity is to be installed and located so that, after due allowance for required maintenance and expected forced outages, NEPOOL will not suffer a loss of load more often than 1 day in 10 years. With continued moderate growth in load, the scheduled construction program provides for adequate reserves. Table 13 shows the reserve picture from 1980 to 1989.

TABLE 12--NEPOOL Available Resources, 1978 and 1979

Resource	12/31/78 Power (MW)*	Percent of Total	12/31/79 Power (MW)*	Percent of Total
Oil-fired	11,553.1	53.7	11,818.5	54.4
Coal-fired	483.5	2.2	456.0	2.1
Nuclear	4,249.3	19.8	4,313.7	19.9
Hydroelectric (conventional)	1,304.6	6.1	1,286.6	5.9
Pumped storage	1,632.6	7.6	1,632.6	7.5
Internal combustion	1,785.1	8.3	1,717.4	7.9
Net purchases	492.6	2.3	503.9	2.3
Total	21,500.8	100.0	21,728.7	100.0

*Winter rating.

Sources: NPCC--Regional Reliability Council Long Range Coordinated Bulk Power Supply Program (ERA-411), 1979 and 1980

Bulk Power Transmission

The region's major generating plants and load centers are interconnected by 345-kV transmission lines extending from New York through the New England States to New Brunswick, Canada. Underlying the 345-kV "backbone" system are lower voltage (69-, 115-, and 230-kV) transmission lines that generally serve local requirements.

These lines, which are shown in Figure 8, are part of the transmission grid covering the northeastern region of the country. This grid improves the reliability of the New England power supply by making it possible to transfer power from one area to another to meet constantly changing needs while always using the most efficient generating units available.

Transmission line additions through December 31, 1989 are summarized in Table 14. Almost all of the additions are in the 345-kV backbone system.

Long-range studies indicate that at currently forecasted load growths, 345-kV transmission expansion will be adequate for NEPOOL for the next 20 years. If load increases much more rapidly than anticipated, the initial stages of a 765-kV network development could be required in the 11- to 20-year period.

Fuel Resources

New England has discovered no significant energy resources of its own, other than water. It must rely on other regions and other

TABLE 13--NEPOOL Estimated Resources, Demand, and Margins, 1980-89 (MW)

	1980		1981		1982		1983		1984	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Resources										
*01 Net dependable capability	20,720	21,429	20,745	21,779	21,035	21,955	22,324	23,115	22,320	23,109
02 All scheduled imports	625	598	618	600	621	601	624	603	627	583
03 All scheduled exports	0	50	0	142	0	0	0	0	0	0
04 Total resources (01+02-03)	21,345	21,977	21,363	22,237	21,656	22,556	22,948	23,718	22,947	23,692
05 Inoperable capability	306	296	306	296	301	273	284	273	284	273
*06 Operable resources (04-05)	21,039	21,681	21,057	21,941	21,355	22,283	22,664	23,445	22,663	23,419
Demand										
07 Peak-hour demand	14,264	16,184	14,284	16,324	14,474	16,664	14,704	17,034	14,984	17,464
08 Interruptible demand	74	74	74	74	74	74	74	74	74	74
09 Demand requirements (07-08)	14,190	16,110	14,210	16,250	14,400	16,590	14,630	16,960	14,910	17,390
Margin										
10 Margin (06-09)	6,849	5,571	6,847	5,691	6,955	5,693	8,034	6,485	7,753	6,029
11 Scheduled outage	1,203	242	1,836	133	531	913	479	133	2,000	1,000
12 Adjusted margin (10-11)	5,646	5,329	5,011	5,558	6,424	4,780	7,555	6,352	5,753	5,029

	1985		1986		1987		1988		1989	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Resources										
*01 Net dependable capability	23,464	25,409	25,764	26,542	25,751	26,416	25,631	26,416	25,631	26,986
02 All scheduled imports	608	381	410	181	210	180	209	180	209	180
03 All scheduled exports	0	0	0	0	0	0	0	0	0	0
04 Total resources (01+02-03)	24,072	25,790	26,174	26,723	25,961	26,596	25,840	26,596	25,840	27,166
05 Inoperable capability	284	273	284	252	263	252	263	252	263	252
*06 Operable resources (04-05)	23,788	25,517	25,890	26,471	25,698	26,344	25,577	26,344	25,577	26,914
Demand										
07 Peak-hour demand	15,254	17,944	15,604	18,494	15,994	19,034	16,374	19,574	16,734	20,114
08 Interruptible demand	74	74	74	74	74	74	74	74	74	74
09 Demand requirements (07-08)	15,180	17,870	15,530	18,420	15,920	18,960	16,300	19,500	16,660	20,040
Margin										
10 Margin (06-09)	8,608	7,647	10,360	8,051	9,778	7,384	9,277	6,844	8,917	6,874

*Includes only NEPOOL planned generating capacity classified as authorized in item 2-B.

Source: NPCC--Regional Reliability Council Long Range Coordinated Bulk Power Supply Program (ERA-411), April 1980.

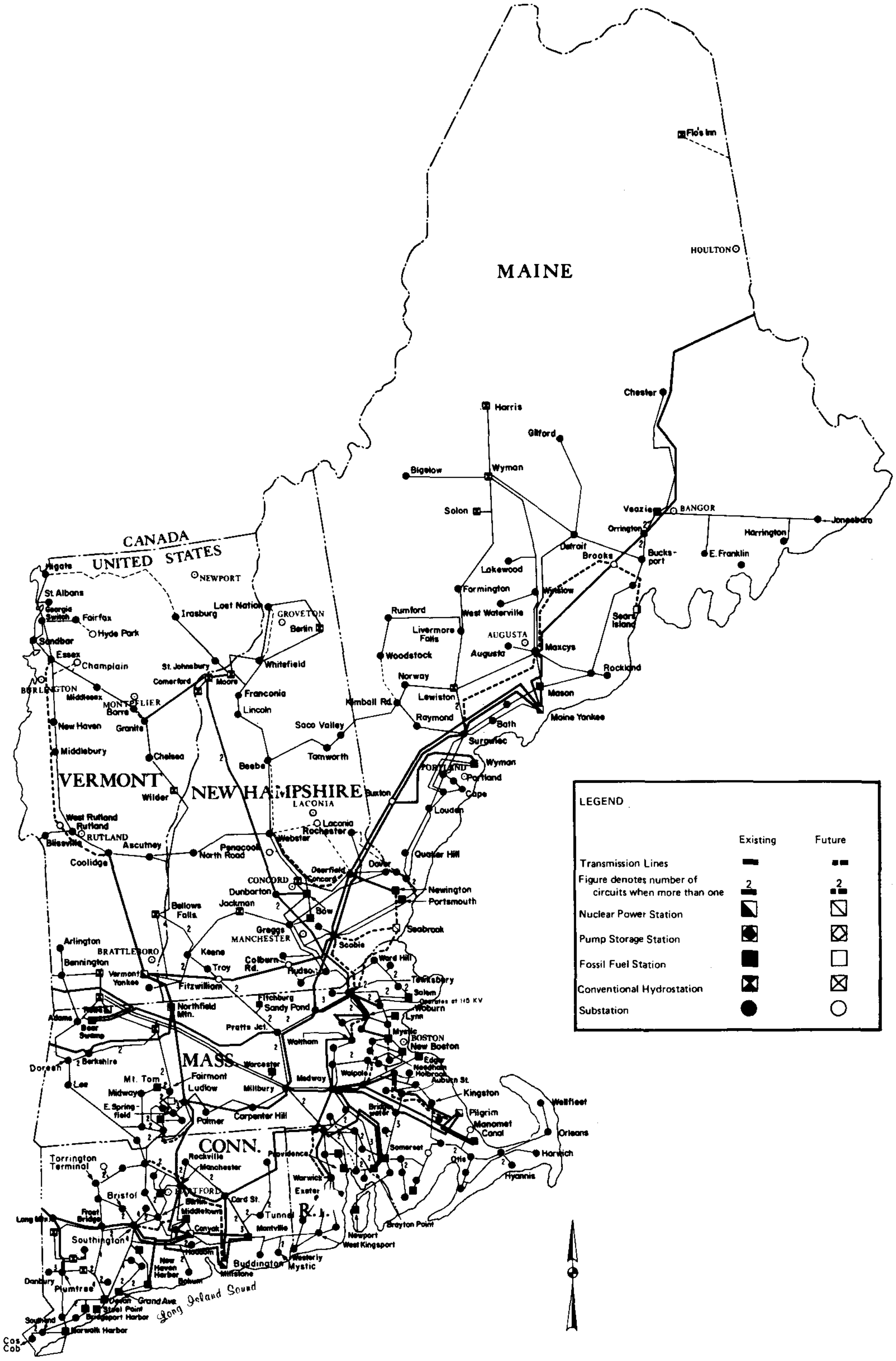


FIGURE 8--NEPOOL Principal Generating Plants and Interconnecting Transmission Lines, Projected to 1989

TABLE 14--Existing, Scheduled, and Proposed Additions of Transmission Lines in NEPOOL (circuit miles)

	765 kV	500 kV	345 kV	230 kV
		Existing		
As of Dec. 31, 1979			1,573	434
		Projected		
Jan. 1, 1980 - Dec. 31, 1980	--	--	12.0	--
Jan. 1, 1981 - Dec. 31, 1981	--	--	32.5	--
Jan. 1, 1982 - Dec. 31, 1982	--	--	56.9	--
Jan. 1, 1983 - Dec. 31, 1983	--	--	--	0.4
Jan. 1, 1984 - Dec. 31, 1984	--	--	86.7	--
Jan. 1, 1985 - Dec. 31, 1985	--	--	92.5	--
Jan. 1, 1986 - Dec. 31, 1986	--	--	115.4	--
Jan. 1, 1987 - Dec. 31, 1987	--	--	67.5	--
Jan. 1, 1988 - Dec. 31, 1988	--	--	229.0	--
Jan. 1, 1989 - Dec. 31, 1989	--	--	--	--
Total additions	--	--	692.5	0.4

Sources: Statistics of Privately Owned Electric Utilities in the United States 1978 (DOE/EIA-0044-78); NPCC--Regional Reliability Council Coordinated Bulk Power Supply Programs (ERA-411), April 1, 1979 and April 1, 1980

countries for coal, oil, gas, and uranium. Fossil fuels are expensive to ship. Nuclear fuel transportation costs are substantially less, in that 1 cubic foot of uranium (U^{235}) has the same energy content as 1.7 million tons of coal, 7.2 million barrels of oil, or 32 billion cubic feet of natural gas.

FUNCTIONS

Planning

The planning of bulk power facilities in New England is presently undertaken through New England Power Planning (NEPLAN), the planning arm of NEPOOL, to enhance the adequacy, reliability, and economy of power supplied in the six-State region.

The responsibilities of NEPOOL include, among other things, forecasting of total NEPOOL loads; joint planning of future generation and transmission facilities based on this forecast and coordination of plans developed by member entities; maintenance of generating reserves adequate to ensure the reliability of the pool; central dispatch of all generating units; and joint use of transmission facilities for specified pool purposes. All functions, except the last one, are the responsibility of NEPLAN and the NEPOOL Planning Committee. The central dispatch and operation of the system that result from the plans are the responsibility of the NEPOOL Operations Committee.

The planning committee, through its task forces and permanent staff, NEPLAN, is charged with developing reliability standards and long-range load forecasts for NEPOOL and New England, and with studying, evaluating, and recommending additions to or changes in generating and bulk transmission facilities.

Forecasting--The Planning Committee is charged with producing a peakload and energy forecast for at least 15 years in the future. This function is performed by the NEPLAN staff with guidance from the Load Forecasting Task Force. The methods used for these projections are continually being revised in an effort to improve forecasting accuracy.

The NEPOOL electric energy and peakload forecasting model is a dynamic simulation model composed of two major sectors: an economic/demographic sector and a power sector. The incorporation of an economic/demographic sector into the model provides the internal capability to develop forecasts of the basic factors that determine the growth of electric energy use in a geographic region. Total electric energy consumption is determined by summing usage in the residential, industrial, commercial, and miscellaneous classes.

Generation Conceptual Planning--Once long-range projections have been developed for the peak demand and energy needs of the New England area, the planning committee through NEPLAN develops general plans or conceptual guidelines for the expansion of system capacity on a regional basis to supply those loads. To accomplish this, a detailed series of generation studies is made taking into account all existing and committed generating capacity and its operating characteristics, and the forecast of future loads with due regard to expected daily, weekly, and seasonal variations.

Generation Criteria--Long-range generation planning must provide for sufficient capacity to be installed and in service to cover all peakloads anticipated throughout the planning horizon. Sufficient reserve capacity, above the operating reserve required to meet any specific peak, must be included to allow for capacity that may be out of service in forced outage or for necessary periodic maintenance and overhaul. Once accepted by the executive committee, this general plan provides a basis by which to judge specific proposals to implement the plan. These guidelines are subject to periodic review by the planning committee, and sensitivity analyses are performed with respect to various factors that affect the determination of mix, such as fuel costs, capital costs, load forecast changes, costs of money, and outage rates.

Current guidelines for New England call for a nuclear baseload expansion pattern with the following preferred mix expressed as percent of capacity:

52 to 62%--Baseload (coal and nuclear)
16 to 24%--Intermediate cycling units (fossil-fueled)
8 to 11%--Hydroelectric peaking, including pumped storage
9 to 12%--Internal combustion peaking

Geographic analysis of location and its impact on the transmission system and the overall reliability of the interconnection is accomplished by dividing the New England interconnection into eight subareas. These subareas are based on logical transmission groupings but follow State boundaries fairly closely in many cases. Massachusetts, because of its size and concentrations of load, is divided into three areas.

After analyzing the generation and transmission expansion plans, the planning committee makes recommendations to the management committee on specific plans to meet the requirements for each year included in the planning horizon. The management committee approves an overall plan. Meanwhile, each of the pool members has been assessing its own requirements for system expansion. The members of the pool must develop specific proposals, which are designed to implement the overall regional plan and, at the same time, the needs and obligations of each individual company. The planning committee, in conjunction with the NEPLAN staff, reviews these proposals to determine whether they are compatible with the overall plan and consistent with the mix guidelines and reliability standards. Recommendations are made to the management committee to aid in determining whether the specific proposals are to receive pool-planned status.

Planning must allow for the impact of weather extremes in all seasons and for a number of unforeseen variations from expected load forecasts or availability of capacity to meet forecasts. This planning is complicated by the long leadtimes now required for modern generating facilities (12 years or more for large nuclear units) and by the fact that predicting loads and operating conditions that far into the future involves a substantial degree of uncertainty.

The failure of the pool interconnected system to meet its reliability criteria will be reflected in the quality of service to the customers. NEPOOL has applied the 1-day-in-10-years loss-of-load criterion in terms of the best statistical data obtainable on generation reliability, maintenance requirements, interconnections with adjacent pools, and possible variations of future loads. Planning has also taken into account the ability to get help from neighboring pools and the various load management steps available to the NEPEX dispatcher in an emergency.

NEPOOL has defined "loss of load" as the last step available to the dispatcher when all previous steps have been completed, when all available help from adjacent systems has been exhausted, and when there is insufficient generation available to maintain the balance between production and consumption on the system. This is when distribution feeders, which serve customers directly, are actually disconnected on a rotating basis.

Each participant's share of the pool objective capability is known as its capability responsibility. Provisions for determining capability responsibility are included in the NEPOOL Agreement. A participant's share of the pool capability is determined initially by the relative magnitude of its annual and seasonal peakloads as compared with the aggregate of all the participants, as determined in the load forecast used by the management committee in establishing objective capability for the pool. Once established, the participant's own load forecast or actual load determines its capability responsibility obligation.

Transmission--The evaluation of alternative proposed extra-high voltage (345-kV and above) and major 115-kV transmission facilities is performed by the Transmission, Stability, System Design Task Forces of the NEPOOL Planning Committee and the NEPLAN staff. Task force personnel are appointed from the staffs of NEPOOL members and thus are able to provide NEPLAN with details of individual transmission systems to aid in developing coordinated system plans. The chairman of each task force is a member of NEPLAN.

In general, the New England bulk power system is examined at various load levels to determine the transmission requirements for each level. The goal of the transmission planning effort is the orderly evolution of a system that will meet all of the reliability design criteria while providing a configuration that is both economically and environmentally acceptable for all pool participants.

After load projections have been made, the individual utilities design transmission additions using the NEPOOL reliability standards as a guideline. The utilities then apply to NEPOOL for acceptance of their plans. The planned system provides the integrated strong transmission grid necessary for NEPOOL operations, resulting in such benefits as reserve sharing, economy interchange, outage service, and mutual assistance during emergencies.

NEW YORK POWER POOL

The New York Power Pool (NYPP) serves New York and small portions of northern New Jersey and Pennsylvania. The land area within the boundaries of the pool is nearly 48,000 square miles, of which more than 99 percent is in New York State. Although the pool area constitutes only about 1.3 percent of the total land area of the United States, about 9 percent of the Nation's population resides within its boundaries.*

---

* 1970 Census data

ORGANIZATIONAL STRUCTURE

In New York State, early bilateral agreements were expanded into pool operations as the capacity of interconnections increased. In the 1930's, Consolidated Edison, relying solely on thermal generation, began interchange of emergency and economy energy with the predecessor of the present-day Niagara Mohawk Power Corporation, which had developed substantial hydroelectric capability. By 1961, the four companies serving southeastern New York were also operating under a pool arrangement. These developments eventually led to the formation of the New York Power Pool.

The New York Power Pool (NYPP) was established with an agreement dated July 21, 1966, signed by the State's seven largest investor-owned electric utilities. Members of the pool under this agreement were the following:

Central Hudson Gas and Electric Corporation
Consolidated Edison Company of New York, Inc. (CON EDISON)
Long Island Lighting Company (LILCO)
New York State Electric and Gas Corporation (NYSE&G)
Niagara Mohawk Power Corporation (NMP)
Orange and Rockland Utilities, Inc.
Rochester Gas and Electric Corporation (RG&E)

The Power Authority of the State of New York (PASNY) agreed to participate in Power Pool Committee activities as stipulated in correspondence dated October 11, 1967. A new agreement, dated March 31, 1971, was entered into by the seven original members and by the Power Authority of the State of New York. Three principal reasons for the new agreement were

1. The desire to strengthen the pool organization, particularly in the areas of management and planning coordination.
2. The recognition of PASNY's desire to cooperate with the other parties in the coordination of planning and operations.
3. The need for establishment, staffing, and operation of the Power Pool Control Center facility near Albany, New York.

In 1974, the agreement was further modified to reinforce the definition of mutual and coordinated activities and the organization of NYPP. The agreement of March 31, 1974 also established an executive committee composed of a senior officer from each member system and an alternate for each committee member. Figure 9 is an organizational chart of NYPP.

The executive committee selects from among its members a chairman and vice chairman to serve for 1 year. The vice chairman succeeds the chairman at the end of each term of office. The agreement provides that the executive committee shall meet at least quarterly and at such other times as the chairman may determine. Actually, the committee has met at least every 2 months since December 1970. The executive committee determines policy on all matters within the scope of the agreement and carries out its

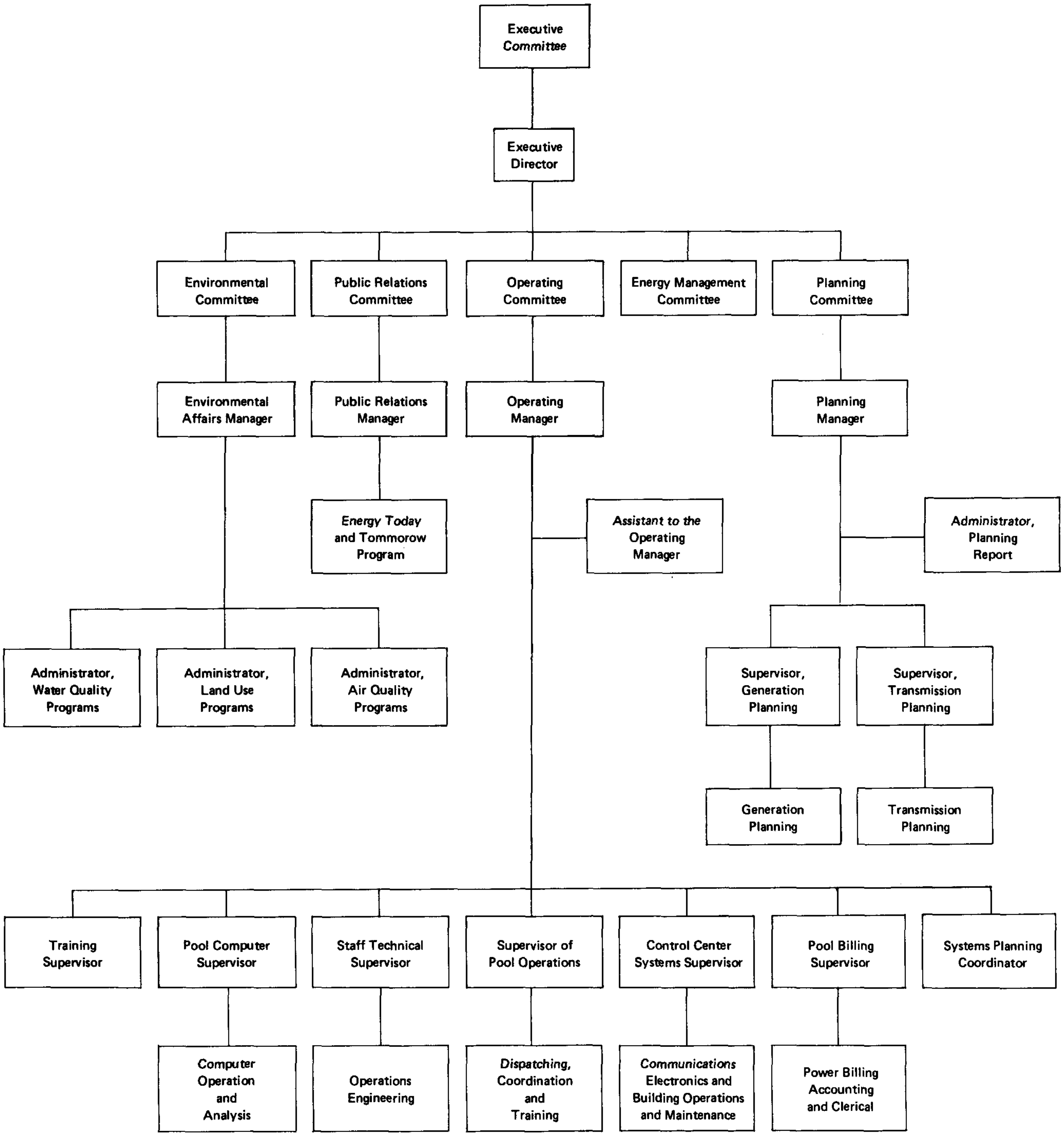


FIGURE 9--NYPP Organization and Functions

provisions. The executive committee also reviews and directs the activities of the other committees of the pool.

On April 27, 1975, the pool agreement was again modified to redefine the level of generating capability required to be maintained throughout the year by the pool member systems.

Five principal committees are responsible to the executive director and the executive committee. The chairmen and vice chairmen of the operating, planning, environmental, and public relations committees are selected and rotated in the same manner as for the executive committee.

Operating Committee

The operating committee is composed of a senior executive from each of the member systems. The committee directs the activities of the power pool operating manager and establishes such rules and practices as may be required to coordinate the operation of the bulk power supply system of the members to ensure reliability of service and economic operation with due regard for environmental factors. The committee has established subcommittees and task forces to assist it.

Planning Committee

The planning committee consists of a senior executive from each member system, who is responsible for electric system planning, and an alternate from each member system. The committee coordinates and develops plans for installing additional generating capability and interconnecting transmission facilities within the power pool. The committee coordinates planning between the NYPP and adjoining pools and with regional power coordinating agencies to the extent appropriate. The committee also directs the activities of the pool's planning manager and staff. The committee has established subcommittees and task forces to assist in carrying out its responsibilities.

Environmental Committee

The environmental committee comprises executives and engineers representing each member system. The committee deals with the technical aspects of environmental protection as it pertains to the planning and operational functions of the pool. The committee members are supported by designated representatives from the environmental engineering staffs of their member systems. The committee directs the activities of NYPP's pool manager of environmental affairs.

Energy Management Committee

The energy management committee is composed of member system executives. The committee coordinates the energy conservation efforts of the member systems and compiles data on the nature, scope, and effectiveness of such programs. In addition, the committee analyzes and encourages the application of proven and developing techniques and technologies for load management by the utilities and their customers. Such efforts include the analysis of the potential effects on load factors resulting from research and development by the Empire State Electric Energy Research Corporation and others, the role of new energy sources, the use of energy storage systems, and the implementation of voluntary load reduction and load interruption programs.

Public Relations Committee

A public relations representative from each member system and an alternate coordinate public relations activities for the pool as a whole.

AREA CHARACTERISTICS

Load

NYPP provided well over 99 percent of the electric energy generated in New York State in 1979. The Power Authority sells its power wholesale to each of the other seven members of the pool, the City of New York and other public bodies in New York City and Westchester County, 46 municipals, 4 rural cooperative distribution systems in New York, 1 rural cooperative in Pennsylvania, 3 industrial plants in Massena, Plattsburg Air Force Base, and the State of Vermont.

NYPP has been summer peaking since 1968 and is expected to remain summer peaking for the near future. The 1979 peak demand, which occurred during August, was 20,402 MW. This peak represented a decrease of 3.8 percent from the record peak of 21,205 MW on July 21, 1977.

From 1968 to 1973, the annual compound growth rate of peak demand was 5.7 percent. In the 1979-1989 time frame, the peak demand is expected to grow at a compound rate of approximately 2.2 percent.

To reflect anticipated diversity, peakload forecasts are prepared from the individual member sytems' adjusted projections. In winter, there is a diversity of approximately 1 percent among the member systems' peaks. Therefore, the sum of the independent winter peakload forecasts divided by a winter diversity factor of 1.01 equals the winter coincident peakload for the pool. In summer, the diversity in the individual systems' summer peak was approximately 2 percent. Therefore, a summer diversity factor of 1.02 has been used for 1980 through 1989.

Table 15 shows the actual and estimated summer peakloads for the members of NYPP 1970 through 1999.

TABLE 15--NYPP Power Requirements and Resources

Year	Energy (GWH)	Annual Peak Demand (MW)	Peak Month	Net Capability at Time of Peak Demand[1] (MW)
1970	97,160	17,037	Jul.	22,039
1971	100,217	18,146	Jul.	22,387
1972	105,113	18,943	Jul.	23,503
1973	110,799	20,408	Sept.	23,715
1974	107,993	19,509	Jul.	25,873
1975	107,664	19,904	Aug.	27,049
1976	111,941	19,177	Jun.	28,144
1977	113,981	21,103	Jul.	27,801
1978	110,117	20,316	Aug.	29,805
1979	117,713	20,402	Aug.	29,697
		Projected		
1980	117,814	21,230		31,117
1984	127,720	22,850		31,971
1989	141,722	25,300		36,359
1994		27,930		37,222
1999		30,890		36,266

Projected Generating Capability Additions

	Hydro-electric	Nuclear	Coal[2]	Other	Total
		1980 through 1989			
Percent	21.1	33.4	41.2	4.3	100.0
Megawatts	1,206	1,909	2,350	247	6,012

[1] Including net imports.

[2] Excludes conversion of oil-fired units to coal.

Source: NPCC--Regional Reliability Council Long Range Coordinated Bulk Power Supply Program (ERA-411), April 1980; NYPP FPC Form 12

Load Density

The density of electric load served by utilities in New York varies greatly. Consolidated Edison has a service area of approximately 600 square miles and serves a load that peaked during the summer of 1973 at 8220 MW. In contrast, New York State Electric and Gas has a service area of 17,000 square miles and a load that peaked during the winter of 1978-79 at 2118 MW.

Generation Characteristics

The generation mix for 1978 and 1979 is presented in Table 16. Table 15 shows that in the period from 1980 through 1989, NYPP plans to add coal-fired, nuclear, and hydroelectric capacity to its system. These planned additions will reduce oil use and allow retirement of inefficient oil-fired units. Although implementation of the pool's generation expansion program will not necessarily prevent brownouts and blackouts, timely installation of planned facilities will help to reduce their severity.

TABLE 16--NYPP Available Resources, 1978 and 1979

Resource	12/31/78 Power (MW)*	Percent of Total	12/31/79 Power (MW)*	Percent of Total
Oil-fired	13,904.2	49.7	13,873.2	45.7
Coal-fired	3,500.0	11.5	3,519.0	11.6
Nuclear	3,694.0	12.2	3,694.0	12.2
Hydroelectric (conventional)	4,029.5	13.3	4,029.4	13.3
Pumped storage	1,000.0	3.3	1,000.0	3.3
Internal combustion	3,588.5	11.8	3,581.5	11.8
Net purchases (summer)	668.0	2.2	650.0	2.1
Total	30,384.2	100.0	30,347.1	100.0

*Summer rating.

Sources: NPCC--Regional Reliability Council Long Range Coordinated Bulk Power Supply Program (ERA-411), April 1979 and April 1980

Bulk Power Transmission

Existing--Existing facilities and total mileages of overhead and underground facilities by voltage level are shown in Table 17. There are 9,569 circuit miles in service, including 6,163 miles at voltages less than 230 kV. Of this total, 85 percent is overhead and 15 percent is underground, mainly in New York City.

Future--The need for planned transmission capacity arises from a number of conditions. First, load centers to be served and potential generating sites that are acceptable from environmental, engineering, and economic viewpoints are frequently some distance from one another. In New York State, about 60 percent of the State load is in the highly concentrated population center of southeastern New York with secondary, but significant, load centers in Buffalo, Rochester, Syracuse, Albany, and Elmira/Binghamton. However, many of the potential generating sites are associated with the large sources of cooling water in the Great Lakes, the St. Lawrence River, the Hudson River, and Long Island Sound.

A second condition is load diversity. Load centers in different regions of the State, and in adjacent States and Canada, often experience peakloads at different times and can, if adequate transmission capacity is available, transmit power from offpeak to onpeak regions, thereby minimizing the total generating capacity that must be installed to meet these special demands.

A third condition is the need to provide generation to replace generating capacity that is temporarily out of service for repair or maintenance.

Finally, transmission capacity is needed to permit use of efficient baseload generating units during times of low demand by dispatching the generation to more distant loads that, at peakload times, would otherwise be served by less efficient generating units. Adequate transmission capability ensures the maximum benefits of the economic dispatch of generation at all load levels.

In general, plans to construct generating facilities are not significantly affected by related transmission facilities. The most significant factor in siting generation is identification of a site that is licensable. The converse, however, is true. Transmission plans are significantly affected by the location of related generation facilities. When generation is far from load centers, major transmission facilities must be constructed to maintain reliable service. The time required to certify and build major transmission facilities ranges from 4 to 6 years. Therefore, it is the rare case when an alternate facility may be substituted in the contingency of a 1-2 year delay in placing a transmission line in service. The contingency plan in most cases is to make the best use of the available facilities.

New York State law requires that a Certificate of Environmental Compatibility and Public Need be granted before most major proposed electric transmission facilities may be built. The proceedings

TABLE 17--Transmission Lines in NYPP 230 kV and Above (circuit miles)

	765 kV	500 kV	345 kV	230 kV
		Existing		
As of Dec. 31, 1979	251*	5	2,071	1,113
		Projected		
Jan. 1, 1980 - Dec. 31, 1980	--	--	0.2	--
Jan. 1, 1981 - Dec. 31, 1981	--	--	--	7.8
Jan. 1, 1982 - Dec. 31, 1982	--	--	176.2	--
Jan. 1, 1983 - Dec. 31, 1983	--	--	56.8	--
Jan. 1, 1984 - Dec. 31, 1984	--	--	--	--
Jan. 1, 1985 - Dec. 31, 1985	9.0	--	--	--
Jan. 1, 1986 - Dec. 31, 1986	65.0	--	72.9	--
Jan. 1, 1987 - Dec. 31, 1987	--	--	1.0	--
Jan. 1, 1988 - Dec. 31, 1988	--	--	16.2	--
Jan. 1, 1989 - Dec. 31, 1989	--	--	125.5	--
Total additions	74.0	--	448.8	7.8

*96 miles will initially be operated at 345 kV.

Sources: Statistics of Privately Owned Electric Utilities in the United States 1978 (DOE/EIA-0044-78); NPCC--Regional Reliability Council Coordinated Bulk Power Supply Programs (ERA-411), April 1, 1979 and April 1, 1980

relative to granting such certificates provide a forum for review of the need for, and alternative routing of, such proposed facilities.

A transmission system map (Figure 10) shows all significant existing facilities at 115 kV and above in service as of January 1, 1980. Also shown are all significant facilities at 115 kV and above proposed for service in the 15-year period (1980-94) following the year in which the expansion plan was filed with the State's Energy Office.

Generation Mix Criteria

The 10-year generation shown in Table 15 was prepared using conventional technologies, namely, light-water nuclear reactors, fossil-fueled generation, and hydroelectric facilities. New technologies were excluded for the following reasons. First, conventional generation projects in the long-range plan can be delayed or cancelled to facilitate integration of developing technologies as they become available. Replacing conventional

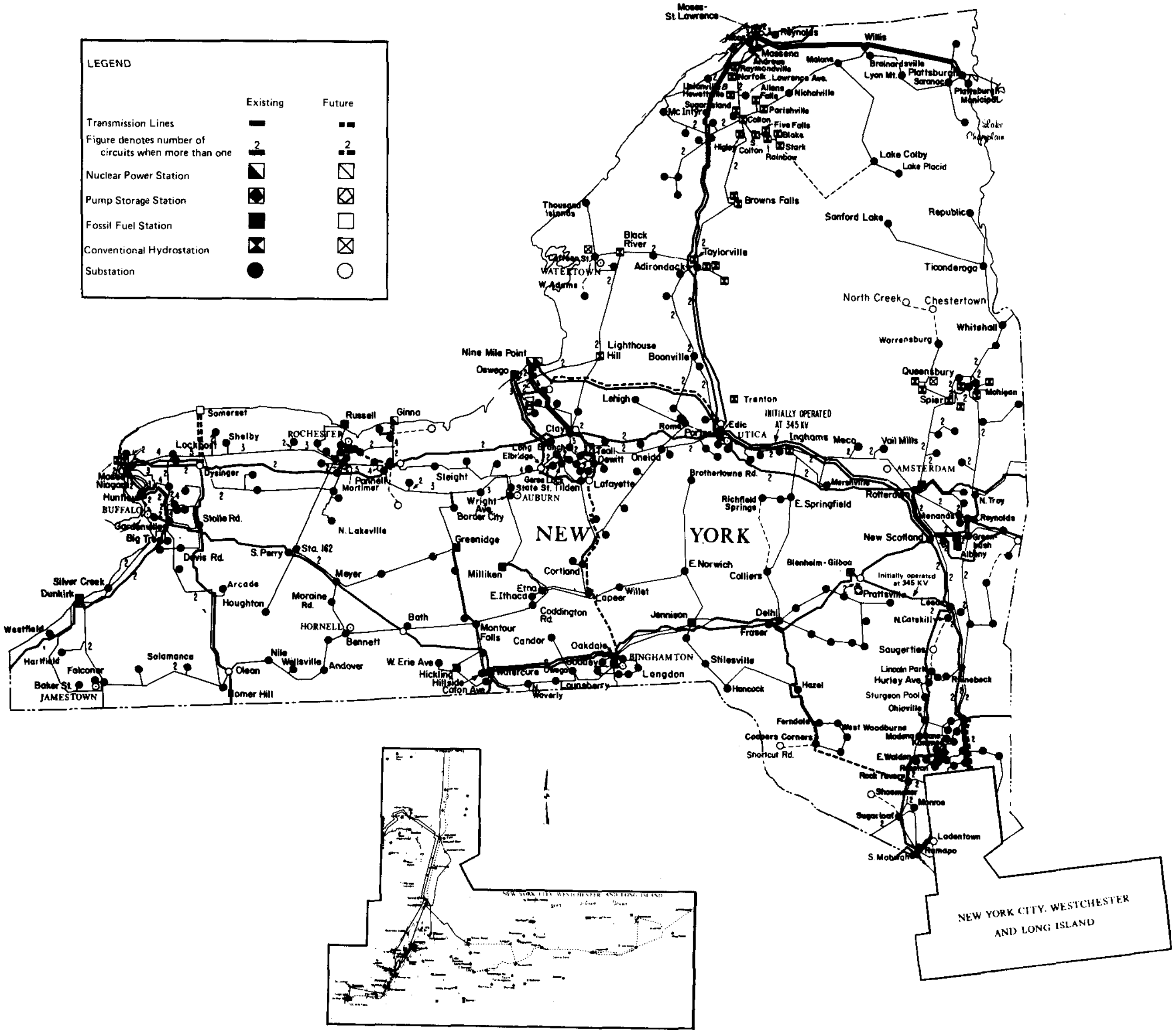


FIGURE 10--Transmission System Map of New York State and Electric Power System Interconnections, December 31, 1979

facilities in the 15-year plan with a promising new technology, however, would probably eliminate the option of installing the conventional facility if the new technology did not develop, e.g., nearly 15 years are required to plan, license, and construct a nuclear powerplant. Second, new technologies are initially applied on a relatively small scale before expanding to a commercial basis. Several years are needed to design and construct a pilot project; obtain experience; plan, design, license, and construct a large-scale demonstration project; gain more experience; and finally, implement the new technology on a widespread basis.

For the baseload component, comparisons based only on typical economic conditions have been found to generally favor nuclear over fossil generation. Nuclear power imposes heavier financial requirements, but its overall revenue requirements are lower because of lower expected fuel costs. However, variations likely to be encountered in cost parameters, the benefits of fuel diversification, or the desirability of using certain sites that are unsuitable for nuclear plants, indicate continued selection between nuclear and fossil on a case-by-case basis.

The cost of generation expansion plans is figured by means of engineering economic studies. The essential parameters in determining the total cost of a given generation project or plan include the following:

- Capital cost
- Fuel cost
- Heat rates
- Operation and maintenance costs
- Outage rates and maintenance cycles
- Escalation rates for cost parameters
- Load forecast
- Reliability criteria
- Fuel availability

Contractual Requirements

The pool considers firm capacity purchases an alternative to new generation facilities. When neighboring systems indicate such capacity is available, the pool members evaluate the cost and other factors associated with the transaction. Normally, these are relatively small short-term transactions; the exception is PASNY's purchase of 800 MW of capacity from Hydro-Quebec.

Two agreements exist between Hydro-Quebec and PASNY. The first is based on a contract signed in 1974 by both parties and approved in 1976 by Canada's National Energy Board. This agreement provides for delivery of up to 800 MW of diversity power during April through October of each year. NYPP is summer peaking, whereas the Hydro-Quebec is winter peaking. The Agreement also stipulates that, beginning in 1982, PASNY must, if Hydro-Quebec so requests, deliver to the Quebec system during the winter months all or part of the energy it received during the previous summer.

The second agreement between Hydro-Quebec and PASNY was approved by the Canadian National Energy Board on September 8, 1978. It is valid until December 31, 1983, and it authorizes the sale, over any period of 12 consecutive months, of a maximum of 10.2 billion kWh, less net exports, under the contract for sales of diversity power. This agreement, which was exercised for the first time on November 1, 1978, enables Hydro-Quebec to sell various classes of power and energy to PASNY on an interruptible basis. It also permits PASNY to sell emergency energy to Hydro-Quebec.

Alternate Planning Strategies

NYPP's long-range plan is designed to meet a 22 percent installed reserve margin, based on a projected load growth of approximately 2.2 percent per year from 1979 through 1989 and 2.0 percent from 1989 through 1999. Because of numerous uncertainties affecting future loads, it is necessary that the pool's plan be flexible, not only for the forecast load growth, but for reasonable deviations therefrom, in order to maintain desired levels of reliability.

Transmission Requirements

Intra-Pool Reliability Criteria--The basic objective of transmission planning is to provide sufficient and adequate links between generation sources and load centers to ensure reliability of supply at reasonable cost and with minimum environmental impact. The continuity of power supply must be ensured under normal and contingency criteria that are sufficiently stringent to reflect practical operating needs, but not so severe as to be economically and environmentally impractical.

In April 1977, the NYPP Planning Committee directed that transmission studies be done in accordance with the following two principles:

1. The NYPP transmission system will be planned with sufficient emergency capacity to meet the NYPP generation reliability criteria.
2. The NYPP transmission system will be planned with the normal capacity that is economically justified by production cost savings achieved on the basis of economic dispatch.

In addition, the system must have sufficient electrical strength to withstand the dynamic stresses of sudden disturbances, such as loss of a line or generator as a result of an electrical fault.

These conditions are set forth in system design criteria and standards established by the Northeast Power Coordinating Council (NPCC) and NYPP. In general, these criteria specify the power transfer, voltage, and stability conditions that must be met to satisfy reliability requirements under normal system operation as well as during various system contingencies. The acceptable alternatives are then compared on the basis of performance, environmental impact, and cost.

An interconnected power system should be designed and operated so that the loss of a major portion of the system would not result from reasonably foreseeable contingencies. In determining this reliability, all combinations of contingencies occurring more frequently than once in some stipulated number of years should be considered. Loss of small portions of the system (such as radial portions) may be tolerated, provided these do not jeopardize the integrity of the overall interconnected power systems. Design studies will assume applicable contractual transfers and the most severe expected load and generation conditions. Operating transfer capability studies will be based on the expected load and generation pattern for the study period. All reclosing facilities will be assumed to be in service, unless it is known that such facilities have been rendered inoperative. Two categories of transmission transfer capabilities--normal and emergency--are to be considered.

The system should be designed with sufficient transmission capacity to serve area loads under the conditions noted below.

Stability Conditions--The NYPP stability and steady state criteria are identical to those of NPCC. The NYPP transmission plans are sensitive to unit size, outage rates, and reliability. As unit size increases, the transmission system must be capable of sustaining the dynamic impact of sudden loss of those units. The inability to place such transmission in service could require long-term reduction in output of large economic units.

Generally, the availability of transmission circuits is well above 95 percent. Transmission facilities tend to be considerably more reliable than generating facilities. Thus, the outage rate of generation is the significant factor in transmission planning.

If the use of 765 kV as a transmission voltage were restricted in New York State, the impact on the transmission plan would be significant. Typically, three to five 345-kV transmission circuits would be required to carry the same amount of power as a single 765-kV circuit. Such a proliferation of 345-kV circuits would also result in an increase in land requirements.

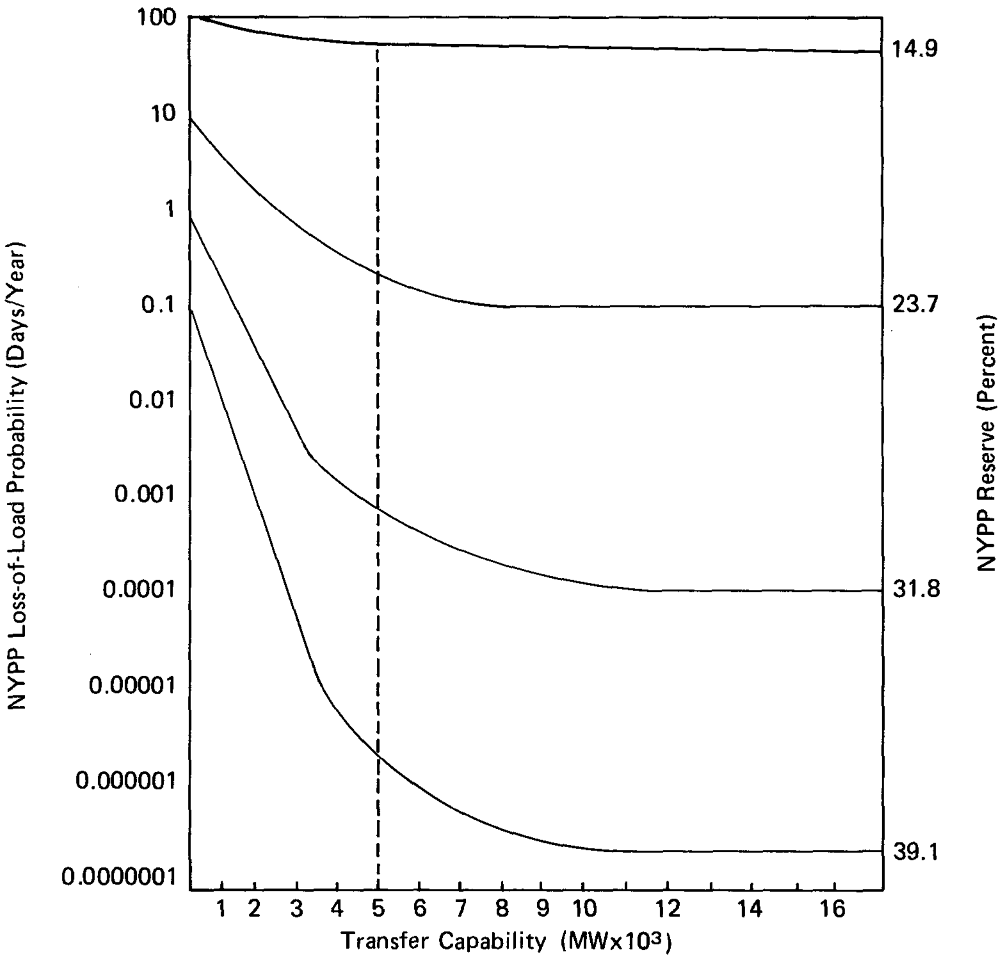
The effects of a nuclear generation moratorium have been considered. Population density criteria, land use, and cooling water requirements will generally result in nuclear units being sited relatively remote from load centers. Ambient air quality criteria, cooling water requirements, and land for fuel storage and waste disposal will similarly affect the location of coal-fired units. In view of this, choice of fuel will not significantly affect generating plant location or transmission requirements.

Interarea Transfer

The amount of installed generating capacity required by a power system such as NYPP for meeting its reliability criteria can be affected by interconnections to neighboring systems. The reserve value of interconnections is influenced by two factors:

1. The transfer capability of the interconnection itself.
2. The ability of the neighboring system to share its reserves as influenced by its planned capacity mix, generating unit reliability, and load pattern.

Figure 11 shows the results of a recent study to determine the benefits to NYPP of variation in its transfer capability with NEPOOL, Ontario-Hydro, and PJM.



SOURCE: NYPP Report 5-112, 1979.

FIGURE 11--New York Power Pool Loss-of-Load Probability Intersystem Transfer Capability (NEPOOL, Ontario-Hydro, PJM)

As interpool transfer capability increases, reliability of the interconnected areas also increases until a limit is reached beyond which additional transfer capacity will have little or no further effect on reliability.

Table 18 shows required 1985-94 installed reserves for NYPP as a function of the total transfer capability to neighboring areas. In the future, with continued moderate load growth, NYPP's scheduled construction program provides for adequate reserves. Table 19 shows the margins expected to be available in NYPP from 1980 through 1989.

Table 20 summarizes the forecast transfer capacities between NYPP and New England, NYPP and PJM, NYPP and Ontario Hydro, NYPP and Hydro Quebec, and Upstate and Southeastern New York as identified by "UPNY-Con Ed." These values are based on system representations that were current as of December 31, 1978. The dynamic state of load forecasts, generation schedules, sites, and transmission requirements, coupled with the time requirements for assembling, checking, and carrying out comprehensive large system load-flow studies, makes it necessary to establish a "firm" date for the load-flow model.

In the dynamic planning situation that exists in a utility industry, plans change rapidly in response to a variety of pressures. The transfer capacities in Table 20 were derived by analysis of load flow tests based on representations that were firmed as of January 1, 1979. Certain system changes were subsequently made during the preparation of the report. As a result, some limits recorded in the table may be altered by the revised system representation.

TABLE 18--Interrelationship Between Reserves and Customer Impact, 1985 Through 1994 (Assuming 5000-MW Total Transfer Capability from PJM, Ohio, and New England into NYPP)

Percent of Company Reserve	Percent of Pool Reserve	LOLP days/ year	5-Percent Voltage Reduction	Customer Appeals*	Disconnections Customer Appeal Effect		
					None	Partial	Full
24	28	0.01	0.2	0.1	0.002	0.0009	0.0004
20	24	0.1	1.2	0.8	0.025	0.01	0.005
19	23	0.2	2	1.3	0.04	0.025	0.01
18	22	0.5	4	3	0.12	0.06	0.03
17	21	1	7	5	0.25	0.12	0.06
13	17	10	48	35	2.5	1.6	1.0

*Voluntary industrial and commercial curtailments and general public appeals.

Source: NYPP Report 5-112, 1979

TABLE 19--New York Estimated Resources, Demand, and Margins, 1980-1989 (MW)

	1980		1981		1982		1983		1984	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Resources										
01 Net dependable capability	30,467	31,540	31,252	32,343	31,277	32,388	31,327	32,418	31,321	33,288
02 All scheduled imports	800	50	800	142	800	0	800	0	800	0
03 All scheduled exports	150	150	150	150	150	150	150	150	150	150
04 Total resources (01+02-03)	31,117	31,440	31,902	32,335	31,927	32,238	31,977	32,268	31,971	33,138
05 Inoperable capability	0	0	0	0	0	0	0	0	0	0
06 Operable resources (04-05)	31,117	31,440	31,902	32,335	31,927	32,238	31,977	32,268	31,971	33,138
Demand										
07 Peak-hour demand	21,230	19,870	21,610	20,310	22,070	20,800	22,480	21,220	22,850	21,630
08 Interruptible demand	0	0	0	0	0	0	0	0	0	0
09 Demand requirements (07-08)	21,230	19,870	21,610	20,310	22,070	20,800	22,480	21,220	22,850	21,630
Margin										
10 Margin (06-09)	9,887	11,570	10,292	12,025	9,857	11,438	9,497	11,048	9,121	11,508
11 Scheduled outage	700	2,200	1,200	1,300	1,200	1,300	1,200	1,300	1,200	1,300
12 Adjusted margin (10-11)	9,187	9,370	9,092	10,725	8,657	10,138	8,297	9,748	7,921	10,208

	1985		1986		1987		1988		1989	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Resources										
01 Net dependable capability	32,230	33,321	32,271	34,338	34,974	35,999	34,936	36,040	35,709	36,797
02 All scheduled imports	800	0	800	0	800	0	800	0	800	0
03 All scheduled exports	150	150	150	150	150	150	150	150	150	150
04 Total resources (01+02-03)	32,880	33,171	32,921	34,188	35,624	35,849	35,586	35,890	36,359	36,647
05 Inoperable capability	0	0	0	0	0	0	0	0	0	0
06 Operable resources (04-05)	32,880	33,171	32,921	34,188	35,624	35,849	35,586	35,890	36,359	36,647
Demand										
07 Peak-hour demand	23,250	22,070	23,720	22,550	24,230	23,100	24,710	23,630	25,300	24,260
08 Interruptible demand	0	0	0	0	0	0	0	0	0	0
09 Demand requirements (07-08)	23,250	22,070	23,720	22,550	24,230	23,100	24,710	23,630	25,300	24,260
Margin										
10 Margin (06-09)	9,630	11,101	9,201	11,638	11,394	12,749	10,876	12,260	11,059	12,387

Source: NPCC--Regional Reliability Council Long Range Coordinated Bulk Power Supply Program (ERA-411), April 1, 1980

TABLE 20--New York Projected Transfer Capabilities Based On System Configurations as Forecast on January 1, 1979 (flows in MW on direct ties)*

Pool	1981	1985	1990	1995
NYPP-NEPOOL	1,350	1,500	1,500	1,500
NEPOOL-NYPP	1,200	1,200	1,200	1,200
NYPP-Ontario	850	1,200	1,200	1,200
Ontario-NYPP	950	1,300	1,300	1,300
NYPP-PJM	2,150	2,200	2,200	2,400
PJM-NYPP	2,400	3,100	3,100	3,500
NYPP-Hydro Quebec	800	800	800	800
Hydro Quebec-NYPP	1,300	1,300	2,300	2,300
UPNY-Con Ed	2,900	5,500	5,500	5,500

*This table is not to be used for NYPP operating purposes.

Source: NYPP Report 5-112, 1980

Figure 12 is a map of interstate transmission tielines of the NYPP systems.

Transmission planning on a broad geographic basis (both intra- and interregional) is coordinated by organizations such as NYPP, NPCC, and the National Electric Reliability Council (NERC). These pool and council organizations formulate general policy and criteria and review plans and designs for conformance. Proposed transmission facilities through 1994 for NYPP member companies are shown in Figure 10.

In some instances, generating units that will be required toward the latter part of the planning period have not been sited, as several locations are under consideration. Transmission required for them is not indicated on the map because of the multiple transmission plans associated with unsited units. As unit sites become more definite, transmission plans will be firmed up.

The latest interconnection agreement between the utilities within NYPP and the members of PJM became effective June 1, 1974. The agreement provides for continued parallel operation of the two areas and calls for both areas to cooperate in the exchange of information with regard to pertinent matters affecting the planned development and reliable operation of their respective systems and, to the extent possible, to coordinate generating capacity and major

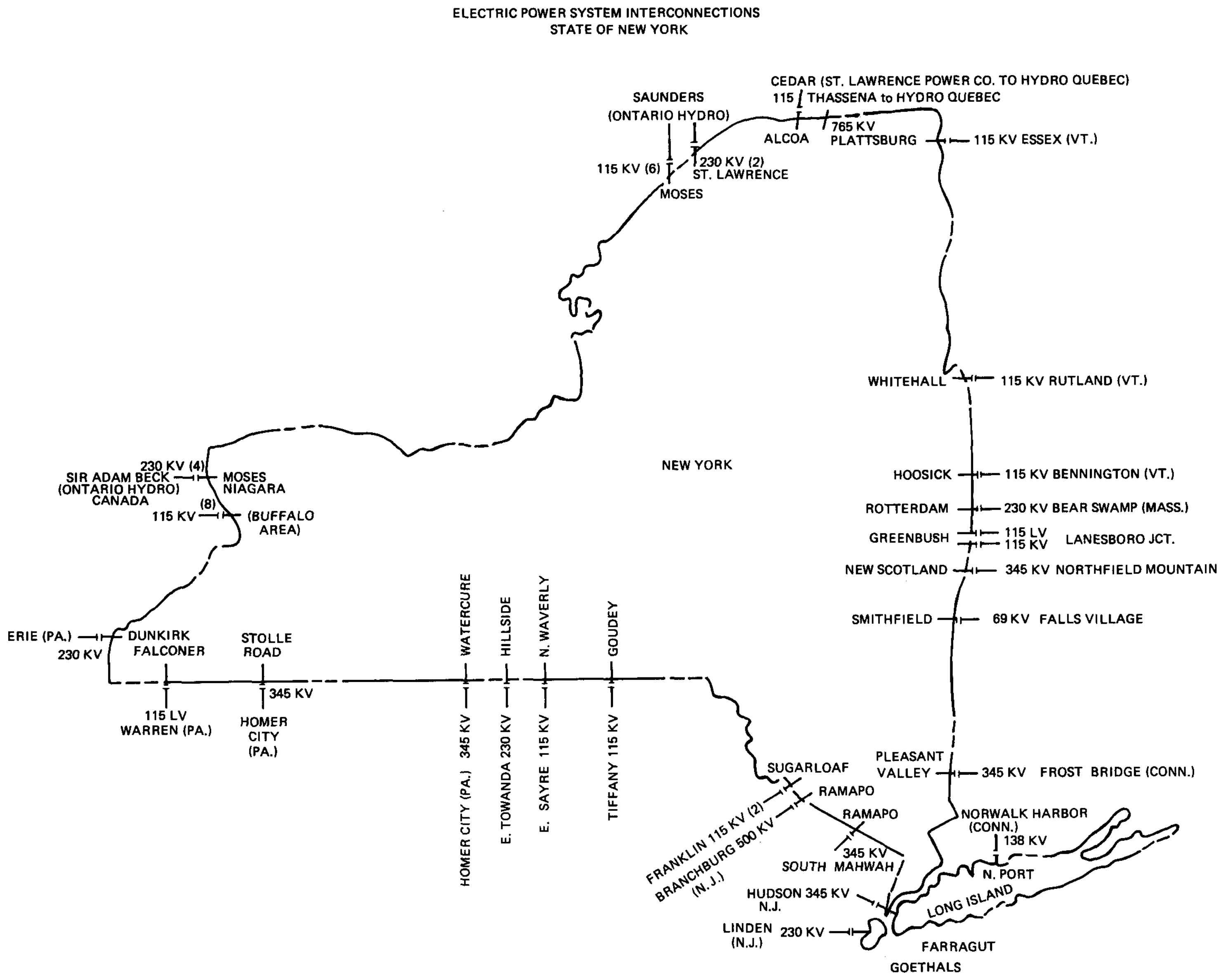


FIGURE 12--Interstate Transmission Tielines of NYPP Systems

transmission additions required. The agreement provides for an NYPP-PJM Operating Committee to monitor the terms of the agreement.

Many contractual agreements exist within NYPP and other interregional entities. These include intraarea "wheeling agreements" such as that between PASNY and a number of investor-owned utilities for transfers of PASNY energy to various customers across the State. Utilities in NYPP usually negotiate unilaterally for purchase and transfer of firm capacity and energy. The pool will arrange short-term firm and economy purchases, but long-term commitments are negotiated by the member systems. In addition to the agreement with PJM, NYPP has pool-to-pool contracts with Ontario Hydro and NEPOOL, as described in other sections of this report.

PENNSYLVANIA-NEW JERSEY-MARYLAND INTERCONNECTION

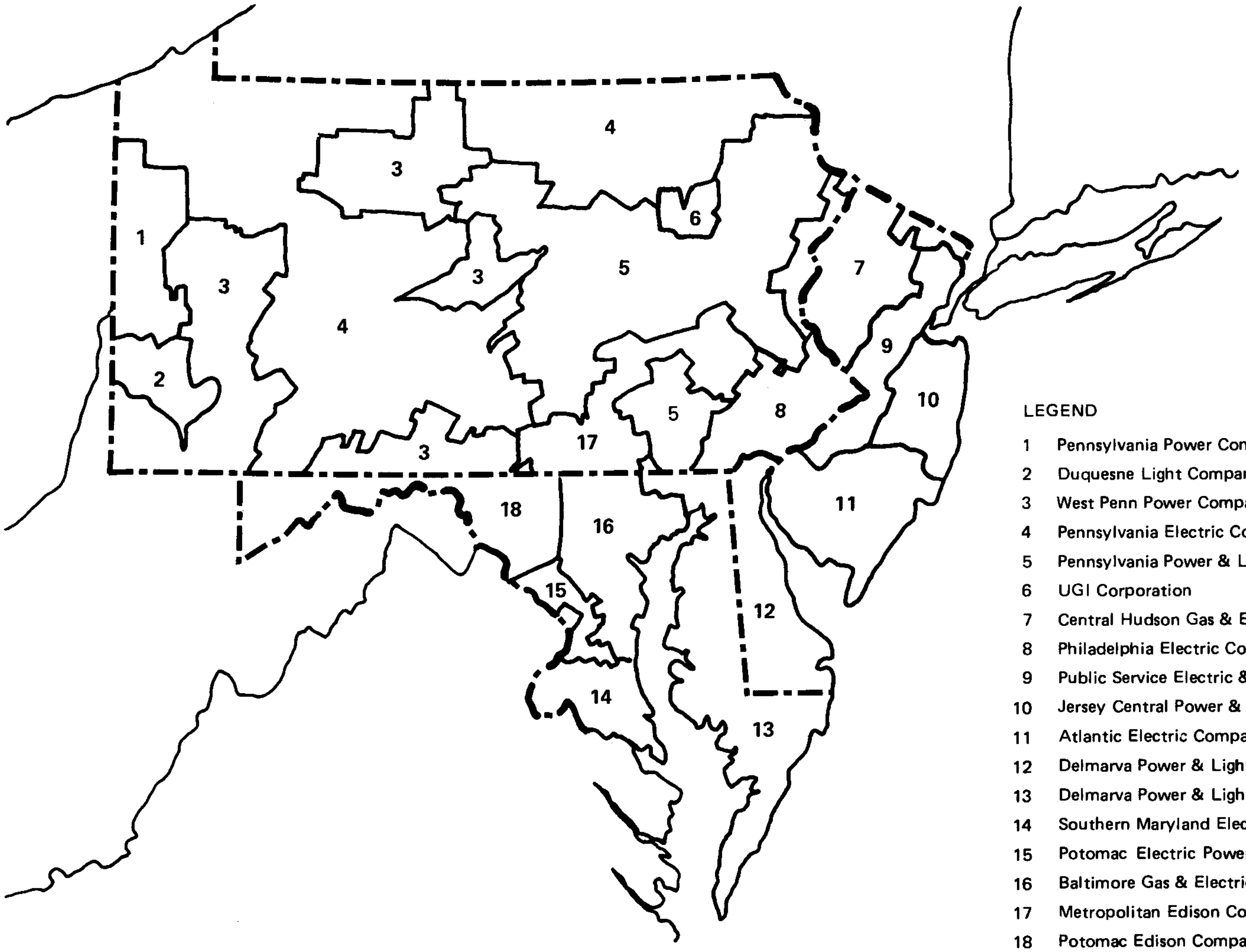
DESCRIPTION

History and Geography

PJM had its beginning in a three-member interconnection, referred to as the Pennsylvania-New Jersey Interconnection. It comprised Public Service Electric and Gas Company, Philadelphia Electric Company, and Pennsylvania Power & Light Company. Under the terms of an interconnection agreement, the companies agreed to construct 230-kV transmission to connect their systems and to obtain the fullest practicable advantages from load diversity and reserve diversity. As a result, the systems were able to operate under the one-system concept. Initially, the pool had a combined generating capacity of 1.5 million kW.

The original interconnection was expanded in 1956 to become the Pennsylvania-New Jersey-Maryland Interconnection, which added Baltimore Gas and Electric Company and four subsidiaries of the General Public Utilities Corporation. Today, three subsidiaries constitute the General Public Utilities System: Jersey Central Power & Light Company, Metropolitan Edison Company, and Pennsylvania Electric Company. Potomac Electric Power Company became a full member of PJM in 1965. In addition to the aforementioned companies, which are signatories to the PJM Agreement, Atlantic City Electric Company, Delmarva Power & Light Company, and UGI Corporation participate in the fully coordinated operation of PJM through separate agreements with certain PJM members. These 11 companies serve the Middle Atlantic States, including all of Delaware and the District of Columbia, 97 percent of New Jersey, 75 percent of Pennsylvania, 60 percent of Maryland, and approximately 1 percent of Virginia. Figure 13 shows the PJM service area.

In 1967, PJM member companies entered into a service-reliability compact known as the Mid-Atlantic Area Coordination Agreement (MAAC). It calls for planned new additions or changes in major



LEGEND

1	Pennsylvania Power Company
2	Duquesne Light Company
3	West Penn Power Company
4	Pennsylvania Electric Company
5	Pennsylvania Power & Light Company
6	UGI Corporation
7	Central Hudson Gas & Electric Corporation
8	Philadelphia Electric Company
9	Public Service Electric & Gas Company
10	Jersey Central Power & Light Company
11	Atlantic Electric Company
12	Delmarva Power & Light Company
13	Delmarva Power & Light Company of Maryland
14	Southern Maryland Electric Cooperative Inc.
15	Potomac Electric Power Company
16	Baltimore Gas & Electric Company
17	Metropolitan Edison Company
18	Potomac Edison Company

FIGURE 13--PJM Interconnection Service Area

existing facilities to be submitted to the MAAC Executive Board for review by its Area Coordination Committee, which determines whether the plans meet established standards of service reliability.

Original Structure

PJM functions through the staffs of the member companies and the Interconnection Office, in the establishment of the principles and practices for the coordinated planning and operation of the power pool. Under a formal contractual agreement on file with FERC, the pool requirements and the member systems' obligations are delineated. Basic accounting principles are contained in rate schedules that are part of the agreement.

By the terms of the PJM Agreement, the six groups of PJM systems each appoint a representative to the PJM Management Committee. This is the policy committee of the power pool. Also by the terms of the agreement, an Operating Committee and a Planning and Engineering Committee are designated. At its first meeting, the Management Committee established a Maintenance Committee. The responsibilities of the Operating Committee relate to operating and accounting principles and practices. The Maintenance Committee is responsible for the coordinated scheduling of the planned outages of generating capacity. The Planning and Engineering Committee is responsible for the conduct of long-range planning and engineering studies. In general, PJM systems involved in the coordinated planning and operation of the pool provide representation on the subcommittees of the Operating Committee and the Planning and Engineering Committee. Personnel of the PJM systems are also appointed to serve on various ad hoc committees and subcommittees and working groups in the PJM organization. Figure 14 shows the PJM organization.

Figure 15 is an organization chart of the PJM Interconnection Office. A staff of approximately 90 employees coordinates the operation of the pool members. Under the terms of the PJM Agreement, Philadelphia Electric Company provides the PJM Control Center and mans the facility. The costs of operating the Interconnection Office are paid by the Philadelphia Electric Company, which is reimbursed monthly by the member systems for their share of the total expenses. The Interconnection Office staff's major responsibility is to coordinate the operation of the 11 PJM systems operating under the one-system concept, so as to attain for the member systems the optimum overall reliability and economy of operation. The staff also coordinates the accounting for interconnection transactions.

Electrical Characteristics

In July 1980, the PJM power pool reached its all time peakload of 34,420 MW. Table 21 shows the peaks experienced by the power pool from 1970 to 1979. PJM has been a summer-peaking pool since

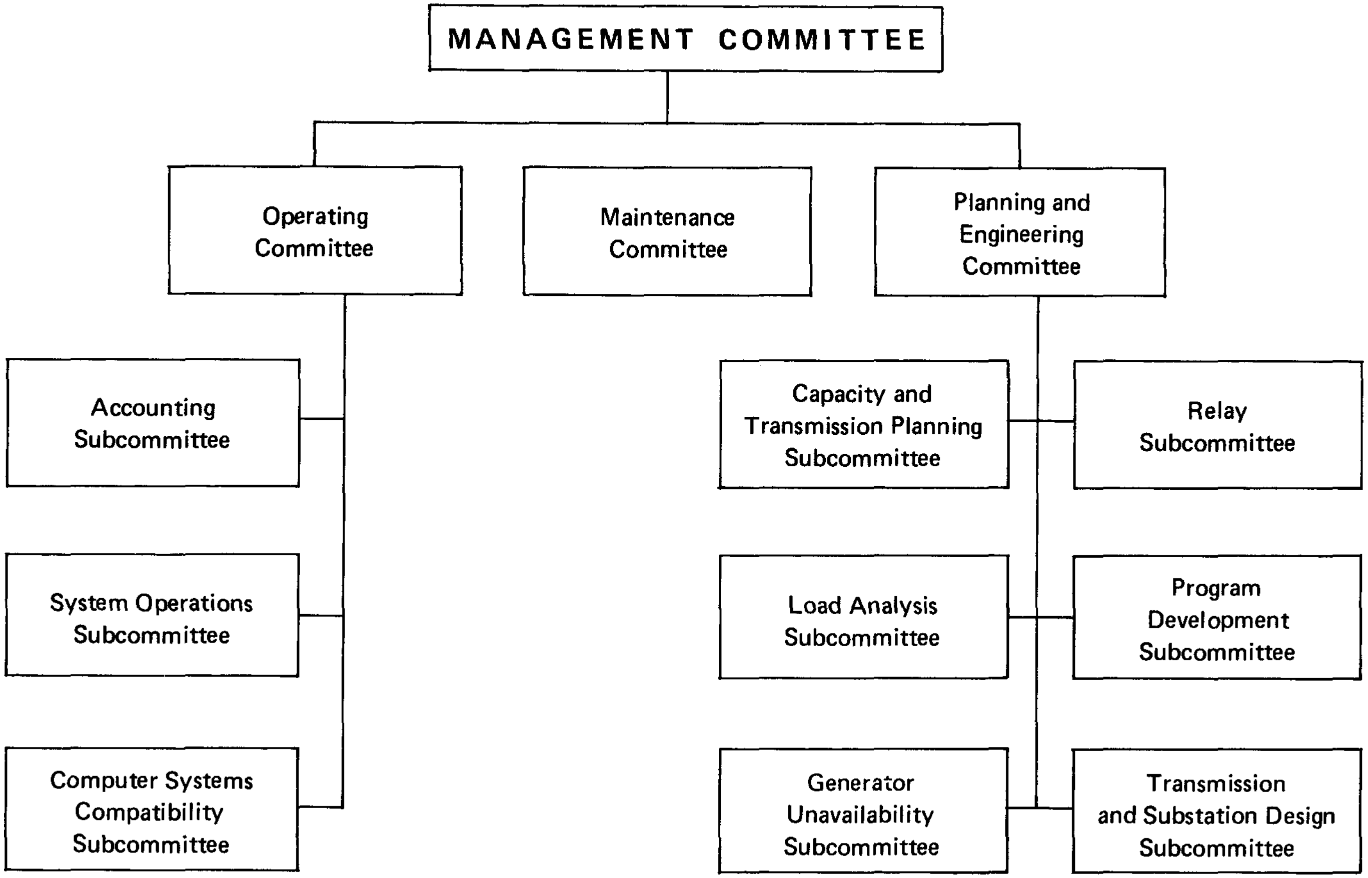


FIGURE 14--PJM Organization

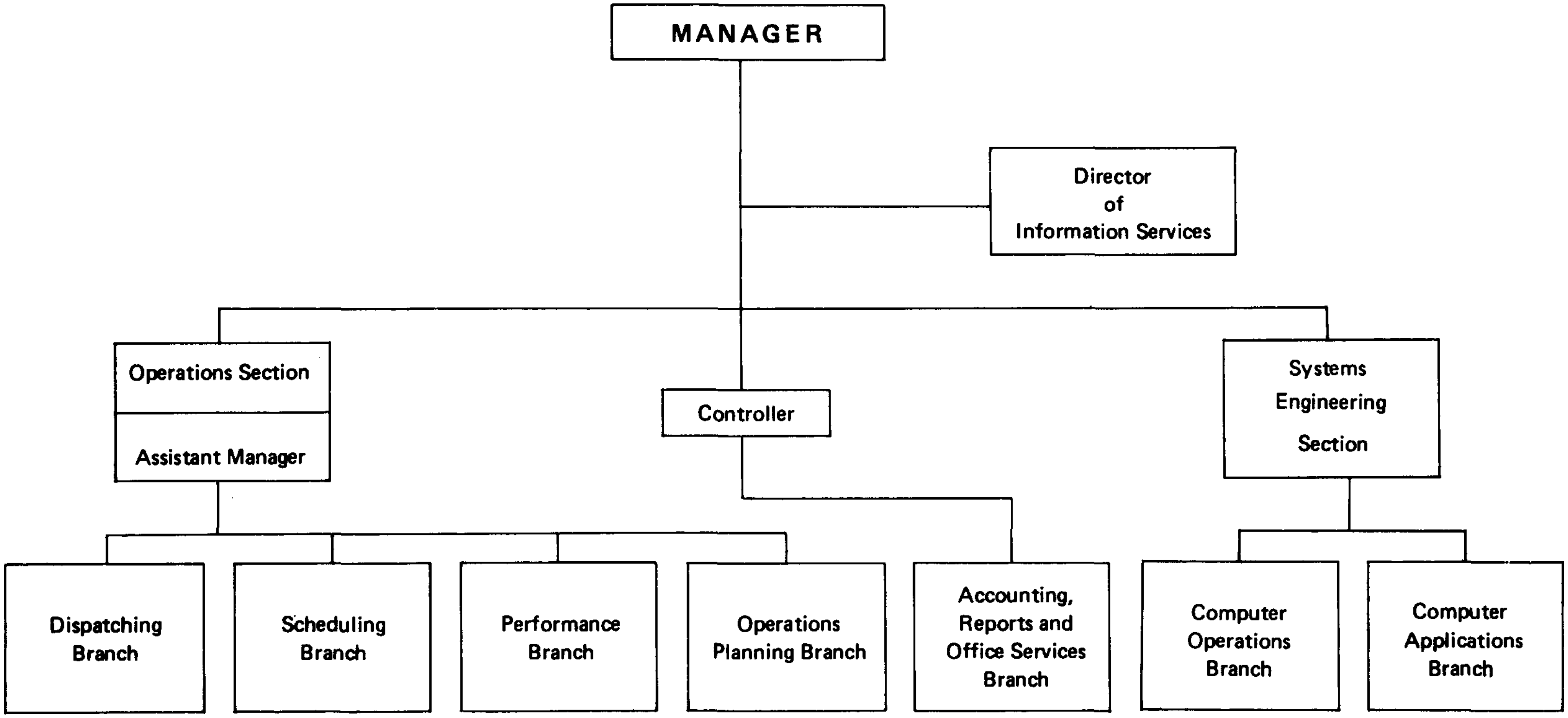


FIGURE 15--Organizational Chart, Office of the PJM Interconnection, May 14, 1979

TABLE 21--PJM Power Requirements and Resources

Year	Energy (GWH)	Annual Peak Demand (MW)	Peak Month[1]	Net Capability at Time of Peak Demand[2] (MW)
		Actual		
1970	130,504	23,838	Jul.	27,385
1971	136,208	25,529	Jul.	31,113
1972	145,158	27,852	Jul.	33,635
1973	155,362	30,993	Aug.	35,936
1974	151,269	29,065	Jul.	37,779
1975	151,495	28,969	Aug.	39,967
1976	159,500	29,264	Aug.	41,066
1977	163,377	32,180	Jul.	43,781
1978	169,036	31,686	Aug.	43,729
1979	171,810	31,654	Aug.	44,701
1980	--[3]	34,420	Jul.	45,030
		Projected		
1980	177,848			
1984	204,058	37,600		49,192
1989	236,938	42,370		56,653
1994		47,130		59,209
1999		52,990		66,020

Projected Net Capability Additions

	Hydroelectric	Nuclear	Coal	Other	Total
		1980 through 1989			
Percent	2.0	77.8	20.2	--	100.0
Megawatts	219	8,369	2,176	--	10,764
		1990 through 1999			
Percent	17.0	3.8	41.7	37.5	100.0
Megawatts	1,592	356	3,906	3,513	9,367

---

[1] PJM is expected to continue to peak during the summer.

[2] Includes all scheduled imports and exports.

[3] Not available.

Source: MAAC--Regional Reliability Council Coordinated Bulk Power Supply Program (ERA-411), April 1980; PJM FPC Form 12

1957. The succeeding winter peak varies between 7.5 and 12 percent below the preceding summer peakload. It is expected that the pool will continue to peak in the summer. The average annual compound load growth for this period was 3.2 percent. The projected growth rates for the periods from 1980 to 1989 and from 1990 to 1999 are 2.6 percent and 2.1 percent, respectively.

During the August 2, 1979 peak, PJM had a total installed capacity of 44,701 MW. This represents approximately 8 percent of the installed capacity of the country to serve more than 10 percent of the total population, more than 21 million people. Table 22 lists the installed capacity by fuel type in number of units, megawatt capability, and percent of total installed for 1978 and 1979. The mix of coal, oil, and nuclear in PJM has been beneficial during periods of oil or coal shortages. In addition to benefiting from greater reliability within the pool, PJM has occasionally been able to assist areas of the country that did not have as favorable a mix of installed capacity by fuel type.

PJM's generating capacity, consisting of more than 540 units in over 110 stations, is operated under the one-system concept to meet total pool requirements.

TABLE 22--MAAC-PJM Available Resources, 1978 and 1979

Resource	12/31/78 Power (MW)*	Percent of Total	12/31/79 Power (MW)*	Percent of Total
Oil-fired	10,085	22.2	12,122	26.9
Coal-fired	12,306	27.1	13,724	30.5
Oil/coal-fired	5,619	12.4	1,753	3.9
Nuclear	7,061	15.5	7,076	15.7
Hydroelectric (conventional)	950	2.1	956	2.1
Pumped storage	1,286	2.8	1,280	2.8
Internal combustion	7,506	16.5	7,496	16.7
Combined cycle	452	1.0	452	1.0
Total generating capacity	45,265		44,859	
Net purchases*	180	0.4	180	0.4
Total resources	45,445	100.0	45,039	100.0

*130 MW from PASNY and 50 MW from Allegheny Power System (APS).

Sources: <u>MAAC--Regional Reliability Council Coordinated Bulk Power Supply Program</u> (ERA-411), April 1979 and April 1980

TRANSMISSION

The high voltage transmission in the PJM area has grown from a very limited amount of 230-kV transmission in the early 1930's to approximately 4300 circuit miles of 230-kV and 160 miles of 345-kV transmission, and almost 1500 circuit miles of 500-kV transmission. A total of 53 intercompany ties within PJM and 27 interpool ties form the interconnection between PJM and its neighboring pools or systems. PJM is interconnected with the New York Power Pool (NYPP), the Cleveland Electric Illuminating Company, Allegheny Power System (APS), and Virginia Electric and Power Company. Figure 16 shows the major transmission systems of PJM, and Table 23 presents mileage of existing and proposed transmission lines at 230 kV and above.

TABLE 23--Existing, Scheduled, and Proposed Additions of Transmission Lines in PJM (circuit miles)

	765 kV	500 kV	345 kV	230 kV
		Existing		
As of Dec. 31, 1979	--	1,263	160	4,400
		Projected		
Jan. 1, 1980 - Dec. 31, 1980	--	52.9	--	162.1
Jan. 1, 1981 - Dec. 31, 1981	--	113.3	--	58.2
Jan. 1, 1982 - Dec. 31, 1982	--	132.8	10.4	69.4
Jan. 1, 1983 - Dec. 31, 1983	--	27.5	--	162.6
Jan. 1, 1984 - Dec. 31, 1984	--	43.3	--	64.5
Jan. 1, 1985 - Dec. 31, 1985		82.9	--	51.7
Jan. 1, 1986 - Dec. 31, 1986		23.0	--	141.3
Jan. 1, 1987 - Dec. 31, 1987	--	16.7	--	113.6
Jan. 1, 1988 - Dec. 31, 1988	--	--	--	48.4
Jan. 1, 1989 - Dec. 31, 1989	--	--	6.0	63.4
Total additions	--	492.4	16.4	960.2

Sources: Statistics of Privately Owned Electric Utilities in the United States, 1978 (DOE/EIA-0044-78); MAAC--Regional Reliability Council Coordinated Bulk Power Supply Programs (ERA-411), April 1, 1979 and April 1, 1980

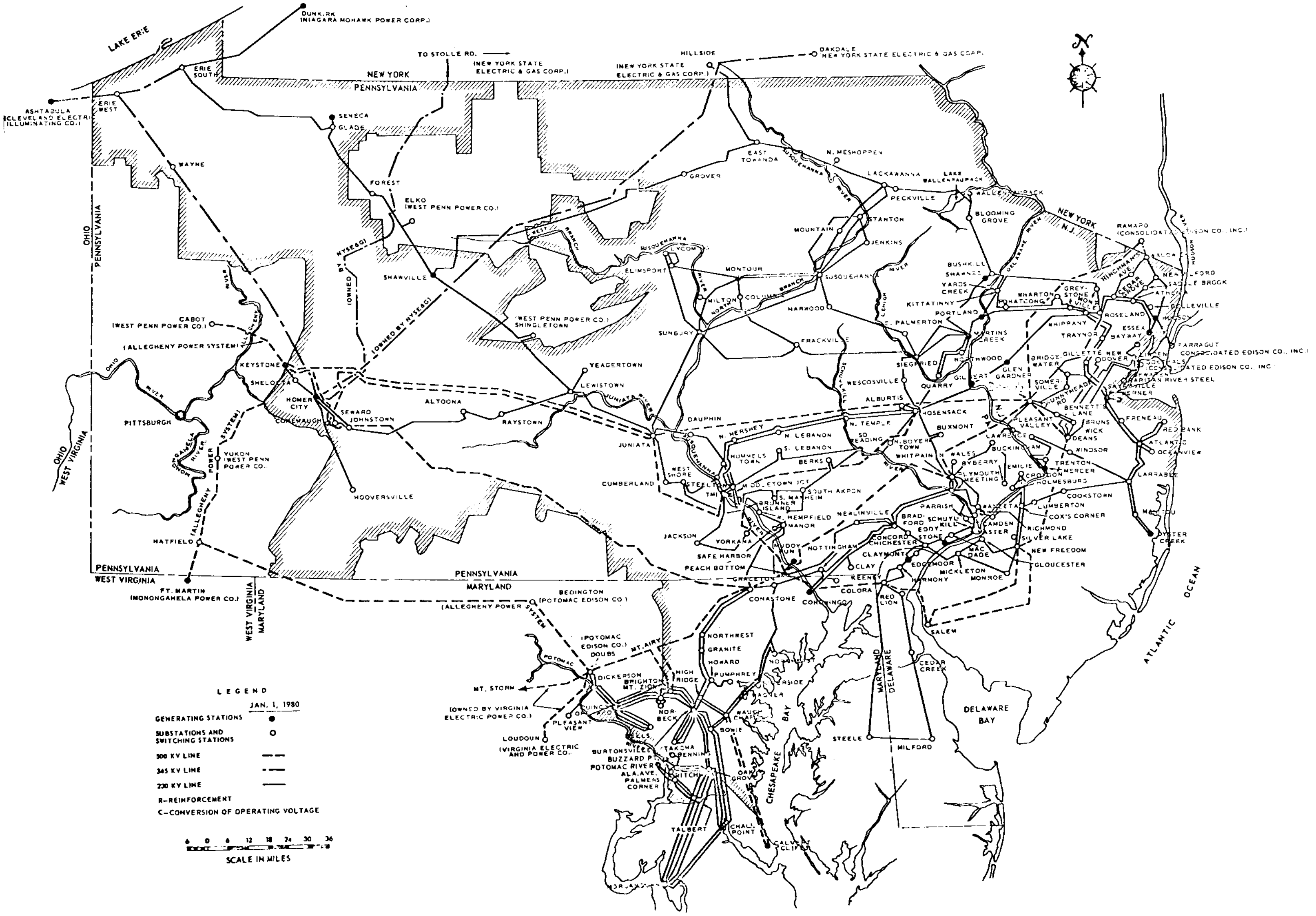


FIGURE 16--Major Transmission Systems of PJM Interconnection

Blank

CHAPTER 4
FORMAL CONTRACTUAL COORDINATION ARRANGEMENTS

Utilities in the Northeast Region have a long history of coordination in operations and planning. The Pennsylvania-New Jersey-Maryland Interconnection (PJM) was the first integrated power pool, formed as an outgrowth of a three-party agreement executed in 1927. A central operating headquarters, the Pennsylvania-New Jersey Interconnection Office was established in 1929 to coordinate operations. The New York Power Pool (NYPP) was formed as an expansion of bilateral agreements, signed during the mid-1930's, between Consolidated Edison and the predecessor of the Niagara Mohawk Power Corporation. The New England Power Pool (NEPOOL) agreement was executed during 1971, but was preceded by coordination of operation among New England utilities as long ago as the 1920's.

NEPOOL, NYPP, and PJM operate in accordance with formal agreements executed by pool members. Each agreement provides for pool organization, operation, planning, intrapool capacity and energy rates, and reserves. The pools are organized so that a management or executive committee directs the activities of other pool committees and establishes overall pool policy. Each of the pools is centrally dispatched and uses generation and transmission resources to serve overall pool requirements as if the pool were a single entity. Operating reserves and planned outages of generation and transmission facilities are also handled on a pool basis.

In PJM, about 60 percent of installed capacity of the pool is under fully automatic control from the Control Center at Valley Forge, Pennsylvania. The balance is also loaded economically. The New England Power Exchange (NEPEX), which is the operator of NEPOOL, has a master control center at West Springfield, Massachusetts that schedules the economical loading of generating units for all of New England. Automatic computer control of most generating units in the pool, however, is exercised through four satellite control centers. In NYPP, generating control remains with the individual pool members, although economic loading of generation is scheduled for the entire pool at the control center near Schenectady, New York. Dispatch calculations are performed at approximately 5-minute intervals and the calculated base points for each dispatchable unit and desired net interchange are transmitted to each member.

NEW ENGLAND POWER POOL

Membership in NEPOOL is open to any entity engaged in the electric utility business in New England. Each of the members of NEPOOL is represented in the NEPOOL management by at least one person. Members of NEPOOL having more than 20 percent of the NEPOOL peakload may appoint additional representatives based upon their peak demand. Each representative casts a number of votes proportional to its system's peakload.

The Management Committee is responsible for overall operation of NEPOOL, but elects an executive committee that is responsible for directing day-to-day operations between meetings of the Management Committee. A decision can be made by the Management Committee with an affirmative vote of 75 percent of the total. However, a negative vote by any two members having at least 15 percent of the total votes is sufficient to defeat any proposed action. The Executive Committee consists of 11 members who are also members of the Management Committee. Each executive committee member, or alternate, casts a single vote. Either six votes, or two-thirds of the votes of the executive committee members present, whichever is greater, constitute an affirmative vote.

NEPOOL has planning and operating committees that report to the Management Committee. The primary responsibility of the Planning Committee is to prepare NEPOOL load forecasts and to recommend power purchases and additions or changes in generation and transmission facilities. The responsibilities of the Operating Committee include

1. Scheduling and coordinating operations of the bulk power supply facilities;
2. Making, from time to time, necessary studies and establishing dispatching procedures based thereon to provide, at all times, adequate spinning reserves and ready reserves;
3. Establishing or approving maintenance schedules for the generating and transmission facilities;
4. Supervising the maintenance and operation of NEPEX headquarters and facilities;
5. Establishing reasonable standards, criteria, and rules relating to protective equipment, switching, voltage control, load shedding, emergency and restoration procedures, and the operation and maintenance of generating and transmission facilities;
6. Determining the capability of each generating unit on the adjusted load curve of the participants;
7. Determining the current annual peak, adjusted annual peak, and capability responsibility of each participant;
8. Determining the incremental costs for each generating unit in which a participant has an entitlement;
9. Establishing appropriate billing procedures;
10. Calculating and equitably apportioning losses incurred in connection with NEPEX transactions.

The NEPOOL Agreement provides for transmission as a pool service. The specific provisions dealing with transmission service, however, are quite complex. Pool transmission facilities (PTF) are defined and separated into two groups: (1) 230-kV and above (EHV-PTF) and (2) lower voltage facilities (LV-PTF). Members owning EHV-PTF facilities are required to allow their use for transfer of the output of "pool planned" units. A poolwide EHV-PTF rate is established each year and members pay this uniform charge. Rates for the use of LV-PTF are developed by each member according to a common formula. Members are entitled to use PTF for various types of short-term services as well as to meet long-term power requirements. Although many NEPOOL participants are served from low voltage lines that are not included in PTF, they are entitled to the use of intervening facilities to transfer pool services and entitlements in pool-planned units, and for separately negotiated power transmissions, at negotiated rates. NEPOOL also has a complex method for handling economy energy transfers. Essentially, suppliers of "Economy Flow" service are compensated at incremental cost, and buyers of the service pay decremental costs. The resulting savings, after deduction of part for NEPEX expenses, are distributed among members in the ratio of the amount of kilowatt-hours purchased or sold by each to the total purchased or sold by all members. NEPOOL has established pool rates for other classes of service, such as scheduled outage, unscheduled outage, and deficiency service.

NEW YORK POWER POOL

The New York Power Pool has a committee structure similar to NEPOOL's. The principal committee in NYPP is the Executive Committee. The NYPP Executive Committee consists of a single representative from each of the eight member utility systems. Decisions of the Executive Committee must be unanimous. The Executive Committee selects from among its members a chairman and vice chairman. The Executive Committee's responsibility is to determine pool policy, to carry out the terms of the NYPP agreement, and to direct the activities of the other pool committees. NYPP has five committees--Planning, Operating, Environmental, Energy Management, and Public Relations.

The Planning Committee consists of a senior executive and an alternate from each member system and is responsible for electric system planning. The committee is responsible for the coordination and development of plans for the installation of transmission ties, for the coordination of planning between NYPP and adjoining pools and with regional power coordinating agencies, and for the activities of the Power Pool Planning Manager and staff.

The Operating Committee is composed of a senior executive from each of the member systems and is responsible for the coordination of the operations of the bulk supply system of the pool's members. The Operating Committee directs the activities of the Power Pool

Operating Manager and establishes such rules and practices as may be required to coordinate the operation of the bulk power supply system of the pool's members so as to ensure reliability of service and economic operation with due regard for environmental factors. The committee has established subcommittees and task forces to assist in carrying out its responsibilities.

The members of NYPP centralized economic dispatch of their generation units in 1977. Under the pool agreement, members transferred operational control of their units to a control center. However, to help protect their corporate interests, individual members can transfer operational control of their units at their discretion. Indeed, the agreement clearly states that each member always has the ultimate control of, and is responsible for, its own units. The NYPP Control Center develops a minimum-cost dispatch schedule, which is then implemented by individual member systems at their own discretion. NEPOOL and PJM, in contrast, dispatch units on a single-system basis. The control center building and facilities are owned by Niagara Mohawk and leased to the pool. Each participating member pays annual fixed charges to Niagara Mohawk.

Under the NYPP agreement, all NYPP members share operating reserves. The procedures used to determine the magnitudes and types of the reserves are formally specified in the operating reserve policy. This policy also delineates the procedures for scheduling the reserves, checking the reserve response, exchanging reserve capacity with neighboring pools, and allocating responsibility among members.

NYPP handles economy energy transactions on a split-savings principle. However, a portion of the savings is deducted to compensate designated utilities for the use of transmission before the remaining savings are split between buyer and seller. Non-economy energy is priced at incremental cost plus a fixed percentage.

PENNSYLVANIA-NEW JERSEY-MARYLAND INTERCONNECTION

The Pennsylvania-New Jersey-Maryland Interconnection (PJM) agreement is silent with regard to membership beyond the original signatory members. This did not, however, prevent the revision in the agreement in 1965 to include the Potomac Electric Power Company as a signatory. Within PJM, no transmission charges are assessed for intrapool transactions. PJM considers economy energy to be an intrapool transaction and prices energy on a split-savings principle. Non-economy energy, also an intrapool transaction, is in essence priced at an incremental cost plus an adder percentage. However, a substantial number of agreements, which provide for jointly planned and jointly owned transmission, contain investment equalization payment arrangements. PJM has a committee structure similar to NEPOOL and NYPP, with the Management Committee as the principal committee. The Management Committee consists of one representative from each of the six groups of utilities in PJM.

These representatives are from Public Service Electric and Gas Company, Philadelphia Electric Company, Pennsylvania Power & Light Company, Baltimore Gas and Electric Company, General Public Utilities Corporation, and Potomac Electric Power Company.

As in NYPP, decisions of the Management Committee must be unanimous. The chairman of the committee is appointed on a rotating basis. The Management Committee is responsible for determining and implementing pool policy and for directing other PJM committees. Under the PJM committee structure, three committees, the Operating, Maintenance, and Planning and Engineering Committees report directly to the Management Committee. Each of the six utility groups within PJM has a voting representative on each of these committees. In addition, Delmarva Power & Light Company, Atlantic City Electric Company, and UGI Corporation have nonvoting representatives on each of the three committees. The chairman of each of the three committees is appointed by the Management Committee for a 1-year term.

The Operating Committee directly administers the operating and accounting functions of PJM. The subcommittees reporting to the Operating Committee are the Accounting, System Operations, and the Computer Systems Subcommittees.

The Maintenance Committee is responsible for coordinating and scheduling generating equipment outages for maintenance. Among the factors considered in the preparation of these schedules are planned installed capacity, firm capacity purchases and sales, forecast loads, reserves required to meet service reliability criteria, transmission, and other limitations on expected capacity availability. The Maintenance Committee has no subcommittees.

The Planning and Engineering Committee is responsible for determining PJM requirements for installed generating capacity and major transmission, and conducts such PJM and regional coordinated planning studies as may be required. The associated subcommittees are the Capacity and Transmission Planning, Relay, Load Analysis, Program Development, Generator Unavailability, and Transmission and Substation Design Subcommittees.

Coordinated planning studies are conducted by the Capacity and Transmission Planning Subcommittee. Several of the other subcommittees provide data for the coordinated planning studies. The use of these subcommittees to provide the data for the studies ensures that all PJM data are consistent. Coordinated planning studies are made of PJM reserve requirements, generating capacity additions, major transmission additions, and interconnections with power systems outside of PJM.

INTERPOOL COORDINATION

Coordination of daily operation between PJM and NYPP and between NYPP and NEPOOL is provided in separate pool-to-pool agreements. The PJM-NYPP agreement is older and more comprehensive. By means of these arrangements, the central pool dispatching offices deal directly with each other, thereby simplifying the transactions and significantly improving regional response to emergencies. This approach contrasts with the bilateral transactions still used by power pool members in most other regions for transactions with members of other pools.

The PJM-NYPP agreement provides for an Operating Committee consisting of one individual from each pool who acts as a representative of the pool in operating and accounting matters. A similarly constituted Planning Committee reviews plans for modification and expansion of bulk power supply facilities, supervises joint studies of reliability and economic development as well as installed capacity requirements. The NYPP-NEPOOL agreement also provides for an operating committee, but there is no provision for a Planning Committee.

Both agreements provide for a variety of services between the pools, including emergency service, economy energy, and transmission service. The PJM-NYPP agreement also includes provisions for exchange of various types of capacity services, as well as for fuel conservation. Of particular interest are the provisions governing transmission services by a pool to permit a transaction between two other pools. In both agreements, different rates apply, depending on whether it is economy energy or some other service that is being transmitted by either pool for a third party. For example, in PJM-NYPP, if economy energy is being transmitted, the transmitter receives its cost of transmission losses plus 15 percent of the total savings after deduction of loss payments. In NYPP-NEPOOL, the transmitter receives a third of the savings defined as the difference between decremental cost to buyer and the sum of the seller's incremental cost and the transmitter's cost of losses.

CHAPTER 5
REGULATION AS A FACTOR IN REGIONAL ELECTRIC COORDINATION

FEDERAL REGULATORY ACTIVITIES

Electric utilities today are subject to myriad rules, regulations, and permit requirements at every level of government. Under Federal law, activities of electric utilities come under the jurisdiction of several agencies. Among the more important of these are the Federal Energy Regulatory Commission (FERC) and the Economic Regulatory Administration (ERA) in the Department of Energy (DOE); the Nuclear Regulatory Commission (NRC); and the Environmental Protection Agency (EPA).

FERC is an independent agency within DOE. As the successor agency to the former Federal Power Commission (FPC), it has retained many of the responsibilities of that body. These functions, as applied to the electric utilities include

- Establish and enforce interstate and wholesale rates and charges for electric energy transmission and sale, and electric interconnections.
- Hydroelectric permitting, licensing, and enforcement.
- Regulate issuances and acquisitions of securities.
- Regulate electric power mergers and dispositions of property.
- Review and authorize interlocking directorates.
- Regulate permanent interconnections of electric utilities.
- Determine adequacy of interstate electric service.
- Establish, administer, and enforce accounting rules, procedures, and uniform systems of accounts.

ERA is responsible for DOE regulatory programs other than those assigned to FERC. These include conversion of oil- and gas-fired utility and industrial facilities to coal, natural gas import/export controls, natural gas curtailment priorities and emergency allocations, regional coordination of electric power system planning and reliability of bulk power supply, and emergency and contingency planning.

The NRC has jurisdiction over the uses of nuclear energy. NRC fulfills its responsibilities through a system of licensing and regulation that includes, among other things, the construction and operation of nuclear reactors and other nuclear facilities; the possession, use, processing, transport, handling, and disposal of nuclear materials; and programs for ensuring the safety and protection of life and property. NRC has delegated authority to certain States to regulate and control selected nuclear materials within State borders. This relationship provides for development by the States of adequate programs for this purpose.

EPA was established as an independent agency to permit coordinated and effective governmental action on behalf of the environment. EPA endeavors to reduce and control pollution systematically by the integration of a variety of research, monitoring, standard-setting, and enforcement activities. Responsibilities with regard to the atmosphere include the development of national standards for air quality, emission standards for new stationary sources, and emission standards for hazardous pollutants. The primary objective of EPA's water quality program is the restoration of the country's water resources to a pollution-free state of an acceptable level of purity. The functions of this program include development of national programs, technical policies, and regulations for control of water pollution; water quality standards and effluent guidelines; and analysis, guidelines, and standards for the land disposal of hazardous wastes.

Under the Public Utility Regulatory Policies Act (PURPA) of 1978, the authority of FERC was increased and modified. The following are some of the changes as they relate to power pooling. FERC may, on its own motion or upon application, and after due process, order interconnections between utilities. Also, upon application and after due process, FERC may order electric utilities to provide wheeling services for the applicant (including any increase in transmission capacity in order to provide such services). FERC can order the interconnection or wheeling service only if such action does not place an undue economic burden on, or impair electric services of, the ordered utility, and provided certain other provisions of PURPA are met.

Under PURPA, FERC may also exempt electric utilities, in whole or in part, from any provisions of State law, or from any State rule or regulation that prohibits or prevents the voluntary coordination of electric utilities, including any agreement for central dispatch, provided that the State law is not required by Federal law and that the State law is not designed to protect the environment, public health, safety, or welfare, or to conserve energy.

PURPA also requires that to ensure continuity of service, each public utility shall report to FERC any anticipated power shortage and shall also submit to FERC (and periodically revise) contingency plans for meeting such shortages.

The formation of power pools in the electric utility industry generally has been on the basis of voluntary, mutually beneficial, and stable relationships and agreements. By means of this "arm's-length" satisfaction of mutual economic self-interest, the current level of power pooling has evolved. The three pools in the northeast have achieved a high degree of coordination among member systems that has resulted in significant savings to all of their consumers.

When conflicts among utilities and government agencies involved in the regulatory process arise, each participant in the process must pursue the course of action that it judges best to meet its mandated responsibilities. Recent and pending rulings have, in the perception of many utilities, cast a significant shadow of doubt on (1) the ability of a party to rely upon the sanctity of a contract entered into at "arm's-length," and (2) the economic incentive to enter into or remain in power pooling arrangements. This apparent tendency to mandate contractual terms to the advantage of one party at the expense of another in place of a true, "arm's-length" negotiated agreement, can only serve to raise questions on the economic benefits and desirability of power pooling to systems that are either engaged in or considering power pooling.

STATE REGULATORY ACTIVITIES

The regulation of electric utilities by States in the northeast, as elsewhere in the United States, has expanded over the years. No longer limited to regulatory functions affecting mainly the retail cost of electricity, State jurisdiction has extended deeply into the planning and decision-making areas as well. Through such entities as energy departments, environmental bodies, siting boards, and the traditional utility commissions, many States now play a positive role in the timing, sizing, selection, and location of new facilities. As this role has taken shape and grown stronger, there has been a corresponding decrease in the freedom of action allowed utilities in the conduct of their affairs. These developments have been brought about by factors of an adverse nature that bear directly on the public interest and, therefore, are of legitimate concern to government. Familiar to all, these conditions require little or no documentation here, and include such things as inflation, economic conditions, high cost of fuel, dependence on foreign oil, limited reserves of fossil fuels, environmental impacts, the Three Mile Island accident and the uncertain future of nuclear power, the New York City blackouts, and active and aggressive intervention in utility matters by consumer groups.

The regulatory activities of the States in the northeast and the District of Columbia served by NEPOOL, NYPP, and PJM are similar in many respects. Besides the traditional jurisdiction over retail rates and utility rate bases, certification of transmission lines is now required, as is approval by siting boards for proposed new generating facilities. Maryland has established a mechanism for the acquisition by the State of suitable powerplant locations, in effect creating a "site bank." In several States, laws provide for intervention by consumers through consumer advocates or forms of consumer councils.

One major problem facing many utilities today is that of regulatory delay in obtaining timely and adequate rate relief and necessary approval to proceed with the construction of planned generating and transmission facilities. Inadequate or delayed rate relief will adversely affect a utility's ability to finance planned expansion, thereby contributing to construction delays. This in turn may have a deleterious effect on system integrity and reliability. This problem can be alleviated somewhat where a regulatory body (such as the New York Commission) uses a fully forecast test period for rate making purposes as well as a one-step siting process with decision deadline dates to aid in the planning process. The Maryland Public Service Commission must reach a decision within 150 days or within 90 days in limited "make whole" rate cases.

Following prolonged delays, regulatory approval to construct PJM's Elroy-Hosensack 500-kV line in Pennsylvania was granted in December 1979. This line, originally scheduled for service in 1974, is now expected to be in service by February 1, 1981. Delay of this line has adversely affected bulk power reliability, significantly increased transmission losses, and restricted the ability to transfer low-cost energy from coal-fired and nuclear plants to eastern load centers. One link of PJM's 500-kV loop of the Washington, D.C. area, which was recently licensed by the Maryland Public Service Commission after lengthy hearings, faces continuing delays due to an appeal filed before the Howard County Circuit Court of Maryland by intervenors. This loop would support critical local loads and provide increased power-transfer capability between MAAC, ECAR, and SERC.

The history of delays in the capacity expansion programs is not encouraging. Many of the difficulties encountered in completion of new facilities and in conversion of existing oil-fired units to coal are caused directly by the regulatory process. Siting of generating facilities is a major problem in the northeast. For example, after approximately 5 years of hearings, the two proposed Jamesport 1150-MW nuclear units of Long Island Lighting Company were rejected by the New York State Siting Board. Instead, the Jamesport site was designated by the Board for a single 800-MW coal-fired unit. With a continued downward trend in projected growth rate the New York Siting Board has been reluctant to certify all of the baseload units requested by the utilities, thereby requiring major modifications and deletions in the pool's expansion program. PASNY's efforts to obtain approval for a large coal-burning unit on Staten Island has met with considerable opposition from environmentalists and local elements. Notification in the New York Siting Laws now specifies a 2-year decision deadline date for all future applications. New England Power Company has given up on two proposed nuclear units in Rhode Island.

The laws of Washington, D.C. and Maryland provide for the establishment of permanent intervenor groups called "The Office of the People's Council." The salaries of the council members in Washington, D.C. are paid by the District of Columbia. Salaries of council members in Maryland come from the utilities by way of an assessment tax. Expenses of consultants hired by the group are borne by the utilities involved in particular proceedings. Under the laws of Pennsylvania and New Jersey, consumer advocates operate in a manner similar to the Office of the People's Council. The time-consuming intervention of such consumer groups has contributed greatly to the delays experienced by utilities in the regulatory process.

It should be noted that by Maryland law the Public Service Commission must reach a decision on a complete rate case within 150 days or within 90 days in limited "make whole" rate cases.

The foregoing examples serve to illustrate the many facets of the regulatory process to which utilities are exposed and subject. Conflicts between the regulated and the regulators, while not always inevitable, are the rule, rather than the exception. To the extent that regulation, in whatever form, unduly burdens utilities in the management and conduct of their planning and operations, their ability to render adequate and reliable electric service will be jeopardized.

Blank

CHAPTER 6
POTENTIAL BENEFITS OF INCREASED COORDINATION

IDENTIFIABLE BENEFITS

Two major power production and supply factors shape the planning of a utility system:

- Economies of scale associated with generation and transmission facilities. Over the years, the average size of generating units has increased. In the 1930's, 20- to 30-MW units were installed; by the 1960's unit size had grown to more than 300 MW; and during the 1970's units of 1000 to 1300 MW were being installed. As the size of the unit increases, capital cost and operating costs per kilowatt-hour output normally decrease.

  Transmission from powerplants to consuming areas also involves economies of scale. Transmission costs are a function of line length, voltage and capacity of the line, and total amount of transferred power; thus, the higher the transmission voltage, the greater the economy of scale. In addition, high voltage transmission lines facilitate economical transfer of energy over long distances, permitting the location of power sources at some distance from load centers.
- Reliability of bulk power supply. Reliability is achieved through the installation of backup, or reserve, facilities in the bulk power system. Reliability considerations are critical in both the generation and transmission components of a bulk power supply system.

Any utility system has a basic economic conflict between achieving economies of scale in generation and transmission and maintaining reliability, through reserve facilities, of the bulk power supply system. To achieve economies of scale, utility systems must build large facilities. However, the size of the largest facility in the system directly influences the amount of reserves required, and the cost of carrying reserves to back up large generating units and high-voltage lines may initially offset the savings realized from the size of the facilities. Thus, an individual utility has two options.

First, it can forego some cost reductions made possible by economies of scale, and invest in a number of smaller facilities that may require lower reserves. Second, it can enter into joint ownership of facilities and support agreements with other utility systems to realize the economies of scale, owning only that portion of capacity actually required, and have a reduced installed reserve requirement for its own system. In addition, it can coordinate the daily operations of the combined systems to further reduce capacity requirements for operating reserves. Automatic coverage of temporary capacity deficiencies and potential markets for capacity excesses facilitates the addition of large blocks of capacity and the avoidance of some consequences of delays in large unit construction. Other benefits of greater coordination include

1. Synergistic effects on the quality of planning and operation from participation in the pool committees' activities.
2. Scheduling of operations and accounting for resulting capacity interchange, and sometimes energy interchange, by the pool coordinating center.
3. Diverse services performed by the pool coordinating center in assembling data for reporting to various commissions.
4. Presentation of an industry consensus to the press, the public, and utility commissions.

The second option entails certain restrictions on operations for the utilities concerned. These restrictions (listed below) have been accepted by most utilities because most systems in the northeast operate as part of one of the three major interconnected networks.

1. The systems become physically interconnected, and the generation and transmission systems of each are affected by the behavior of the other systems.
2. They must coordinate their generation, transmission, and maintenance schedules with the schedules of other participants in the joint facilities. Indeed, if the participating utilities can coordinate their maintenance and operate their generating units as if they were part of one system, further economies can be realized because the levels of installed and operating reserves can be further reduced. The most economical units in the coordinating system can be run at all times, and can be scheduled on the basis of technical and economic efficiency rather than on ownership considerations.
3. If the load patterns of the coordinated utilities have significantly different characteristics, such as different seasonal peaking (known as demand diversity), installed capacity can be further reduced by "swapping" capacity during the different periods.
4. The utilities must relinquish control of the day-to-day operations of their facilities to centralized pool control.

Economies from central dispatch arise both from the operation of the most efficient units in the region at all times and from the reserve-capacity reductions achieved through sharing capacity on a poolwide basis.

Efficiencies are effected through the savings in fuel expense from incremental cost scheduling of operating capacity and energy, with economic interchange both within the pool and between the pool and other areas of an interconnected group of systems.

Other benefits are realized (1) by sharing available energy during fuel shortages and other unusual conditions resulting from strikes or natural disasters, and (2) from capacity and energy made available by other members through voltage reduction or load curtailment under emergency conditions.

QUANTIFIABLE BENEFITS

NEW ENGLAND POWER POOL

NEPOOL savings in 1978 were $30,473,000, the highest since the pool went into operation in 1970. Yearly savings are shown in Table 24 and 1978 transactions are summarized in Table 25.

Economy transactions with NYPP and the New Brunswick Electric Power Commission were somewhat below those of recent years as shown in Table 26. Most of the savings were accumulated during the first 3 months of 1978, when a coal strike affected energy supply in the Midwest.

NEW YORK POWER POOL

NYPP savings for the calendar year 1978, which were accrued with the pool operating under computer-directed economic dispatch and the revised pool agreement, amounted to $67,665,479.

TABLE 24--NEPOOL Annual Savings

Year	Gross Savings (dollars)	Energy Interchanged (MWh)	Savings/MWh (dollars)
1970 (7 months)	1,629,300	2,476,482	0.66
1971	2,808,400	5,151,592	0.55
1972	3,388,900	6,150,841	0.55
1973	13,012,100	7,599,450	1.71
1974	11,843,000	7,024,111	1.69
1975	20,304,700	7,136,150	2.85
1976	26,560,674	7,529,973	3.53
1977	25,439,981	7,638,048	3.33
1978	30,473,000	8,418,063	3.62

Source: NEPEX Report for 1978

TABLE 25--Summary of 1978 NEPOOL Transactions

Type of Service	Energy (MWh)	Cost (dollars)	Cost (mills/kWh)
Economy	6,324,686	130,404,321	23.09
Scheduled outage service (SOS)	1,747,747	40,361,367	32.05
Unscheduled outage service (UOS)	146,994	4,711,279	35.89
Deficiency SOS loader (11/1/77-10/31/78)	7,704	276,465	15.68

Source: NEPEX Report for 1978

TABLE 26--NEPOOL Transactions with NYPP and New Brunswick Electric Power Commission (NB), 1976-1978

	NYPP	NB	Total
Energy (MWh)			
1976	543,652	850,993	1,394,645
1977	805,221	407,019	1,212,240
1978	386,647	171,720	558,367
Savings (dollars)			
1976	2,888,582	3,263,348	6,151,930
1977	2,906,970	2,242,328	5,149,298
1978	1,596,112	668,128	2,264,240

Source: NEPEX Report for 1978

PENNSYLVANIA-NEW JERSEY-MARYLAND INTERCONNECTION

Annual or Seasonal Peakload Diversity

Under PJM operation and accounting, the 11 member systems are maintained as six groups of systems. Although the annual diversity of the 11 systems would be greater, the annual peakload diversity of the six groups of systems in 1978 amounted to 1278 MW.

Weekly Peak-Load Diversity

On the average, the six groups of systems in PJM during 1978 experienced an average weekly peakload diversity of 225 MW. The benefits of weekly diversity can include reduction in installed capacity, because such diversity improves utility flexibility in performing maintenance of generating units.

Daily Diversity

The average daily peakload diversity experienced by the six groups of PJM systems amounted to 155 MW. The average was based on 5 weekdays only, with holidays excluded. Under a pool operation with a low mix of combustion turbines, this could result in savings in daily operating capacity. However, quantification of this saving must recognize the capacity operated in excess of the spinning or operating reserve requirements for economy energy generation. Such capacity will reduce the apparent savings in daily peakload diversity.

Diversity in Forced Outages

A longstanding approach to quantifying savings in operating reserve capacity is to sum the capacity of the units of the members of the pool and deduct the largest unit that becomes the largest single hazard in the pool for which spinning reserve must be maintained.

PJM total gross savings are presented in Table 27, and the savings realized from external transactions are presented in Table 28.

TABLE 27--PJM Total Gross Annual Savings

Year	Savings (dollars)
1975	190,398,729
1976	183,205,525
1977	311,102,185
1978	241,804,978
1979	407,240,192
Total 5 years	1,333,751,609
Average (dollars/year)	266,750,322

Source: PJM Interconnection

TABLE 28--PJM Savings From External Transactions

		Savings	
	MWh	Total Dollars	Dollars/MWh
Interchange energy--1979			
Received	7,854,131	55,265,820	7.04
Delivered	904,265	4,909,455	5.43
Total	8,758,396	60,175,275	6.87
Operating capacity--1979			
Received		0	
Delivered		251,425	
Total		251,425	
Total external transactions--5 years			
1975		33,785,172	
1976		27,011,270	
1977		33,146,663	
1978		41,563,828	
1979		60,426,700	
Total 5 years		195,933,633	
Average (dollars/year)		39,186,727	

Source: PJM Interconnection

CHAPTER 7

IMPEDIMENTS TO AND OPPORTUNITIES FOR INCREASED COORDINATION*

Electric utilities continue to evolve in reaction to technological advances, the inflationary pressures of today's economic climate, and the impacts of Federal and State regulation in areas of system planning, construction, operation, and interutility and power pool relationships. This evolution has been marked by an increase in system costs and deep uncertainty with regard to critical planning and operating factors. Many of the forces that influence the planning, implementation, and operation of utility power supply programs are external to the industry and beyond utility management control. The level and shape of future demand are only partially controllable by a utility, and governmental policies and actions are among the major external forces affecting planning.

The responsibility of individual utility managements is to provide reliable electric service at the lowest possible cost. The primary incentive for pooling is to achieve operational and financial benefits that further these objectives.

LEGAL, JURISDICTIONAL, REGULATORY

IMPEDIMENTS

To the extent that governmental policies impose additional cost burdens on operations that tend to negate the benefits of pooling, they act to discourage further pooling involvement. To the degree that existing statutes generate concern regarding the potential violation of antitrust legislation, further pooling activity will also be discouraged. Another issue that is often a cause for dissension among public and private utilities is the matter of preference customers for power from Federal hydroelectric projects. Centralized planning and operation by utilities can be complicated and even frustrated by the varied perspectives of State regulators

---

*Although the individual members of the Task Force are in basic agreement with the content of this report, they do not necessarily agree on the comments or interpretations of events set forth. This chapter in particular contains statements by Task Force members for which a consensus may not have been reached.

in multistate power pool operations. Divergence of Federal and State policies can result in additional disincentives.

Pricing of energy and capacity transfers can affect pooling transactions. Pricing methods must ensure that intervening utilities do not have wheeling rates inappropriate to their costs, inhibiting the possibility of transactions between companies separated by one or more intervening utilities. Energy charges and transmission use charges should reflect the impact upon each company involved. When engaging in economy energy transactions, the receiving utility, supplying utility, and wheeling utility (if any) should all receive benefits commensurate with their contributions, facilitating consummation of economy transactions.

Regulators are required by statute to allow the use of only reasonable expenses in setting rates. Contracts for purchased power must be beneficial to ratepayers or they may be disallowed. Pooling contracts must be framed and administered in such a manner as to permit the evaluation of costs, benefits, service quality, and reliability. Presently, many utilities are experiencing substantial delays in obtaining approval of purchased power costs at the State level. This delay in recovery of costs has a chilling effect upon economy purchases; indeed, some utilities find it financially preferable on a short-term basis to use their own higher cost generation than to make economy purchases.

OPPORTUNITIES

In recognition of the interstate nature of most electric power pool operations, consistent economic, energy, and environmental policies should be developed at the State and Federal levels of utility regulation. Clarification of antitrust legislation with regard to power pool operation could serve to allay industry's fear of antitrust laws and would further pooling interests.

Legislation affecting system operation should be reviewed to evaluate its impact on the goals being sought through improved power pooling. Modification of such legislation may be warranted to further the objectives sought in the pooling area. A good example of the type of legislation needed is found in Section 205 of PURPA under the title of "Pooling." This section provides that, after notifying the State Governor and providing opportunity for public hearing, FERC may exempt electric utilities from any State law, rule, or regulation that operates against voluntary coordination of electric utilities.

Cooperation should also be fostered among Federal, State, and other agencies, particularly between State commissions and FERC. An example of such cooperation, which should be the rule rather than the exception, is the action taken after the 1977 Con Edison blackout. The New York Public Service Commission ordered a variety of measures to improve bulk power system planning, operation, and maintenance in New York; these measures incorporated recommendations by city, State, Federal, and utility investigators, as well as FERC's staff.

FINANCIAL/ECONOMIC

IMPEDIMENTS

Traditionally, the sources of capital for investor-owned utilities have been about 35 percent common stock, 10 percent preferred stock, and 55 percent long-term debt. The requirement to sell new stock as a part of the overall financing makes investor-owned financing strongly subject to the vagaries of the stock market. Thus, the availability of equity financing is tied closely to investor judgments of future earning and dividend yields. The yields, in turn, are determined primarily by the rate of return on equity allowed by the various regulatory bodies and the ability of the utility to actually earn that allowed rate of return. In recent years, some regulatory bodies have recognized the need for increased electric rates to provide improved earnings and cash flow to maintain allowed rates of return, and to support construction of facilities to meet future demands.

However, because of the lag inherent in the regulatory process, rate relief and its effect on earnings has not kept abreast of requirements in an extremely inflationary environment. Because of this and other forces, the quality of earnings has become a major concern. The interstate nature of most power pool operational and system problems in the northeast, the individual State regulatory responses to such problems, and varied financial difficulties within the pool all create additional stresses and complexities in the pooling mechanism.

Before increasing their pooling and coordinating activities, utilities must be able to show at least an equitable balance between costs and benefits. Federal regulations that impose constraints on the economic compensation available for operating services and that fail to adequately address the total cost of those services can also have negative impact on the financial well-being of utilities and the operational effectiveness of pooling entities. In many cases, local regulations have introduced additional complications in the pooling operation and negative impacts in the financial climate within which a utility must operate.

OPPORTUNITIES

A major opportunity for improvement in utility finances and economics would result from the reduction and control of inflation. Within an extremely inflationary environment, utility rate regulation must adjust in a timely manner to provide utilities sufficient revenue to maintain adequate return on investment and financing capability and to reduce the financial burden of continually expanding demands on the utilities. The volatile nature of fossil-fuel prices and uncertainties in load and resource forecasts and construction, mean that long-term stability of system reliability and system costs (including interutility transactions) cannot be ensured. Utilities cannot always pass costs associated with purchased power along to their customers as they can increased fuel costs. A reduction in the inflation rate would help to mitigate these problems.

A judicial reaffirmation by FERC and State public utility commissions of the generic appropriateness of the basis for balancing costs and benefits of pooling energy transactions would also aid utility finances. Present doubt as to the appropriateness of methods of distributing the benefits of pooling transactions may cause utilities to be less willing than otherwise to enter into these transactions. Legislation is also recommended to clarify and establish a utility's liability under antitrust laws when pooling is attempted.

ENVIRONMENTAL

IMPEDIMENTS

New generating plants and transmission lines have been delayed or cancelled as a result of air and water quality control regulations. Some of these projects should, perhaps, have been cancelled, and often the delay has been justified. However, new projects cost more as a result of these regulations. This is especially frustrating to utilities when they are faced with redundant and/or duplicate Federal, State, or local environmental requirements.

Environmental laws and regulations are often used for purposes other than protection of the environment. Those opposed in general to all utility generation or transmission projects, or specifically opposed to a single project, have used environmental laws and regulations as a means of halting or delaying those projects. Environmental protection used in this manner is a substantial obstacle to utility systems.

OPPORTUNITIES

While full recognition should be given to the merits of environmental programs, policy actions should be reviewed within the context of energy program requirements to determine where modifications might provide optimum benefits with a balanced concern for national objectives. Rate regulators must recognize that environmental regulations significantly add to utility costs and must be included in rate structures. Environmental requirements and regulations must not be misused if the natural environment is not truly a factor.

PLANNING AND OPERATING PRACTICES

IMPEDIMENTS

Two key intertwined issues surrounding the concept of regional electric power transfers are the perceived benefits of such transactions and the problem of public acceptance. In some instances, there are those who take a parochial view of exporting local natural resources in the form of electricity for the benefit of others outside their immediate geographical, economic, or environmental domain. State power plant siting commissions and other State agencies have in the past reflected this view and have been critical of plans for constructing a generating plant within a State or area that is self-sufficient or is a net exporter of electric power.

OPPORTUNITIES

The opportunity exists for improvement in the public perception of the desirability of powerplants. A powerplant can be a boon to a community's tax base. A change in the public view could eventually be reflected in an improved attitude on the part of State agencies.

TECHNICAL

IMPEDIMENTS

The economics associated with the transmission of electric power over long distances favor use of the highest applicable voltage levels to maximize power flows and minimize associated power losses. Experience with the initial installation of 765-kV line in New York indicates that safety and health questions may be raised when additional transmission at this or higher voltage levels is planned. Such issues add to the complexity of transmission system expansion planning and to the potential for costly delays in the construction of proposed facilities. This, in turn, tends to discourage consideration of further pooling opportunities.

OPPORTUNITIES

Research results from the study of health and safety aspects of extra-high voltage (EHV) power transmission have not documented harmful effects from properly constructed EHV lines. These findings should contribute to the more expeditious licensing of transmission lines through elimination of repetitive investigations related to the generic issues of health and safety of EHV lines.

COST/BENEFIT ALLOCATION

IMPEDIMENTS

Although the Northeast Region has achieved considerable success in constructing and financing pool facilities, problems remain with regard to justifying and financing their construction (particularly transmission facilities), when they may not be necessary for individual pool members, but are deemed essential from a pool standpoint.

Identification and allocation of the related costs and benefits for facilities used for pool purposes can cause difficulties when their characterization as such is not universally accepted by the pool members.

OPPORTUNITIES

Although exceedingly complex, opportunity exists to identify and equitably allocate costs and benefits for facilities that benefit the pool as a whole. Another opportunity should provide for small utilities to assume a more equitable share of pool responsibility, including the building and operation of pool facilities. The recent development of a transmission use measurement procedure for the EHV system within PJM may provide a guideline for such allocations in the future. This procedure provides a comprehensive, technical method for assessing use.

INSTITUTIONAL

IMPEDIMENTS

The more participants involved in a pooling endeavor, the more difficult it becomes to reach consensus and the more compromise is required to achieve it. Although some think the difficulty in reaching agreement is solely a function of the level of commitment of pool members, political obstacles and constraints arising from conflicting or overlapping regulatory jurisdictions often contribute to this impasse. State interests often conflict with regional or national goals. Importing power does not contribute to a municipality's tax base, as does constructing indigenous generation. There is often opposition to exporting electric power to another region. For example, in many States, the public does not wish land in its area to be used, or pollution increased, to provide electricity to customers outside the State or even in other areas of the same State.

OPPORTUNITIES

To manage operations successfully and smoothly in a pool involving many entities, member systems must exhibit a strong sense of commitment. Commitment, however, can be attained only if each party believes pooling to be in his economic self-interest. A judicial reaffirmation by FERC of the appropriateness of the industry's approach to utility pooling transactions would aid in the formation of this commitment.

PHYSICAL

IMPEDIMENTS

Land-use restrictions present obstacles to power and energy exchanges because the timely acquisition of generating plant sites and transmission line rights-of-way at reasonable cost is often impeded. Difficulties associated with line routings often occur when Federal and State agencies are concurrently involved in designating acceptable transmission corridors, and extensive coordination is then required. At the least, these problems can result in delays, which extend the leadtime and increase the cost required for project completion. In some instances, needed facilities have been stalled indefinitely.

For example, in New York State, neither generating facilities nor transmission lines can be built on certain protected portions of some State park lands. In addition, utility construction could be restricted if it interferes with a possible archaeological site or a historical preservation area. Both the Federal Government and other States have land-use restrictions similar to those in New York State.

OPPORTUNITIES

States and the Federal Government do have the opportunity to aid in the selection and acquisition of generating sites and transmission line routes. For example, the State of Maryland has a program worthy of emulation, whereby potential plant sites in the State are identified and evaluated by the State. The State has the responsibility to acquire a sufficient number of sites to satisfy expected requirements within the next 10 years. Those sites selected for purchase by the State are funded by a State tax on customers' utility bills and, after purchase, are placed in inventory as a future site. Any utility may, where necessary, subsequently purchase such site from inventory, or lease it on a 99-year basis, at fair market value.

CURRENT EFFORTS INVESTIGATING INCREASED POOLING PLANNING

Three large pools have evolved in the northeast: NEPOOL, NYPP, and PJM. These pools are already coordinated to a high degree internally, with each other, and with neighboring systems. In the northeast, the goal for the foreseeable future is not to seek one monolithic "fully-coordinated" pool in which the committee structure would be unmanageably large, but to promote closer coordination among the three pools and with neighboring pools and systems. In particular, PJM's relationships with the systems to the west and south should be at least as close as its relationship with NYPP.

Many planning and operating studies recently conducted by adjacent pools have led to the establishment of new interpool ties and the development of a stronger, more reliable transmission system. As the transfer capability between pools has increased, the ability to interchange both economy and emergency power has grown.

Numerous joint planning studies are in progress among the three pools and between them and neighboring systems. The results of studies in New England and New York are evaluated for reliability by the Northeast Power Coordinating Council (NPCC). An NPCC-MAAC study group is working on future plans affecting those two regions, and another interregional study group is concerned with coordination of plans of PJM and adjacent systems in the ECAR and VACAR areas. In this way, plans are closely coordinated without having all systems represented directly on all committees.

Pool operations in the Northeast Region are continuously monitored, reviewed, and modified. The control centers act and react to achieve better results based on past experience, current conditions, and anticipated future conditions. Performance reviews identify errors and actions to remedy or minimize them and determine improvements that can be achieved in both reliability and economy.

AREAS WORTHY OF FURTHER INVESTIGATION AND PROSPECTS FOR IMPROVED POOLING

Ongoing programs have identified a number of possible avenues for improved pooling in the region. Because of the degree of pooling and the relative sizes of the pools, however, little justification exists to change the number and size of pools in the northeast. The practical limits of pool size and operating viability reduce the benefits to be gained from further consolidation of the pools in the region.

PLANNING

Planning considerations that hold promise for improved pooling involve increased coordination on the periphery of the region. Specifically, increased ties to systems to the south and southwest of PJM and north of NYPP and NEPOOL should provide additional benefits. Studies of such opportunities are being conducted.

Internal, intrapool, and transpool power transfer capabilities are continually being studied. Recent crises in fuel availability have shown that increased reliability and economic benefit may result from reevaluating transfer capabilities and related operational procedures. These may improve pool responses to emergency situations.

OPERATIONS

In the ongoing review of operations, pools in the region have identified possibilities for improving operation through improved voltage support, unit commitment programs, transmission loss treatment, and maintenance scheduling. Studies in these areas are underway.

APPENDIX A
ELECTRIC UTILITIES OF THE NORTHEAST REGION

Name	State	Code	Installed Capacity[1] 1978 (MW)	Peakload[2] 1978 (MW)	Major Interconnections (230 kV and above)	Radial Inter-connection	Purchases Power From
<u>New England Power Pool</u>		NEPEX	20,875	14,712W	COEN,[3] NIMP,[3] NBEP,[3]	--	--
Allied Power & Light Co.	Vt.	APLC	0	4W	--	CEVP	CEVP
Ashburnham Municipal	Mass.	ASHB	0	3W	--	MASE	NEEP, MAYA
Ashland Municipal	N.H.	ASNH	0	3W	--	PSNH	PSNH
Bangor Hydro Elec. Co.	Me.	BAHE	75	211W	--	--	MAYA, BOEC
Barton Village Municipal	Vt.	BAVI	3	3W	--	CIUC	VEPI, CIUC
Belmont Municipal	Mass.	BELM	0	20W	--	CAEL	CAEL
Blackstone Valley Elec. Co.	R.I.	BLVE	0	238S	NAEC, NEEP, BOEC, COLP	--	--
Block Island Power Co.	R.I.	BLIP	2	1W	isolated utility	--	--
Boston Edison Co.	Mass.	BOEC	2675	1942S	NEEP, BLVE, BREC, CACO, NEBG	--	--
Boylston Municipal	Mass.	BOLY	0	4W	--	WBOY	WBOY, BOEC
Bozrah Light & Power Co.	Conn.	BLPC	1	5W	--	COLP	COLP
Braintree Municipal	Mass.	BRAI	137	59S	--	BOEC	NEBG, NU
Brockton Edison Co.	Mass.	BREC	0	273W	BOEC, NEBG	--	--
Burlington Municipal	Vt.	BULI	53	61W	--	GRMP	VTYA, POAS[3]
Cambridge Elec. Light Co.	Mass.	CAEL	118	177S	--	BOEC	BOEC, COYA
Canal Elec. Co.	Mass.	CACO	864	0	NEBG, BOEC	--	--
Carrabassett Light & Power Co.	Me.	CALP	0	1W	--	CEMP	CEMP
Central Maine Power Co.	Me.	CEMP	939	1153W	PSNH, MAYA	--	--
Central Vermont Public Serv. Corp.	Vt.	CEVP	85	309W	--	VEPI	VEPI, POAS[3]
Chester Municipal	Mass.	CHES	0	1W	--	WEME	WEME
Chicopee Municipal	Mass.	CHIC	8	54S	--	HOWP	HOWP
Citizens Util. Co.	Vt.	CIUC	15	32W	--	VEPI	QHEC[3] POAS[3]
Concord Municipal	Mass.	CONC	0	18W	--	BOEC	BOEC
Concord Elec. Co.	N.H.	COEL	0	58W	--	PSNH	PSNH
Connecticut Light & Power Co.	Conn.	COLP	2939	1881W	COEN,[3] UNIC, COYA, WEME, BLVE, HAEL	--	--
Connecticut Valley Elec. Co.	N.H.	COVE	0	33W	--	CEVP	CEVP
Connecticut Yankee Atomic Power Co.	Conn.	COYA	575	0	COLP	--	--
Danvers Municipal	Mass.	DANV	0	43W	--	NEEP	NEEP
Eastern Maine Elec. Coop.	Me.	EMEC	3	20W	--	NBEP[3]	NBEP,[3] MAPS
Enosburg Falls Municipal	Vt.	ENOS	2	3W	--	CIUC	POAS,[3] CIUC
Exeter & Hampton Elec. Co.	N.H.	EXHE	0	63W	--	PSNH	PSNH
Fall River Elec. Light Co.	Mass.	FARE	0	110S	--	MOEL	MOEL, NAEC
Farmington River Power Co.	Conn.	FARP	10	13S	--	COLP	--
Fisher Island Elec. Corp.	N.Y.	FIEL	0	1S	--	GROT	GROT
Fitchburg Gas & Elec. Light Co.	Mass.	FIGE	47	75S	--	MASE	BOEC, NEEP
Fletcher Gas & Elec. Co.	Mass.	FLGE	0	1S	--	WEME	WEME
Fox Islands Elec. Coop.	Me.	FOXI	0	1W	--	CEMP	CEMP
Franklin Elec. Light Co.	Vt.	FREL	0	1W	--	CIUC	POAS,[3] SWAN
Georgetown Municipal	Mass.	GEOR	0	5W	--	MASE	NEEP
Granite State Elec. Co.	N.H.	GSEC	0	75W	--	NEEP	NEEP
Green Mountain Power Corp.	Vt.	GRMP	112	215W	--	VEPI	VEPI, POAS[3]
Groton Municipal	Conn.	GROT	0	77S	--	COLP	COLP
Groton Municipal	Mass.	GMED	0	5W	--	MASE	NEEP
Groveland Municipal	Mass.	GROV	0	4S	--	MASE	NEEP
Hardwick Municipal	Vt.	HARD	2	6W	--	GRMP	POAS,[3] GRMP
Hartford Elec. Light Co.	Conn.	HAEL	1797	1133S	COLP, WEME	--	--
Hingham Municipal	Mass.	HING	0	21W	--	MASE	NEEP, MAYA
Holden Municipal	Mass.	HOLD	0	14W	--	MASE	NEEP
Holyoke Municipal	Mass.	HOGE	27	42S	--	WEME	WEME, VTYA
Holyoke Power & Elec. Co.	Mass.	HOPO	0	--	--	HOWP	HOWP
Holyoke Water Power Co.	Mass.	HOWP	181	22S	--	WEME	--

Houlton Municipal	Me.	HOUL	0	10W	--	MAPS	MAPS
Hudson Municipal	Mass.	HLPD	20	24W	--	MASE	NEEP, BOEC
Hull Municipal	Mass.	HULL	0	8S	--	MASE	NEEP, MAYA
Hyde Park Municipal	Vt.	HYDE	0	2W	--	CEVP	CEVP,POAS[3]
Ipswich Municipal	Mass.	IPSW	9	11W	--	NEEP	NEEP
Jacksonville Municipal	Vt.	JACV	0	1W	--	GRMP	POAS,[3] VEPI
Jewett City Municipal	Conn.	JEWE	0	3W	--	COLP	COLP
Johnson Municipal	Vt.	JOHS	0	4W	--	CEVP	CEVP, POAS[3]
Kennebunk Municipal	Me.	KENE	1	11W	--	CEMP	CEMP
Lake Elec. Corp.	Vt.	LAEL	0	1W	--	CIUC	POAS,[3] SWAN
Littleton Municipal	Mass.	LITT	0	12W	--	MASE	NEEP, BOEC
Littleton Municipal	N.H.	LITN	0	7W	--	PSNH	NEEP
Lubec Municipal	Me.	LUBE	0	2W	--	BAHE	BAHE
Ludlow Municipal	Vt.	LUDL	0	7W	--	CEVP	CEVP, VEPI
Lyndonville Municipal	Vt.	LYED	1	9W	--	CEVP	POAS,[3] VTYA
Madison Municipal	Me.	MAEW	1	4W	--	CEMP	CEMP
Maine Elec. Power Co.	Me.	MAPO	0	0	MAYA, NBEP[3]	--	--
Maine Public Serv. Co.	Me.	MAPS	48	89W	--	BAHE	BHAE, MNBE[3]
Maine Yankee Atomic Power Co.	Me.	MAYA	829	0	CEMP, MAPO, PSNH	--	--
Manchester Elec. Co.	Mass.	MAEC	0	4W	--	MASE	NEEP
Mansfield Municipal	Mass.	MANS	0	24W	--	MASE	NEEP, VEPI
Marblehead Municipal	Mass.	MMLD	6	17W	--	MASE	NEEP, MAYA
Massachusetts Elec. Co.	Mass.	MASE	0	2050W	--	NEEP	NEEP, WEME
Matinicus Light & Power Co.	Me.	MALP	1	1W	isolated utility	--	--
Merrimac Municipal	Mass.	MERR	0	3W	--	MASE	NEEP
Metropolitan District Commission	Mass.	MEDC	5	1S	--	BOEC	NEEP, BOEC
Middleborough Municipal	Mass.	MIDD	0	17W	--	BREC	MOEL
Middleton Municipal	Mass.	MIDT	0	8W	--	MASE	NEEP, MAYA
Montaup Elec. Co.	Mass.	MOEL	253	671S	--	BREC	--
Morrisville Municipal	Vt.	MOVI	3	9W	--	GRMP	POAS,[3] VTYA
Nantucket Elec. Co.	Mass.	NANT	20	12S	isolated utility	--	--
Narragansett Elec. Co.	R.I.	NAEC	251	721S	BLVE	--	--
New Bedford Gas & Edison Light Co.	Mass.	NEBG	75	469W	BREC, BOEC, CACO	--	--
New England Power Co.	Mass.	NEEP	3752	146W	BLVE, BOEC, PSNH, VEPI, WEME, NIMP[3]	--	--
New Hampshire Elec. Coop.	N.H.	NHEC	0	83W	--	PSNH	PSNH, CEVP
New Hampton Municipal	N.H.	NEWH	0	1W	--	PSNH	PSNH
Newport Elec. Co.	R.I.	NEWP	32	70W	--	NAEC	MOEL, MAPO
North Attleborough Municipal	Mass.	NATT	0	20W	--	MASE	NEEP
Northfield Municipal	Vt.	NOVT	0	5W	--	GRMP	VEPI, POAS[3]
Norwalk 3TD Municipal	Conn.	NTTD	0	9S	--	COLP	COLP
Norwich Municipal	Conn.	NOWI	20	42S	--	COLP	COLP
Norwood Municipal	Mass.	NOMA	0	48S	--	BOEC	BOEC
Orleans Municipal	Vt.	ORLE	0	3W	--	BOEC	VEPI, POAS[3]
Pascoag Municipal	R.I.	PASC	0	4W	--	BLVE	MOEL
Paxton Municipal	Mass.	PAXT	0	4W	--	MASE	NEEP, MAYA
Peabody Municipal	Mass.	PEAB	27	58S	--	MASE	NEEP, NBEP[3]
Princeton Municipal	Mass.	PRIN	0	2W	--	MASE	NEEP
Providence Municipal	R.I.	PRVI	2	1W	--	NAEC	NAEC
Public Service Co. of New Hampshire	N.H.	PSNH	1270	937W	CEMP, VTYA, NEEP, MAYA	--	--
Reading Municipal	Mass.	RMLP	0	76S	--	BOEC	BOEC
Readsboro Municipal	Vt.	REDB	0	1W	--	GRMP	POAS,[3] GRMP
Rochester Elec. Co.	Vt.	ROCR	0	1W	--	CEVP	CEVP
Rowley Municipal	Mass.	ROWL	0	3W	--	IPSW	IPSW
Russell Municipal	Mass.	RUSL	0	1W	--	WEME	WEME
Shrewsbury Municipal	Mass.	SELP	11	31W	--	BOEC	NEEP, BOEC
South Hadley Municipal	Mass.	SHAD	0	20W	--	HOPO	HOPO
South Norwalk Municipal	Conn.	SNEW	15	12S	--	COLP	COLP
Sterling Municipal	Mass.	STER	0	4W	--	MASE	NEEP, MAYA
Stonington & Deer Isle Power Co.	Me.	SDIP	0	2S	--	BAHE	BAHE
Stowe Municipal	Vt.	STOW	0	10W	--	GRMP	POAS,[3] HAEL
Swan's Island Elec. Coop.	Me.	SWIE	1	1W	isolated utility	--	--

Inter- Name connection	Purchases State Power From	Code	Installed Capacity[1] 1978 (MW)	Peakload[2] 1978 (MW)		Major Interconnections (230 kV and above)	Radial
New England Power Pool (Continued)							
Swanton Municipal	Vt.	SWAN	4	9W	--	CIUC	CIUC, MAYA
Taunton Municipal	Mass.	TAUN	135	66W	--	BREC	MOEL, MAYA
Templeton Municipal	Mass.	TEMP	0	8W	--	MASE	NEEP, BOEC
Union River Elec. Coop.	Me.	UNRC	0	1S	--	BAHE	BAHE
United Illuminating Co.	Conn.	UNIC	1268	953S	COLP	--	--
Van Buren Municipal	Me.	VANB	0	4W	--	MAPS	MAPS
Vermont Elec. Coop.	Vt.	VCOP	0	26W	--	CEVP	CEVP, GRMP
Vermont Elec. Power Co.	Vt.	VEPI	0	7W	VTYA, NEEP	--	--
Vermont Marble Co.	Vt.	VEMC	8	7W	--	CEVP	NEBG, PSNH
Vermont Yankee Nuclear Power Co.	Vt.	VTYA	520	1W	PSNH, VEPI, WEME	--	--
Wakefield Municipal	Mass.	WAKF	0	24S	--	MASE	NEEP, MAYA
Wallingford Municipal	Conn.	WDPU	22	74S	--	COLP	COLP, SNEW
Washington Elec. Coop.	Vt.	WAEL	0	11W	--	GRMP	GRMP, VEPI
Wellesley Municipal	Mass.	WELY	0	31W	--	BOEC	BOEC
West Boylston Municipal	Mass.	WBOY	0	9W	--	MASE	NEEP, BOEC
Western Massachusetts Elec. Co.	Mass.	WEME	938	640W	COLP, NIMP,[3] VTYA, NEEP, HAEL	--	--
Westfield Municipal	Mass.	WFLD	0	46S	--	WEME	WEME, HAEL
Wolfeboro Municipal	N.H.	WOLF	2	6W	--	PSNH	PSNH
Woodsville Municipal	N.H.	WOVI	0	5W	--	CEVP	CEVP
Yankee Atomic Elec. Co.	Mass.	YAEC	176	12W	--	NEEP	--
New York Power Pool		NYPP	29,715[4]	20,418[5]	--	--	--
New York Regional			29,867[6]	20,439[7]	--	--	--
Akron Municipal	N.Y.	AKNY	--	--	--	NIMP	POAS
Andover Municipal	N.Y.	ANDO	--	--	--	NIMP	POAS
Angelica Municipal	N.Y.	ANGE	--	--	--	ROGE	POAS
Arcade Municipal	N.Y.	ARCD	--	--	--	NIMP	POAS, NIMP
Bath Municipal	N.Y.	BATH	--	--	--	NEYE	POAS
Beebee Island Corp.	N.Y.	BEIC	1	--	--	NIMP	--
Bergen Municipal	N.Y.	BERG	--	--	--	NIMP	POAS
Boonville Municipal	N.Y.	BOON	--	--	--	NIMP	POAS
Brocton Municipal	N.Y.	BROC	--	--	--	NIMP	POAS
Castile Municipal	N.Y.	CAST	--	--	--	NEYE	POAS
Cataldo Elec. Serv.	N.Y.	CATA	1	--	--	NIMP	--
Central Hudson G&E Corp.	N.Y.	CEHG	922	630	NIMP, COEN	--	--
Churchville Municipal	N.Y.	CHVI	--	--	--	NIMP	POAS
Consolidated Edison Co. of N.Y.	N.Y.	COEN	9454	6714	NIMP, CEHG, PSEG, COLP	--	--
Delaware County Elec. Coop.	N.Y.	DCEC	--	--	--	NEYE	POAS
Dexter Hydro Elec. Corp.	N.Y.	DEHE	5	--	--	NIMP	--
Endicott Municipal	N.Y.	ENDI	--	--	--	NEYE	POAS
Fairport Municipal	N.Y.	FAPO	--	--	--	NIMP	POAS
Frankfort Municipal	N.Y.	FRAK	--	--	--	NIMP	POAS
Freeport Municipal (LI)	N.Y.	FREP	50	40[8]	--	LOIL	LOIL, POAS
Gouverneur Municipal	N.Y.	GOUV	1	--	--	NIMP	--
Green Island Municipal	N.Y.	GRIS	--	--	--	NIMP	POAS, NIMP
Greene Municipal	N.Y.	GRVI	--	--	--	NEYE	POAS, NEYE
Greenport Municipal (LI)	N.Y.	GREP	7	--	--	LOIL	POAS
Groton Municipal	N.Y.	GDOU	--	--	--	NEYE	POAS

Hamilton Municipal	N.Y.	HHMO	--	--	--	NEYE	POAS
Holley Municipal	N.Y.	HOLL	--	--	--	NIMP	POAS
Ilion Municipal	N.Y.	ILIO	--	--	--	NIMP	POAS
Jamestown Municipal	N.Y.	JAME	60	67	--	NIMP	POAS
Lake Placid	N.Y.	LAKP	--	--	--	NIMP	POAS
Lawrence Port Heat, Light	N.Y.	LAPH	1	--	--	--	--
Little Valley	N.Y.	LITV	--	--	--	NIMP	POAS
Long Island Lighting	N.Y.	LOIL	3842	2997	COEN	--	--
Long Sault	N.Y.	LOSI	--	--	--	NIMP	--
Marathon	N.Y.	MARA	--	--	--	NEYE	POAS
Mayville Municipal	N.Y.	MAYV	--	--	--	NIMP	POAS
Mohawk Municipal	N.Y.	MOHA	--	--	--	NIMP	POAS
Moreau Manufacturing	N.Y.	MORM	6	--	--	NIMP	--
New York State Dept. of Transportation	N.Y.	NEYS	(11)9	--	--	NIMP	--
New York State Elec. & Gas	N.Y.	NEYE	1781	2043	NIMP, PEEC, POAS	--	--
Niagara Mohawk Power Corp.	N.Y.	NIMP	4940	5345	ONTARIO HYDRO, POAS, NEEP, NEYE, COEN, PEEC	--	--
Oneida-Madison Elec. Coop.	N.Y.	ONMA	--	--	--	NEYE	POAS
Orange & Rockload Util.	N.Y.	ORRV	1020	662	--	--	--
Otsego Elec. Coop.	N.Y.	OTSE	--	--	--	NEYE	POAS
Park Ridge Elec. Dept.	N.J.	PANJ	--	--	--	ROEL	ROEL
Peach Lake Util.	N.Y.	PELU	--	--	--	NEYE	NEYE
Penn Yan Municipal Board	N.Y.	PENY	--	--	--	NEYE	POAS
Philadelphia Municipal	N.Y.	PHIA	--	--	--	NIMP	POAS
Pike County Light & Power	Pa.	PIKE	--	--	--	ORRU, JECP	ORRU, JECP
Plattsburgh Municipal	N.Y.	PLAT	3	--	--	POAS	POAS
Power Authority of State New York	N.Y.	POAS	6740	2474	NIMP, NEYE, ROGE, ONTARIO HYDRO	--	--
Richmondville Municipal	N.Y.	RICM	--	--	--	NIMP	POAS
Rochester Gas & Elec.	N.Y.	ROGE	995	983	POAS	--	--
Rockland Elec.	N.J.	ROEL	--	--	--	ORRU	ORRU, MEEC
Rockville Centre	N.Y.	ROCK	31	31	--	LOIL	POAS
Rouses Point Municipal	N.Y.	ROUS	--	--	--	NEYE	POAS
Salominca, Board of	N.Y.	SALH	--	--	--	NIMP	POAS
Sherburne Municipal	N.Y.	SHEB	--	--	--	NEYE	POAS
Sherrill-Kenwood Power	N.Y.	SHKL	--	--	--	NIMP	POAS
Silver Springs Village	N.Y.	SISP	--	--	--	NEYE	POAS
Skoneateles Elec. Dept.	N.Y.	SKAN	1	--	--	NIMP	POAS
Solvay Water & Elec.	N.Y.	SOLV	--	--	--	NIMP	POAS, NIMP
Spencerport Elec.	N.Y.	SPNP	--	--	--	NIMP	POAS
Springville Elec.	N.Y.	SVES	1	--	--	NIMP	POAS
Steuben Rural Elec. Coop.	N.Y.	STEU	--	--	--	NEYE	POAS
Theresa Municipal	N.Y.	THER	--	--	--	NIMP	POAS
Tupper Lake Municipal	N.Y.	TUPP	--	--	--	NIMP	POAS
Watertown Municipal	N.Y.	WATN	5	--	--	NIMP	NIMP
Watkins Glen Elec.	N.Y.	WATK	--	--	--	NEYE	POAS
Wellsville Water & Light	N.Y.	WELV	--	--	--	NIMP	POAS
Westfield Board	N.Y.	WESF	--	--	--	NIMP	POAS
Pennsylvania-New Jersey-Maryland Interconnection			43,748	31,686 --	WEPP, CLEI, NIMP, NEYE, ORRU, COEN, VIEP, POEC		
A & N Elec. Coop.	Va.	ACNE	3	--	--	DEPV	DEPV
Allegheny Elec. Coop. Inc.	Pa.	ALEC	--	--	--	PEEC, MEEC, JECP, WEPP, NEYE	POAS, PEEC, WEPP, JECP, MEEC
Atlantic City Elec. Co.	N.J.	ATCE	1415	1117	PSEG, PHEC	--	--
Baltimore Gas & Electric Co.	Md.	BAGE	4853	3553	POEP, PHEC, PEPL	--	--
Berlin Elec. Light Plant	Md.	BELP	4	6	--	DEPM	DEPM
Berlin Municipal Elec. System	Pa.	BERP	--	--	--	PEEC	PEEC
Blakely Borough Elec. Light Dept.	Pa.	BLAK	--	--	--	PEPL	PEPL
Butler Light Dept.	N.J.	BUNJ	--	--	--	JECP	JECP

Name	State	Code	Installed Capacity[1] 1978 (MW)	Peakload[2] 1978 (MW)	Major Interconnections (230 kV and above)	Radial Inter- connection	Purchases Power From
Pennsylvania-New Jersey-Maryland Interconnection (Continued)							
Catawissa Light Dept.	Pa.	CATW	--	--	--	PEPL	PEPL
Centerville Elec. Plant	Md.	CEVI	--	--	--	DEPM	DEPM
Choptank Elec. Coop., Inc.	Md.	CHOP	--	--	--	DEPM	DEPM
Citizen Elec. Co., Lewisburg	Pa.	CECL	--	--	--	PEPL	PEPL
Conowingo Power Co.	Pa.	CONP	--	--	--	PHEC, SUEC,	PHEC, SUEC, DEPL
Delaware Elec. Coop., Inc.	Del.	DEEC	--	--		DEPL	DEPL
Delmarva Power & Light Co.	Del.	DEPL	1697	990	PHEC, DEPM, PSEG	--	--
Delmarva Power & Light Co. of Md.	Md.	DEPM	251	377	DEPL	--	--
Delmarva Power & Light Co. of Va.	Va.	DEPV	41	61	--	DEPM, ACNE	DEPM
Dover Elec. Dept.	Del.	DODE	135	96	--	DEPL	--
Duncannon, Borough of	Pa.	DUNP	--	--	--	PEPL	PEPL
East Conemaugh Municipal Elec. Light Plant	Pa.	EACO	--	--	--	PEEC	PEEC
Easton Util. Commission	Md.	EAUC	44	23	--	DEPM	--
Elkland Elec. Co.	Pa.	ELKL	--	--	--	PEEC	PEEC
Ephrata Elec. Dept.	Pa.	EPHR	--	--	--	PEPL	PEPL
Girard Borough Light Distributor	Pa.	GIRA	--	--	--	PEEC	PEEC
Hatfield Municipal Elec. Plant	Pa.	HATF	--	--	--	PEPL	PEPL
Hershey Elec. Co.	Pa.	HEEC	--	--	--	MEEC	MEEC
Jersey Central Power & Light Co.	N.J.	JECP	2805	2689	PSEG, MEEC	--	--
Kutztown Elec. Dept.	Pa.	KUTZ	--	--	--	MEEC	MEEC
Lansdale Municipal Power Plant	Pa.	LADA	--	--	--	PHEC	PHEC
Lavellette Dept. of Public Util.	N.J.	LAVE	--	--	--	JECP	JECP
Lehighton Light & Power Dept.	Pa.	LEHI	--	--	--	PEPL	PEPL
Lewes Board of Public Works	Del.	LBPW	3	--	--	DEPL	DEPL
Lincoln & Ellendale Elec. Co.	Del.	LIEE	--	--	--	DEPL	DEPL
Madison Elec. Light Dept.	N.J.	MANJ	--	--	--	JECP	JECP
Metropolitan Edison Co.	Pa.	MEEC	1684	1483	PEPL, PHEC, JECP, PEEC	--	--
Middletown, Town of	Del.	MIDE	--	--	--	DEPL	DEPL
Middletown Borough Light Plant	Pa.	MIDP	--	--	--	MEEC	MEEC
Mifflinburg Borough Light Dept.	Pa.	MIFF	--	--	--	PEPL	PEPL
Milford Light & Water Dept.	Del.	MILD	--	--	--	DEPL	DEPL
Milltown Electric Dept.	N.J.	MINJ	--	--	--	PSEG	PSEG
New Castle Board of Water & Light Commission	Del.	NEWC	--	--	--	DEPL	DEPL
Newark Elec. Dept.	Del.	NEWA	--	--	--	DEPL	DEPL
Olyphant Borough Light Commission	Pa.	OLYP	--	--	--	PEPL	PEPL
Pennsylvania Elec. Co.	Pa.	PEEC	2535	1993	MEEC, NIMP, PEPL, NEYE, WEPP, CLEI	--	--
Pennsylvania Power & Light Co.	Pa.	PEPL	6460	4431	MEEC, PEEC, PSEG, PHEC, BAGE, SAHW, UGIC	--	--
Perkasie Elec. Light Dept.	Pa.	PERK	--	--	--	PEPL	PEPL
Philadelphia Elec. Co.	Pa.	PHEC	7215	5576	ATCE, BAGE, DEPL, MEEC, PEPL, SUEC, PSEG	--	--
Potomac Elec. Power Co.	D.C.	POEP	5007	3714	BAGE, POEC, VIEP	--	--
Public Service Elec. & Gas Co.	N.J.	PSEG	9028	6615	DEPL, PHEC, PEPL, JECP, COEN, ATCE, ORRU	--	--
Quakertown Municipal Elec. Dept.	Pa.	QUAK	--	--	--	PEPL	PEPL
Rockingham Light, Heat & Power Co.	Pa.	ROLH	--	--	--	PEEC	PEEC
Safe Harbor Water Power Corp.	Pa.	SAHW	228	--	PEPL	--	--

St. Clair Elec. Light Dept.	Pa.	SACL	--	--	--	PEPL	PEPL
St. Michaels Util. Commission	Md.	SAMI	--	--	--	DEPM	DEPM
Schuylkill Haven Elec. Light Dept.	Pa.	SCHU	--	--	--	PEPL	PEPL
Seaford Light & Power Co.	Del.	SEAF	7	--	--	DEPL	DEPL
Seaside Heights Municipal Elec. Dept.	N.J.	SEAS	--	--	--	JECP	JECP
Smethport, Borough of	Pa.	SMET	--	--	--	PEEC	PEEC
Smyrna Elec. Dept.	Del.	SMYR	--	--	--	DEPL	DEPL
South River Board of Public Works	N.J.	SORI	2	--	--	PSEG	PSEG
Southern Md. Elec. Coop.	Md.	SOME	--	--	--	POEP	POEP
Susquehanna Elec. Co.	Pa.	SUEC	512	--	PHEC	--	--
UGI Corp.	Pa.	UGIC	65	142	PEPL	--	PEPL
Vineland Elec. Util.	N.J.	VINE	93	74	--	ATCE	--
Watsontown Elec. Light Dept.	Pa.	WATS	--	--	--	PEPL	PEPL
Weatherly Borough Light & Power Plant	Pa.	WETH	--	--	--	PEPL	PEPL
Wellsborough Elec. Co.	Pa.	WEEC	--	--	--	PEEC	PEEC
Windber Elec. Corp.	Pa.	WIEC	--	--	--	PEEC	PEEC
York Haven Power Co.	Pa.	YOHP	19	--	--	MEEC	--
Clayton Municipal Light & Power Plant	Del.	CLAN	--	--	--	DEPL	DEPL
Goldsboro Borough Council	Pa.	GOLD	--	--	--	MEEC	MEEC
Hooversville Borough Elec. Light Co.	Pa.	HOOV	--	--	--	PEEC	PEEC
Lewisberry Borough Council	Pa.	LEWI	--	--	--	MEEC	MEEC
Pemberton Borough Elec. Dept.	N.J.	PENJ	--	--	--	JECP	JECP
Royalton Municipal Elec. Light System	Pa.	ROYA	--	--	--	MEEC	MEEC
Summerhill Municipal Light Plant	Pa.	SUMM	--	--	--	PEEC	PEEC

---

[1] Capability of generating plants based on peak season of individual utilities.

[2] W=Winter, S=Summer

[3] Outside NEPEX area.

[4] Summer rating.

[5] Coincidental summer peak. Includes Jamestown and Freeport Municipal.

[6] Noncoincidental as to seasonal capability.

[7] Coincidental summer peak for New York region.

[8] 1977 peak.

[9] Leased to NIMP and included in their capacity.

Blank

APPENDIX B
COMMENTS FROM INVITED ORGANIZATIONS

The following organizations provided comments on this report, as requested by the Director, Office of Electric Power Regulation, Federal Energy Regulatory Commission:

- Edison Electric Institute
- Maryland Public Service Commission
- Massachusetts Department of Public Utilities
- Mid Atlantic Area Council
- New York Public Service Commission
- Northeast Power Coordinating Council
- Office of Power Marketing Coordination, Resource Applications, Department of Energy
- Office of Utility Systems, Economic Regulatory Administration, Department of Energy
- Pennsylvania Public Utility Commission
- Public Service Commission of the District of Columbia

The following were also invited to comment:

- American Public Power Association
- Committee on Electricity, National Association of Regulatory Commissioners
- National Rural Electric Cooperative Association
- State Regulatory Commissions of Connecticut, Delaware, Maine, New Hampshire, New Jersey, Rhode Island, Vermont, and Virginia

The following Task Force members also provided comments on the report for inclusion in this Appendix:

o	David L. Mohre	Allegheny Electric Cooperative, Inc.
o	Jack R. Templeton	Potomac Electric Power Company

This Appendix includes all the comments received through November 15, 1980. The Task Force members met on November 19, 1980 and resolved to their satisfaction all issues raised by the commenters.

Allegheny ELECTRIC COOPERATIVE, INC.
212 LOCUST ST. P.O. BOX 1266 • HARRISBURG, PENNSYLVANIA 17108 • PHONE 717 233-5704

OFFICE OF
ELECTRIC POWER REGULATION

October 10, 1980

RECEIVED
OCT 15 1980
DIV. OF ISA

Mr. William F. Lindsay, Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, D. C. 20426

Dear Mr. Lindsay:

I have reviewed the external draft of the study of power pooling in the Northeast region prepared by the Northeast Regional Task Force in response to Section 205b of P.L. 95-617. As a member of that task force, I concur that the report provides a well-rounded understanding of the current level of coordination and power pooling between utilities in that region. I also feel that the report appropriately identifies several impediments to continued and/or enhanced levels of coordination and power pooling in the northeast and across the country. However, I believe that the identified impediments in several cited examples should be more fully explained and quantified so that the relative merits of removing the impediments could be better understood.

Specifically, there was considerable mention of the problems of delayed siting and licensing of needed facilities that would benefit pool operations. The 8-year delay experienced in the construction of the Elroy-Hosensack 500 KV line in the PJM was used as an example. Yet the lost opportunity for saving oil and reducing consumer cost for electricity was not quantified as a function of the delay in operation of the line. Similarly, although the enormous cost burden to current and future consumers of unnecessary licensing delays for needed generation facilities was cited, their costs were not quantified. Yet, a one-year delay in the granting of an operating license on a typical nuclear plant by the NRC can add more than $1 billion to the bills of current and future consumers. Quantification of these hidden costs to consumers will serve to demonstrate the weak position energy and economic interests have when confronted by environmental and no-growth interests. Lost opportunity is a very real cost to consumers and to the economy which is more abhorrent given our current energy and economic situation.

On another issue, the need for federal legislation in the area of anti-trust liability associated with the development and operation of a fully-coordinated power pool is certainly reasonable, given access to pool membership and pool services (e.g. transmission service) is not arbitrarily or economically restricted, and both public and private interests are represented.

Another area deserving more immediate attention by the federal legislative process is that of federal legal and investigative protection of bulk power facilities used in multi-state pool operations (e.g. United Power Association's DC line). Should sabotage to these types of facilities become more prevalent, utilities may be less willing to depend on bulk power ties to neighbors to meet their requirements. This could certainly affect the degree of coordination of utilities, particularly in areas where load centers and resources are separated by wide distances. Along these same lines and related to the issue of reliability of supply, the voluntary cooperation of utilities and power pools in carrying out certain emergency preparedness functions within the framework of the Defense Production Act should not be overlooked. Here too federal legal and investigative protection is mandatory if the emergency preparedness function is to be as serious an endeavor on the part of the federal establishment as it is in the utility sector.

Finally, a general comment on a very emotional issue. Although the split savings concept has worked effectively for several decades, the enormous differentials now being experienced as a result of uncontrollable price increases on the world oil market should call this practice into question. This is not to suggest that the practice should be changed or arbitrarily removed, only that it should be reevaluated in light of today's situation. While it is true that shareholders of a seller have made an investment in capacity to allow the sale of economy energy to take place - and therefore have the right to expect a return on their investment - the current return to that investment may be considered beyond the bounds of "reasonable return" that is typically associated with regulation of utility investment. On the other hand, a practice which does not recognize the need for an appropriate return will act as an effective disincentive to coordination and power pooling in the future.

In closing, I want to thank you for the opportunity to have served on the Northeast Regional Task Force. I hope these comments will prove useful to you in your further deliberations on this issue.

Best regards,

DL Mohre

David L. Mohre
Director, Power Supply &
Engineering

DLM:ceb

Department of Energy
Washington, D.C. 20461

1980 SEP 15 PM 4: 15
OFFICE OF
ELECTRIC POWER REGULATION

SEP 10 1980

Mr. William W. Lindsay
Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, DC 20426

Dear Mr. Lindsay:

This is in reply to your letter of September 2, 1980, requesting our comments on the Commission's Northeast Region Task Force Report.

We have reviewed the report "Power Pooling in the Northeast Region" and believe the report fairly represents the objectives and accomplishments of the power industry in the Northeast Region toward power pooling.

We appreciate the opportunity to comment on the report and if we can further assist you in your studies, please feel free to contact my office.

Sincerely,

Daniel M. Ogden, Jr.
Director, Office of Power
Marketing Coordination
Resource Applications

ELECTRIC POWER REGULATION

Department of Energy
Washington, D.C. 20461

RECEIVED
OCT 2 1980
DIV. OF ISA

September 29, 1980

Dr. William W. Lindsay
Director, Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, D.C. 20426

Dear Dr. Lindsay:

The draft report on Power Pooling in the Northeast Region (August 1980) has been reviewed by the Office of Utility Systems' staff. The following comments are provided on the report's description of regional coordination and power pooling in the Northeast region.

The report presents an excellent description of the current status of coordination arrangements in the three power pools in this region -- NEPOOL, NYPP and PJM. Our review indicates the following areas where the report can be clarified and improved:

- Clarification is needed on the member and associate systems in PJM (MAAC). Page 12 indicates that there are eight member companies in PJM (MAAC) while the table on page 13 indicates nine member companies.

- The discussion on page 16 (last paragraph) of the construction of new transmission facilities mentions the region's ability to provide assistance to neighboring areas during fuel emergencies. Some mention should also be made of the region's ability to receive assistance during fuel emergencies; e.g., oil shortages.

- An explanation of Figure 3 on page 17 would be helpful, particularly in light of the fact that the ECAR to MAAC emergency transfer capability seems to be significantly reduced in 1988.

- The interchange description on page 36 (first paragraph) of Table 6 appears to be wrong in stating that the bulk of MAAC interchanges is made internally. Also, on Table 6, the 1978 MAAC internal interchange appears to be very low in relation to the other figures shown. Is this correct?

- The maps on page 53 (NEPOOL) and page 87 (PJM) are dated 1975 and 1976, respectively. More current maps would be an enhancement.

- The Federal Regulatory Activities section, discussed on page 95, should have more emphasis on ERA's authority under Section 202(a) of the Federal Power Act to encourage, on a voluntary basis, increased system coordination and interconnection.

- The example on page 97 (third paragraph) concerning conflicting regulatory objectives does not really pertain to pooling. An appropriate pooling example would be helpful in this section.

- There was no mention made under the discussion of state regulatory activities, pages 97-99, of the treatment of purchased power costs by the 12 states and the District of Columbia. Some discussion of how this is handled in particular instances would seem appropriate to a power pooling report.

- The section on financial/economic impediments to pooling page 111, made reference to "federal regulations imposing constraints on economic compensation available." It would be helpful to be more specific in this area.

- The discussion of inflationary effects on utility finances and economics, while extremely important, does not seem germane to utility pooling issues.

- It was noted in the report that PJM does not have a central planning staff while NEPOOL and NYPP do. This may imply that PJM's planning coordination is not as highly developed as their operating coordination. Some discussion of the advantages and disadvantages of maintaining a centralized staff seems necessary.

- There was very little discussion of the benefits of pooling in assisting in the power supply planning options of the GPU system following the outage of the Three Mile Island nuclear station. Some discussion of the assistance GPU received from PJM and other electric systems would seem appropriate.

- The report mentioned extensive communications between NYPP and NEPOOL and NYPP and PJM. Are communications as extensive between PJM and NEPOOL?

The Office of Utility Systems appreciates the opportunity to offer these comments.

Sincerely,

Jerry L. Pfeffer
Assistant Administrator
for Utility Systems
Office of Utility Systems
Economic Regulatory Administration

PUBLIC SERVICE COMMISSION
OF THE DISTRICT OF COLUMBIA

1625 I Street, Northwest
WASHINGTON, D. C. 20006
(202) 727-3050

1913

OFFICE OF ELECTRIC POWER REGULATION

October 29, 1980

William W. Lindsay, Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, D. C. 20426

Dear Mr. Lindsay:

We acknowledge receipt of your draft of the report on Power Pooling in the Northeast Region, along with your cover letter.

Since the report represents the singular effort of the Federal Energy Regulatory Commission we feel that much of the information and conclusions which it contains does not necessarily represent the perspective of a state level jurisdiction such as ours; therefore, we do not believe we have a meaningful basis for comment.

Very truly yours,

Mary B. Jordan

Mary B. Jordan
Secretary

JOHN J. KEARNEY, Senior Vice President

EDISON ELECTRIC INSTITUTE The association of electric companies

1111 19th Street, N.W.
Washington, D.C. 20036
Tel: (202) 828-7400

RECEIVED
1980 OCT -3 PM 3:26
OFFICE OF
ELECTRIC POWER REGULATION

October 3, 1980

RECEIVED
OCT 3 1980
DIV. OF ISA

Mr. William W. Lindsay
Director, Office of Electric
  Power Regulation
Federal Energy Regulatory Commission
Washington, DC 20426

Dear Mr. Lindsay:

The Edison Electric Institute appreciates the opportunity to comment on the draft report on Power Pooling in the Northeast Region.

We believe that the report generally provides an accurate and informative description of existing modes of regional coordination and power pooling in the Northeast region.

As compared to the other four regional reports on power pooling, the report for the Northeast region deals with a somewhat less diverse and more tightly interconnected electrical system. We would agree with the statement in the report to the effect that "the pools in this region have reached their practical limits on size and operating viability" and "further benefits cannot be expected to be gained from further consolidation of pools."

We would point out that the methods for quantifying savings from pooling differ from region to region. Such evaluations depend more on good engineering judgement than on precise economic analysis. The saving cited in this report are reasonable in our judgement.

Your cover letter points out that the task force was not asked to provide explicit findings or recommendations. Since the task force began with this point of departure, the report's contents should not be considered to be complete, balanced, or necessarily representative of an industry position. It should further be noted that most of the utilities in the region were not represented on the task force and have not had an opportunity to give input or comments.

If the Edison Electric Institute can be of further assistance, please contact Fred Denny, our Director of Engineering, who was involved in reviewing the report and preparing our comments.

Sincerely,

John J Kearney

John J. Kearney

JJK:fda

cc: Justin Karp
Fred I. Denny

RECEIVED
1980 OCT 14 AM 9:33
OFFICE OF ELECTRIC POWER REGULATION

COMMISSIONERS
THOMAS J. HATEM
CHAIRMAN
WILLIAM A. BADGER
LILO K. SCHIFTER
GEORGE A. SHEHAN
WAYNE B. HAMILTON
Haskell N. Arnold

STATE OF MARYLAND
PUBLIC SERVICE COMMISSION
ENGINEERING DEPARTMENT
AMERICAN BUILDING
231 E. BALTIMORE STREET
BALTIMORE, MARYLAND 21202
(301) 659-6079

JOHN W. DORSEY
CHIEF ENGINEER
JOSEPH H. WALTER
ASSISTANT CHIEF ENGINEER

October 8, 1980

RECEIVED
OCT 14 1980
DIV. OF ISA

Mr. William W. Lindsay
Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, DC 20426

Dear Mr. Lindsay:

Our Chairman Hatem has asked me to respond to your letter of September 2 seeking review comments on the FERC report "Power Pooling in the Northeast Region".

Along with other members of this Engineering Division, I have carefully reviewed the subject report as it relates to the PJM and to the MAAC. In that regard the report is certainly a concise and factual description in accordance with the objectives defined in the report. I would like to offer for your consideration several minor comments as follows:

1. On page 12 it is indicated that eight companies are signatories to the PJM agreement. I am not certain if this is the correct number depending on how companies are counted and also by way of recent events concerning Delmarva. Also on page 13 the members of the MAAC are identified in TABLE 4. This table appears to exclude the New Jersey Power and Light Company as a member.

2. The map shown in FIGURE 13 on page 80 denotes the UGI Corporation, however it does not show the UGI area on the map.

3. On page 98 there appears discussion concerning the 500-kV loop around the Nation's Capital and one section of same facing construction delay. In looking at the

factual situation, you may or may not wish to modify the given statements. It is true that this Commission approved this vital link and granted a Certificate of Public Convenience and Necessity after some two years of hearings and proceedings (the longest on record of any case). One party to the case has appealed this decision to the courts of Maryland. The other appeal motions by parties to the Commission have not been taken up by the Commission pending the outcome of the court case. Thus the entire matter rests with the court proceedings at this time, which could impose a serious and further delay, possibly in terms of years.

4. On page 99 there appears some discussion concerning the Maryland Office of People's Counsel, which is incorrectly set out. The Maryland Office of People's Counsel is not part of this Commission and is by law the omnibusman or representative of the residential class of ratepayers. Their entire budget, including the expense of consultants, does not come from the State but rather from the utilities by way of the assessment tax, in the same manner as the Commission is funded. I should also call your attention to the very significant difference between Maryland and Washington, D.C. By Maryland law this Commission must reach a decision on a complete rate case within 150 days or, within 90 days in the limited make-whole rate cases. This is in stark contrast to Washington, D.C. where there are no time constraints.

Thank you for the opportunity of reviewing your report, and may I receive final copy of same as well as the other report dealing with the northcentral U. S. region which includes ECAR.

Very truly yours,

John W. Dorsey

John W. Dorsey
Chief Engineer

JWD:gf

RECEIVED
1980 OCT 20 PM 2:58
OFFICE OF
ELECTRIC POWER REGULATION

The Commonwealth of Massachusetts
Department of Public Utilities
Leverett Saltonstall Building, Government Center
100 Cambridge Street, Boston 02202

October 9, 1980

Mr. William W. Lindsay
Director, Office of Electric
Power Regulation
Federal Energy Regulatory Commission
Washington, D.C. 20426

Dear Mr. Lindsay:

Thank you for sending the draft copy of the report, "Power Pooling in the Northeast Region", for our comments. I referred it to our Long Range Utility Planning Division for review. The staff thought it was an extremely informative report and were especially interested in the comparisons between NEPOOL, the New York Power Pool, and the PJM Interconnection. They did think, however, that the report could be strengthened by standardizing the descriptions of the individual pools' characteristics in each category.

Sincerely,

Doris R. Poté
Chairman

RECEIVED
OCT 20 1980
DIV. OF ISA

RECEIVED
1980 OCT -6 PM 3:42
OFFICE OF
ELECTRIC POWER REGULATION

MID
ATLANTIC
AREA
COUNCIL

Pennsylvania
New Jersey
D.C.
Delaware
Maryland
Virginia

REPLY TO:

Philadelphia Electric Company
2301 Market Street, S25-1
Philadelphia, PA 19101

October 3, 1980

Mr. William W. Lindsay, Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, DC 20426

Dear Mr. Lindsay:

FERC External Review Draft Report on
Power Pooling in the Northeast Region

On September 2, 1980, you sent copies of the subject report to Messrs. Astley, Thompson and Haak of MAAC and Mr. Stys of PJM and invited comments from these organizations. The following are the MAAC/PJM comments and suggestions with respect to the content of the report. A list of corrections and typos is attached.

Both the cover page and the Foreward state that the regional report was prepared by the Task Force. We believe that these statements are not accurate and should be revised. While most of the material was supplied by the Task Force, the draft was not prepared by it and material was added with which members of the Task Force do not concur. It would be more accurate to state that the draft was prepared by FERC based on material supplied by the Task Force.

The Commission's Northeast Regional Task Force is to be commended for contributing to a very useful summary of the history, organization and operating procedures of the three pools in the region. The draft has appropriately noted the improved reliability and reduction in costs achieved through

Participating Companies

Atlantic City Electric Company • Baltimore Gas and Electric Company • Delmarva Power & Light Company
Jersey Central Power & Light Company • Metropolitan Edison Company
Pennsylvania Electric Company • Pennsylvania Power & Light Company • Philadelphia Electric Company
Potomac Electric Power Company • Public Service Electric and Gas Company • UGI Corporation

the coordination efforts of the individual electric power companies in this region.

The purpose of study by FERC as directed by PURPA, and as stated in the Foreward is to examine the opportunities for:

(a) Conservation of energy
(b) Efficient use of facilities and resources
(c) Increased reliability through pooling

The report covers (b) and (c) but makes no specific mention of (a). We suggest the addition of a new paragraph on page 3 - Executive Summary - noting that the one-system operation of each of the three pools in the Northeast Region; the full coordination of daily operation, and innovative contractual arrangements to obtain coal-fired energy from systems south and west of the region (multi-party economy transactions - page 94) have enabled the members of each pool to maximize conservation of oil.

Under "Federal Regulatory Activities" in the second full paragraph on page 97, the reference to Philadelphia Electric Company's Eddystone Station should be deleted because it is not really related to power pooling arrangements and there really was no conflict in objectives between PE and EPA. The only conflict was one of timing of the completion of additional facilities to meet air quality standards, and this conflict has been resolved.

Under "Financial/Economic - Opportunities" on page 112, we strongly suggest that the second paragraph which refers to split-savings should be deleted. It was not based on data provided by the Task Force. Split-savings accounting procedures are currently in effect in probably hundreds of pooling agreements accepted for filing by the FERC, so reaffirmation of the appropriateness of this procedure is not needed for its use. There is no evidence that selling companies are avoiding economy transactions involving split-savings. The only reason a buying company would avoid such economy transactions is because other types of transactions are less costly.

We suggest that the reference to split-savings under "Institutional - Opportunities" on page 115 be deleted for the same reasons.

Under "Cost/Benefit Allocation - Opportunities" on page 114, we suggest the addition of the following sentence:

> "The recent development of a transmission use measurement procedure for the Extra High Voltage Transmission System within PJM may provide a guideline for such allocations in the future. This procedure provides a comprehensive, technical method for assessing use.

Finally, we note in the Foreward to the report that the Commission intends to provide an additional separate report to the President and the Congress regarding its overall assessment of the status of power pooling and the prospects for increased application of power pooling in the United States. Needless to say, such a report would be of considerable interest to us and we would appreciate the opportunity to comment on its draft, or, at the very least, to receive a copy at the time of initial distribution.

Sincerely,

Wayne C. Astley, Chairman
MAAC Executive Board

Attachment

cc: MAAC Executive Board
PJM Management Committee
MAAC Area Coordination Comm.
J. D. Hebson

RECEIVED
1980 OCT 14 AM 9 35
OFFICE OF
ELECTRIC POWER REGULATION

RECEIVED
OCT 14 1980
DIV. OF ISA

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION
ALBANY

CHARLES A. ZIELINSKI
CHAIRMAN

THE GOVERNOR NELSON A. ROCKEFELLER
EMPIRE STATE PLAZA

October 7, 1980

Dear Mr. Lindsay:

Thank you for the invitation to comment on the draft report "Power Pooling in the Northeast Region."

My staff has reviewed the document and believes that with one minor addition, the report presents an accurate description of power pooling in the Northeast. We would suggest that in paragraph 1 of page 2, note should be taken that the heavy north-south power flows between upstate and downstate New York are influenced by the fuel cost differential between the low sulphur oil required in the downstate region for generation and the high sulphur oil and coal used in the upstate region. I am sure you are aware of the critical dependence of the utilities in Southwest New York on imported low sulphur oil.

There were several minor typographical errors as follows:

Page 15 - "NAAC" should read "MAAC"
Page 23, item 3 - "have been placed by" should read "have been replaced by"
Page 30, item 5 - "NEPOOL" should read "NPCC"
Page 37, table 8 - delete "Sterling 1" from table
Page 60, figure 9 - source of reference on bottom of page appears to be incorrect

Again, thank you for the opportunity to comment.

Sincerely,

Charles A. Zielinski

Mr. William W. Lindsay, Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, D. C. 20426

NORTHEAST POWER COORDINATING COUNCIL
1250 BROADWAY / NEW YORK, N.Y. 10001
TELEPHONE: 212/868-1400

MEMBERS

BOSTON EDISON COMPANY
BURLINGTON ELECTRIC DEPARTMENT
CENTRAL HUDSON GAS & ELECTRIC CORPORATION
CENTRAL MAINE POWER COMPANY
CENTRAL VERMONT PUBLIC SERVICE CORPORATION
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
EASTERN UTILITIES ASSOCIATES
GREEN MOUNTAIN POWER CORPORATION
LONG ISLAND LIGHTING COMPANY
NEW BRUNSWICK ELECTRIC POWER COMMISSION, THE
NEW ENGLAND ELECTRIC SYSTEM
NEW ENGLAND GAS AND ELECTRIC ASSOCIATION
NEW YORK STATE ELECTRIC & GAS CORPORATION
NIAGARA MOHAWK POWER CORPORATION
NORTHEAST UTILITIES
ONTARIO HYDRO
ORANGE AND ROCKLAND UTILITIES, INC.
POWER AUTHORITY OF THE STATE OF NEW YORK
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
ROCHESTER GAS AND ELECTRIC CORPORATION
UNITED ILLUMINATING COMPANY, THE

October 10, 1980

Mr. William W. Lindsay, Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
400 First Street, N. E.
Washington, D. C. 20426

Dear Mr. Lindsay:

In connection with your request for comments on the "review draft of a report on power pooling in the Northeast region prepared by the Commission's Northeast Regional Task Force", I have attached herewith a copy of several pages from the report with comments noted thereon, by the New York Power Pool (NYPP). NYPP also comments that the data presented in the report are for different time periods, thus would tend to be confusing.

Very truly yours,

Julius Bleiweis

Julius Bleiweis
Executive Director

JB:LG
Attachment

RECEIVED
1980 OCT -6 PM 3:41
OFFICE OF
ELECTRIC POWER REGULATION

PENNSYLVANIA PUBLIC UTILITY COMMISSION
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG, PENNSYLVANIA

SUSAN M. SHANAMAN
CHAIRMAN

October 3, 1980

Mr. William W. Lindsay, Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
Washington, D.C. 20426

Dear Mr. Lindsay:

This is in reply to your letter of September 2, 1980 transmitting a copy of a review draft of Power Pooling in the Northeast Region.

I appreciate the summary of the historical development of the three power pools in the Northeast Region. I recently had the pleasure of inspecting the PJM Interconnection Center at Valley Forge, Pennsylvania and have a better insight into the complexity of controlling the constant interchange and flow of electric power in this heavily populated area of the nation. As you are well aware, Pennsylvania has historically been the keystone for commerce to the northeastern states and now it appears it is also critical to the power flow.

The study apparently did not address in detail the potential for conservation in the region, and I believe that subject should receive attention in the final draft. Conservation is a factor that is difficult to define, but I believe will play a very important role in future energy resources. Load control, although administered on a local utility level at the direction of a power pool, is a form of conservation that should be explained for the regulatory agencies to respond to questions about the different power pool philosophies.

I also noted that communications within and among the power pools was not addressed in detail. From past experience during a local area crisis at Three Mile Island, I found that communications should receive priority attention when analyzing problems of electric power operations. In view of the complexity of understanding the function of power pools, the future may require that communications include regulatory agencies who must respond to the public and executive level of government.

On page 98, paragraph 2, under State Regulatory Activities, I believe the entire paragraph can be deleted. It appears to be an unnecessary confirmation of the criticism by the utility industry of our regulatory activity. I dislike adding credence to remarks by utility executives carried almost daily in the newspapers.

On page 111, paragraph 1 and 2 under the Financial/Economic title, I believe the remarks about capital resources, financing, rates of return and regulatory delay do not belong in this report. Under that heading the mention of Impediments and Opportunities appear like commercials for the utilities and are not appropriate. I cannot endorse the utilities' claimed problems.

I appreciate the opportunity to comment on the External Review Draft and believe it would be in the best interest of this Commission if our name is removed from the publication. Incidently, Mr. Marquis Seidel, who is identified as economist with this Commission, actually left our employment in September 1979 and did not act as our representative on the project.

Sincerely,

S M Shanaman

SUSAN M. SHANAMAN
Chariman

SMS/jge

POTOMAC ELECTRIC POWER COMPANY · **1900 PENNSYLVANIA AVENUE, N. W., WASHINGTON, D. C. 20068**
(202) 872-2000

November 6, 1980

Mr. F. Craig Zigman
c/o Mr. James D. Hebson, Regional Engineer
Federal Energy Regulatory Commission
22nd Floor, 26 Federal Plaza
New York, New York 10007

Dear Mr. Zigman:

This is to confirm my suggested re-wording of the Foreword of the Northeast Regional Report to remove the implications that the report was prepared by the Task Force.

Delete the words, "by Task Forces" from the first sentence of the first paragraph.

Substitute the following for paragraph two, "Five regional task forces contributed to the total study effort. Each task force consisted of utility, industry, and regulatory agency representatives formed after consultation with industry and regulatory representatives. Although various individuals and government organizations suggested candidates to serve on the task forces, the membership was named by the Commission. The task forces served primarily to address the characteristics and problems of coordinated utility operations in their respective regions. They were not advisory and did not provide recommendations.

Very truly yours,

J. R. Templeton, Manager
Energy Systems and Interconnections

*U S GOVERNMENT PRINTING OFFICE: 1981 338-441/8078