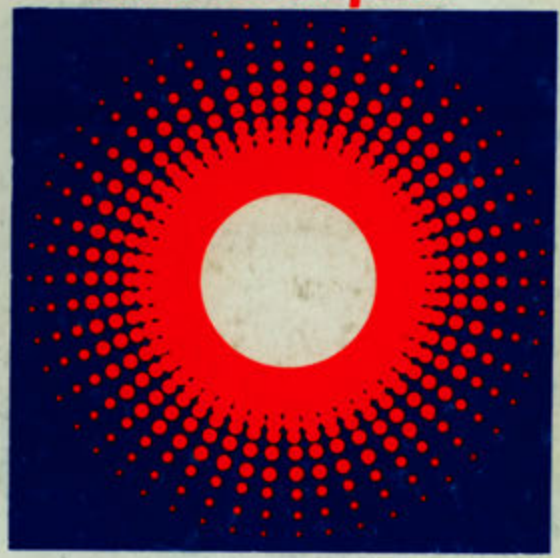
NEW YORK STATE ENERGY MASTER PLAN

and Long-Range Electric and Gas Report



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FINAL REPORT MARCH 1980

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ENERGY MASTER PLAN
FINAL REPORT

On August 7, 1979, the State Energy Office published the first Draft State Energy Master Plan and Long-Range Electric and Gas Report as required by Sections 5-110 and 5-112 of the Energy Law. Proceedings to review and evaluate the Draft Plan and Report were conducted during September, October and November by the New York State Energy Planning Board. Following a final vote on February 8, 1980, the Energy Planning Board published, on March 20, 1980, an Opinion and Order detailing its actions in approving, with modifications, the Draft Plan and Report. The State Energy Office has modified the Draft Plan and Report in conformance with the Energy Planning Board's Opinion and Order and has adopted a final New York State Energy Master Plan and Long-Range Electric and Gas Report. The Board's Opinion and Order is Appendix F to this final Plan and Report.

NEW YORK STATE
ENERGY MASTER PLAN
FINAL REPORT

Approved by: State of New York Energy Planning Board

Members: James L. Larocca, Commissioner State Energy Office, Chairman

Charles Zielinski, Chairman Public Service Commission
Robert Flacke, Commissioner Department of Environmental Conservation
David Blabey, Esq., Appointee of the Temporary President of the Senate
Ira Millstein, Esq., Appointee of the Speaker of the Assembly

Adopted by: The New York State Energy Office
March 1980

SECTION I

Preface

The New York State Energy Master Plan and Long-Range Electric and Gas Report, and the proceedings which have led to its adoption, mark the State's first efforts at comprehensive and integrated State energy planning. The Plan represents a significant accomplishment and a significant improvement over past efforts, which were limited in scope and in perspective. New York has now taken positive steps to shape its energy future in a comprehensive and rational manner.

Under the Master Plan, New York will reduce its dependence on oil through a variety of strategies:

- Increased penetration of conservation measures and technologies into every phase of energy use. Energy conservation is the least expensive, environmentally safest, and most economically beneficial supply option now available to New York.
- Increased use of renewable energy resources, including hydroelectric power, resource recovery (energy from waste), wood and solar. The State Plan provides for 725 megawatts of electric load being met with small hydro and almost 300 megawatts from resource recovery plants. In addition, the State Plan sets forth the possibility of 325 additional megawatts of small hydro and 292 megawatts of resource recovery on the theory that success will breed success as the economic and environmental attractiveness of these energy forms is widely demonstrated. Further, the equivalent of 12.5 million barrels of oil annually could be displaced by 1994 by wood and solar.
- Increased coal use. The Plan projects the need for six major power plants, beyond those already under construction, providing a total of 4100-4600 additional megawatts of power by 1994. The Plan calls for five of these new plants to be coal or coal/refuse fired and one to be a pumped storage hydro plant. In addition, the Plan calls for the conversion of nearly 6000 MW of currently oil-fired generating capacity to coal during the next ten years.
- Increased gas use. Natural gas is the cleanest, most efficient major conventional source of energy. Use of natural gas in New York can be significantly increased during the forecast period by removing regulatory impediments to increased use, by promoting use, and by promoting aggressive pursuit of additional gas supplies by the State's gas utilities.

The Plan also calls for an increasing role for imported hydroelectric power from Canada in amounts of between six and twelve billion kilowatthours per year.

The State Plan does not propose any new nuclear power plants beyond those already licensed or in the final stages of construction. Prior to increasing the State's reliance on additional new nuclear capacity, there is first a need to develop a fully adequate national nuclear waste disposal program, and a need to clarify substantial uncertainties associated with economic, safety and regulatory issues associated with the nuclear option.

The Plan projects cumulative economic savings in the State of at least $10 billion by 1994 as a result of implementation of the broad range of proposed actions. The substantial savings to consumers associated with the State Plan will flow through the State's economy and create significant additional income for other purposes.

The Plan is projected to create an additional 40,000 jobs by the year 1994, just as a result of implementation of the conservation and selected renewable resource proposals.

Since issuance of the draft State Energy Master Plan last August, a number of State and Federal energy initiatives haved been undertaken which are consistent with this Plan.

- State Actions
  - •• Power Plan Siting—Boards on Electric Generation Siting and the Environment have approved the siting of coal-fired electric power plants on Lake Erie and Long Island and have denied a proposal to build a nuclear power plant at Sterling, New York.
  - •• Legislation - Significant measures to promote energy conservation and renewable resources as well as mitigate the impact of high energy costs on low income households have been enacted by the Governor and the State Legislature. The enacted energy conservation proposals of the draft plan include:
    - . . . Chapter 743 of the Laws of 1979, amending the State Lighting Efficiency for Existing Public Buildings Act of 1978, to extend the mandatory lighting efficiency standard to existing nonresidential buildings, using the State Energy Office, local agencies, and self-certification procedures as enforcement mechanisms.
    - . . . Chapter 741 of the Laws of 1979, amending the Home Insulation and Energy Conservation Act of 1977 to:
      - — include as eligible measures furnace and boiler retrofits, furnace and boiler replacements, regardless of the fuel used, and heat pumps;
      - — extend the program to four-family housing; and
      - — increase the maximum loan amounts available.
    - . . . Chapter 740 of the Laws of 1979, amending the Vehicle and Traffic Law to exempt van pool drivers of non-profit vans from the special licensing requirements needed for bus drivers.
- Federal Actions
  - •• Legislation—Final agreement is being reached in Congress on the President's Windfall Profits Tax, the creation of a national synthetic fuels industry, establishment of an Energy Mobilization Board, new energy conservation programs and the establishment of a federal solar and conservation bank. Furthermore, the President has submitted a legislative proposal to provide federal assistance for conversion of existing oil-fired power plants to coal.
  - •• Regulation—The Federal Energy Regulatory Commission is finalizing rules with respect to encouraging electricity production from renewable resource and cogeneration facilities by changing the pricing structure for the provision of standby electric service and electricity sales from such facilities.

However, we must recognize that much more needs to be done. The Plan calls for a broad range of actions and numerous additional studies. It is only through the successful pursuit of these many actions that our energy future will be improved. The Energy Planning Board, in approving

this Plan, has indicated its intent to monitor the progress of the recommended actions and take whatever action is necessary to further their implementation. The challenge of implementation, however, must go far beyond the Energy Planning Board, to all those whose decisions impact on our energy future, and thus to all New Yorkers.

James L. Larocca
Commissioner of Energy
and Chairman of the Energy
Planning Board

SECTION II

Introduction

1. BACKGROUND

A. Statutory Basis

Chapters 819 & 820 of the Laws of 1976 created the New York State Energy Office (SEO). In the statement of intent accompanying that law, the New York State Legislature described the conditions leading to SEO's creation:

> ". . . that the people of New York State have suffered shortages of all forms of energy; that such shortages are likely to recur; that New York is dependent on sources of energy from outside the state; and such shortages and high costs have been inimical to health, safety and welfare of the people." (L. 1976, C. 198, §1.)

The SEO is charged with a broad range of responsibilities and specific duties: developing and implementing energy policies, maintaining energy supplies, encouraging conservation and accelerating the development and use of renewable energy sources.

In 1978, the Energy Law was amended to broaden SEO's mission and to mandate the preparation of a draft State Energy Master Plan (SEMP) and a draft Long-Range Electric and Gas Report by the State Energy Office (Energy Law Sections 5-110 and 5-112).

An Energy Planning Board was created by the 1978 statute as the final decision-making body to approve both the master plan and the report. The Board consists of the Commissioner of Energy, who was designated by the Governor as Chairman of the Board; the Commissioner of Environmental Conservation; the Chairman of the Public Service Commission; the Temporary President of the Senate or his designee; and the Speaker of the Assembly or his designee.

The 1978 law created a fund to help defray the costs of participation by interested parties in developing the SEMP and long-range electric and gas report. Section 5-114 and the regulations issued thereunder, allowed any interested person, except a major energy supplier or a federal or state government agency, to apply to the Energy Office for funds to defray fees of experts who participated in the public hearings mandated by the law. Legal fees were not included. Decisions on funding applications were made by the Energy Planning Board.

B. Scope and Purpose of the Plan

The State Energy Master Plan and Long-Range Electric and Gas Report have been integrated by the Energy Office into a single document. Together they represent an initial effort by the State of New York to plan its energy future in a comprehensive and integrated manner. Comprehensive energy planning requires that all relevant variables be considered in developing the planning document. The SEMP therefore contains an assessment of the potential impact of these variables on New York's energy future: State economic and demographic factors; energy pricing, supply and demand trends; energy conservation; new energy technology development; indigenous energy resource development; and national energy policies. The impact of alternative energy sources and energy conservation on the environment, economy, health, safety, and welfare of the State and its population is also included.

A major shortcoming of prior energy planning has been its fuel-specific nature. This document overcomes that deficiency by embracing an integrative energy planning approach. Integrative energy planning allows a consideration of trade-offs between and among conventional fuels, renewable energy sources and energy conservation. This approach, for example, permits greater choice and flexibility in the specific mix of fuels within New York's energy future. It allows an examination of the relative contribution of coal, oil, natural gas, electricity, and renewable resources in meeting total future energy demand. Ultimately, the scope of the plan provides an informed framework for evaluating the State's future energy choices and reaching decisions for future actions.

The State Energy Master Plan and Long-Range Electric and Gas Report serves a variety of purposes consistent with State energy policy. The primary uses of the final document approved by the Energy Planning Board include:

- Article VIII Decisions.

  The forecast electric demands of the Energy Planning Board will become binding on the State Board on Electric Generation Siting and the Environment. These forecasted demands will govern any determination of need for future steam electric generating facilities under Article VIII of the New York Public Service Law (Energy Law, Section 5-112). In addition, upon adoption of the State Energy Master Plan, the State Board on Electric Generation Siting and the Environment must find that a proposed facility is consistent with the Master Plan before it may grant an application for a certificate under Article VIII of the New York Public Service Law, (Energy Law, Section 5-110).

- Article VII Decisions.

  Energy Planning Board findings on projected electric and natural gas demand will become binding on the Public Service Commission.

  They will govern any determination of need for major electric and natural gas transmission facilities which the Commission must certify for environmental compatibility and public need under Article VII of the New York State Public Service Law (Energy Law, Section 5-112).

- Public and Private Sector Planning.

  The State Energy Master Plan as approved by the Energy Planning Board does "provide the framework for energy-related decisions made throughout the state." (Energy Law Section 5-110). This framework will help guide public and private sector energy-related decisions.

- Plan for State Government Programs.

  The State Energy Master Plan and Long-Range Electric and Gas Report includes specific recommendations on the scope, directions, and substance of State programs for energy conservation, indigenous resource development, renewable resources, energy technology and conventional fuels.

- Guide for State Administrative Actions.

  The State Energy Master Plan makes a series of specific recommendations to guide the energy-related activities of New York State administrative agencies.

- Guide for State Legislative Actions.

  The State Energy Master Plan contains a number of proposals for State legislative considerations.

- Federal Energy Policy.

The State Energy Master Plan also suggests specific actions for consideration by the federal government in these areas: conventional fuels, energy conservation, renewable resources, and energy technology.

C. *Planning With Uncertainty*

Any effort to plan for the future is beset with difficulty and unknown elements. It is especially difficult to plan for New York State's future energy requirements since the various components of energy supply and demand influence each other in a variety of ways.

In assessing what is an adequate, safe supply of energy for the future, energy demand must be estimated and projected. Demand is a function of many variables, including population, employment, income levels and their changes, the price and availability of each fuel, federal regulations, and end user perception and attitudes toward conservation and consumption. All must be either foreseen or assumed in forecasting demand.

In the past 2 to 3 years, deliverable supplies of primary fuels have been unstable. During the 1976-1977 heating season sufficient quantities of natural gas were undeliverable in New York State; now there exists an apparent natural gas surplus. In 1978 there was an oil glut; in 1979 there was a shortage and petroleum product prices soared. In 1977 and 1978 there was a coal strike; in 1979 the price of coal fell.

Since the State is so dependent on imported oil, New Yorkers are subject to the capriciousness of the supplying nations. In 1977, it was thought that Saudi Arabia would produce 12 million barrels per day (MMBBL/D) in 1985; in 1978, that estimate was changed to 17 MMBBL/D; this year the federal government is predicting 10 MMBBL/D at most.

The substantial uncertainty which surrounds nuclear waste disposal, as well as uncertainty with regard to economic, safety and regulatory issues associated with this fuel form, have led to a decision not to depend in this Plan on new nuclear power plants, beyond those already under construction.

The natural gas industry could be revived with an increased supply of North American gas and a host of supplemental supplies that are being proposed, but the full cost of the resulting gas is uncertain. The recent round of OPEC oil price increases changes the basic economics of energy source choice. New sources of conventional fuels such as geopressurized methane may be developed, or a major breakthrough in synthetic fuel technology may occur. Into all of these unknowns enters the politics of price controls and the effects of decontrol. Finally, the relation between oil producing and oil consuming nations are subject to rapid change.

Recognition of the uncertain nature of future energy supply and demand does not, however, mean that New York is powerless to influence and shape its energy future significantly.

Of primary importance to our energy future is the widespread acknowledgement of society's collective ability and responsibility to make the vital decisions necessary to a desirable energy future. There is nothing inherently predetermined about that future. There are complex and difficult choices to make, and to abdicate or deny this responsibility is to choose by default. The will and the capacity to act positively in energy policy must be developed. The Energy Master Plan represents New York State's effort to deal with energy head-on.

The SEMP and Long-Range Electric and Gas Report show that significant changes can be and have been instituted to foster a new energy era within New York State. Increased use of coal in a manner compatible with environmental and economic objectives, the potential for additional secure natural gas supplies, greater use of commercially available renewable resource technologies, enhanced development of the State's indigenous resources, and continued gains in energy conservation are the major elements for altering New York's current energy profile.

Flexibility is the key to a new energy era. The State energy planning process is flexible enough to allow for changes in future energy supply and demand. The Energy Law contains a variety of provisions that recognize the uncertainty surrounding future energy planning and embodies a continuous scheme for incorporating change. The Energy Law mandates that:

- The planning process be based on a variety of public and private inputs;
- The State Energy Master Plan be reviewed by the Energy Office for updating at least every two years. The Long-Range Electric and Gas Report must be updated at least every two years;
- An interested person may seek an amendment to the Master Plan and Long-Range Electric and Gas Report under specified conditions;
- A comprehensive long-range electric planning report be submitted by the New York Power Pool to the Energy Office annually;
- A comprehensive long-range natural gas report be submitted by the New York Gas Group to the Energy Office every two years.

Basic State energy policies are a substantive means for coping with the uncertainties of energy planning. These policy commitments provide a clear and consistent set of objectives and serve as guiding principles for the planning process. The primary objectives are:

- continued economic growth and increased employment opportunities in the State;
- protection of environmental quality;
- reduced reliance on energy sources from outside the State, and particularly on foreign energy sources, with a corresponding emphasis on developing the State's indigenous energy sources;
- reduction of energy demands;
- fulfillment of energy demands in the most economical manner;
- reduction in energy costs as a percentage of disposable income, to more closely approximate average energy costs nationwide;
- use of a diverse primary fuel mix;
- increased competition between fuels for specific end uses;
- accelerated development and use of renewable energy sources, through the use of various incentives as needed to offset initial market disadvantages; and,
- protection of the public health and safety.

2. *METHODOLOGY*

A. *General Inputs*

The Energy Master Plan and Long-Range Electric and Gas Report were developed by the State Energy Office with input from many sources. Figure II-1 illustrates the scope and diversity of activities and organizations that helped shape this document. State and national energy policies, energy research and development trends, and submittals by

the State's major energy suppliers were considered. Input from other State agencies, local government, consumers, public interest groups, and individual citizens was also considered along with Energy Office research and information activities and the public hearing input to produce this State Energy Master Plan and Long-Range Electric and Gas Report. Among the major inputs were the following:

1) State Energy Policy

The Plan and Report reflect current New York State energy policy, including those programs and activities conducted or completed by the Energy Office and other State agencies. Among them:

- The State Energy Conservation Plan. Implementation of the Plan has helped to reduce projected energy consumption in the State 7 percent for 1980. The Plan features:
  - the Energy Conservation Construction Code, which establishes energy efficiency standards for new and renovated buildings;
  - the Energy Advisory Service to Industry, which lends technical assistance to small- and medium-sized industries Statewide;
  - State lighting efficiency standards for existing public buildings;
  - establishment of Energy Outreach Service to disseminate energy conservation information to commercial and residential sectors.
- Section 3-101 of the New York State Energy Law. The section lists the major objectives of New York State energy policy, including:
  - maintaining an adequate and continuous supply of safe, dependable, and economical energy;
  - speeding the development and use of renewable energy sources;
  - encouraging energy conservation within all sectors of the State's economy; and,
  - fostering, encouraging and promoting the prudent development and wise use of all indigenous State energy resources.
- 1978 long-range electric plans. The hearing record compiled by the Public Service Commission for the 1978 long-range electric plans, pursuant to Section 149-b of the Public Service Law, contained useful information on a variety of issues covered by the Plan and Report.

2) National Energy Policy

All national energy policies and programs enacted with the signing of the National Energy Act by President Carter on November 9, 1978 were considered in shaping the State Plan. The major program initiatives articulated by the President on April 5, 1979 including the supporting analysis, National Energy Plan-II, were considered as well as the new energy goals announced by the President on July 15, 1979.

3) Energy Research and Development Trends

The Energy Office analyzed and incorporated information on the availability, cost, and likely penetration of new energy conservation and supply technologies. The information was furnished primarily by the New York State Energy Research and Development Authority, and the federal Department of Energy, with some inputs from other interested parties.

4) Energy Supplier Submittals

Relevant information about New York State's current and future supplies of electricity, natural gas, oil, and coal was provided by the State's major energy suppliers. The New York Power Pool, including the Power Authority of the State of New York (PASNY), submitted a plan on behalf of the State's electric utilities for meeting future electric demand. The New York Gas Group submitted a similar report for meeting natural gas needs over the next 15 years. Oil and coal companies submitted individual reports of their future plans. In addition, on February 23, 1979, Commissioner Larocca issued an order directing that a broad investigation of the oil industry be conducted. The information obtained in compliance with that compulsory process was also used in the development of the Master Plan.

The Power Pool report forecasted electric demand over 5, 10 and 15 year periods, identified generating capacity for meeting that demand; inventoried facilities now in operation or planned; anticipated expenditures for research in energy conservation, load management, electric generation and transmission, new energy technologies and pollution abatement and control; and estimated electricity prices to consumers over the forecast periods.

The gas report included a forecast for the next 5, 10 and 15 year periods—by service area—of peak day, winter season, and annual gas requirements by appropriate end use classification; an identification of potential sources of natural gas supplies; a description of demographic projections and load forecasting methodology; and a projection of estimated gas prices to consumers over the forecast periods.

Major petroleum suppliers generally indicated in their submissions that no specific plans were made for New York's needs. Rather, companies consider their operations on a larger regional level, such as New England, the Northeast, East Coast, or Petroleum Administration for Defense Districts (PAD). Thus, depending on the individual company, the applicability of the reports vary. The petroleum suppliers also indicated that, in general, regional level plans are not prepared on a fifteen year basis. Long term planning was reported by the major petroleum suppliers to be done on a U.S. or worldwide basis.

The major coal suppliers presented some discussion of future plans. These plans, however, contained very little information on plans for meeting New York's forecasted coal requirements. Generally, the companies indicated that coal production is currently demand constrained and that adequate supplies of coal are available at competitive prices to meet any projected increases in demand.

5) Local Governments, Consumers, and Interest Groups

Various local government officials and interested persons added advice, ideas, and insights on a number of relevant issues, especially through the Energy Office hearings and through direct funding by the Energy Planning Board. This fund of $200,000 was provided for in the legislation establishing the planning process. It enables private groups to more effectively participate in the plan preparation and resulted in 12 funding awards representing over 34 private organizations.

6) State Energy Office Research & Information

The Energy Office developed various energy sector models. Its analysis of specific issues, energy prices, supply options and fuel availability are an integral part of the Plan.

B. Forecasts and Supply Plans

The State Energy Master Plan and Long-Range Electric and Gas Report present forecasts of end use energy demand over the next 5, 10 and 15 years. Energy demand is reduced by the estimated impact of price and non-price induced energy conservation during the forecast period. Forecasts are presented for each sector of the State's economy—residential, commercial, industrial, and transportation—and by fuel type, as shown in Figure II-2. Supply plans, including recommendations for State and federal action, are presented for each of the major energy forms including renewable resources and conservation.

The demand forecasts include information on future energy prices and estimated availability. The forecasts are sensitive to certain key considerations, including future State economic activity, government actions, energy prices, and production, use, and likely development and penetration of new energy technology. Figure II-3 lists the various factors that impact energy demand.

The energy demand forecasts are described in Section IV. The various energy supply plans are presented in Section V.

C. Planning Process

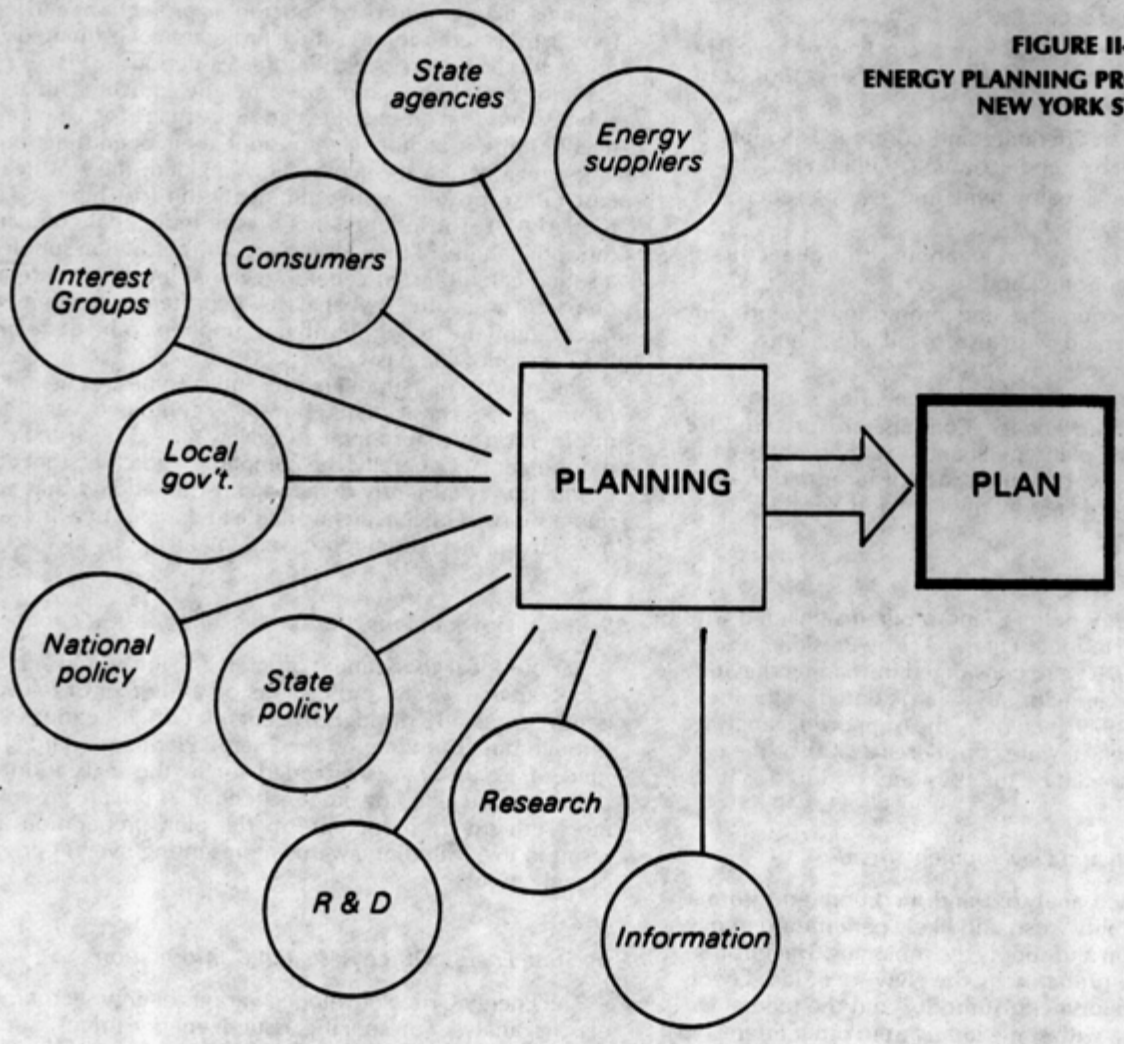
The 1979-1980 State energy master planning and long-range electric and gas system planning proceedings began on January 12, 1979, with the issuance by SEO of a public notice in accordance with the Planning regulations. (Scheduling for the Master Plan and for the Long-Range Electric & Gas Report were overlapped.)

Under the planning regulations, any interested person except a major energy supplier or Federal or State agency was eligible to apply for a portion of a $200,000 fund established by Section 5-114 of the Energy Law, to defray fees of experts retained to participate in the energy planning hearings. On May 4, 1979, the Board issued an Order allocating $190,000 to 12 grantees. (A list of the funding awards is included in Appendix A).

During 1979 extensive public hearings on the master plan were held by the State Energy Office and the Energy Planning Board. During six days of hearings in May, SEO received unsworn testimony on the plans submitted by the State's major energy suppliers on April 1, 1979. The public hearings were held in the following locations: Rochester—May 7, 1979; New York City May 9, 1979; Hauppauge—May 10, 1979; Albany—May 14, 1979; Buffalo—May 15, 1979; and Syracuse—May 17, 1979. Written comments on the energy supplier plans were also received by the Energy Office for thirty days after the conclusion of hearings.

These six public hearings were conducted by the State Energy Office in recognition of the essential importance of public participation in the development of the Energy Master Plan. The statute required only three hearings.

FIGURE II-1
ENERGY PLANNING PROCESS INPUTS
NEW YORK STATE



A panel of State Energy Office senior staff, including the Commissioner and/or Deputy Commissioner, attended each hearing to receive personally the views of the citizens testifying.

The Energy Planning Board held two series of public hearings on the draft Energy Master Plan and Report. Interested persons and public officials presented unsworn statements on September 6, September 10, September 11 and September 20 in New York City, Syracuse, Buffalo and Mineola. A total of 193 people spoke or submitted testimony at these four hearings, or during the following 30-day comment period. Regulatory-type hearings were held in Albany for 11 days between October 19 and November 9, 1979. Direct testimony from 92 witnesses was received during the hearings and 32 parties submitted initial briefs to the planning board following the hearings. During this last series of hearings, every interested person and organization who requested party status for the proceeding was able to sponsor witnesses and to question witnesses sponsored by others, including the State Energy Office. (A more detailed description of the planning process and procedure can be found in Appendix A).

FIGURE II-2
NEW YORK STATE ENERGY DEMAND CLASSES

- Sectors
  - Residential
  - Commercial
  - Industrial
  - Transportation
- Fuels
  - Petroleum
  - Gas
  - Electric
  - Coal
  - Renewables

FIGURE II-3
NEW YORK STATE ENERGY DEMAND FACTORS

- Economic Change
- Availability of Each Fuel
- Price of Each Fuel
- End Use Regulations — Efficiency
- Renewable Resource Impact
- Government Actions Impact
  - Availability
  - Price

SECTION III

Policy Context

State energy planning cannot be conducted in a vacuum. Many events, issues,and institutions interact to form a framework for energy planning. Examination of the possibilities and constraints inherent in the ongoing interaction of these various factors is an important component of New York State's energy planning effo ts. This section will explore the five key elements constituting the context of the State Energy Master Plan and Long-Range Electric and Gas Report.

1. INTERNATIONAL CONTEXT

The world oil market is the focal point of international energy issues. The market is dominated by the member nations of the Organization of Petroleum Exporting Countries (OPEC), who collectively account for about 60 percent of worldwide crude oil production and currently supply about 26 million barrels/day to the world oil market. This consortium of countries, through close cooperation, has held effective control over world oil prices since the embargo of 1973 and has recently reached agreement on limiting production levels to accompany further price increases.

The multinational oil companies are also involved in the world oil market. These companies operate in some or all of the four sectors of the oil industry—production, refining, transportation, and marketing. Initially, the multinational oil companies owned the production facilities in most of the major oil-producing nations and made royalty payments to the host governments. But the production facilities in OPEC countries have largely been nationalized over the last decade. The major oil companies currently serve as the conduit for crude supplies and products into worldwide markets.

In Saudi Arabia, the largest OPEC oil supplier, these companies are more directly involved in oil production through their participation on ARAMCO, the Arabian-American Oil Company. Petromin, the Saudi national oil company, owns 60 percent of the Company's production assets, the remaining owned by Texaco, Mobil, Exxon, and Standard Oil of California. The Saudi government sets quarterly production ceilings and each company's allowed production levels are based on its percentage of total ARAMCO assets. Even with this degree of participation by the multinational oil companies, ultimate control over ARAMCO oil production is clearly in the hands of the Saudi Arabian government.

United States dependence on foreign oil results in dangerous vulnerability to disruptive fluctuations in prices and production levels. Tightening supplies generally bring greater reliance on the spot market, leading to yet higher prices for end-users. The threat of arbitrary limitations on supplies to the economic stability of oil-importing nations has spurred the creation of an international alliance as a political and economic counterforce to OPEC. The International Energy Alliance Agreement (IEA) was signed by 20 nations, including the United States, in 1975. The agreement provides that a 7 percent shortfall of petroleum supplies in any participating nation will activate measures by which the other countries will share their supplies with the affected country(ies), thus spreading the shortage equitably.

This situation was nearly reached early in 1979 when Iranian oil production stopped, reducing OPEC oil exports by about 4 million barrels/day (MMB/D) to a level of 25 MMB/D—or about 3 MMB/D less than demand for oil on the world market. Japan and West Germany had been particularly dependent on Iranian supplies, each relying on Iran for 19 percent of their total petroleum. Representatives from nations participating in the IEA met in late February, 1979, to discuss the implications of the supply shortage and the possibility of implementing the sharing mechanism. The group agreed to a 5 percent across-the-board reduction in oil consumption in each nation on an attempt to cut oil imports below OPEC's preferred export levels.

The cutoff of Iranian oil hit the U.S. hard. Oil from Iran accounted for approximately 500,000 barrels per day, or 3 percent of U.S. total daily consumption.

The supply shortfall traceable to the Iranian production shutdown has also hurt New York. The cutoff was initiated during the winter before refining capacity had been refocused on gasoline production for the summer driving season. Deepening shortages of crude supplies prevented refiners from operating at full capacity, delaying the normal first quarter shift to maximize gasoline output. As a result, an estimated 12 percent shortfall on available gasoline supplies for the State emerged during June 1979. An odd-even rationing system was implemented in the downstate area in mid-June in response to sharp cuts in dealer allocations.

The strictures the international oil situation places on energy planning in New York State are based on the role of oil in the State's fuel mix. In 1977, 66 percent of the State's total energy demand was met by oil, with approximately 70 percent of these supplies originating in foreign countries. Nearly one half of the oil used in the State is from OPEC sources. These percentages are significantly higher than for the nation as a whole, thus accounting for the disproportionate economic impact of recent OPEC actions on New York State. Besides placing the State in a position of uncertainty and vulnerability, this dependence constitutes a severe economic drain. In 1979, OPEC oil dependence cost the New York State economy $3.8 billion. Surcharges and price increases announced as of December, 1979, could add another $2 billion during 1980. Considering that in 1972, New Yorkers spent about $0.7 billion for OPEC oil, the constraints imposed by OPEC become clear. Consequently, a primary objective of the State's energy plan is to reduce the use of oil, particularly from OPEC sources.

The weapons available to deal with international issues of energy supply at the State level are necessarily limited. State planning must, therefore, take place within an international framework almost entirely beyond its direct scope of influence.

2. NATIONAL CONTEXT

The energy-related activities of the federal government also bear heavily on state planning efforts. State planning must be consistent with national objectives. To that extent, national policy can place significant constraints on state energy planning. At the same time, the states can participate in shaping national policies and objectives, increasing the likelihood that state and national planning efforts can complement and reinforce each other. Federal involvement in energy matters encompasses a number of broad policy areas. The major areas are discussed below.

A. Energy Pricing

To a large extent, recent national policy actions have focused on deregulation of controlled energy pricing systems.

1) Deregulation of Natural Gas

A major component of the National Energy Act of 1978 was the Natural Gas Policy Act. This act:

- extended price ceilings to sales of natural gas on the intrastate market;
- established a series of maximum lawful prices for various categories of natural gas, allowing for monthly inflation adjustments;
- set January 1, 1985, for lifting price controls on all new gas and certain categories of intrastate gas; and
- established a means to protect residential gas customers from sudden price increases by incremental pricing of higher cost gas supplies to industrial customers.

Primary responsibility for implementation of the Natural Gas Policy Act is vested in the Federal Energy Regulatory Commission (FERC).

As a net gas-consuming state, New York stands to benefit from the freeing of supplies to the interstate market following the elimination of regulatory distinctions between interstate and intrastate sales.

2) Decontrol of Domestic Crude Oil

On April 5, 1979, President Carter announced his decision to decontrol domestic crude oil prices over a period of 28 months beginning June 1, 1979. This action allows domestic oil prices to gradually escalate from the current controlled price, to world market levels by the end of the decontrol period. At the end of 1979, the controlled wellhead price averaged $14.06/BBL and the world market price, including surcharges, average about $27.26/BBL.

To ensure that domestic oil decontrol does not produce significant unearned profits for producers, Congressional conferees are preparing to enact the windfall profits tax which will tax producers $227 billion as domestic oil reaches the world price of crude oil. Portions of the proceeds of the windfall profits tax will be used to stimulate the production of new sources of energy including renewable and synthetic fuels, mitigate the impact of higher energy prices on low income consumers, generate additional federal dollars for mass transit projects, and stimulate increased energy conservation. The final funding amounts for each of these activities are presently being negotiated in the Senate and House Conference, final passage of the legislation is expected this Spring.

3) Regulation of Electric Rates

The Federal Energy Regulatory Commission (FERC) regulates wholesale electric rates, both within and between states. The Public Utility Regulatory Policies Act of 1978 extends federal involvement in this area with a number of provisions, including:

- requirements that state utility commissions determine the appropriateness of implementing a number of rate-making standards relating to cost of service, declining block rates, time of day pricing, lifeline rates, and others. The New York State Public Service Commission addressed many of these standards in a recent generic rate case. It intends to consider them further in the context of specific rate cases.
- granting authority to FERC to require interconnections of electric power transmission facilities between small power producers and electric utilities, and to order utilities to supply transmission services between two non-contiguous utilities;
- requirements that FERC develop rules covering non-discriminatory rate practices between regulated electric utilities and private cogenerators and small power producers.

B. Resource Use

Only the federal government has the capability and the authority to deal with the nation's natural resources as a unified, closely interrelated system. Each state has reliable access only to the resources located within its own borders. However, as in New York's case, other domestic resources may be integral components of state energy supply plans. Thus, federal actions in resource management have important implications for state-planning efforts.

1) Leasing of Federal Lands

The federal government owns a great deal of land that is periodically leased to energy producers to develop various energy resources including oil, natural gas, and coal. The federal Outer Continental Shelf (OCS) is an area potentially rich in natural gas and oil deposits. Recent revision of the statute that governs the OCS, the Outer Continental Shelf Lands Act Amendments of 1978, contains provisions for the active involvement of coastal states in the offshore oil and gas leasing and development process. It provides a mechanism for considering recommendations from the affected states, particularly in leasing schedules, lease sales, and development and production plans.

New York State borders two of the OCS frontier areas—the Baltimore Canyon and the Georges Bank. A significant oil and/or natural gas discovery in either area could reduce the State's dependence on foreign sources of fossil fuels.

2) Fuel Use

The Powerplant and Industrial Fuel Use Act of 1978 calls for greatly expanded federal involvement in fuel conversion. The Act prohibits the use of oil or natural gas in new electric generation facilities or new industrial boilers of greater than a certain fuel heat input rate. It also requires that coal-capable large boilers be converted to coal. It generally restricts the use of natural gas by existing powerplants and bans the use of natural gas in base-load or intermediateload generating plants beyond 1990. The Act shifts the responsibility for proving that conversion to coal from oil or natural gas is not feasible to the utility or industry wishing to burn such fuels. However, it does provide clear mechanisms for seeking exemptions and delays.

3) Environmental Standards

The impact of federal environmental regulations on State energy planning is exemplified by requirements in the 1977 amendments to the Clean Air Act. The amendments include strict standards (new source performance standards) to control emissions from fossil-fueled powerplants, and have been interpreted by U.S. EPA to require scrubbers for coal-burning plants. These standards will have a considerable effect on the cost of new coal plants and limit the type of coal that can be burned economically.

C. Taxes and Subsidies

The federal government administers many programs employing various financial mechanisms, such as tax credits, direct grants, and loans to expedite the development or use of energy supplies and technologies. The National Energy Act of 1978 contains a number of such programs, which fall into these four general categories:

- grant and loan programs and tax credits for improving conservation and fuel efficiency in residences and facilities of various types, such as low-income residences, and schools and hospitals;
- loan programs and tax credits for using solar technology for residential heating and cooling;
- tax incentives for stepped-up development of conventional and alternate energy sources, such as gasohol, geopressurized natural gas, and geothermal energy; and for industrial investment in alternative energy facilities, such as alternative fuel boilers and heat conservation and recycling equipment; and
- tax penalties on both producers and consumers for failure to meet certain automobile fuel efficiency standards and for investment in new oil or gas-fired boilers.

Federal involvement in energy policy and regulation has expanded rapidly in recent years and undoubtedly will continue to expand. To apply national goals most effectively to its own circumstances and objectives, State energy planning must use the framework that national policy provides.

3. STATE CONTEXT

New York State is involved in a number of energy-related activities that bear directly on the planning process. The State plays a role in every phase of the energy cycle, including production, transportation, and use.

A. Regulation of Public Utilities

The Public Service Commission (PSC) is the primary State agency charged with the responsibility for regulating natural gas and electric utility companies operating within the State.

The PSC regulates the natural gas utilities (comprised of 21 gas distribution companies in the State, 7 of which are combination gas and electric utilities) through ratemaking, approval of capital expenditures for supply projects, approval of load attachment plans, and siting approvals for major gas transmission lines. The New York State Consumer Protection Board and N.Y.S. Department of Law also participate in rate cases before the Public Service Commission.

The State Board on Electric Generation Siting and the Environment was created in 1972 to certify environmental compatibility and public need for major steam electric generating facilities.

The 1978 amendments to the Energy Law empowered the Energy Planning Board to determine projected long-range electric and gas demands for the State's electric and gas utilities. These projections will subsequently serve as the basis for determinations of the need for major new electric generation or major new gas and electric transmission facilities.

B. Environmental Programs

The Department of Environmental Conservation is responsible for establishing environmental standards, including air quality and water quality standards and the development of a State Implementation Plan to assure compliance with federal air quality standards. All energy facilities in the State must conform to these standards, as well as to federal standards. In addition, DEC is responsible for certifying onshore and offshore well drilling in New York State waters and siting liquefied natural gas (LNG) storage facilities. The Department has been involved in assessing the impact of natural gas drilling in Lake Erie.

DEC is responsible for administering the State Environmental Quality Review Act (SEQRA), which provides that environmental impact must be considered in such actions as public utility ratemaking.

C. Transportation

New York State pursues a number of activities to increase energy efficiency in all modes of transportation. The Department of Transportation is the primary State agency in this area and works jointly with other State agencies and the private sector. The primary energy-related responsibility of the Department of Transportation is to provide an efficient transportation system. New York State's lower than national average per capita consumption of transportation fuels is a reflection of the State's early development and subsequent maintenance of an extensive highway and mass transit system. Continuation and expansion of this energy-efficient transportation system is vital.

Specific transportation-related measures being implemented include right-turn-on-red at traffic signals, stricter enforcement of the 55 m.p.h. speed limit, vanpool demonstration and promotion, and transportation systems management. The New York State Energy Research and Development Authority (NYSERDA) is seeking funds for research and testing of new energy-saving transportation technologies under the Federal Electric and Hybrid Vehicle Act. The transportation sector presently accounts for 26 percent of the total energy and 40 percent of the petroleum supplies consumed in the State. It is therefore a prime target for State action.

D. Energy Conservation

The State Energy Conservation Plan, promulgated in 1977, commits the State to reducing annual energy use by 7 percent by the end of 1980. To this end a number of programs have been implemented and include:

- an energy conservation construction code that sets efficiency standards for new and renovated buildings;
- mandatory lighting standards for existing government buildings;
- appliance efficiency standards for new air conditioners and hot water heaters;
- residential audit services for homeowners and managers of multi-family housing, including workbooks and educational workshops throughout the State;
- an advisory service for industry, to help increase the energy efficiency of small- and medium-sized industries;
- technical assistance to help local governments implement conservation programs.

E. Energy Resource Development

The State is actively involved in developing and promoting energy resources that can reduce dependence on imported oil. The institutional framework for these efforts includes the State Energy Office (SEO) Bureau of Resource Development, the New York State Energy Research and Development Authority (NYSERDA), and the Power Authority of the State of New York (PASNY).

NYSERDA is the energy research and development arm of State government. Its focus is on developing technologies to enhance the State's energy supply situation and to improve energy use efficiency. The Authority actively seeks funding from larger research and development organizations, effectively multiplying the State's financial resources for energy research and development. NYSERDA cooperates closely

with SEO's Resource Development Bureau, which coordinates all energy development efforts in the State, including the deployment of existing economically viable technologies and the removal of institutional constraints on such deployment. The Bureau's major areas of involvement include the encouragement of renewable resources such as: large-scale wood utilization; small hydropower development; resource recovery; the use of cogeneration by industrial and institutional facilities; the development of in-state natural gas resources; and the encouragement of increased coal utilization. The Commissioner of the State Energy Office is also Chairman of NYSERDA, further ensuring the integration of R&D with State energy policy.

F. The Power Authority of the State of New York

The Power Authority of the State of New York is a public benefit corporation that finances, builds, and operates electric generation and transmission facilities. In 1978, Power Authority facilities generated nearly 30 percent of the total electricity in the State. The Power Authority was created in 1931 for the purpose of improving commerce and navigation on the St. Lawrence River and developing the River's hydroelectric power resources. Construction of the first power project there did not begin, however, until 1954 and was completed in 1959. In 1957 federal legislation permitted the Authority to develop hydroelectric generating facilities on the U.S. side of the Niagara River, and this project was completed in 1962. State legislation in 1968 permitted the Authority to develop nuclear and pumped storage facilities and, accordingly, the Blenheim-Gilboa Pumped Storage Plant and the Fitzpatrick Nuclear Power Plant were constructed. The Authority has also been given legislative authority to sell power to public customers in the downstate area as well as purchase generating facilities under construction by one of the State's privately owned utility companies. In 1978 the Authority was empowered by the legislature to participate in small hydro development activities. The authority also began importing Canadian hydropower, and began negotiations to obtain additional electric energy from Canada. In addition, it cancelled the proposed Cementon nuclear facility. Each of these acts illustrates PASNY's present substantial role in State electric planning.

4. REGIONAL CONTEXT

The regional framework for energy planning is itself a vehicle for cooperation among states with similar concerns and interests. The Northeastern states are linked by their dependence on imported oil and resulting high energy prices, which hurt the regional economy. The states share a mutual interest in curbing the region's dependence on energy imports and in redressing regional inequities which have developed in recent years. New York State is an active participant in two regional organizations involved in energy planning—the Coalition of Northeastern Governors (CONEG) and the Appalachian Regional Commission (ARC).

A. Coalition of Northeastern Governors

The Coalition of Northeastern Governors was organized by Governor Carey in 1976 to focus attention and efforts on problems common to the member states. The Coalition has pressed for reforms in federal funding policies to quicken the flow of federal funds to the region. In December, 1978, CONEG adopted the Northeast Economic Development Strategy, which emphasizes the need to broaden the region's economic base and make it more competitive with other regions in the nation. CONEG is working with the Federal Administration to implement the objectives of this strategy.

New York's Energy Commissioner is currently serving as Chairman of CONEG's Advisory Board Subcommittee on Energy Policy. This subcommittee has developed the concept of an Energy Corporation of the Northeast (ENCONO) as the agency to plan, expedite, and finance projects to reduce regional energy costs and increase energy supplies. With ENCONO as the funding mechanism, the Northeast, and New York State specifically, would develop its own sources of energy, thereby reducing the region's dependence on imported oil.

The Regional Energy Development Act of 1979 was introduced to Congress at the urging of the Coalition of Northeastern Governors to authorize the creation of ENCONO and similar regional approaches throughout the nation. Legislation authorizing New York State to become a member of ENCONO is now before the State legislature as well.

B. Appalachian Regional Commission

The Appalachian Regional Commission which Governor Carey currently chairs, is a federal-state governmental agency concerned with the economic, physical, and social development of the 13-state Appalachian region, which includes most of New York's Southern Tier. Energy matters are the responsibility of the Energy Policy Guidance Council.

The Council is responsible for evaluating project proposals submitted for funding by member states. The Council's primary objective is to encourage the development and use of resources indigenous to the region in a manner that coincides with the needs and circumstances of the region.

The regional framework allows energy planning to reflect both regional problems and opportunities. Its relatively loose and informal structure permits maximum flexibility and maintains state autonomy. To the extent that states within a region have specific concerns or policy disagreements, they may act independently, while maintaining the influence of the group on issues of common concern. Thus, the framework created for State planning by regional cooperation appears to be primarily one of increased opportunities, rather than constraints.

5. STATE ENERGY PROFILE

Various factors interact to form the energy profile for New York State. By examining the past and present patterns of consumption and supplies of energy in the State—including the sources, types and quantities of energy utilized, the end uses of that energy, and prices and availability of supplies—basic conclusions can be drawn to help chart energy policy directions for the State.

A. Trends in Energy Consumption

1) New York experienced (as shown in Figure III-1) a steady increase in energy consumption through the 1960's. However, events in the 1970's—first a major recession, then the Arab Embargo and resulting price increases—triggered periods of declining energy use. In fact, total energy consumption in 1978 approximated the level of 1970.

2) There are some exceptions to the generally stable level of energy consumption since 1970. Gasoline sales dropped 1.4 percent from 1970 to 1978, while electric requirements increased 19.5 percent.

3) As shown in Figures III-2, III-3 and III-4, major shifts in the consumption of energy by fuel type have occurred over the past two decades:

- a shift away from coal and a shift toward oil as a fuel for utilities and industrial boilers;
- increasing use of nuclear and hydro energy to produce electricity;
- a shift to a greater proportion of oil use by New Yorkers as residual oil consumption increased.

4) A shift in consumption of energy by sector has occurrred (as shown in Figures III-5 and III-6):

- the relative amount of energy consumed to generate electricity has increased as electricity has played a larger role in energy supply;
- industrial energy consumption has dropped as manufacturing levels in the State declined;
- relative consumption in the residential-commercial sector remained stable.

B. Energy Consumption by Sector

1) The profile of energy consumption by sector in New York State differs significantly from the U.S. profile (as shown in Figure III-7):

- more of New York's energy is consumed by the residential sector (21.1 percent vs. 12.3 percent);
- more energy is also consumed by the commercial sector (13.1 percent vs. 6.4 percent);
- less energy is consumed by the industrial sector (9.5 percent vs. 20.0 percent).

2) Figure III-8 illustrates in detail energy consumption by end use in each sector:

- space heating, a very weather-sensitive end use, accounts for 73.7 percent of residential and 76.2 percent of commercial use;
- hot water heating is significant, accounting for 13.9 percent of residual use and 9.3 percent of commercial use;
- industrial energy consumption varies significantly by specific industry. Four basic energy-consuming industries—primary metals, chemicals, paper and allied products, and stone, clay, and glass—account for 50 percent of total industrial energy consumption;
- the automobile accounts for 64.6 percent of total energy consumption for transportation.

C. Fuel Mix

1) The New York State primary fuel profile differs significantly from the U.S. fuel profile (Figure III-9):

- New York's consumption of coal is limited (8.5 percent vs. 20.0 percent);
- New York's relative consumption of natural gas is far below that of the nation (14.2 percent vs. 26.4 percent);
- New York's petroleum consumption is significantly greater than that of the nation (65.3 percent vs. 46.3 percent);
- the State is a relatively large user of hydro and nuclear energy (6.6 percent vs. 3.4 percent and 5.4 percent vs. 3.9 percent).

2) As shown in Figure III-10, New York's petroleum consumption profile differs markedly from the nation's as a whole:

- relatively more residual oil consumption in New York (37.6 percent vs. 22.6 percent), most of which is imported (94 percent);
- relatively less gasoline consumption than the nation (28.7 percent vs. 45.2 percent).

3) Figure III-11 shows that New York State's consumption of energy in the generation of electricity differs significantly from the national profile:

- much less coal (14.6 percent vs. 45.5 percent);
- more nuclear and hydro (17.7 percent vs. 11.7 percent and 21.9 percent vs. 10.3 percent).

D. Fuel Mix by Sector

1) The diagram of New York State's energy flows (Figure III-12) depicts the complex relationship between the primary fuel mix and end use sectors:

- electric generation is the single greatest consumer of primary energy resources;
- more energy is lost in conversion to electricity—transmission and conversion to mechanical energy—than is used by the final end user;
- petroleum is used extensively in all sectors.

2) The end use profile of major fuels is depicted in Figure III-13. The variation between fuels is significant:

- the dominant (42.5 percent) use for electric energy is lighting and small appliances, not space heating or cooling;
- residential and commercial end uses dominate the use of electricity (61.3 percent);
- residential space heating is by far (42.4 percent) the dominant end use for gas;
- residential and commercial space heat end uses combined consume more petroleum than either automobile transportation or electric generation.

3) Weather-based variations in end use patterns cause a significant seasonal variation in consumption of some fuels, as shown in Figures III-14a and III-14b:

- gasoline consumption peaks in the summer; home heating oil consumption peaks in the winter;
- gas demand peaks in the winter due to space heating demands; electricity peaks in the summer, due primarily to air conditioning.

E. Per Capita Consumption

1) As shown in Figure III-15, New York's overall per capita consumption of energy is about 3/4 that of the nation, demonstrating that New Yorkers are not prolific consumers of energy despite New York's climate. However, its per capita use of energy is higher in the residential and commercial sectors.

2) New York's low per capita energy use is due to both the transportation and industrial sectors being significantly below the national average. The highly urban settlement pattern and related efficient transportation system cause New York's per capita consumption of gasoline to be about 2/3 of the national average.

F. Sources of Supply

1) As shown in Figures III-16 and III-17, New York State is more dependent on imported petroleum than is the nation as a whole. In the entire country, only New England is more dependent on imported petroleum than New York.

2) As Figure III-18 shows, New York State is primarily dependent on Louisiana for natural gas (73 percent); New York's own gas wells supply a very small share (2 percent).

3) As shown in Figure III-19, New York imports over 70 percent of its coal from Pennsylvania—and all from the

Appalachian region. Western coal is not used at the present time in New York State.

G. Prices

1) The price of energy in general and the price of specific sources has increased over the past 18 years:

- imported crude oil has increased 747 percent in price since 1960, as compared to a consumer price index increase of 120 percent;
- natural gas prices have increased 111 percent since 1960, mostly in the '70's;
- electricity prices have increased 109 percent since 1960 mostly in the '70's
- gasoline prices have increased 133 percent since 1960.

2) There is a considerable variation in electric prices throughout New York State (Figure III-21). The highest prices are in the New York City area, the lowest in upstate areas.

3) As shown in Figures III-22, 23, and 24, New York City has considerably higher (75 percent, 71 percent, and 104 percent) electric prices for residential, commercial and industrial customers than the national average. Electric prices in upstate metropolitan areas are more competitive.

6. CONCLUSIONS

Several conclusions can be drawn from New York's energy trends and profiles:

- Energy consumption is strongly related to the level of economic activity; as the State's economy has grown or contracted, so has the State's energy consumption. Therefore, a strong expansion of the State's economy will require supporting energy growth.
- New York over the past two decades had become dependent upon petroleum for 2/3 of its energy needs—a most dangerous trend considering the loss of Western control over petroleum prices and supplies. Continuation of such dependence is unthinkable.
- Electricity, produced primarily from residual oil, has been steadily increasing as an energy source for the State. Considering recent OPEC price hikes and availability problems, this is a most alarming trend that must be dampened by energy conservation.
- New York's energy consumption is atypically concentrated in the residential and commercial sectors. Thus, New York State energy conservation effort must emphasize buildings—their insulation levels, boiler or furnace efficiencies, HVAC systems, and lighting levels.
- The dominant form of New York electric consumption is lighting and appliances, not space heating and air conditioning. Therefore, electric energy conservation must include more efficient lighting and appliances. Action toward that end is underway at present in New York State; much more needs to be done.
- Residential and commercial space heating and air conditioning, while not major electric energy end users, do contribute significantly to electric peak demand. Therefore, they must be targeted for conservation actions to reduce electric peak demand.
- The State's industrial energy consumption is considerably lower than the national average, primarily because of relatively limited manufacturing activity. Yet, New York does have considerable activity in four energy-intensive industries (State ranking by energy consumption is in parentheses): Chemicals (2), Stone, Clay, and Glass (4), Primary Metals (1) and Paper and Allied Products (3) (which rank 2, 3, 4, and 5 nationally). Therefore, the ability of New York's industries to reduce energy consumption via energy conservation is significant and must be addressed by State and federal programs.
- New York's current energy mix has placed the State in a difficult economic situation in the 1970's because of the heavy reliance on imported petroleum; government action is necessary to alter this energy mix.
- Most of New York's petroleum supplies do not come from secure regions of the world. New York should be in the forefront of any move to diversify national sources of petroleum supplies and to develop strategic petroleum reserves.
- Electric generation, as the single largest consumer of primary energy in New York and consuming 17 percent of the nation's residual oil used for electric generation, should start developing a more diverse fuel mix. The only significant change possible in the next few years would be to replace oil with coal as a fuel via a series of plant conversions.
- Seasonal variations in energy consumption are an extremely important factor in system planning and operation. Gas storage and electric system peaking requirements greatly complicate the design of both gas and electric systems; thus, the need to alter peak demand by load management, energy storage, and other means is important.
- Considering current coal shipment patterns, New York and Appalachia should have a natural partnership in the development of coal resources and their use in New York. New financial institutions to promote such a partnership are necessary.
- New York's low supply and consumption of natural gas as compared to the nation as a whole, resulting in part from the curtailments of the '70's, has been a significant disincentive for economic development. A major objective of New York's energy policy must be to expand access to its gas supplies, thus, reducing its dependence on imported petroleum products and promoting natural gas based industrial development.

The data, relationships, and conclusions presented in this energy profile are a general summary of the State's current energy situation. An understanding of the current energy demand and supply picture, its relationship and trends, is vital both in forecasting the future and devising a strategy to improve upon that future by government actions.

FIGURE III-1

**TRENDS IN TOTAL ENERGY CONSUMPTION,
TOTAL STATE EMPLOYMENT AND WORLD OIL PRICES
NEW YORK STATE, 1960-1978 (ESTIMATED)**

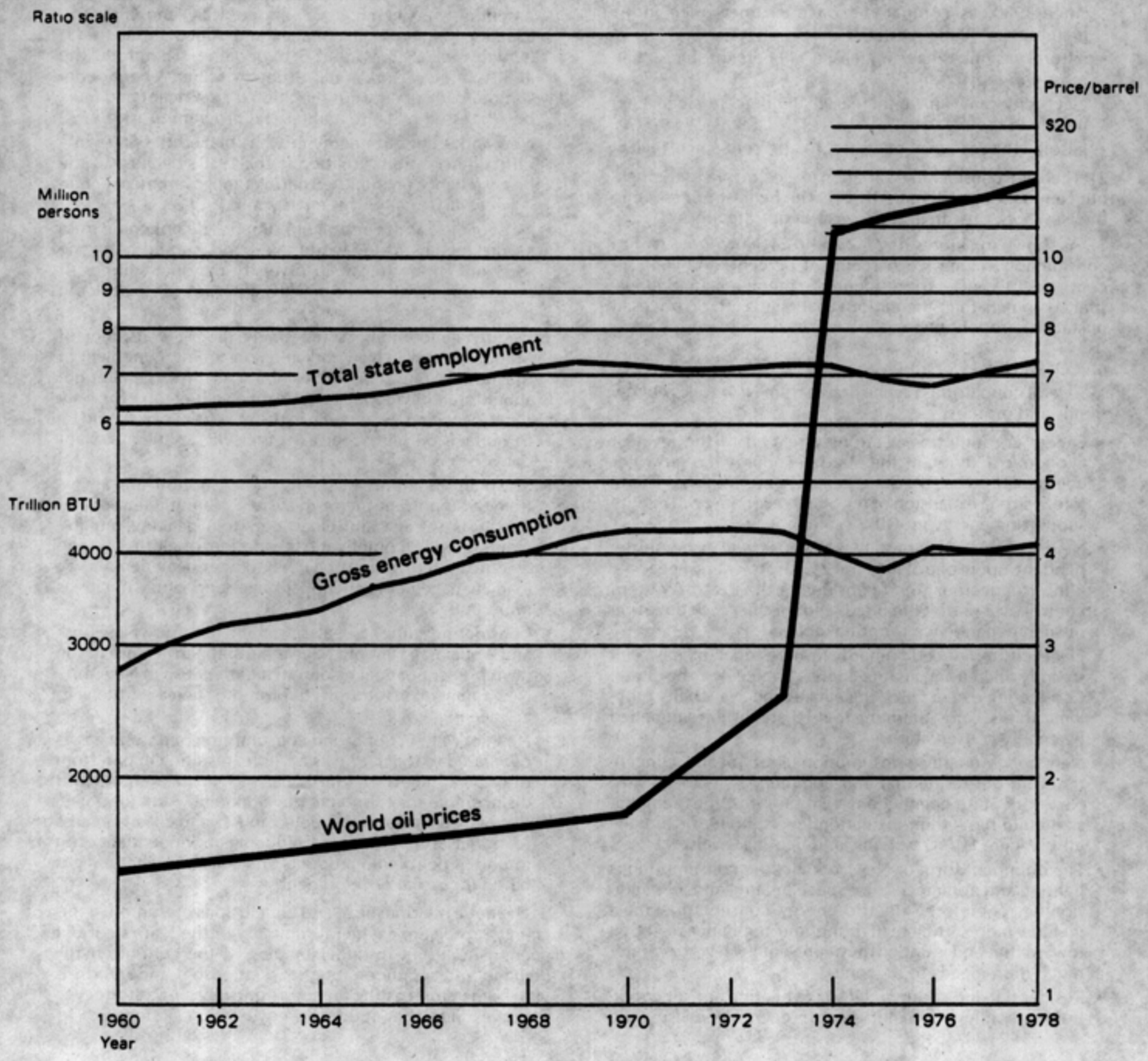


FIGURE III-2
PRIMARY SOURCES OF ENERGY BY PERCENT
NEW YORK STATE, 1960 AND 1978

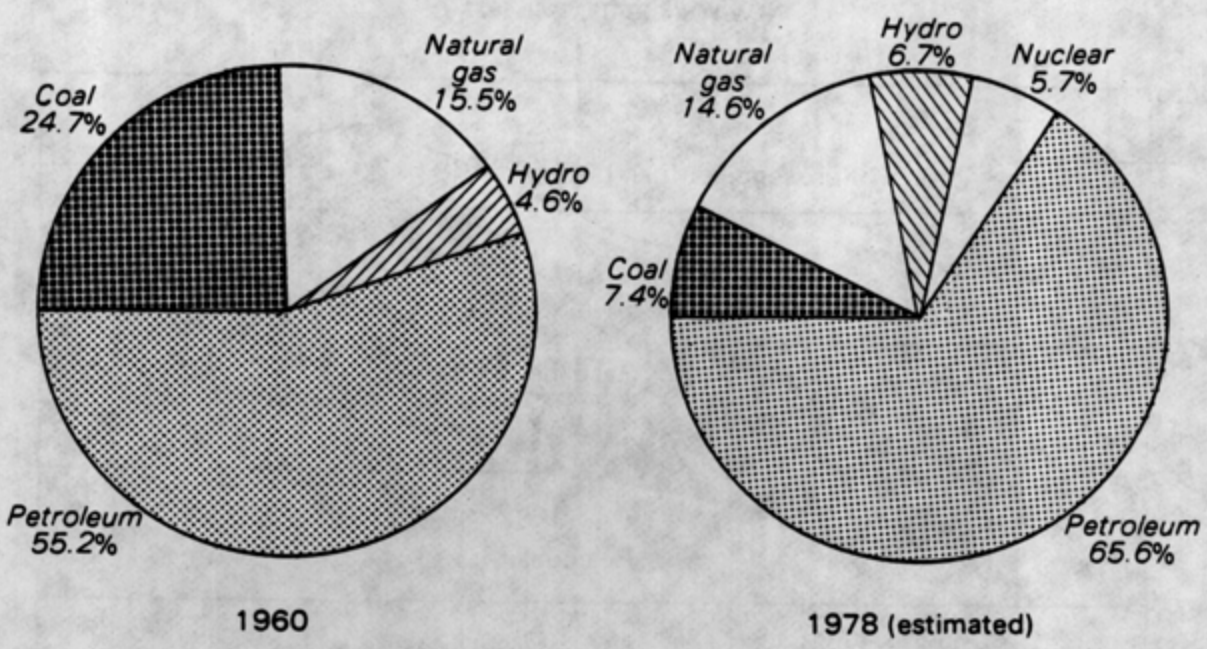


FIGURE III-3
PRIMARY ENERGY RESOURCES CONSUMPTION
BY FUEL TYPE
NEW YORK STATE, 1960-1977

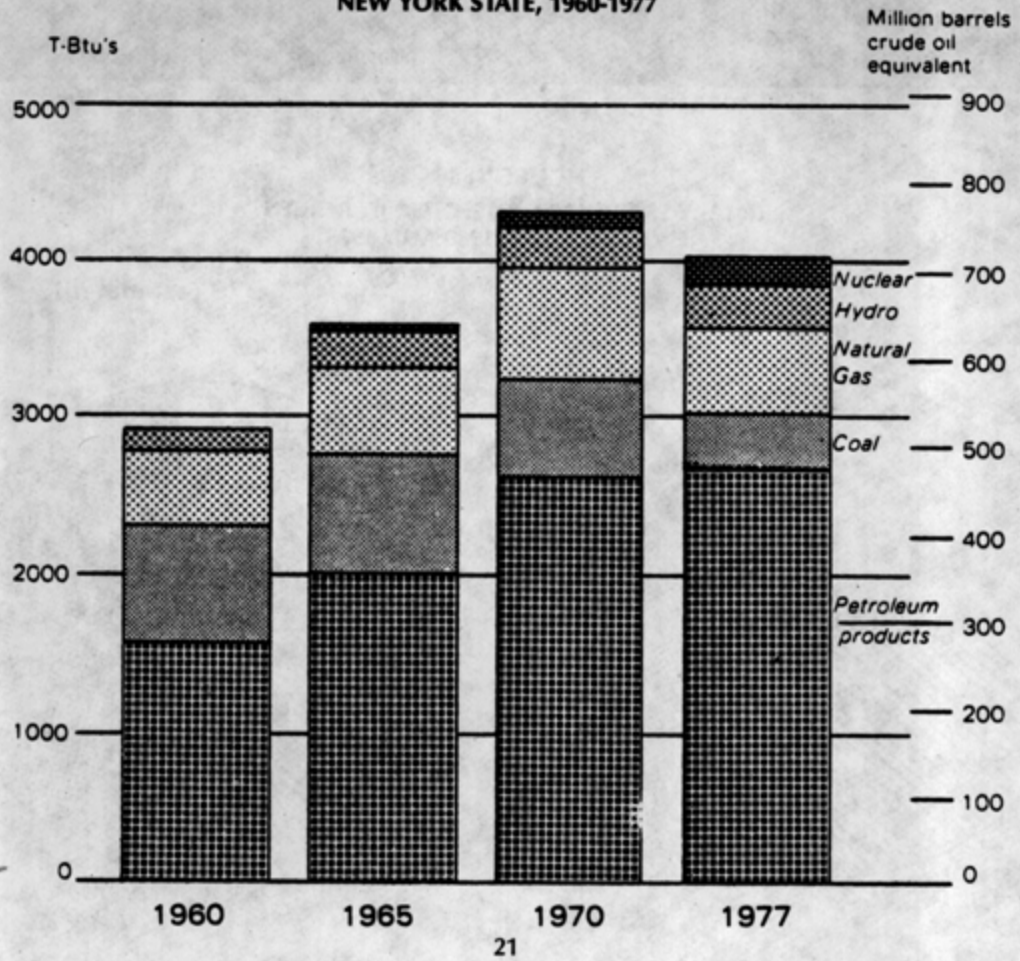


FIGURE III-4
ENERGY CONSUMPTION BY REFINED PETROLEUM PRODUCTS NEW YORK STATE, 1960-1977

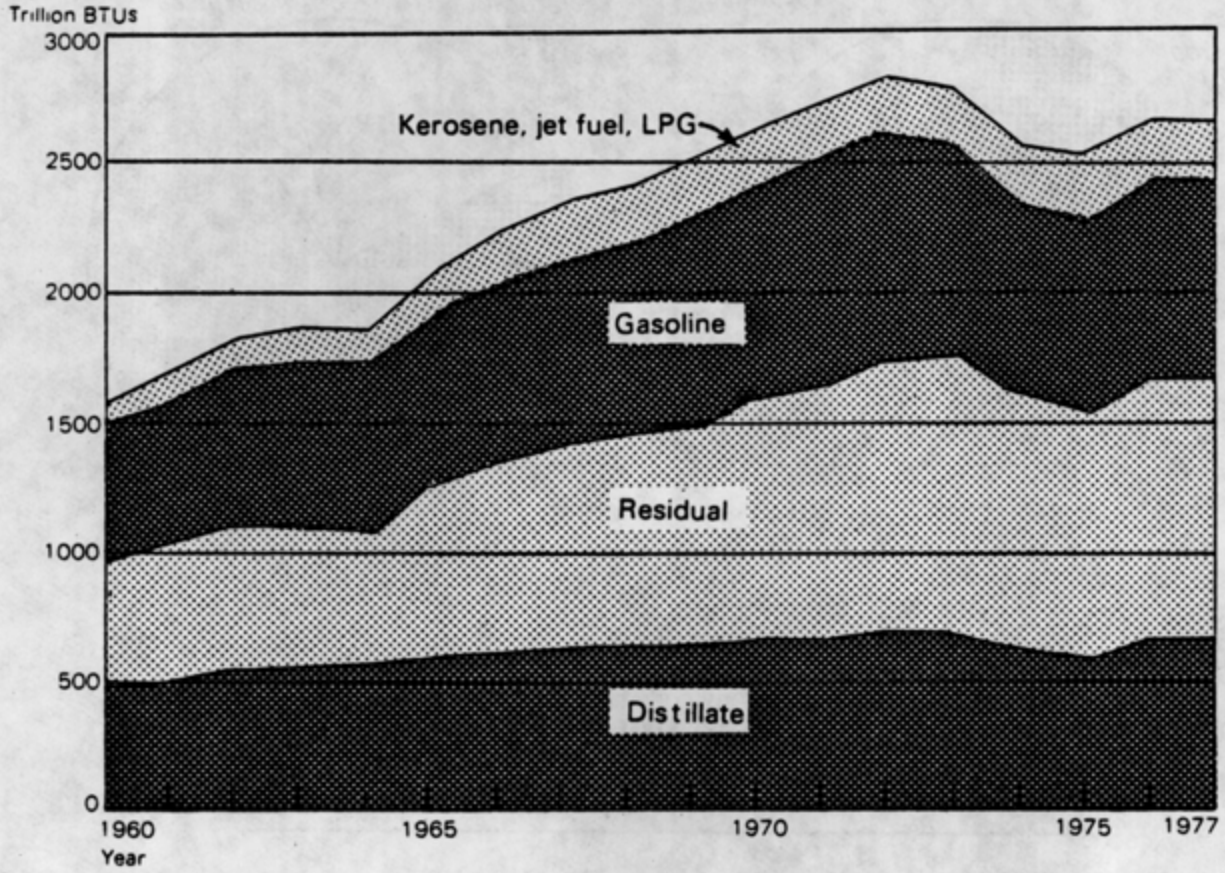


FIGURE III-5
PRIMARY ENERGY USE BY SECTOR BY PERCENT NEW YORK STATE, 1960 AND 1978

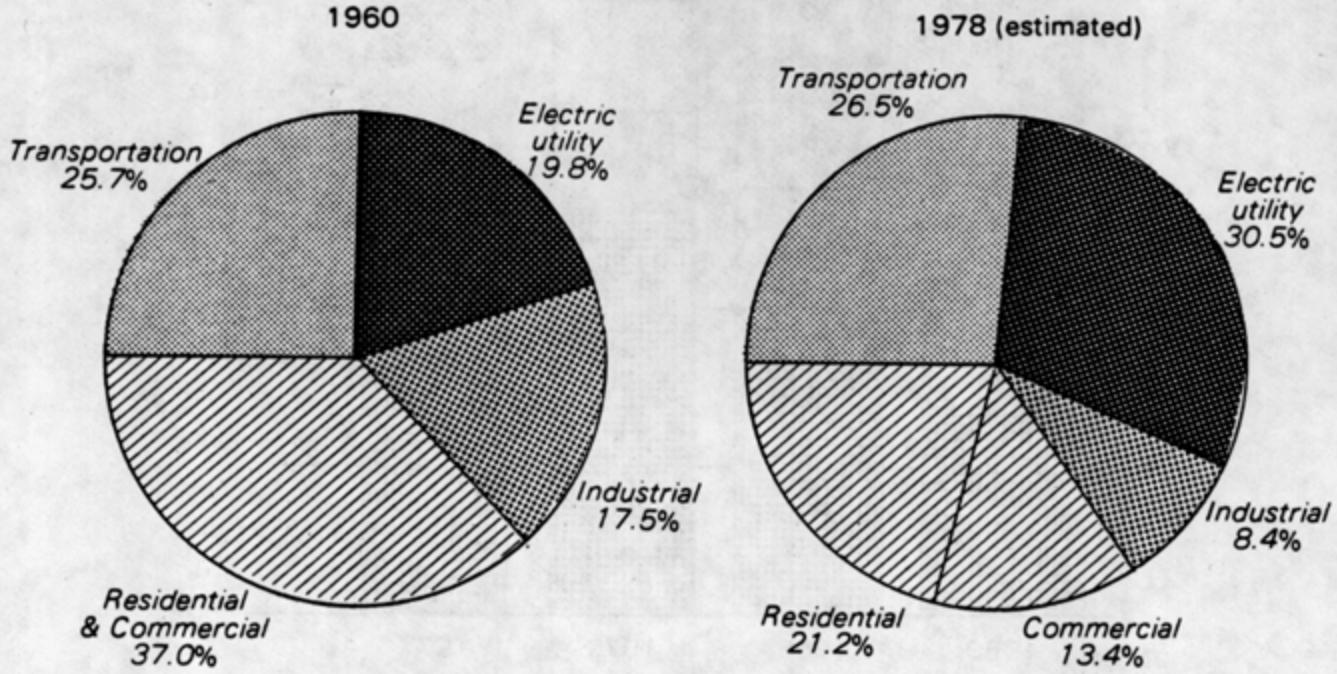


FIGURE III-6
PRIMARY ENERGY RESOURCES CONSUMPTION
BY SECTOR
NEW YORK STATE, 1960-1977

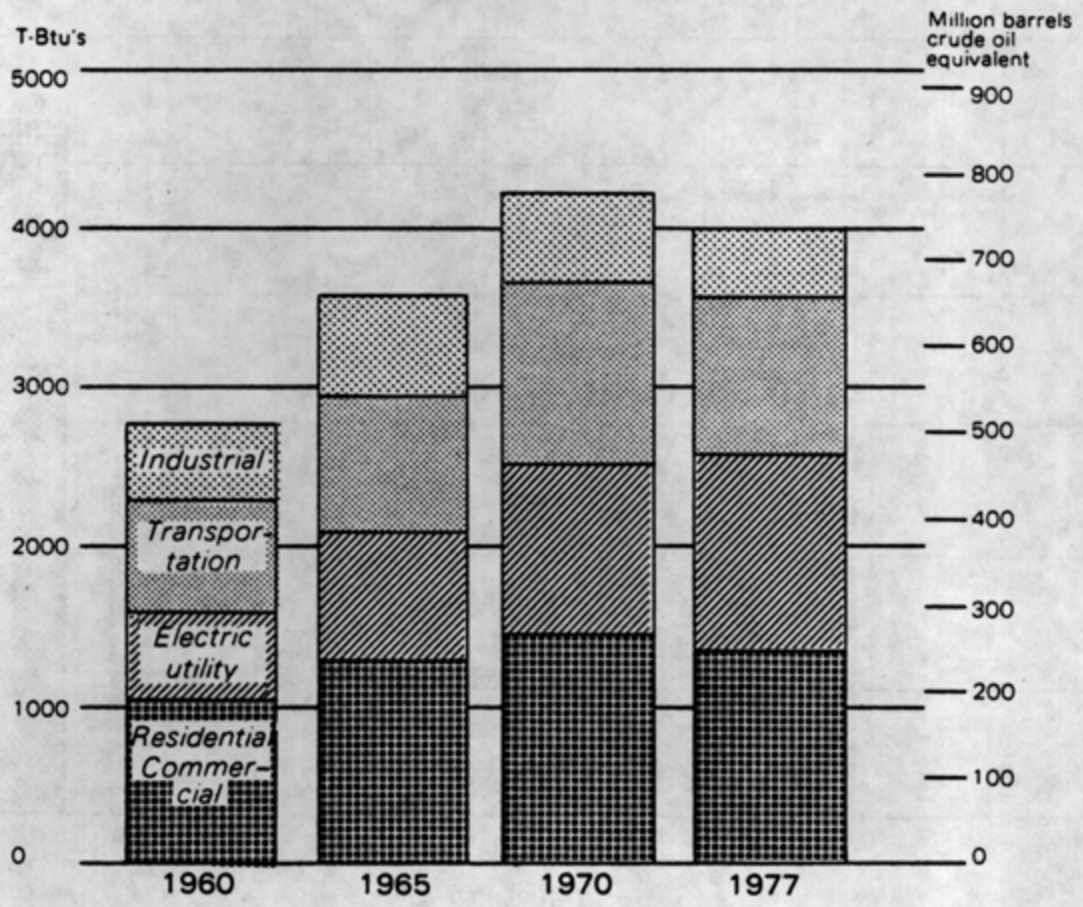
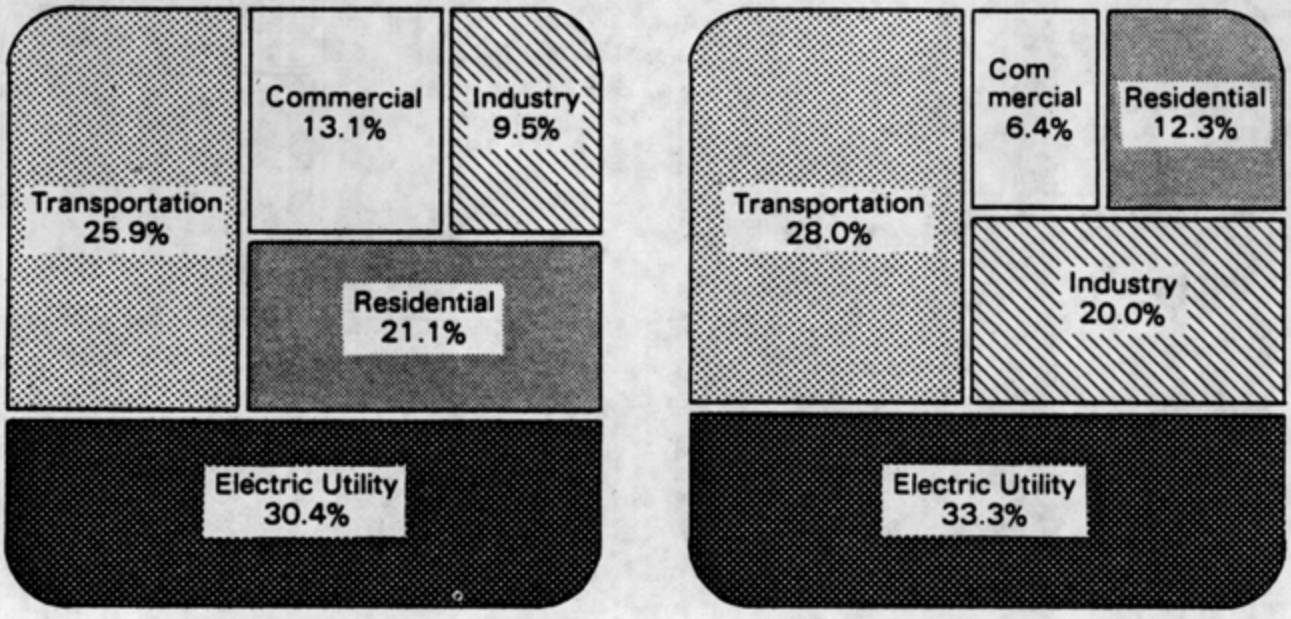


FIGURE III-7
PRIMARY ENERGY USE BY SECTOR BY PERCENT
NEW YORK STATE AND UNITED STATES, 1977



New York State

United States

FIGURE III-8
END USE CONSUMPTION DETAIL
NEW YORK STATE, 1977

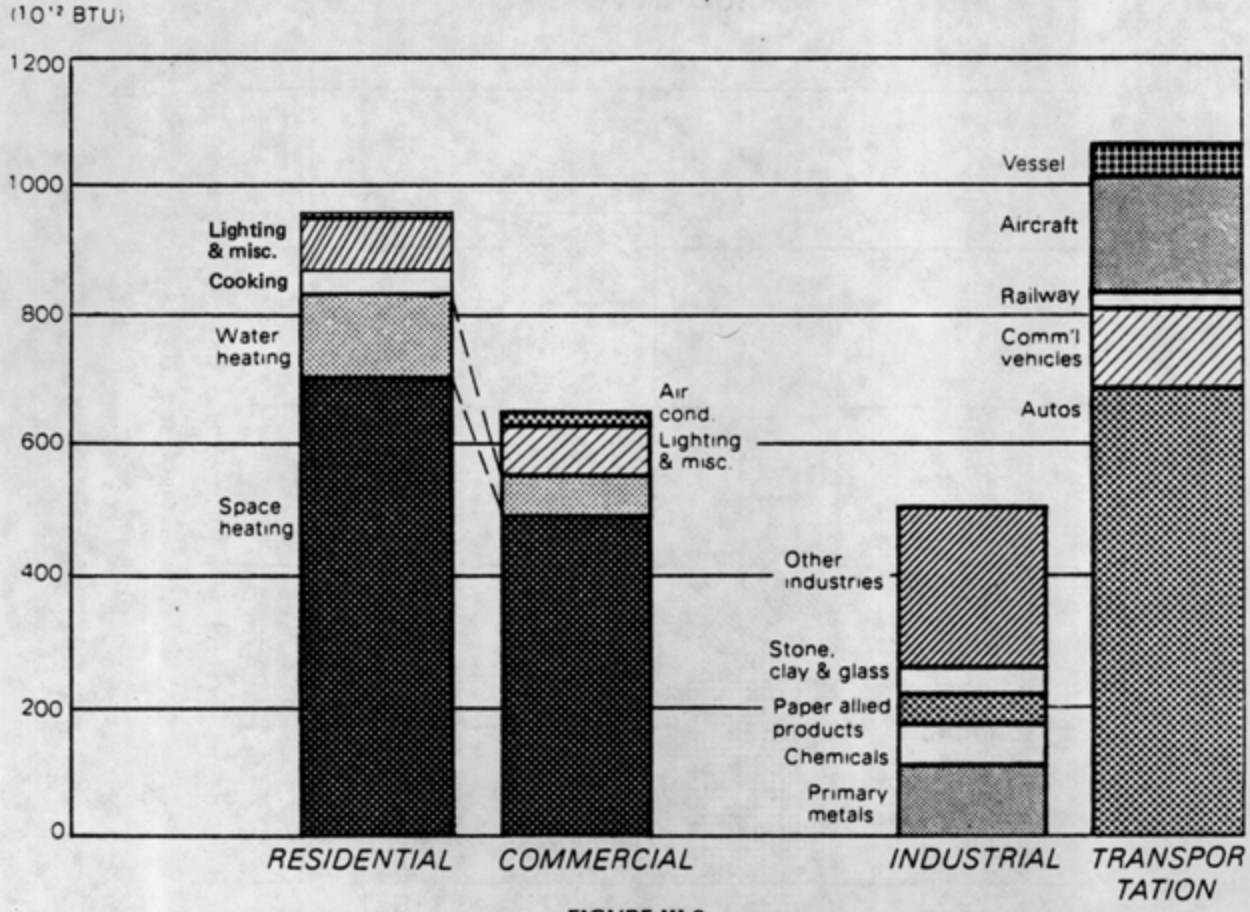


FIGURE III-9
PRIMARY SOURCES OF ENERGY BY PERCENT
NEW YORK STATE AND UNITED STATES, 1977

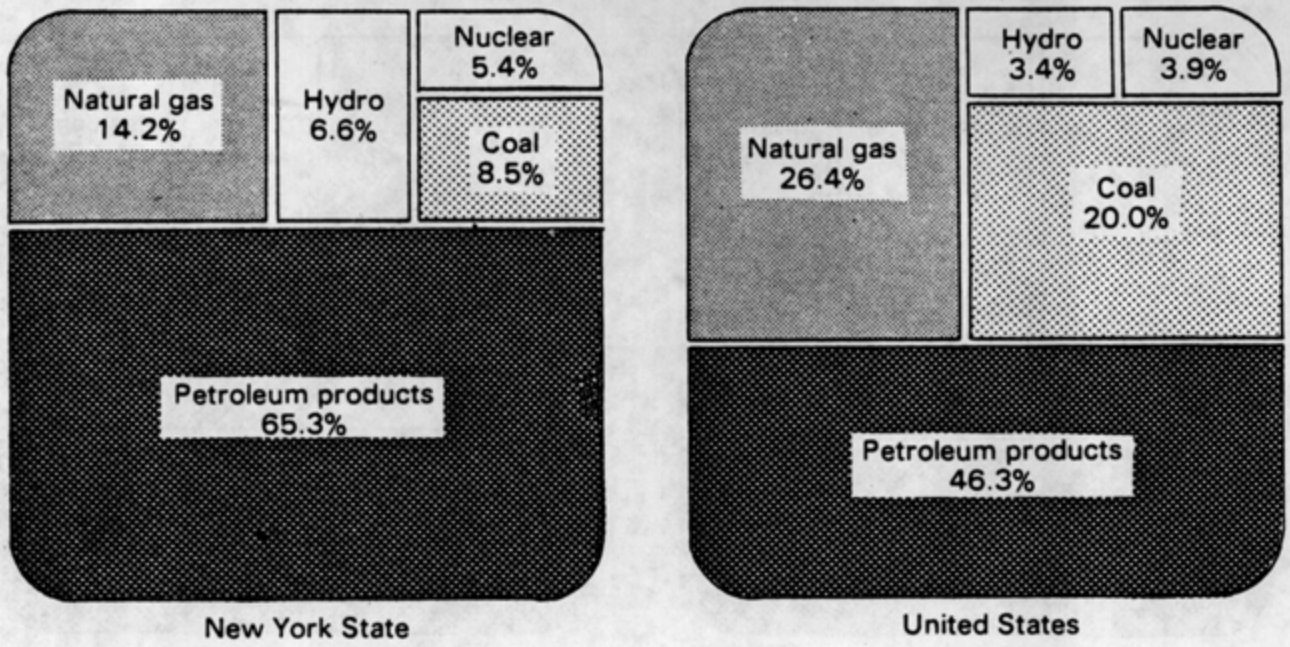


FIGURE III-10

PETROLEUM CONSUMPTION BY PRODUCT AND SOURCE OF SUPPLY NEW YORK STATE AND UNITED STATES, 1977

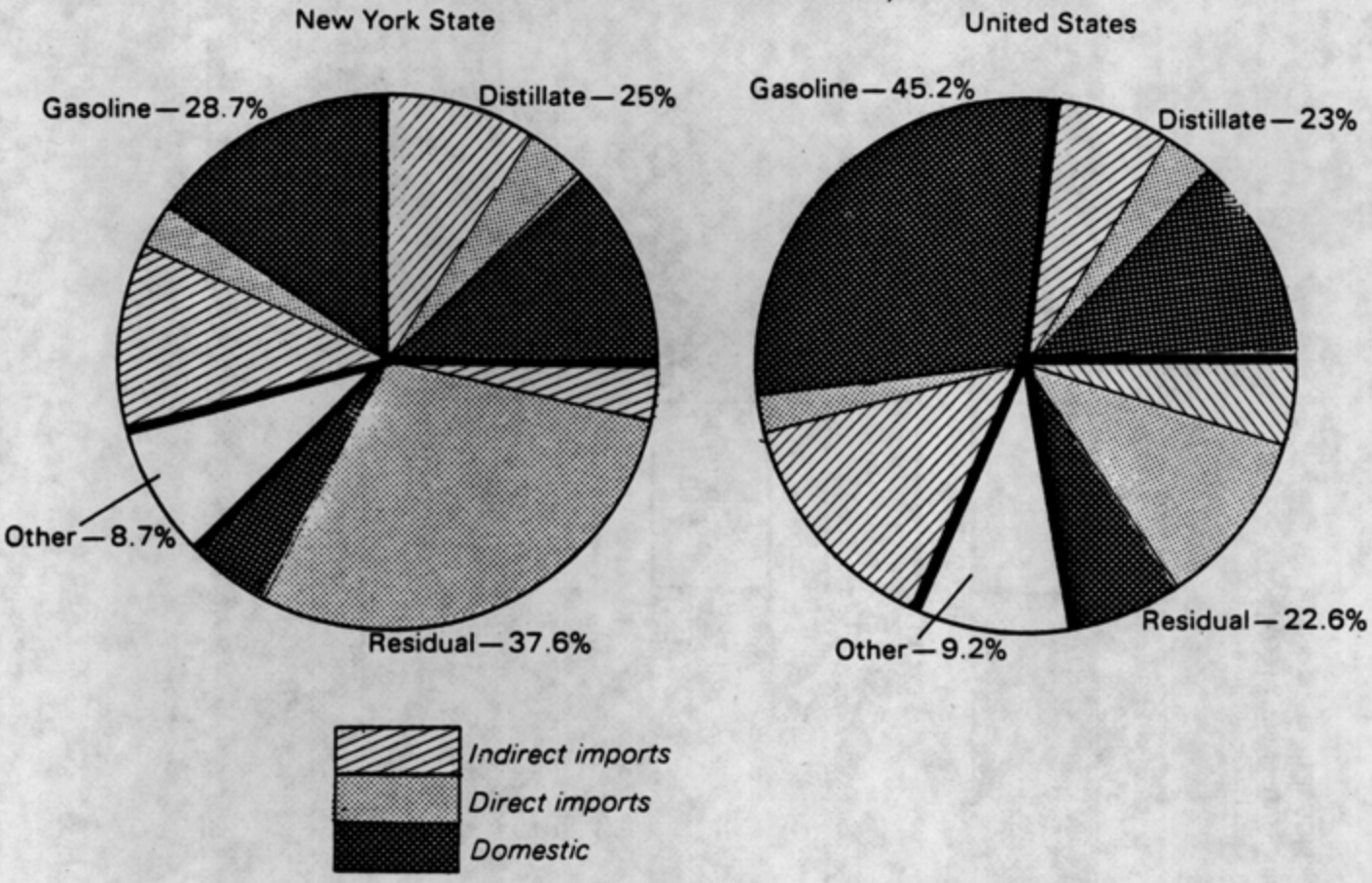


FIGURE III-11

CONSUMPTION OF ENERGY IN THE ELECTRIC GENERATION SECTOR NEW YORK STATE AND UNITED STATES, 1977

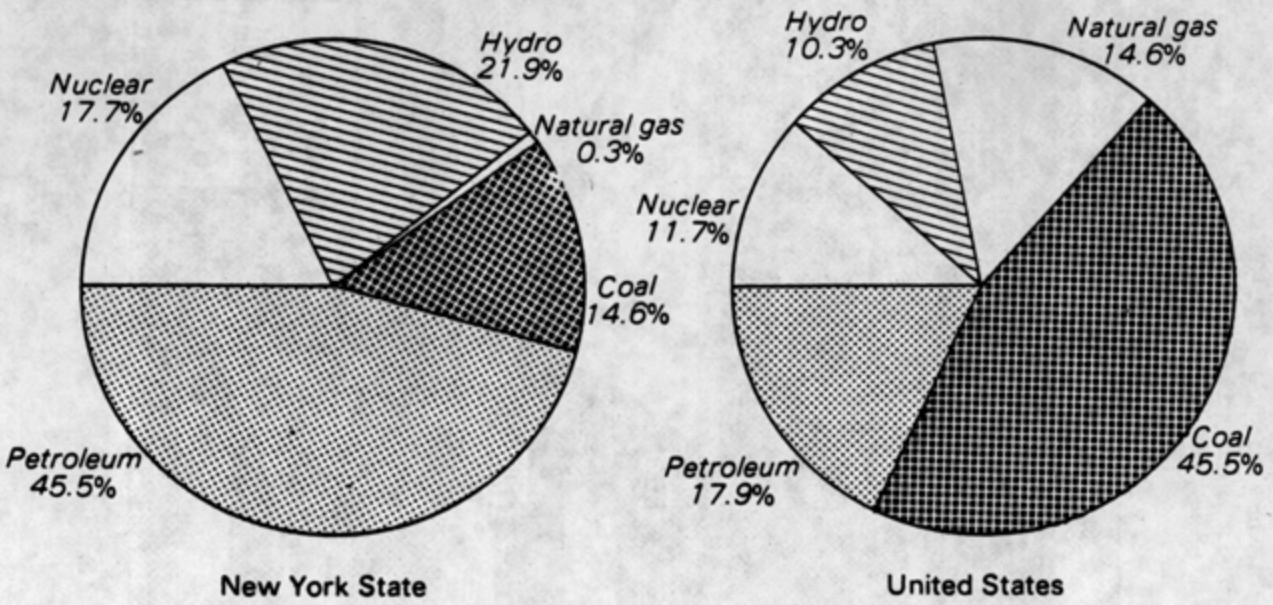


FIGURE III-12
NEW YORK STATE ENERGY FLOWS
1977
T-Btu's

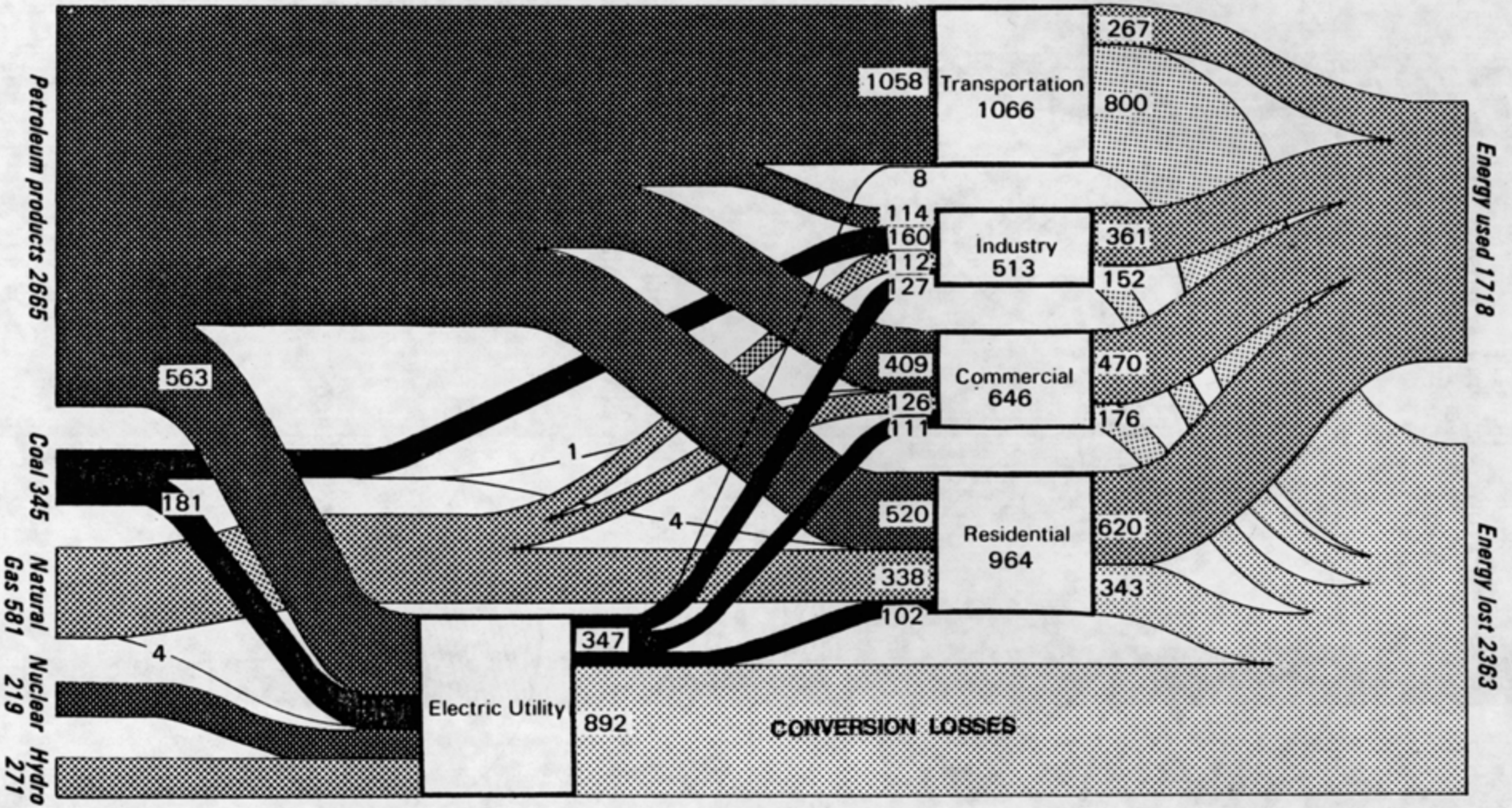


FIGURE III-13
FUEL USE BY END USE
NEW YORK STATE, 1977

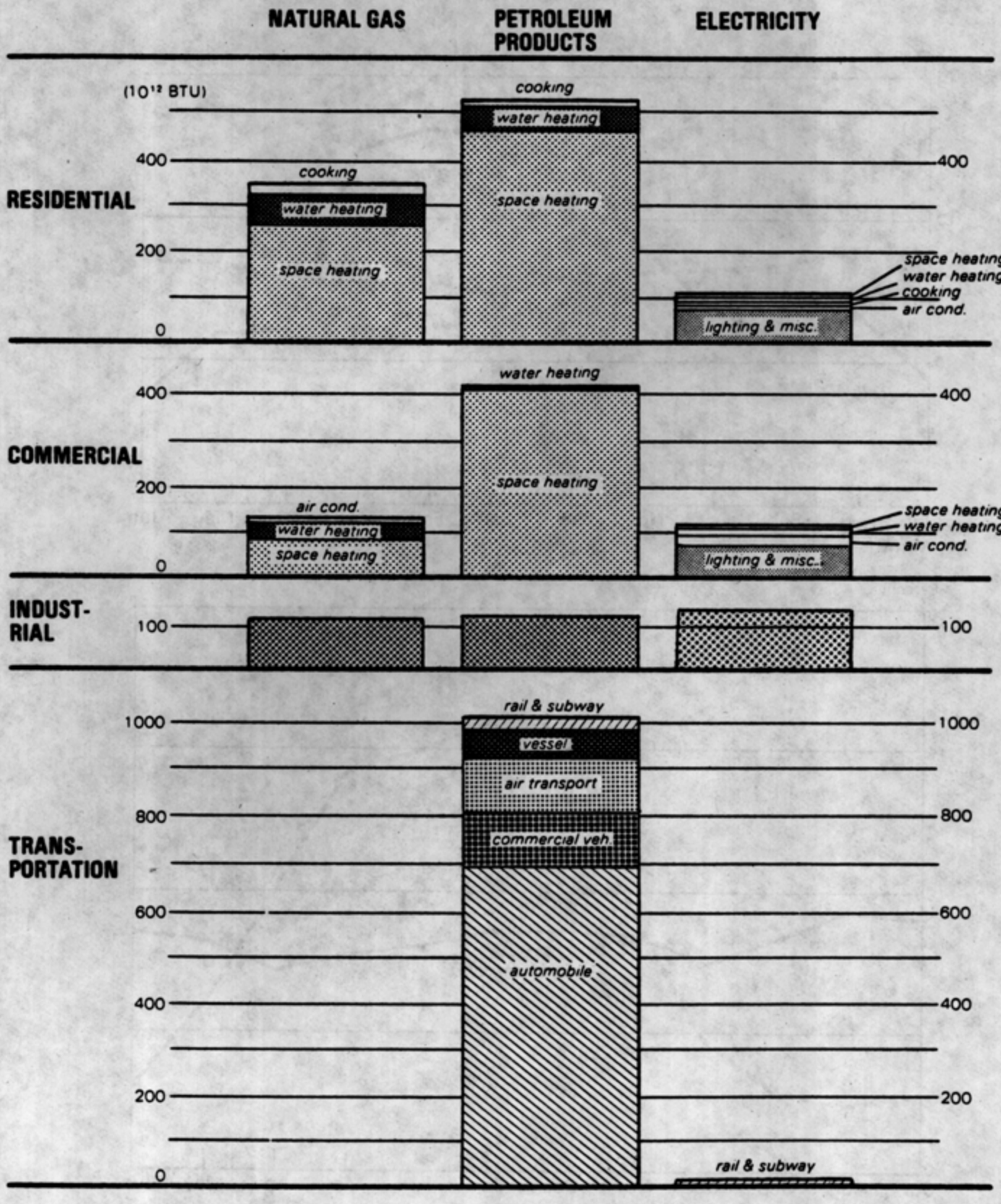
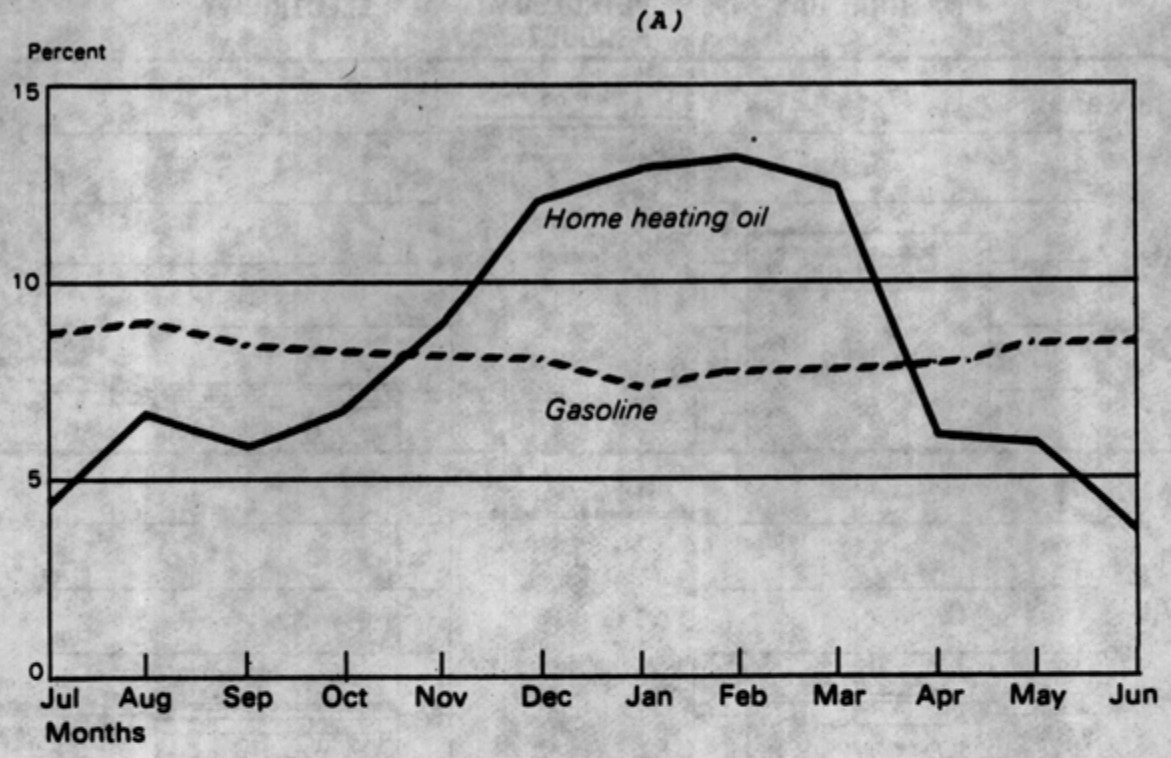


FIGURE III-14

MONTHLY VARIATION IN GASOLINE AND HOME HEATING OIL, IN NATURAL GAS AND ELECTRIC DEMAND NEW YORK STATE, 1978



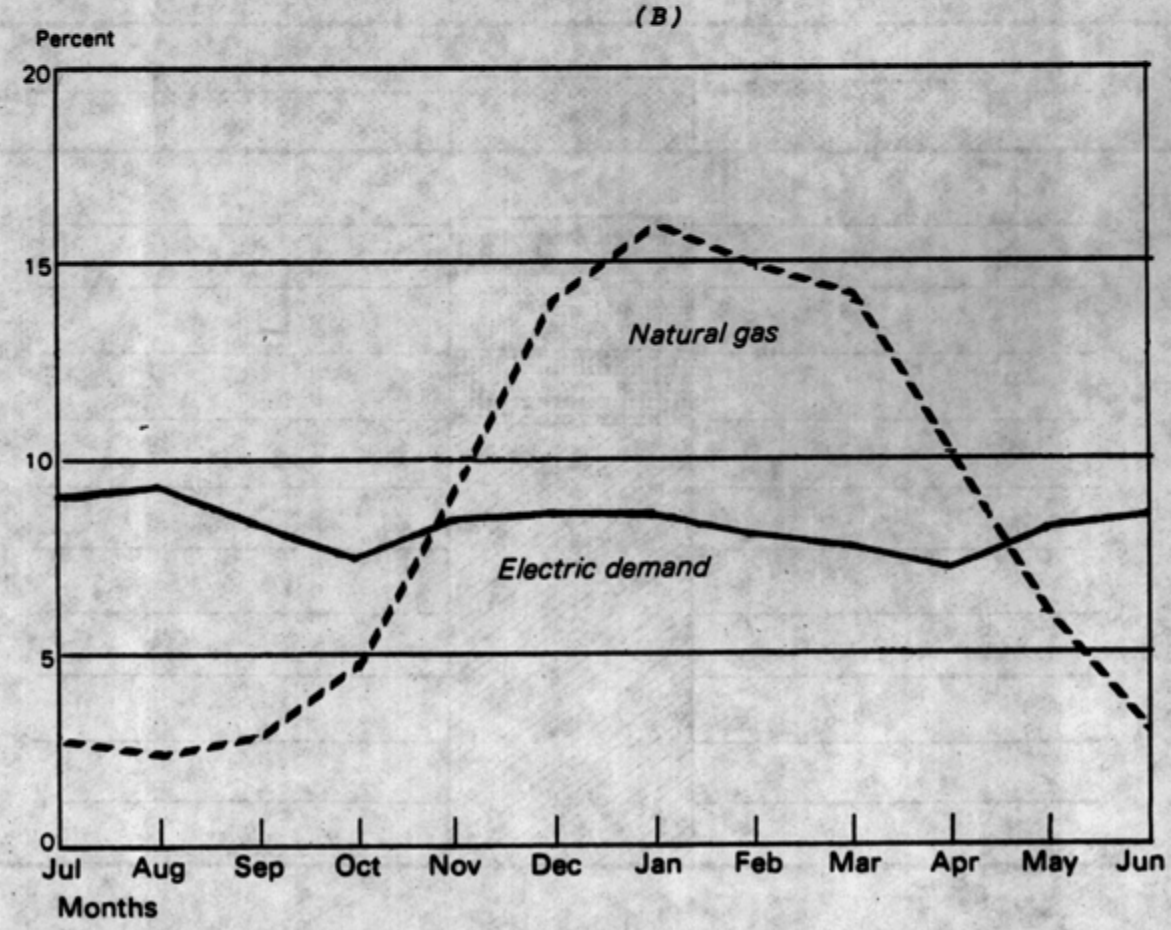


FIGURE III-15
PER CAPITA PRIMARY ENERGY CONSUMPTION BY SECTOR
NEW YORK STATE AND UNITED STATES, 1977

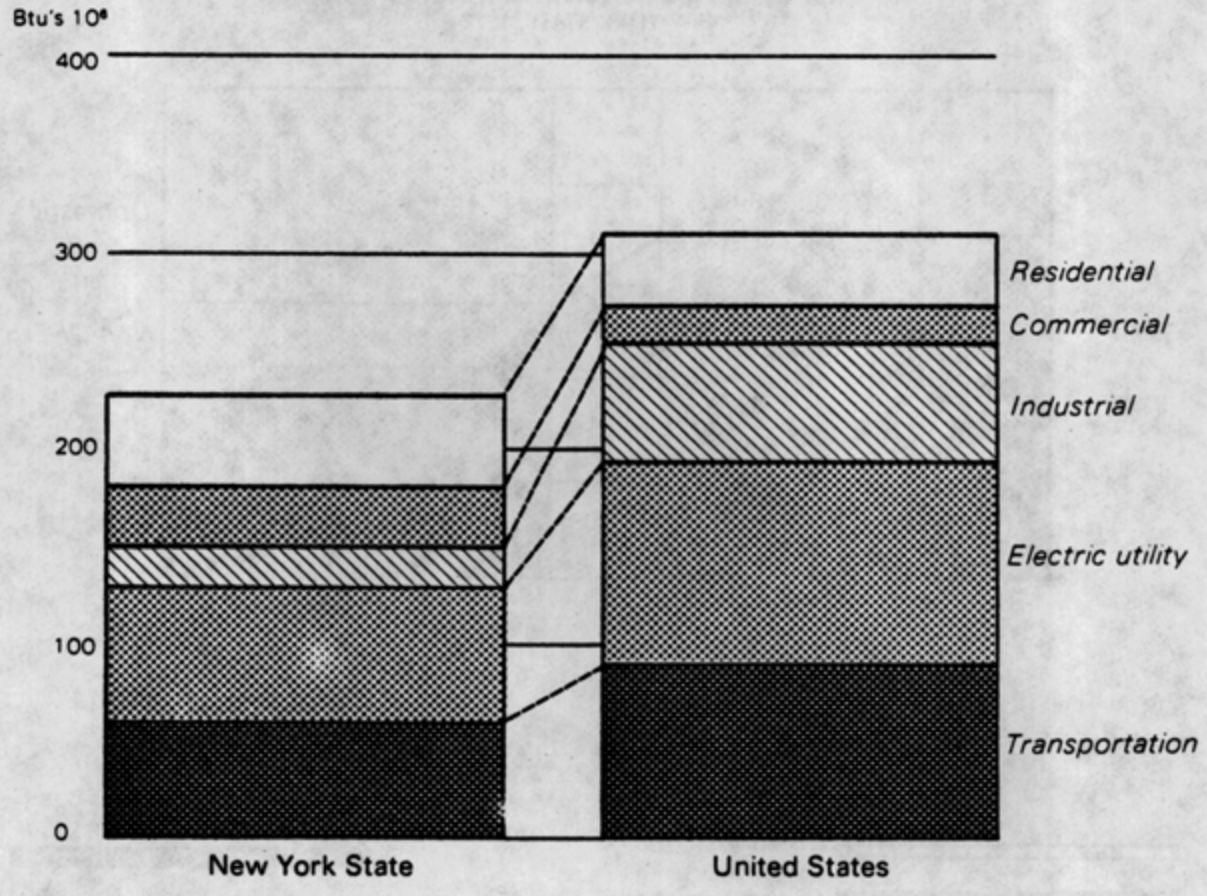


FIGURE III-16
SOURCES OF PETROLEUM CONSUMED
IN NEW YORK STATE AND UNITED STATES, 1977

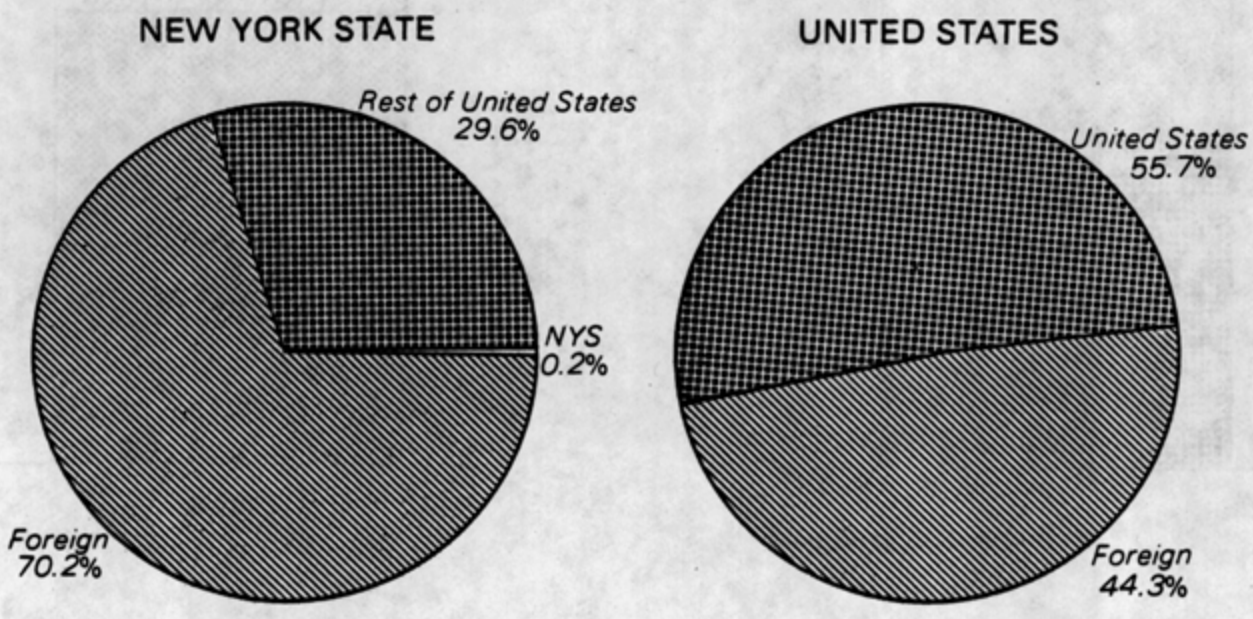


FIGURE III-17
SOURCES OF TOTAL PETROLEUM PRODUCTS AND GASOLINE BY COUNTRY OF ORIGIN NEW YORK STATE, 1977

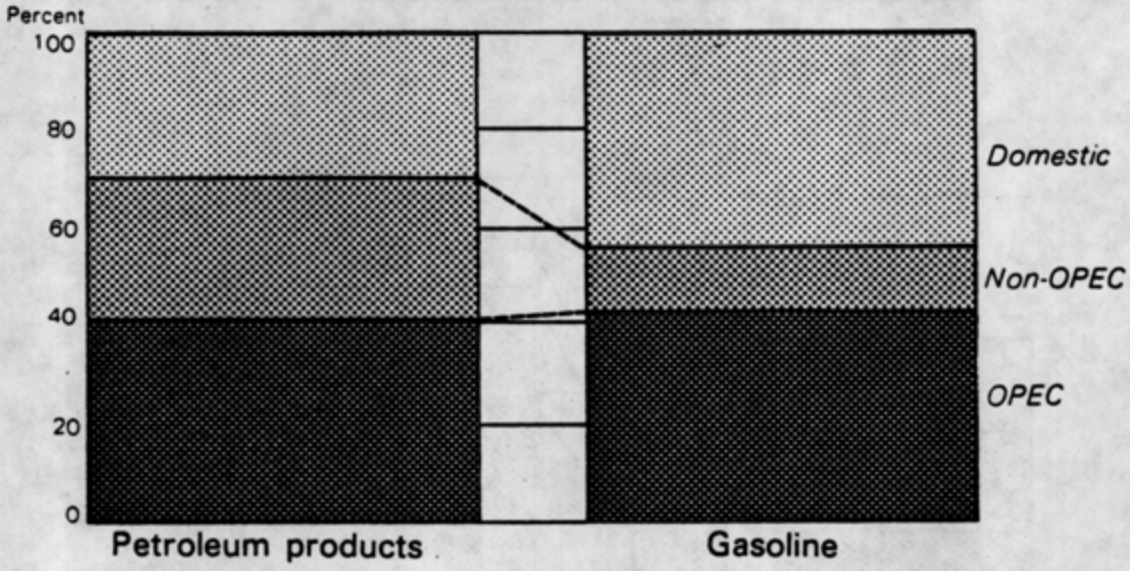


FIGURE III-18
SOURCES OF CURRENT NATURAL GAS USED IN NEW YORK STATE

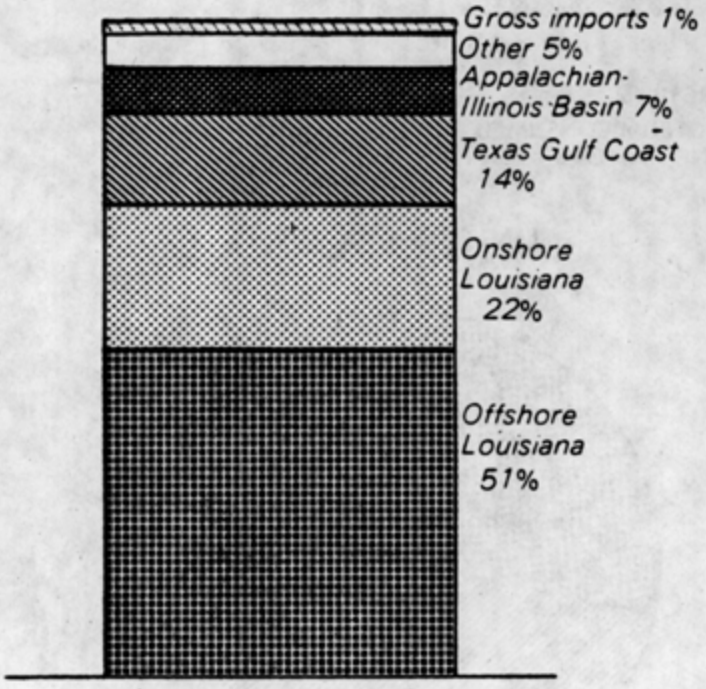


FIGURE III-19
SOURCES OF COAL USED IN NEW YORK STATE, 1977

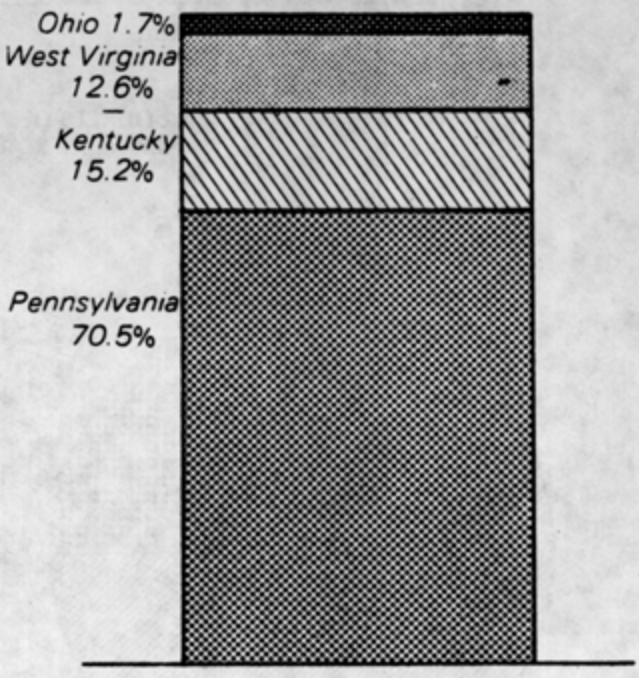


FIGURE III-20
RESIDENTIAL SECTOR ENERGY PRICES, ELECTRIC AND NATURAL GAS NEW YORK STATE, 1960-1978

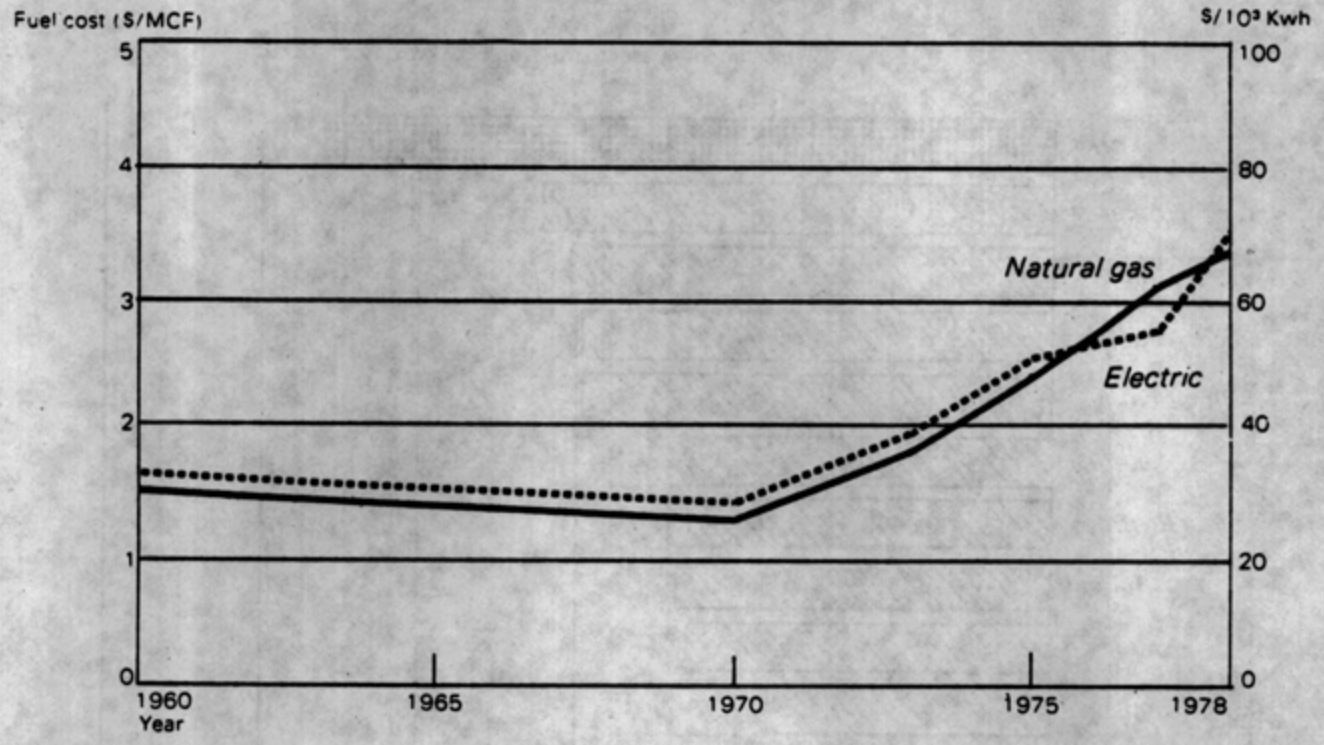


FIGURE III-21
RESIDENTIAL ELECTRIC RATES NEW YORK STATE AND UNITED STATES, JANUARY 1979

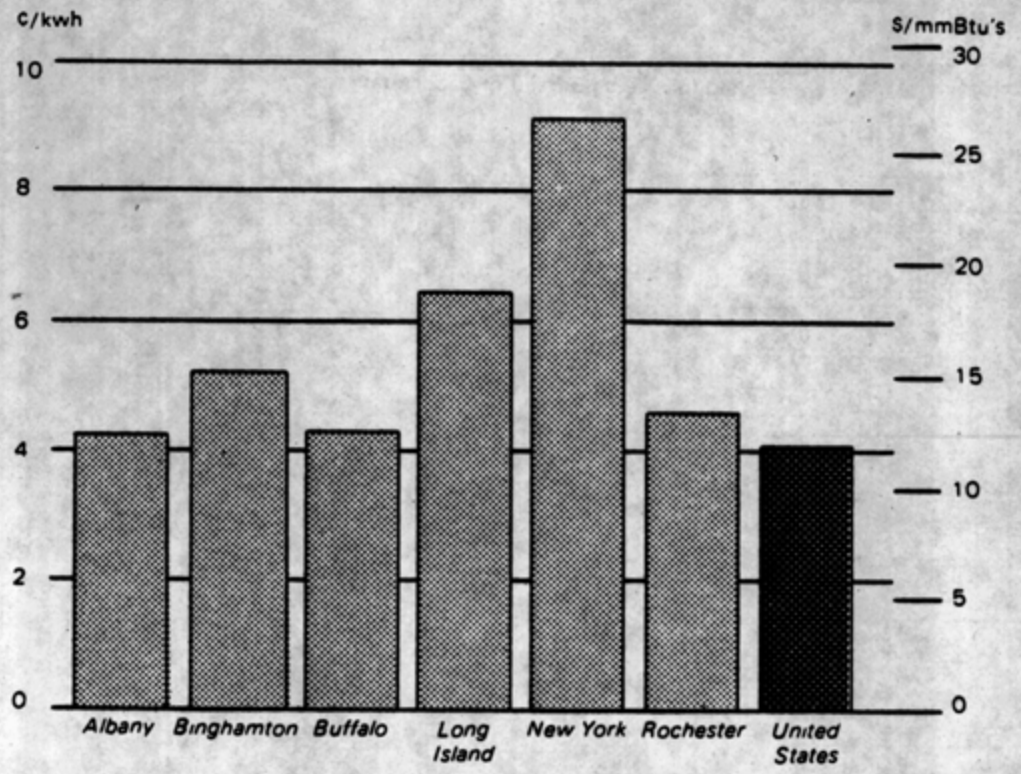
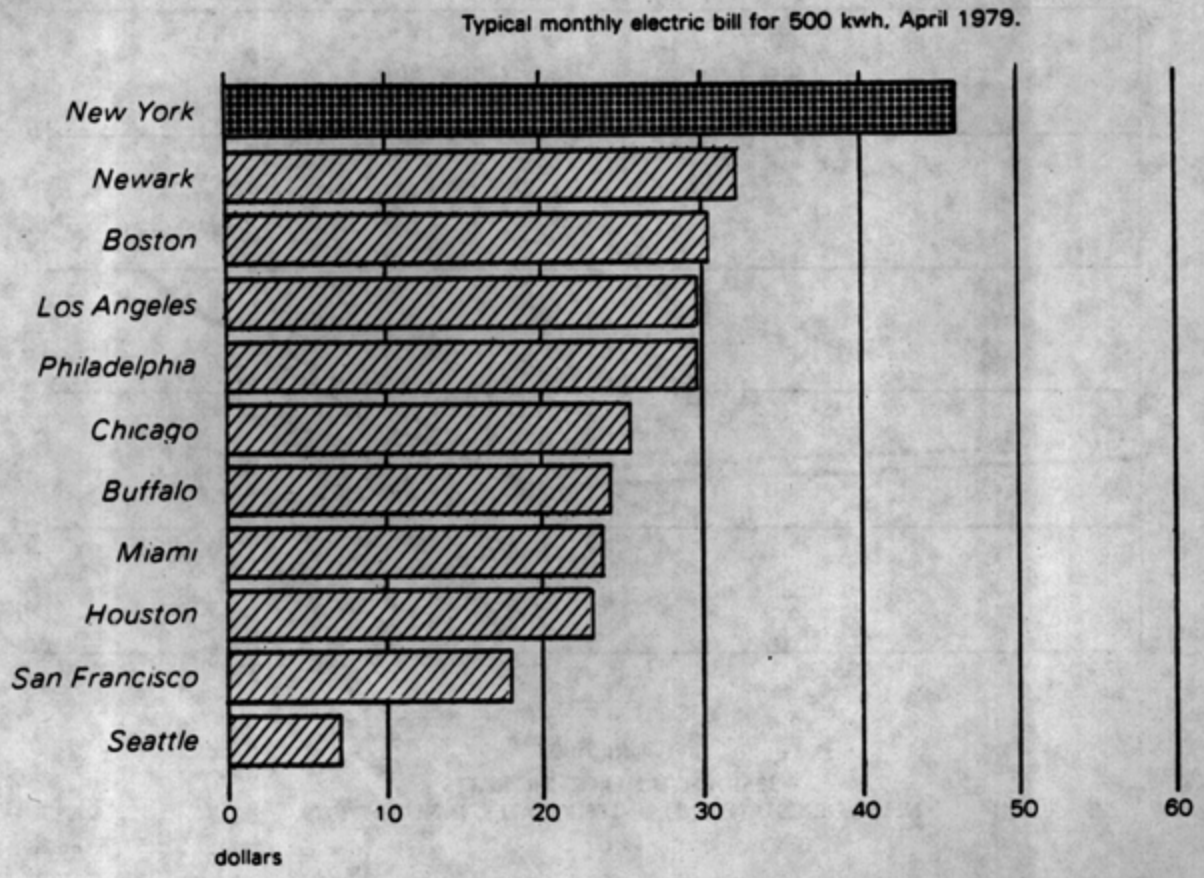


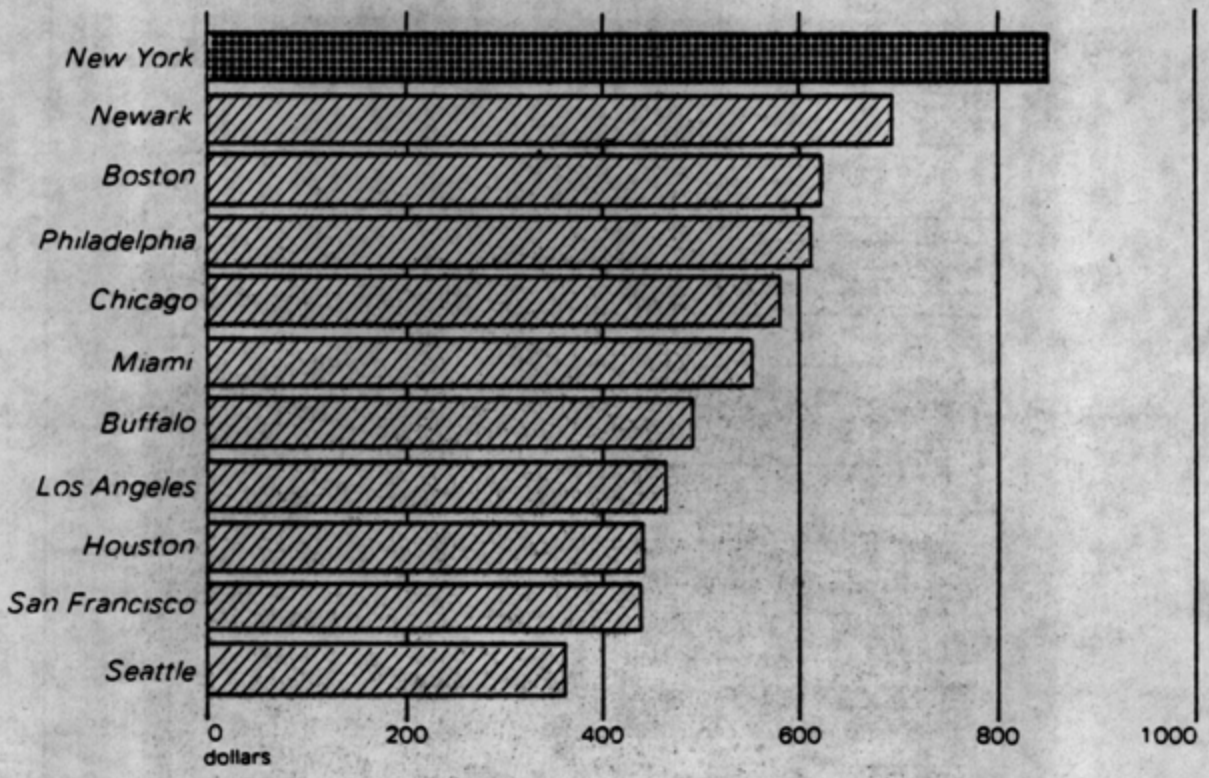
FIGURE III-22
RESIDENTIAL ELECTRICITY PRICES BY CITIES
APRIL, 1979



SOURCE: "Residential Electricity Price by Cities" is from Department of Energy Data collected for use by Bureau of Labor Statistics.

FIGURE III-23
COMMERCIAL ELECTRICITY PRICES BY CITIES
MARCH, 1979

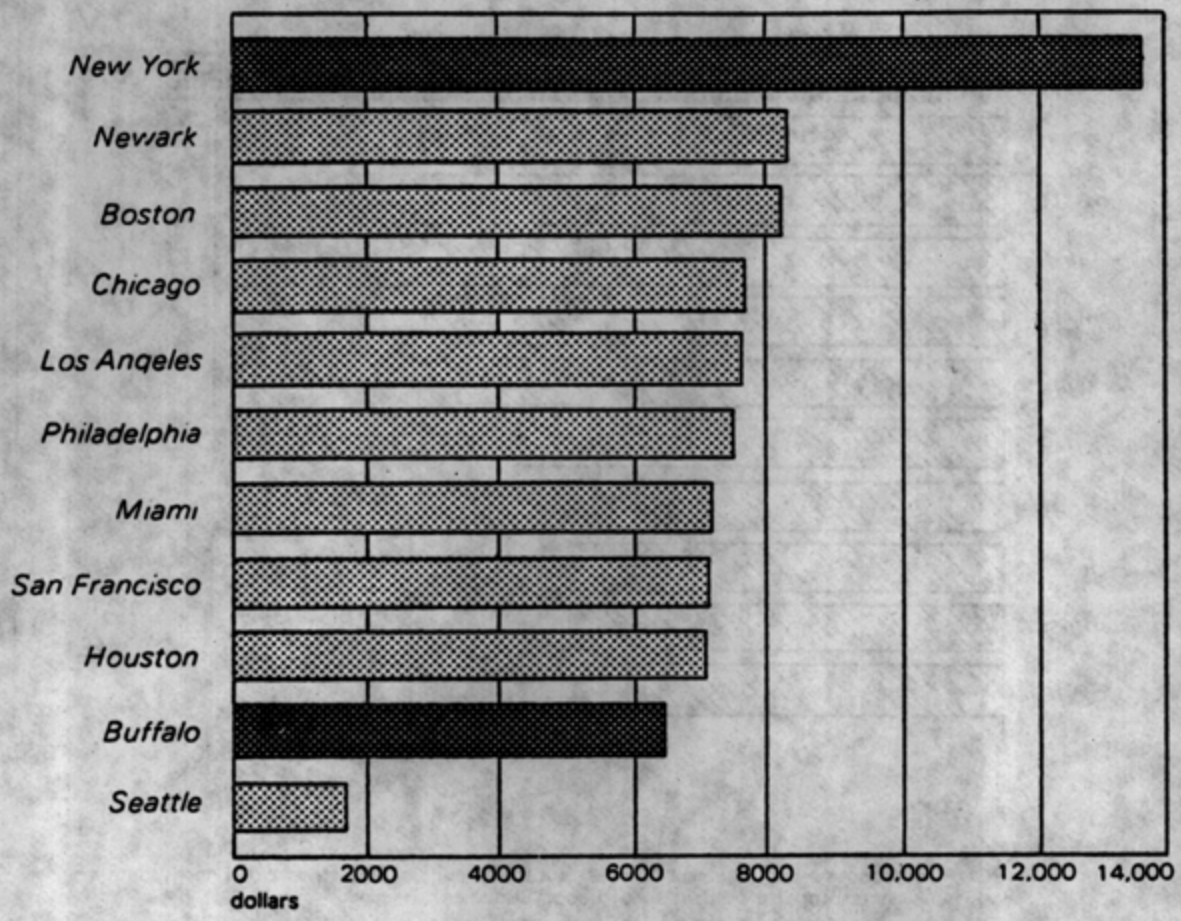
Monthly bill to a commercial customer using a hypothetical 10,000 kwh at a maximum volume of 40 kilowatts.



SOURCE "Commercial Electricity Prices by Cities" is from Department of Energy data collected for use by Bureau of Labor Statistics.

FIGURE III-24
INDUSTRIAL ELECTRICITY PRICES BY CITIES
MARCH, 1979

Monthly bill to a manufacturing plant using a hypothetical 200,000 Kwh at a maximum volume of 500 Kw.



SOURCE: "Industrial Electricty Prices by Cities" is from Department of Energy data collected for use by Bureau of Labor.

SECTION IV

New York State End-Use Energy Requirements, Base Case*

1. LEGISLATIVE FRAMEWORK

Sections 5-110 and 5-112 of the New York State Energy Law require that the State Energy Master Plan and Long-Range Electric and Gas Report contain, among other things, a forecast of State energy requirements, including electric and gas demands, for 5, 10 and 15 year forecast periods, and the basis for those forecasts. This section presents the forecast of State energy requirements as approved by the Energy Planning Board.

The forecast, as required, has taken into consideration, among other things, the following factors:

- Economic growth and development trends, including: changing patterns of population growth, urban development, transportation modes, and building designs, which might significantly affect energy consumption in the State;
- The extent to which energy conservation measures and new energy technologies may affect the State's energy requirements;
- The extent to which the development of indigenous energy resources may contribute to meeting the State's energy requirements;
- The impact of national energy policies on the State's energy needs and on available sources of supplies; and
- The impact of alternative energy sources and energy conservation upon the economy of the State, the health, safety and welfare of tbe people of the State, and the quality of the State's environment.

Figure IV-1 illustrates schematically the factors affecting the development of the forecast.

2. DESCRIPTION OF FORECASTING EFFORT*

This section describes the principal needs addressed in the forecast, the relation of this forecast to previous forecasting efforts, an overview of the forecasting system model structure, and basic forecast assumptions. The section concludes with a brief discussion of the inherent limitations of the forecast.

A. Needs

The forecast was prepared with several important needs and considerations in mind:

- The need to develop an analytic and forecasting capability independent of forecasts submitted by the major energy suppliers;
- The need to develop an energy forecasting system capable of providing a framework for examining relationships and interactions among energy use, economic activity, prices, and public policy—as implied in the legislative directive;
- The need to analyze energy requirements in terms of basic building blocks of energy use: specific end uses, such as space heating, air conditioning, hot water heating, cooking and clothes drying;
- The need to address energy use within a total energy (all fuel forms) context that is sensitive to the potential for substitution among competitive fuels for specific end uses, wherever appropriate;
- The need to analyze the responsiveness of various energy uses to price changes;

*The Energy Planning Board, upon review of the alternative forecasts in the Energy Master Plan and Long-Range Electric and Gas Report proceeding record, approved the SEO draft Plan energy forecasts with several modifications.

In reviewing the basis for the draft Plan forecasts, the Board recognized fully the uncertainties inherent in any forecast and, further, the need to review the basic forecast assumptions in view of events and developments since the submittal of the draft Plan in August, 1979.

The Board weighted carefully the estimated impacts of changes in numerous factors upon the end use requirements forecast gener ally, and the long-range electric demand forecast, specifically, and concluded that the electric demand forecast should be reviewed with respect to two factors:

> "Updating the world oil price assumption (and the resulting impact on petroleum product prices) would, according to SEO, result in both a significant reduction in petroleum product consumption and an increase in electricity use. The growth in electric energy use would increase by approximately 0.1 percent per year, with a resulting increase in 1994 peak demand of approximately 400 MW. Implementation of the recently enacted State lighting standards legislation will reduce growth in electric energy use by approximately 0.1 percent per year. The impact on electricity peak demand would be a reduction in 1994 peak demand of approximately 425 MW. These two effects thus approximately counterbalance one another with respect to the overall impact on electric energy (KWH) and peak demand (MW) growth rates." (Opinion and Order p. 33).

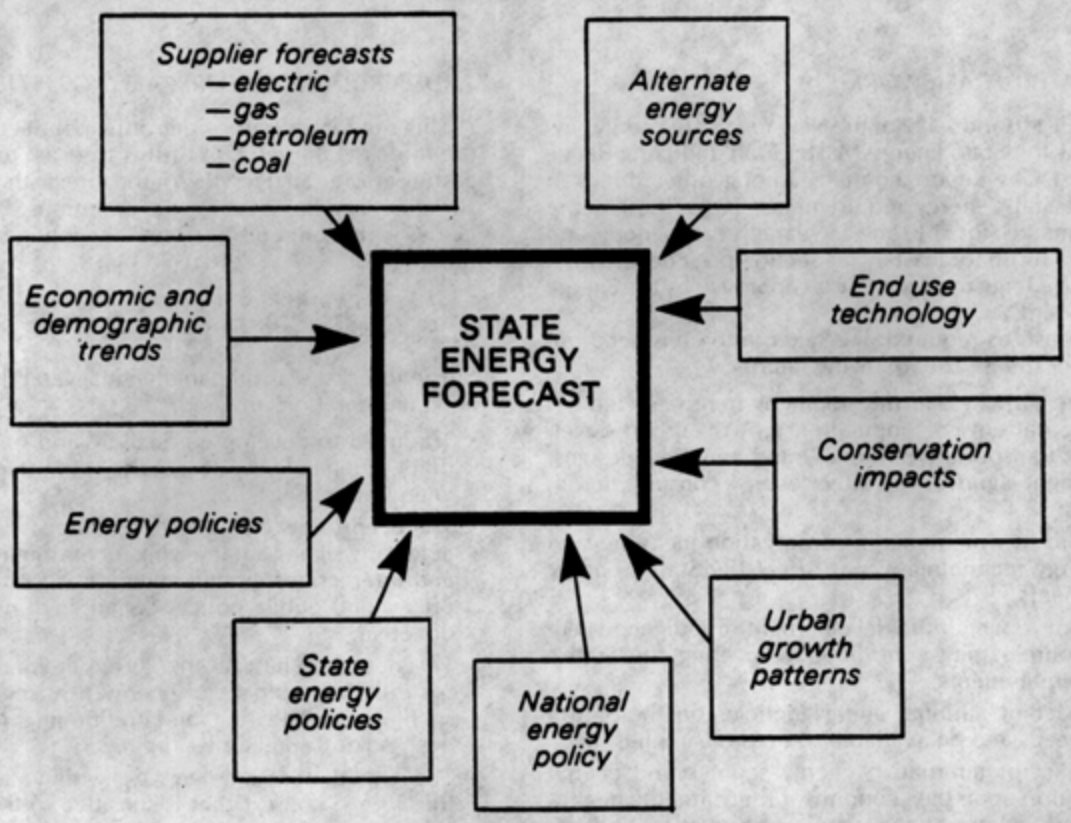
The forecast of end use energy requirements presented herein reflects the Board's finding that electricity sales (KWH) will increase an average 2.1 percent annually, as forecast in the draft Plan. (Note: The electricity sales forecast by end use presented in Section IV has not been adjusted for the impacts of the recently enacted State lighting standards and higher than assumed 1980 oil prices).

More importantly, the forecast of electricity peak demand (MW) presented herein reflects the Board's finding that electricity peak demand will increase an average 1.8-1.9 percent annually over the forecast period, reflecting moderate improvements in the load factor. The draft Plan had forecast that electricity demand would increase an average 2.1 percent annually.

> "Our review of the record convinces us that the statewide load factor will improve in the future. And, in view of the inherent limitations in the SEO load factor assumption . . . the Board concludes that the SEO projection of a constant load factor should be modified to reflect a moderate improvement."
>
> "The revisions result in an electric peak demand forecast of 1.8-1.9 percent, which is adopted by the Board." (Opinion and Order, p. 60).

To the extent that world oil and petroleum product price assumptions presented in this Plan fail to reflect fully recent OPEC pricing actions, the forecast of end use energy requirements (primarily petroleum) presented herein will be overstated; price-induced conservation impacts presented herein will tend to be understated; and the assessment of the potential for renewable resources presented herein will tend to be understated.

FIGURE IV-1
STATE ENERGY FORECAST



- The need, to the extent possible, to examine in an explicit manner, the impact of efficiency improvements related to mandated energy efficiency standards and conservation measures;
- The need, in view of inherent forecast uncertainties, to begin to develop a capability for analyzing the sensitivity of a baseline or most likely forecast to alternative assumptions or scenarios.

B. The Approach to the Forecasts

The forecast of State energy requirements is unique in four important aspects.

First, the forecast reflects the impact of mid-1979 dramatic OPEC price increases and rising energy prices generally.

Second, the forecast takes into account the impact of federal and State energy legislation, including the National Energy Act of 1978, and programs authorized by such legislation through June 30, 1979. Thus, it reflects all important current federal and State conservation policies and programs, including the recently promulgated State Energy Conservation Construction Code.

Third, the forecast is the first integrated forecast of energy requirements for all major fuel forms: electricity, natural gas, petroleum products, and coal. This approach permits analysis of the potential for substitution among competitive fuels for specific end uses.

Finally, the forecast reflects a combined econometric and engineering end use approach, seeking to build on the respective strengths of each. Such an approach combines two advantages: the price responsiveness capability of the econometric approach and the capability of the engineering approach to examine the impacts of efficiency standards and conservation on specific energy end uses.

Figure IV-2 compares the general scope and methodology of the New York State Energy Master Plan forecast, developed by SEO, with other forecasts prepared within the last two years. The New York Power Pool and New York Gas Group forecasts, prepared earlier in 1979, were submitted to the Energy Office as part of the Energy Master Plan process. In addition, three electricity forecasts were prepared a year earlier by participants in Phase II of the 1978 149-b Long-Range Electric System Planning proceedings.

C. Overview of Model Structure

The New York State Energy Forecasting System, developed by the State Energy Office, is a system of linked computer-based models and forecasting techniques. The system embraces five major components: four energy use models broken down by sector—residential, commercial, industrial, and transportation—and an underlying macroeconometric model.

The energy use model in each sector analyzes specific building blocks of energy use or end uses based upon a range of assumptions. State economic activity (provided by the macroeconometric model), prices, national and State energy policies, and fuel supply availability or constraints or assumptions are all considered (See Figure IV-3).

Several points in the development and structure of the Forecasting System merit attention. First, the State Energy Office, after an exhaustive investigation of existing methodologies, selected the most appropriate models and either adopted them directly or improved upon them.

The Office, however, concentrated combined staff and

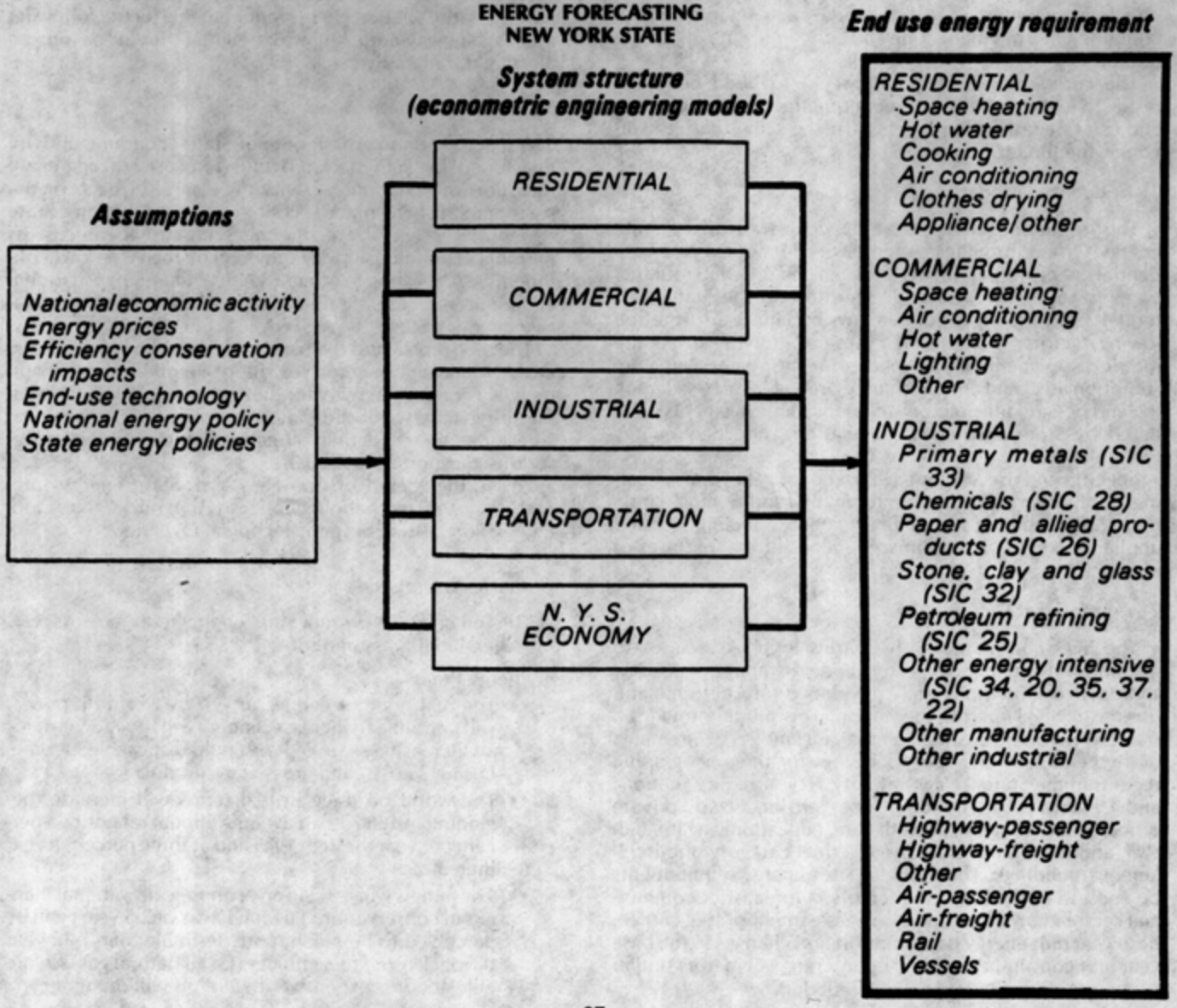
FIGURE IV-2

COMPARISON OF NEW YORK STATE END USE ENERGY REQUIREMENTS FORECASTS

Forecast	Year	Fuel Type				Approach/Methodology	
		Electric	Natural Gas	Petroleum	Coal	Econometric	Engineering End Use
State Energy Office	1979	X	X	X	X	X	X
New York Power Pool	1979	X				X	
New York Gas Group	1979		X				X
Public Service Commission/ Consumer Protection Board	1978	X				X	
Dept. of Environmental Conservation/ Energy Systems Research Group	1978	X					X
Cornell University/National Consumer Law Center	1978	X				X	

FIGURE IV-3

ENERGY FORECASTING NEW YORK STATE



consultant resources on developing residential and commercial sector models, since those two sectors account for 52 percent of the total energy consumption and 71 percent of electricity consumption, respectively.

Existing State and national models were employed where appropriate. For example, the transportation forecasting techniques developed by the New York State Department of Transportation formed the basis for forecasting energy demand in the transportation sector. The Long Run Annual Economic Forecasting Model,developed by Wharton Econometric Forecast Associates, Inc., supplied the national economic activity input to the State model.

Second, the Forecasting System blends econometric and engineering end use methodologies and techniques, as appropriate. By combining the two, the State Energy Office seeks to improve upon prior State energy demand forecasts. Its aim is to integrate demand for conventional fuels and renewable resources with estimates of all relevant variables impacting such demand—including current State and national economic activity, energy prices, and improvements in energy end use technology.

The combined approach shifts the focus of inquiry to the point of actual energy consumption, thus recognizing the impact of energy efficiency standards, conservation measures, and new energy technologies. Each sectoral model contains a mix of engineering and economic data, as appropriate.

The Forecasting System thus seeks to build upon the respective strengths of the econometric and engineering end use forecasting approaches. At the same time it overcomes the limitations of each.

1) Residential Model

The residential model, developed by staff of the State Energy Office, provides a framework for forecasting residential energy requirements by seven end uses and four fuel types for each electric service territory in the State. This model relates energy requirements by end use to the following factors: forecasts of customer growth, an econometric assessment of fuel choice, a base year unit consumption level and annual changes in that level based upon a blend of economic factors, efficiency improvements mandated by State and federal regulations, and new energy technologies.

Specific end uses include: space heating, hot water heating, central air conditioning, room air conditioning, cooking, clothes drying; and a final category including other appliances, lighting, and miscellaneous household uses of electricity.

2) Commercial Sector

The SEO contracted with Charles River Associates to develop the commercial sector model by adapting to New York State a model originally developed for California and used extensively across the nation. This model provides a framework for forecasting commercial energy requirements by five end uses and four fuel types for three geographic regions in the State—New York City, New York City suburbs, and Upstate. Eight building types are analyzed: private office, retail/wholesale, health care, educational, state, federal, and local government, and a final category of miscellaneous buildings. The model relates energy requirements by end use to the following factors: a forecast of commercial sector economic activity, an assessment of fuel choice, base year unit energy consumption,and changes in the base year unit consumption based upon a range of factors similar to those noted for the residential model.

The end uses include: space heating, air conditioning, water heating, lighting, and a miscellaneous category, including such auxilliary uses as data processing.

3) Industrial Sector

The industrial model, developed by the SEO staff, employs an econometric approach to forecasting energy requirements for eight industry groupings. This approach relates energy consumption by industry to forecasts of economic activity (output and employment), fuel choice, and relative energy prices. The model makes individual forecasts for the five most energy intensive manufacturing industries in the State, the next five most energy intensive manufacturing industries combined, all other manufacturing industries, and other industrial energy uses including construction and mining.

4) Transportation Sector

For the transportation sector, the SEO relied on forecasting techniques developed by the New York State Department of Transportation (NYSDOT). NYSDOT techniques relate energy consumption by seven modes of travel to levels of economic activity, vehicle miles of travel, prices, fuel efficiency standards, and other factors. The techniques provided forecasts of transportation energy requirements for the following modes: highway-auto, highway-freight, other, air-passenger, air-freight, rail and vessels.

5) State Econometric Model

A macro econometric model of State economic activity developed by SEO staff provides forecasts of aggregate measures of economic activity necessary for each of the sector models. The macro econometric model relates State economic activity by economic sector to a forecast of national economoc activity provided by the Wharton Econometric Forecasting Associates, Inc., long-range national economic forecasts, State-national relationships and relative energy prices.

The model provides the basic framework to develop forecasts of personal income for the residential model, commercial economic activity for the commercial model, manufacturing activity for the industrial model, and basic measures of economic activity affecting vehicle miles of travel for the transportation model.

For further detail on the New York State energy forecasting system methodology refer to Appendix C: New York Energy Forecasting System: Technical Overview.

D. Basic Assumptions

The forecast of New York State energy requirements rests on several major assumptions:

- Energy Prices
  - The real price of energy, driven by world oil prices, will continue to increase. Energy will thus account for an increasing share of household disposable income, business costs, and gross State product.
  - The world oil price in real terms will increase, beginning in 1980, at an average annual rate ot two percent per year through 1985 and at three percent a year thereafter.
  - Consumers will react in an economically rational manner in conservation (i.e., paybacks of 2-5 years will be perceived to be much more desirable than 8-12 year paybacks) and fuel choices (i.e., if natural gas is available and less expensive than oil, it will dominate).

- Economic Activity
  - The State's economy, as indicated by the macro econometric model, will experience moderate economic growth over the forecast period—a rate of growth well above the limited growth of the mid-seventies but below that of the pre-embargo period.
  - It is important to note that this forecast is fully supportive of the energy requirements of a moderate growth economy. It is consistent with national post-embargo trends which amply demonstrate that there is no fixed relationship between energy and economic growth in a period of significant energy price, public policy and institutional change.
- National and State Energy Policy
  - National and State energy legislation, including the National Energy Act of 1978, and programs authorized by such legislation through 1979 are taken into account.
  - Domestic oil decontrol will occur in a phased manner over the next several years.
- Energy Supply
  - Petroleum products, while generally available, will become increasingly more costly relative to other fuels.
  - Greater quantities of natural gas will be available in the 1980's than in the 1970's, but at an increased cost.

For further discussion of specific assumptions used in sectoral components of the Energy Forecasting System, refer to Appendix C.

E. Inherent Limitations

Recent events, such as the OPEC pricing actions, the Iranian situation, and Three Mile Island emphasize the uncertainties of energy forecasting. Energy forecasting is, at best, an imprecise art. Energy demand forecasting, a relatively new discipline, is limited by the general constraints on forecasting.

The most general constraint is that a forecast of energy requirements is essentially a series of estimates that are, in turn, based on assumptions about key variables. Should any of the basic assumptions prove inaccurate, the energy requirements forecast would change. For example, two key factors driving the forecast of energy requirements are the assumptions of world oil prices and the forecast of State economic activity. Should world oil prices or State economic activity deviate from anticipated levels, it may be necessary to revise the energy requirements forecast.

The Energy Law recognized the uncertainties in energy forecasting. Section 5-110(9) requires, at least, a biennial review of the State Energy Master Plan and Section 5-112(3b) mandates a biennial review of the long-range electric and natural gas planning reports.

Furthermore, in recognition of such uncertainties, the SEO is developing a capability to examine more fully the sensitivity of forecasts of State energy requirements to alternative sets of assumptions or scenarios.

3. FORECAST OF NEW YORK STATE END USE ENERGY REQUIREMENTS

The forecast of State energy requirements, 1978-1994 includes:

- an overview of the baseline forecast within a historical context;
- a detailed discussion of the forecast for the four demand sectors: residential, commercial, industrial, and transportation;
- a discussion of the forecast by fuel type; and
- presentation of the baseline forecast of energy requirements by sector and fuel type over the forecast period.

FIGURE IV-4

NEW YORK STATE ENERGY REQUIREMENTS, PRICES AND ECONOMIC ACTIVITY, 1960-1994: SELECTED MEASURES

					Average Annual Percent Change		
	1960	1973	1978	1994	1960-1978	1973-1978	1978-*1994
END USE ENERGY CONSUMPTION (TBTU)	2343	3240	3167	3408	+2.5	−0.5	+0.5
ELECTRICITY CONSUMPTION (TBTU)	168	340	360	501	+5.6	+1.1	+2.1
TOTAL PRIMARY ENERGY CONSUMPTION (TBTU)	2741	4120	4073	4668	+3.2	−0.2	+0.9
GROSS STATE PRODUCT (MILLIONS 72$)	89.3	137.1	137.0	197.7	3.4	0.0	2.2
PERSONAL INCOME (MILLIONS 72$)	63.5	96.0	96.2	147.2	3.2	0.3	2.5
PER CAPITA INCOME (72$)	3790	5249	5393	7603	2.5	0.8	2.0
RATIO OF PRIMARY ENERGY CONSUMPTION GROWTH TO GSP GROWTH					.94	n.a	.41

n.a.—not applicable

*Based upon adjusted 1978 data; refer to Appendix C for detail.

A. Overview

The forecast of end-use energy consumption predicts a 0.5 percent annual growth rate over the forecast period, down significantly from the pre-embargo growth rate of 2.5 percent annually. Nonetheless, the forecast shows a reversal in trend from the 1973-1978 experience—a period of limited economic growth in the face of severe recession that hit New York harder than the Nation at large. Figure IV-4 summarizes the historic and forecasted trends in energy consumption, prices and economic activity from 1960 to 1994.

The slowed growth rate of anticipated energy requirements reflects the increasing efficiency of energy use anticipated from the complex set of forces set in motion by the Arab oil embargo five years ago and recent OPEC oil pricing actions. Key factors in the forecast of future energy use include the rising world oil price and energy prices generally, introduction of new conservation policies and programs, and a somewhat lower anticipated growth rate of the national economy.

The forecast of end use energy requirements over the forecast period, 1978-1994, shows significant variation in growth rates among the residential, commercial, industrial and transportation sectors (see Figure IV-5).

End use consumption is the energy consumed directly by the sector and differs from primary energy consumption by excluding electricity generation and transmission losses.

1) Residential Sector

End use energy consumption in the residential sector will increase 0.3 percent annually over the forecast period, a rate well below that of the pre-embargo period. Extensive residential retrofits in the face of rising energy prices, improved building design and construction, conservation programs, and appliance efficiency standards will all act to reduce the growth rate.

Efficiency improvements, however, will not fully offset factors causing the requirements to rise. Growth in the number of housing units will follow anticipated moderate economic growth. Further, the increased use of electricity for appliances, air conditioning in existing homes, and in some localities space heating, will add to the limited overall increase in net energy consumed in the residential sector.

Within the residential sector, the forecast predicts a variation in average annual growth rates from 0.2 for space heating to 2.9 percent for central air conditioning among the seven major end use categories or groupings (see Figure IV-6).

The forecast of residential energy requirements by fuel type also indicates considerable variation in growth rates (see Figure IV-7). The major change over the forecast period

FIGURE IV-5

FORECAST OF NEW YORK STATE ENERGY REQUIREMENTS BY SECTOR, 1978-1994

Sector of Energy Use	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Residential	966.9	1019.9	+0.3
Commercial	673.1	784.8	+1.0
Industrial	380.2	430.0	+0.8
Transportation	1105.8	1172.8	+0.4
Total End Use Energy Consumption	3126.0	3407.5	+0.5

FIGURE IV-6

FORECAST OF NEW YORK STATE RESIDENTIAL SECTOR ENERGY REQUIREMENTS BY END USE, 1978-1994

End Use	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Space Heating	739.6	767.3	+0.2
Hot Water	95.5	99.6	+0.3
Cooking	36.5	38.1	+0.3
Air Conditioning-Room	6.1	7.4	+1.2
Air Conditioning-Central	1.4	2.2	+2.9
Clothes Drying	11.4	17.2	+2.6
Other	76.4	88.1	+0.9
Total Residential End Use Requirements	966.9	1019.9	+0.3

is the shift from the use of home heating oil to natural gas and to a lesser extent, electricity. The shift to electricity reflects a continuation of the post-embargo trend.

Natural gas requirements, however, particularly for space heating, will reverse the recent decline because of the end of restrictions on natural gas hook-ups that characterized the 1970's, a cost advantage for the forseeable future and an anticipated increase in available supplies.

FIGURE IV-7

FORECAST OF NEW YORK STATE RESIDENTIAL SECTOR END USE ENERGY REQUIREMENTS BY FUEL TYPE

Fuel Type	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Electricity*	111.1	142.9	+1.6
Natural Gas	334.2	455.2	+2.0
Petroleum Products	498.4	380.2	−1.7
Other (Wood, Solar and Other)	23.2	41.6	+3.7
Total Residential End Use Energy Requirements	966.9	1019.9	+0.3

*The electricity sales forecast by end use and sector has not been adjusted for the impacts of the recently enacted State lighting standards and the higher than assumed 1980 petroleum product prices.

Petroleum product requirements will decrease over the forecast period. Natural gas will surpass home heating oil, the present dominant fuel for residential energy use, by 1990.

Renewable resources (wood and solar) will make a significant contribution to residential end use energy consumption over the forecast period. The 3.7 percent average annual growth rate will far exceed that of natural gas (2.0 percent)—the fastest growing conventional fuel.

2) Commercial Sector

End use energy consumption in the commercial sector will rise 1.0 percent annually, a rate well below that of the

pre-embargo period. Contributing to the reduced growth rate will be extensive commercial retrofits, and improved new building design and construction practices. Since implementation of conservation measures call for sizable investments, that will also be a factor.

Energy efficiency improvements, however, will not offset forces contributing to an increase in requirements in this sector—particularly anticipated growth in the commercial sector of the State's economy. Over the forecast period, the commercial sector will continue, as in both post embargo and pre-embargo periods, to be the major source of economic growth in the State. Steady growth is anticipated in many commercial subsectors, including finance, insurance and real estate, business services, personal services, trade, transportation, and communications. Further, the increased use of electricity for air conditioning in existing buildings, for electro-mechanical ventilation systems, and other uses, such as data processing, will increase net energy consumption in this sector.

The forecast shows considerable variation in the average annual growth rate in the commercial sector;from 0.6 percent for space heating to 3.3 percent for air conditioning among the five end uses: space heating, air conditioning, lighting, hot water heating, and other (see Figure IV-8). Energy requirements will increase most rapidly for other and air conditioning end uses.

FIGURE IV-8

FORECAST OF NEW YORK STATE COMMERCIAL SECTOR ENERGY REQUIREMENTS BY END USE, 1978-1994

End Use	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Space Heating	465.0	513.8	+0.6
Air Conditioning	33.2	55.9	+3.3
Water Heating	50.8	57.6	+0.8
Lighting*	70.3	87.7	+1.4
Other	53.8	69.8	+1.6
Total Commercial End Use Requirements	673.1	784.8	+1.0

*The electricity sales forecast by end use and sector has not been adjusted for the impacts of the recently enacted State lighting standards and the higher than assumed 1980 petroleum product prices.

The forecast of commercial energy requirements by fuel type also shows considerable variation in growth rates (Figure IV-9). The major change over the forecast period will be a modest shift away from petroleum products toward electricity and natural gas. Electricity will experience the most rapid increase—an average annual growth rate of 2.1 percent. Natural gas use will grow moderately, a reversal of the recent decline, primarily because of an end to restrictions of the seventies, a price advantage for the foreseeable future, and an anticipated increase in available supplies nationally.

3) *Industrial Sector*

Industrial end use energy requirements in New York State will increase by 0.8 percent annually, reflecting anticipated moderate long-term economic growth. Industrial end use energy consumption declined in the post-embargo period,

FIGURE IV-9

FORECAST OF NEW YORK STATE COMMERCIAL SECTOR ENERGY REQUIREMENTS BY FUEL TYPE, 1978-1994

Fuel Type	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Electricity*	145.0	201.4	+2.1
Natural Gas	131.7	151.1	+0.9
Petroleum Products	395.2	432.3	+0.6
Total Commercial End Use Requirements	673.1	784.8	+1.0

*The electricity sales forecast by end use and sector has not been adjusted for the impacts of the recently enacted State lighting standards and the higher than assumed 1980 petroleum product prices.

reflecting both tremendous improvements in energy efficiency nationally, and heavy State employment losses in the mid-seventies, a period of the most severe national recession since the Depression.

Replacement of older plants and equipment will lead to higher energy productivity in the industrial sector. Industrial firms in many instances have realized the limits of low-cost housekeeping adjustments and improvement. Thus, the rate of improvement in energy consumption in this sector depends primarily on the rate of investment in new energy efficient stock and equipment.

FIGURE IV-10

FORECAST OF NEW YORK STATE INDUSTRIAL SECTOR ENERGY REQUIREMENTS BY INDUSTRY, 1978-1994

Industry	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Energy Intensive Manufacturing Industries	286.7	305.3	+0.4
Primary Metals (SIC 33)	64.3	55.4	−0.9
Chemicals (SIC 28)	47.7	51.5	+0.5
Paper & Allied Products (SIC 26)	45.8	47.5	+0.2
Stone, Clay & Glass (SIC 32)	32.8	24.4	−1.8
Petroleum and Coal (SIC 29)	4.6	5.5	+1.1
Other Energy Intensive (SIC 34, 20, 35, 37, 22)	91.5	121.0	+1.8
Other Manufacturing Industries	77.5	105.6	+1.9
Other Industrial	16.0	19.1	+1.1
Total Industrial End Use Requirements	380.2	430.0	+0.8

Within the industrial sector, the forecast calls for a wide variation in growth rates among the various industrial sector groupings (see Figure IV-10). Energy intensive manufacturing industries, as a whole, are likely to see only a limited increase in energy consumption. The basic reason will be the higher prices and the State's energy cost disadvantage with the Southwest in competing for new investments in such industries. Growth in energy consumption, however, is anticipated in many of the State's large non-energy intensive industries where industrial growth will tend to be concentrated. In particular, energy consumption in machinery-intensive industries that require electricity is likely to grow at a faster rate than industrial consumption generally.

The mix of industrial energy requirements by fuel type, shown in Figure IV-11, is difficult to forecast. It must be viewed within the context of federal regulation uncertainties in coal conversion, natural gas, and environmental quality. Such policies will have a critical impact on fuel substitution in the industrial sector.

Industrial consumption of specific fuels also tends to be more responsive to changing relative fuel prices than other sectors. This is because of a greater fuel-switching capability stemming,in part, from the recent curtailment of natural gas supplies.

FIGURE IV-11

FORECAST OF NEW YORK STATE INDUSTRIAL SECTOR ENERGY REQUIREMENTS BY FUEL TYPE, 1978-1994

	Trillion BTU		Average Annual Percent Change
Fuel Type	1978	1994	1978-1994
Electricity*	95.9	143.4	+2.5
Natural Gas	105.0	107.4	+0.1
Petroleum Products	120.1	113.2	−0.4
Other (Coal, Wood and Other)	59.2	66.0	+0.7
Total Industrial End Use Requirements	380.2	430.0	+0.8

*The electricity sales forecast by end use and sector has not been adjusted for the impacts of the recently enacted State lighting standards and the higher than assumed 1980 petroleum product prices.

Electricity use will grow more rapidly than purchased fuels—petroleum products, natural gas, and coal. Electricity use will depend heavily on the costs and availability of oil and natural gas. Some of the new electricity is likely to come from cogeneration, rather than central station generation. Direct coal use (used for boilers and non-boiler industrial processes) and, to a lesser extent, natural gas will account for portions of increased industrial demand. Consumption of petroleum products, which will remain an important swing fuel, will decrease slightly.

4) Transportation Sector

End use energy consumption in the transportation sector will grow at an average rate of 0.4 percent over the forecast period. As in other sectors, this growth rate reflects a marked slowdown from the more than three percent of the pre-embargo period.

Higher oil prices and federal regulations, particularly the mandated auto fleet efficiency standards, will improve energy efficiency in the sector.

Petroleum product prices will have an impact on the total amount of travel by New Yorkers—especially personal travel by automobile. While personal mobility is central to the accepted values and life styles of Americans, the effect of rising gasoline prices will result in a decline in gasoline consumption.

Within the transportation sector, the forecast shows wide variation in energy consumption growth rates among travel modes (see Figure IV-12). They will range from an average annual increase of 3.8 percent for rail to a decline of 1.0 percent for automobiles. Energy consumption for personal and freight air travel will grow most rapidly,after rail. Automobile gasoline consumption, however, will drop at an annual average rate of 1.0 percent over the forecast period, assuming that fleet fuel efficiency standards are met.

The forecast of transportation energy requirements by fuel type shows considerable variation in growth rates (Figure IV-13). The sector's almost total dependence on petroleum fuels is expected to continue throughout the forecast period. Gasoline consumption, as noted, will decrease through 1990 and then increase in the absence of further improvements in currently mandated fleet fuel efficiency standards. Jet fuel, on the other hand, will continue its rapid rate of growth throughout the forecast period.

FIGURE IV-12

FORECAST OF NEW YORK STATE TRANSPORTATION SECTOR ENERGY REQUIREMENTS BY TRAVEL MODE, 1978-1994

	Trillion BTU		Average Annual Percent Change
Travel Mode	1978	1994	1978-1994
Highway	820.1	753.4	−0.5
Passenger (Auto)	560.0	476.9	−1.0
Freight	242.9	254.2	+0.3
Other	17.2	22.3	+1.6
Air	183.0	261.4	+2.3
Passenger	142.7	206.1	+2.3
Freight	40.3	55.3	+2.0
Rail	27.0	49.4	+3.8
Vessels	75.7	108.6	+2.3
Total Transportation End Use Requirements	1105.8	1172.8	+0.4

FIGURE IV-13

FORECAST OF NEW YORK STATE TRANSPORTATION SECTOR ENERGY REQUIREMENTS BY FUEL TYPE, 1978-1994

	Trillion BTU		Average Annual Percent Change
Fuel Type	1978	1994	1978-1994
Electricity	7.8	13.0	+3.2
Petroleum Products	1098.0	1159.8	+0.3
Gasoline	776.8	694.0	−0.7
Total Transportation End Use Requirements	1105.8	1172.8	+0.4

C. Fuel Type Review

Forecasts of energy consumption by fuel type between 1978-1994 show significant variation in growth rates among electricity, natural gas, petroleum products, and coal, as Figure IV-14 shows.

End use energy consumption, as noted, is the energy consumed directly by the sector of end use and differs from primary energy consumption by excluding electricity generation and transmission losses.

FIGURE IV-14

FORECAST OF NEW YORK STATE END USE ENERGY REQUIREMENTS BY FUEL TYPE, 1978-1994

	Trillion BTU		Average Annual Percent Change
Fuel Type	1978	1994	1978-1994
Electricity	359.8	500.7	+2.1
Natural Gas	570.9	713.7	+1.4
Petroleum Products	2111.7	2085.5	−0.1
Coal	83.6	107.6	+1.6
Total End Use Energy Requirements	3126.0	3407.5	+0.5

1) Electricity—Sales (KWH)

The forecast of electricity sales indicates a 2.1 percent average annual growth rate over the forecast period, a dramatic change from the pre-embargo period (5.6 percent annually). The forecast, however, as noted earlier, represents an increase over the post embargo period, 1973-78, of 1.2-percent annually. Those were years of very limited economic growth in the State. Figure IV-15 depicts past and future trends.

FIGURE IV-16

NEW YORK STATE POWER POOL ELECTRICITY REQUIREMENTS (SALES) FORECAST BY UTILITY, 1978-1994

	Trillion BTU		Average Annual Percent Change
Industry	1978	1994	1978-1994
Central Hudson	11.3	16.5	2.4
Con Ed	90.7	106.5	1.0
Long Island Lighting Company	42.5	59.5	2.1
NYS Electric & Gas	35.7	57.4	3.0
Niagara Mohawk	100.0	135.2	1.9
Orange & Rockland	9.8	15.7	3.0
Rochester Gas & Electric	17.4	26.6	2.7
PASNY	52.4	83.3	2.9
New York Power Pool	359.8	500.7	2.1

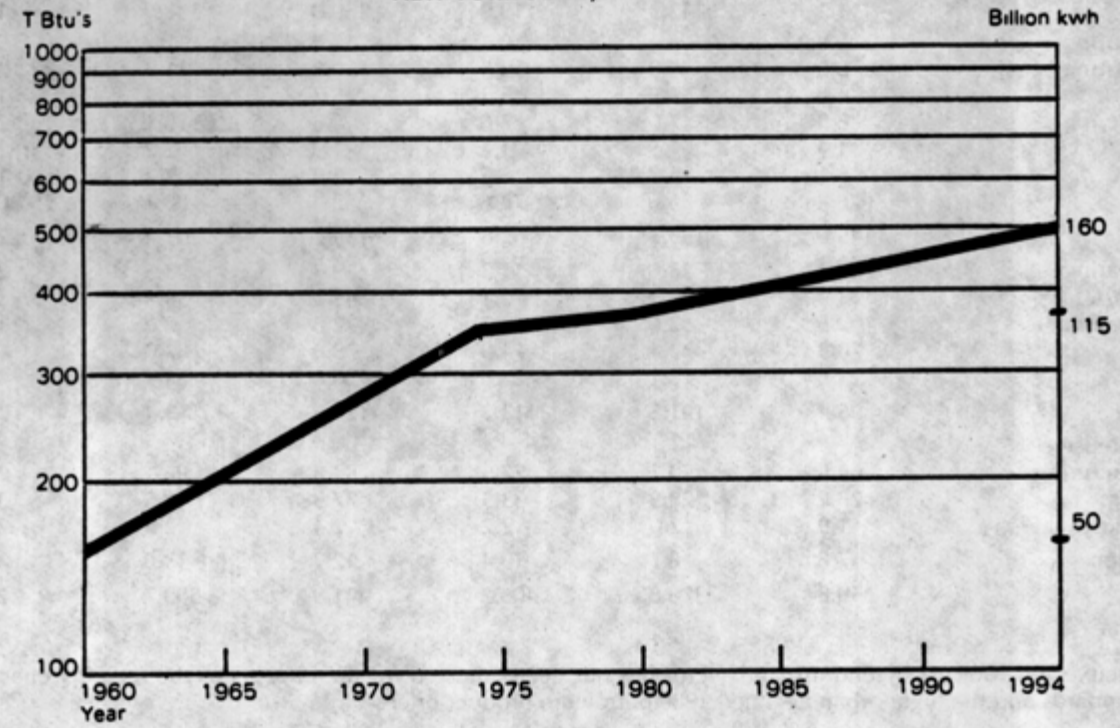
New building designs, higher efficiency standards, and other conservation measures, will all contribute to a substantially slower growth in electric energy consumption than experienced in the pre-embargo era.

Continued moderate economic expansion, the unparalleled flexibility of electricity for so many uses in a modern society, and some improvement in the price of electricity relative to fossil fuels, however, will result in a moderate rate of growth in electricity requirements.

The statewide forecast of electricity requirements represents the combined requirements for the New York Power Pool—the seven investor owned utilities and the Power Authority of the State of New York. Figure IV-16 reflects the

FIGURE IV-15

ELECTRICITY REQUIREMENTS (SALES) NEW YORK STATE, 1960-1994



State Energy Office forecasts of electricity requirements for each of the individual investor owned utilities and PASNY.

The forecast of electricity requirements indicates some variation in growth rates among the four demand sectors, as shown in Figure IV-17. Residential sector electricity requirements will grow an average of 1.6 percent annually as a result of household growth, continuing growth in electric space heating upstate, and an increase in air conditioning and appliances use.

FIGURE IV-17

FORECAST OF NEW YORK STATE ELECTRICITY REQUIREMENTS (SALES) BY SECTOR, 1978-1994*

	Trillion BTU		Average Annual Percent Change
Sector	1978	1994	1978-1994
Residential	111.1	142.9	+1.6
Commercial	145.0	201.4	+2.1
Industrial	95.9	143.4	+2.5
Transportation	7.8	13.0	+3.2
Total Electricity Requirements	359.8	500.7	+2.1

*The electricity sales forecast by end use and sector has not been adjusted for the impacts of the recently enacted State lighting standards and the higher than assumed 1980 petroleum product prices.

Figure IV-18 shows the forecast of electricity sales by sector and end use.

2) Electricity—Peak Demand (MW)

Figure IV-19 depicts the actual New York State interconnected systems summer peak for the years 1970-1978 and the Energy Planning Board approved forecast of electric peak demand.

The Energy Planning Board approved a peak demand forecast of an average increase of 1.8-1.9 percent annually. Review of the record convinced the Board that the statewide load factor will improve in the future. The Board therefore concluded that the SEO projection of a constant load factor should be modified to reflect a moderate improvement. The Board considered a projected increase in statewide load factor from 62.9 percent to 64.5 (similar to that forecast by NYPP) to be reasonable. This would result in a reduction in the 1994 peak demand projected by SEO in the Draft Plan of approximately 717 MW.

In addition, the Board concluded that the SEO peak load projection should be revised using the appropriate percentage allowance for transmission losses and company use rather than the absolute amounts contained in the utilities' forecasts. This revision results in an additional reduction of statewide peak demand of 180 MW.

These revisions result in an electric peak demand forecast of 1.8-1.9 percent, which is approved by the Board. Figure IV-20 indicates the derivation of that forecast from the forecast of peak demand in the Draft Plan.

This forecast takes into account Base Case conservation impacts discussed in Section V-B and also Base Case development of biomass and solar energy as discussed in Section

FIGURE IV-18

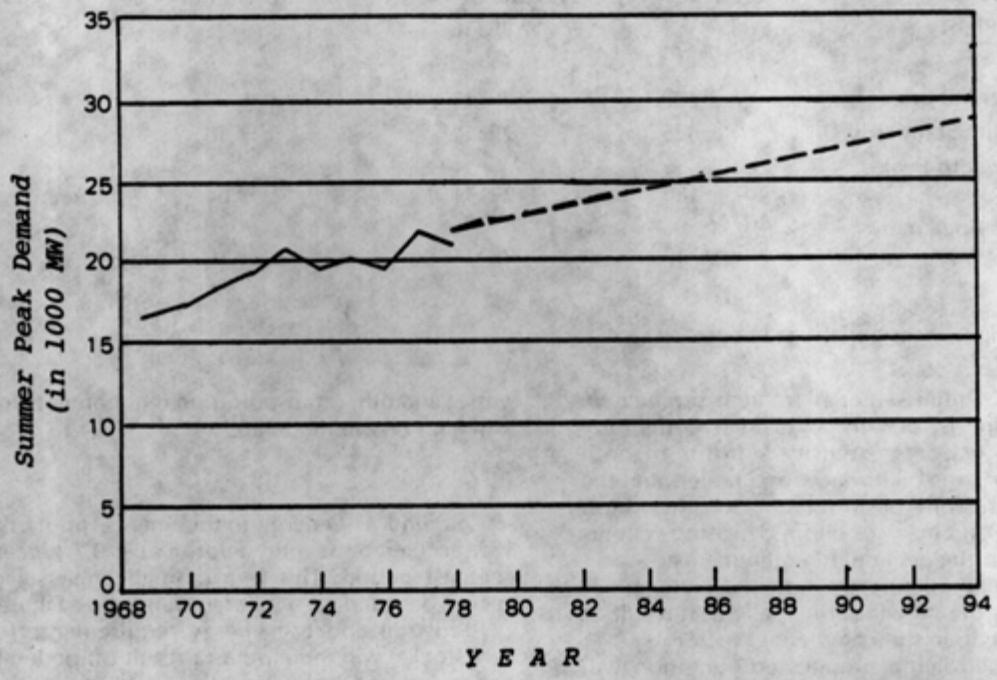
ELECTRIC ENERGY FORECAST BY SECTOR AND END-USE 1978-1994*

(Trillion BTU)

	1978	1980	1984	1989	1994	1978-1994 Growth Rate (%)
Residential	111.1	113.3	119.9	130.0	142.9	1.6
Space Heating	6.9	8.1	10.5	13.7	17.2	5.8
Water Heating	8.6	9.0	9.8	10.8	11.8	2.0
Cooking	4.8	4.9	5.2	5.7	6.1	1.5
Clothes drying	6.9	7.0	7.6	8.6	10.1	2.4
Central A/C	1.4	1.5	1.7	1.9	2.2	2.9
Room A/C	6.1	6.2	6.5	6.9	7.4	1.2
Other	76.4	76.6	78.6	82.4	88.1	0.9
Commercial	145.0	153.2	162.8	175.2	201.4	2.1
Space Heating	15.4	15.6	17.3	19.7	23.5	2.7
Cooling A/C	33.2	36.5	40.1	45.3	55.9	3.3
Water Heating	2.5	2.6	2.7	2.8	3.2	1.6
Lighting	70.3	72.4	74.9	78.8	87.7	1.4
Other	23.6	26.1	27.8	28.6	31.1	1.7
Industrial	95.9	101.6	113.2	124.5	143.4	2.5
Energy Intensive Manufacturing	65.8	70.7	77.5	84.8	94.1	2.3
Other Mfg.	28.2	28.9	33.5	37.3	46.5	3.2
Other Industrial	1.9	2.0	2.2	2.4	2.8	2.5
Transportation	7.8	8.7	10.4	12.2	13.0	3.2
TOTAL	359.8	376.8	406.3	441.9	500.7	2.1

*The electricity sales forecast by end use and sector has not been adjusted for the impacts of the recently enacted State lighting standards and the higher than assumed 1980 petroleum product prices.

FIGURE IV-19
INTERCONNECTED SYSTEMS ELECTRIC DEMAND AND FORECAST OF ENERGY PLANNING BOARD NEW YORK STATE (1969-1994)



V-C. To the extent that proposals for further development in these areas are adopted or enacted, the forecast of electric energy peak demand growth can be expected to decrease.

The Board also derived a peak demand forecast for each utility by taking the individual company sales forecasts approved herein and applying the individual load factors projected by the NYPP member companies. These load factors are consistent with the overall load factor underlying the statewide coincident peak demand forecast of 1.8-1.9 percent annually, and reasonably represent the company-specific load factor improvements which should be achievable. The resultant peak demand forecasts for the individual NYPP members are presented in Figure IV-21.

3) Natural Gas

Natural gas end use energy requirements will experience a 1.4 percent average annual growth rate over the forecast period, a dramatic reversal from the decline in the mid-seventies (See Figure IV-22). Figure IV-23 presents a summary of the forecast of natural gas requirements by sector.

Extensive residential retrofits in response to rising oil prices, improved building design, appliance efficiency standards, and new industrial process technology will contribute to improvement in natural gas end use efficiency.

Nonetheless, moderate economic growth spurring new household and commercial expansion, the distinct advantages of natural gas as a clean burning fuel, and price advantage over oil through 1989 will cause a moderate rate of growth in natural gas requirements.

The statewide forecast of natural gas requirements represents the combined natural gas requirements for the New York State Gas Group, composed of the major natural gas utilities in the State (See Figure IV-22).

The forecast of natural gas requirements indicates some variation in growth rate among the three demand sectors, as indicated in Figure IV-23 . Residential sector natural gas requirements will grow by 2.0 percent as a result of growth in households, and substantial conversion of existing housing from fuel oil to take advantage of lower costs.

Commercial sector natural gas requirements will rise moderately (0.9 percent annually) for similar reasons. This reflects the desirability of natural gas as a clean burning fuel and assumes increased supplies to New York.

Industrial sector natural gas requirements will increase at an annual rate of 0.1 percent. This points primarily to an increased use by firms with dual fuel capabilities in the wake of an easing of past supply shortages.

4) Petroleum Products

Petroleum product end-use requirements will decline slowly over the forecast period—a dramatic shift from the rapid growth (3 percent annually) of the pre-embargo period and a continuation of the decline since 1973.

Extensive residential and commercial retrofits (building shells and heating systems) and the effect of automobile fuel efficiency standards will lead to substantial improvements in efficiency and , therefore, a reduction in petroleum product requirements.

Moderate economic growth, reflected in increased air and freight transportation requirements, however, will offset, to a large extent, the anticipated reductions in residential space heating and automobile transportation needs.

Petroleum products, nonetheless, will remain the predominant fuel for end-use energy consumption. Natural gas, however, will replace home heating oil as the dominant fuel for space heating. Gasoline will account for one-fifth of total State end-use energy requirements in 1994 in the absence of new and more stringent fuel efficiency standards. Currently, gasoline accounts for one-quarter of State energy requirements.

The forecast of petroleum product requirements indicates significant variation in growth rates among sectors, as shown

FIGURE IV-20
ELECTRICITY PEAK DEMAND

	Impact (MW)	1994 Summer Peak (MW)	Incremental Impact on Growth Rate (%)	Average Annual* Growth Rate (%) (1979-1994)
SEO Forecast (Draft Plan)		29336		2.09
Board Adjustments				
• Impact of Higher Oil Prices	+400	29736	+.09	2.18
• Impact of Lighting Standards	−425	29311	−.10	2.08
• Revision of Energy to Peak Methodology	−180	29131	−.04	2.04
• Impact of Improving Load Factor	−717	28414	−.16	1.88

*Growth rate resulting from cumulative changes.

in Figure IV-24. Residential sector petroleum product requirements will decline 1.7 percent annually over the forecast period for two reasons: extensive retrofits of both building shells and existing oil furnaces and boilers and the rising cost of home heating oil in relation to other fuels. Improvements in the efficiency of oil-fired heating systems will also contribute to the decline in requirements.

Commercial sector petroleum requirements, on the other hand, will undergo some growth, principally as a result of strong economic growth in the commercial sector.

Industrial sector petroleum product consumption will undergo moderate decline. Petroleum products, nonetheless, will continue to remain an important swing fuel for many industrial firms and users.

Petroleum product requirements in the transportation sector will increase moderately, despite a decline in gasoline consumption in the decade of the 1980's. This reflects the weakening impact of mandated fuel efficiency standards. Moderate economic growth will lead to increased passenger and freight energy requirements throughout the forecast period. Gasoline requirements will increase after 1990 in the absence of more stringent fuel efficiency standards than are currently required. Highway freight, railroad, vessel and other transportation requirements for petroleum will all increase moderately.

5) Coal

Coal end use energy requirements, primarily industrial, will accelerate at a moderate pace, 0.7 percent, over the forecast period. This is a dramatic reversal of both the recent past and pre-embargo trends (see Figure IV-25).

Industrial end use energy requirements (exclusive of feedstocks) will increase as a result of moderate industrial expansion and limited coal conversions mandated by the Powerplant and Industrial Fuel Use Act of 1978.

6) Renewable Resources

Renewable resources (wood and solar) will make a significant contribution to end use energy requirements over the forecast period. The major contribution will occur in the residential sector. The 3.7 percent average annual rate of growth of renewables in the residential sector over the forecast period will far exceed that of the fastest growing conventional fuel—natural gas (2.0 percent). It will be ten

FIGURE IV-21
ELECTRIC PEAK DEMANDS AND GROWTH RATES BY UTILITY, 1978 and 1979

	Summer Peak (MW)			Winter Peak (MW)		
	1978	1994	Growth Rate (%)* (79-94)	1978	1994	Growth Rate (%)* (79-94)
CHE&G	614	964	2.47	623	964	2.61
CE	6714	7710	0.54	862	5313	0.40
LILCO	2997	4203	1.83	2456	3749	2.39
NYSEG	1729	2742	2.78	2138	3413	2.69
NMPC	5002	6890	2.11	5500	7558	2.05
O & R	662	1088	2.80	515	839	2.88
RG&E	983	1531	2.71	941	1514	2.87
PASNY	2348	3854	3.35	2500	4180	3.17
TOTAL	21049	28982		19535	27530	
Coincident Peak	20418	28414	1.88	18939	27257	2.10

*These growth rates are based upon weather normalized 1979-1994 peak demand projections.

FIGURE IV-22

NATURAL GAS REQUIREMENTS (SALES)
NEW YORK STATE 1960-1994

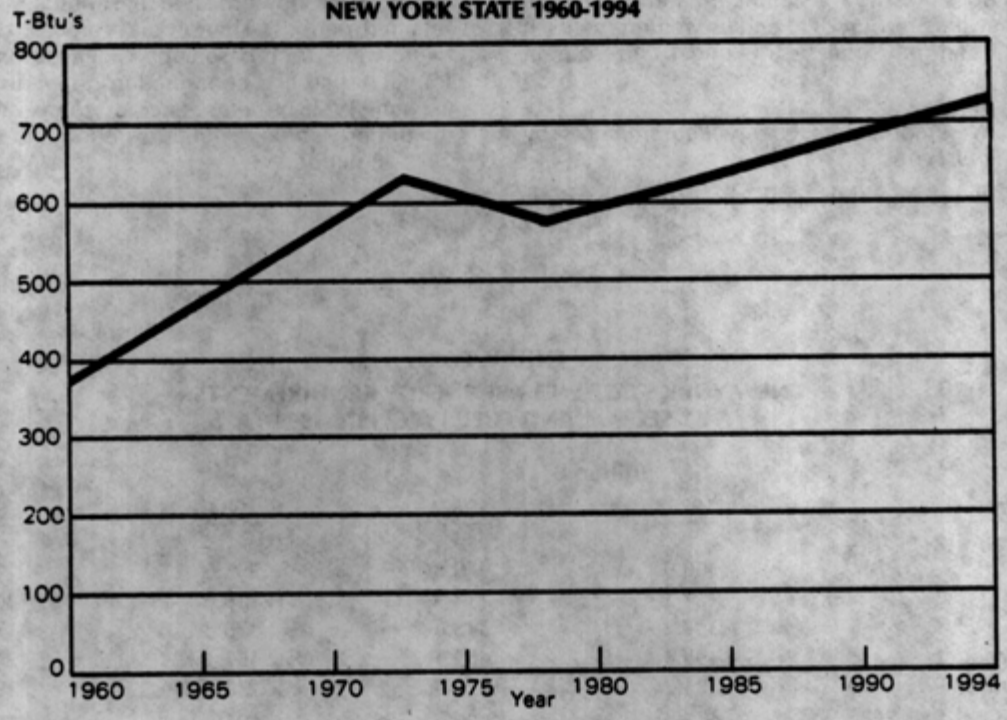


FIGURE IV-23

FORECAST OF NEW YORK STATE NATURAL GAS REQUIREMENTS (SALES) BY SECTOR, 1978-1994

Sector	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Residential	334.2	455.2	+2.0
Commercial	131.7	151.1	+0.9
Industrial	105.0	107.4	+0.1
Total Natural Gas Requirements	570.9	713.7	+1.4

FIGURE IV-24

FORECAST OF NEW YORK STATE PETROLEUM PRODUCT REQUIREMENTS BY SECTOR, 1978-1994

Sector	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Residential	498.4	380.2	−1.7
Commercial	395.2	432.3	+0.6
Industrial	120.1	113.2	−0.4
Transportation	1098.0	1159.8	+0.3
Total Petroleum Product Requirements	2111.7	2085.5	−0.1

FIGURE IV-25

FORECAST OF NEW YORK STATE INDUSTRIAL COAL REQUIREMENTS, 1978-1994

Sector	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Industrial	52.2	59.0	+0.7

times greater than the over-all sectoral growth rate of 0.3 percent.

The forecast does not show a significant additional contribution of renewable resources to end use requirements in the commercial and industrial sectors under current policies.

D. Forecast of New York State Energy Requirements by Sector and Fuel Type

Figure IV-26 depicts in full detail the official baseline forecast of New York State energy requirements by sector and fuel type by five-year intervals over the forecast period. Figure IV-27 shows the average annual percent changes for selected periods. This official forecast of energy requirements by sector is based upon aggregation of end use detail for each sector, as contained in Appendix C.

Figure IV-28 presents generally comparable historical data for the pre-embargo 1960-73 period and the post-embargo 1973-78 period.

FIGURE IV-26
NEW YORK STATE END USE ENERGY REQUIREMENTS BY SECTOR AND FUEL TYPE, 1978-1994

Trillion BTU

End Use Requirements	1978*	1980	1984	1989	1994
By Sector					
Residential	966.9	978.8	995.6	1011.1	1019.9
Electricity	111.1	113.3	119.9	130.0	142.9
Natural Gas	334.2	348.6	378.2	417.5	455.2
Petroleum Products	498.4	489.1	461.1	424.6	380.2
Wood and Other	23.2	27.8	36.4	39.0	41.6
Commercial	673.1	680.4	693.8	716.9	784.8
Electricity	145.0	153.2	162.8	175.2	201.4
Natural Gas	131.7	138.7	141.6	143.8	151.1
Petroleum Products	395.2	387.5	388.7	397.6	432.3
Other	1.2	1.0	0.7	0.3	-0-
Industrial	380.2	378.2	391.1	395.9	430.0
Electricity	95.9	101.6	113.2	124.5	143.4
Natural Gas	105.0	117.0	119.5	110.2	107.4
Petroleum Products	120.1	102.6	97.4	97.2	113.2
Coal (excluding coking) & Others	59.2	57.0	61.0	64.0	66.0
Transportation	1105.8	1081.8	1047.3	1054.9	1172.8
Electricity	7.8	8.7	10.4	12.2	13.0
Petroleum Products	1098.0	1073.1	1036.9	1042.7	1159.8
Gasoline	776.8	743.6	681.2	643.8	694.0
Total End Use Requirements	3126.0	3119.2	3127.8	3178.8	3407.5
Electricity End Use Requirements	359.8	376.8	406.3	441.9	500.7
Electric Utilities**	906.0	948.7	1022.9	1112.3	1260.3
Total Primary Energy Requirements	4032.0	4067.9	4150.7	4291.1	4667.8
End Use Requirements By Fuel Type					
Electricity	359.8	376.8	406.3	441.9	500.7
Natural Gas	570.9	604.3	639.3	671.5	713.7
Petroleum	2111.7	2052.3	1984.1	1962.1	2085.5
Other	83.6	85.8	98.1	103.3	107.6
Total End Use Requirements	3126.0	3119.2	3127.8	3178.8	3407.5

*Preliminary SEO estimates

**End use consumption is the energy consumed directly by the sector and differs from primary energy consumption by excluding electricity generation and transmission losses.

FIGURE IV-27

NEW YORK STATE END USE ENERGY REQUIREMENTS BY SECTOR AND FUEL TYPE, 1978-1994: AVERAGE ANNUAL PERCENT CHANGE FOR SELECTED PERIODS

End Use Requirements By Sector	1978-1980	1980-1984	1984-1989	1989-1994	1978-1994
Residential	+0.6	+0.4	+0.3	+0.2	+0.3
Electricity**	+1.0	+1.4	+1.6	+1.9	+1.6
Natural Gas	+2.1	+2.1	+2.0	+1.7	+2.0
Petroleum Products	-0.9	-1.5	-1.6	-2.2	-1.7
Wood and Other	+9.5	+7.0	+1.4	+1.3	+3.7
Commercial	+0.5	+0.5	+0.7	+1.8	+1.0
Electricity**	+2.8	+1.5	+1.5	+2.8	+2.1
Natural Gas	+2.6	+0.5	+0.3	+1.0	+0.9
Petroleum Products	-1.0	+0.1	+0.5	+1.7	+0.6
Industrial	-0.3	+0.8	+0.2	+1.7	+0.8
Electricity**	+2.9	+2.7	+1.9	+2.9	+2.6
Natural Gas	+5.6	+0.5	-1.6	-0.5	+0.1
Petroleum Products	-7.6	-1.3	-0.0	+3.1	-0.4
Coal (excluding coking) & Others	-1.9	+1.7	+1.0	+0.6	+0.7
Transportation	-1.1	-0.8	+0.2	+2.1	+0.4
Electricity	+5.6	+4.6	+3.2	+1.3	+3.2
Petroleum Products	-1.1	-0.9	+0.1	+2.2	+0.3
Gasoline	-2.2	-2.2	-1.1	+1.5	-0.7
Total End Use Requirements	-0.1	+0.1	+0.3	+1.4	+0.5
Electricity End Use Requirements	+2.3	+1.9	+1.7	+2.5	+2.1
Electric Ulitities*	+2.3	+1.9	+1.7	+2.5	+2.1
Total Primary Energy Requirements	+0.4	+0.5	+0.7	+1.7	+0.9
End Use Requirements By Fuel Type					
Electricity	+2.3	+1.9	+1.7	+2.5	+2.1
Natural Gas	+2.9	+1.4	+1.0	+1.2	+1.4
Petroleum	-1.4	-0.8	-0.2	+1.2	-0.1
Other	+1.3	+3.4	+1.0	+0.8	+0.8
Total End Use Requirements	-0.1	+0.1	+0.3	+1.4	+0.5

*End use consumption is the energy consumed directly by the sector and differs from primary energy consumption by excluding electricity generation and transmission losses.

**The electricity sales forecast by end use and sector has not been adjusted for the impacts of the recently enacted State lighting standards and the higher than assumed 1980 petroleum product prices.

FIGURE IV-28

NEW YORK STATE END USE ENERGY REQUIREMENTS BY SECTOR AND FUEL TYPE, 1960-1978

	Trillion BTU			Average Annual Percent Change	
	1960	1973	1978	1960-1973	1973-1978
Residential & Commercial	1129.1	1672.2	1642.5	+3.1	-0.4
Electricity	71.5	209.3	220.6	+8.6	+1.1
Natural Gas	303.1	479.2	476.1	+3.6	-0.1
Petroleum Products	674.4	973.5	940.9	+2.9	-0.7
Coal	80.1	10.2	4.9	-14.7	-13.6
Industrial	471.1	421.5	418.6	-0.9	-0.1
Electricity	87.4	121.8	131.3	+2.6	+1.5
Natural Gas	78.0	147.4	115.0	+5.0	-4.8
Petroleum Products	104.2	101.1	120.1	-0.2	+3.5
Coal	201.5	51.2	52.2	-10.0	+0.4
Transportation	742.6	1146.3	1105.9	+3.4	-0.7
Electricity	8.7	8.7	7.9	0.0	-1.9
Petroleum Products	733.9	1137.6	1098.0	+3.4	-0.7
Total End-Use Requirements	2342.8	3240.0	3167.0	+2.5	-0.5
Electricity End Use Consumption	167.6	339.8	359.8	+5.6	1.2
Electric Utilities*	398.3	879.5	906.0	+6.3	+0.6
Total Primary Energy Requirements	2741.1	4119.5	4073.0	+3.2	-0.2
End Use Requirements by Fuel Type					
Electricity	167.6	339.8	359.8	+5.6	1.2
Natural Gas	381.1	626.6	591.1	+3.9	-1.2
Petroleum Products	1512.5	2212.2	2159.0	+3.0	-0.5
Coal	281.6	61.4	57.1	-11.1	-1.4

*End use consumption is the energy consumed directly by the sector and differs from primary energy consumption by excluding electricity generation and transmission losses.

SECTION V-A

Plan Elements—Overview

1. INTRODUCTION

The forecasts of energy requirements in the previous section are a background against which to frame plans to best meet future energy needs. They are baseline forecasts that take into account the most likely future effect of the many variables that influence energy demands.

For example, the forecasts reflect the impact of recent OPEC price hikes and the likely assumption that these prices will continue to rise at a certain rate. They also take into account the impact of Federal and State governmental programs already in place, such as the State Energy Conservation Code, on future State energy requirements.

The forecasts also mirror certain assumptions about future economic activity in the State and the effects of inter-fuel competition, such as the expected shift in the residential and commercial sectors from oil to natural gas. These forecasts, then, draw a picture of the most likely energy requirements and the probable mix of fuels over the next 15 years—unless new actions are taken.

The forecasts suggest that the State's energy requirements will change significantly over the next fifteen years. The principal conclusion is that while growth in the State's energy requirements over the next fifteen years will be far below pre-embargo levels, a significant increase will nevertheless occur and will require, among other things, an expansion in electric system generation capacity beyond plants now under construction.

If the State's current mix of energy supplies were to continue, in the same proportions, to meet the growing demands of the next fifteen years, the results would be devastating to the economy and welfare of New York. The State would continue to be dependent for nearly two thirds of its energy supplies on petroleum. Since total energy demands are projected to increase somewhat, the State would consume even larger quantities of petroleum, most of which would have to be imported. With petroleum price projected to rise significantly faster than inflation, this growing consumption of petroleum would represent a continually spiraling economic drain on the State and its citizens. This is clearly an energy future which cannot be allowed to happen.

The supply elements of this plan project a substantial departure from the status quo. Two energy futures are presented, one of which is termed the "base-case" and the other the "proposed-case." The base case future is that which is projected to result if the base case forecast of energy requirements is met through a supply mix which evolves without major changes in the laws, regulations and programs which currently apply to energy supply, demand and price. This is thus an energy future fashioned on the presumption that only existing laws, regulations and programs can be counted on to affect energy consumption and supply trends over the next fifteen years.

The base case forecasts of energy requirements and the base case projections of energy resource development can, however, be altered by new laws, regulations and programs. The primary purpose of this energy planning process is to develop and implement actions which will improve the future. Once these actions are implemented, the forecasts and the projections of energy sources available to meet forecast demands will change.

Thus, the "proposed-case" energy future is that which would result if the many proposed actions recommended in this plan are implemented. It is a future in which greater conservation achievements result in lower energy requirements, and in which greater contributions are made by renewable energy resources.

In both the base and proposed cases, substantial progress is made toward improving New York's current energy mix; petroleum consumption is reduced and consumption of more plentiful resources, such as coal, and renewable resources, such as hydropower and solid waste, is increased.

2. IMPACT OF DRAFT STATE ENERGY MASTER PLAN

Section V is the core of the draft State Energy Master Plan. The various elements analyze current and future sources, issues of major concern and relevant technology trends for conservation and renewable resources as well as the conventional fuel types: natural gas, oil, electricity and coal. Three additional elements address: research and development, energy financing and the impact of energy costs on low income households.

A series of actions are proposed in Section V. If implemented, these actions will significantly alter the State's energy future in relation to the current fuel mix and the base forecasts as Figure V-A-1 illustrates. Full implementation of the draft Energy Master Plan proposals will:

- reduce current petroleum consumption by 120 million barrels per year by 1994;
- reduce current oil consumption in the utility sector by 85 percent by 1994; and
- increase the current share of coal from 7 percent to 17 percent.

The plan will save approximately 860 million barrels of oil during the Forecast Period. There would be a reduction in 1994 State oil consumption of approximately 120 million barrels due to the impact of conservation and direct renewables, and shifts from oil to coal and oil to renewable resources in the electric sector.

The cumulative economic savings associated with implementation of the Plan's proposals is projected to be at least $10 billion over the fifteen year planning period. These savings result largely from displacement of expensive imported petroleum through less expensive conservation investment and through greater use of coal, natural gas, and renewable resources.

The substantial cost savings to consumers results in increased disposable income that will flow through the State's economy and create significant additional jobs, earnings and personal income.

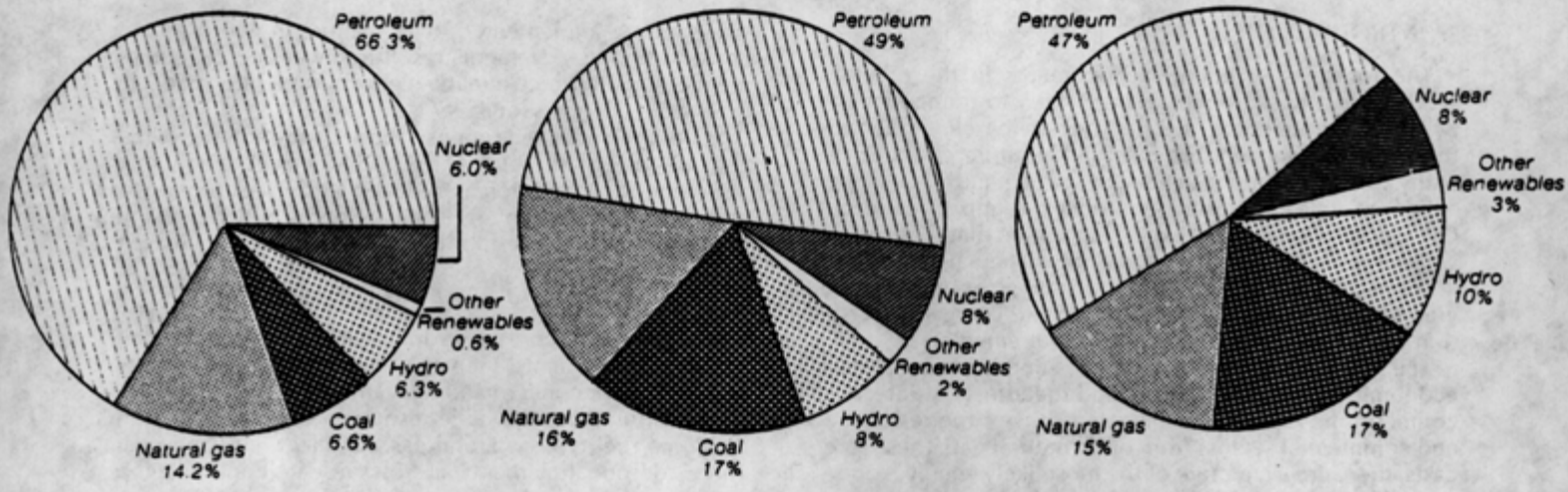
There would be 40,000 additional jobs created by 1994 as a result of full implementation of the conservation and selected renewable resource proposals.

The overall environmental impact of the conservation and renewable resource proposals in 1994 appears to differ only marginally from base case environmental impacts. At worst, there may be a net increase in particulate emissions due to increased reliance on wood burning and resource recovery facilities.

Full implementation of the Plan will result in slight increases in most environmental residuals as the overall growth in energy consumption outstrips gains in the environmental efficiency of the new sources which will meet these higher levels of consumption. Notable exceptions to

FIGURE V-A-1

TOTAL PRIMARY ENERGY CONSUMPTION
NEW YORK STATE, 1978 AND 1994

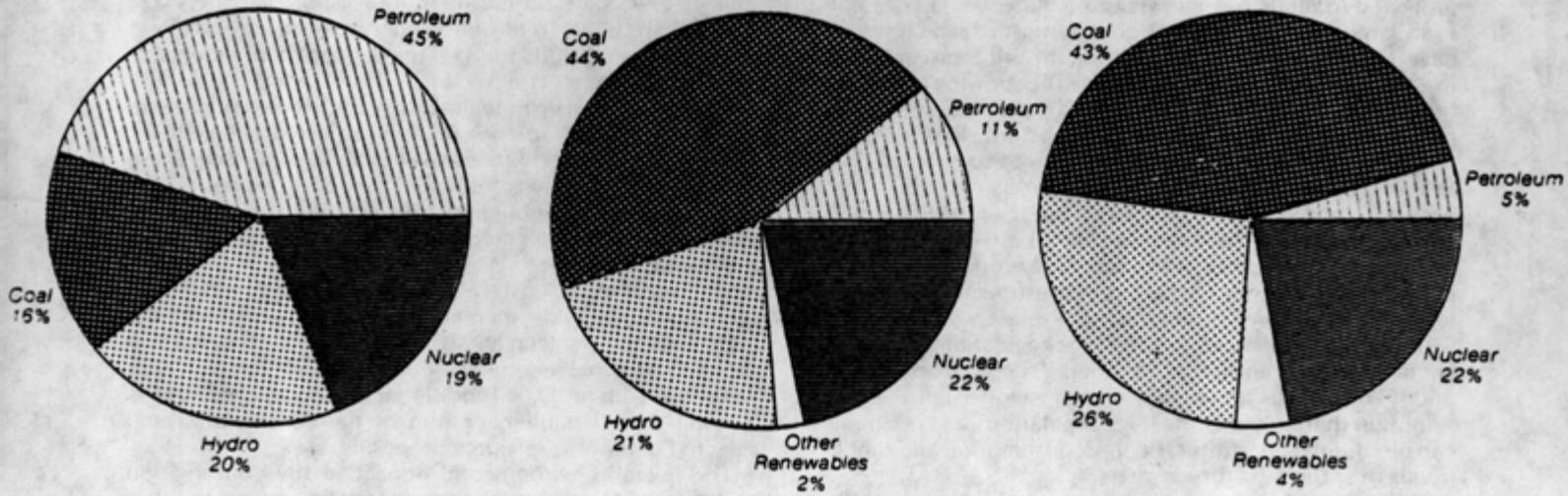


1978

1994
ENERGY MASTER PLAN
BASE CASE

1994
ENERGY MASTER PLAN
PROPOSED CASE

PRIMARY ENERGY USED TO GENERATE ELECTRICITY
NEW YORK, 1978 AND 1994.



1978

1994
ENERGY MASTER PLAN
BASE CASE

1994
ENERGY MASTER PLAN
PROPOSED CASE

this general rule are carbon monoxide and hydrocarbon emissions, which actually decline over the forecast period.

3. *STATE ENERGY POLICIES*

In Section 3-101 of the Energy Law, the Legislature set forth the energy policy of the State:

> ". . . to obtain the maintain an adequate and continuous supply of safe, dependable and economical energy for the people of the state and to accelerate development and use within the state of renewable energy sources, all in order to promote the state's economic growth, to create employment within the state, to protect its environmental values, to husband its resources for future generations, and to promote the health and welfare of its people;
>
> ". . . to encourage conservation of energy in the construction and operation of new . . . buildings, and in the rehabilitation of existing structures . . .
>
> ". . . to encourage the use of performance standards in all energy-using appliances and in industrial and commercial applications of energy-using apparatus and processes;
>
> ". . . to encourage transportation modes and equipment which conserve the use of energy;
>
> ". . . to foster, encourage and promote the prudent development and wise use of all indigenous state energy resources . . .; and
>
> ". . . to encourage a new ethic among its citizens to conserve rather than waste precious fuels; and to foster public and private initiatives to achieve these ends at the state and local levels."

These broad objectives have been refined during the course of the planning process into a set of energy policies required by Section 5-110(b)(4) to be specifically identified and justified in the Master Plan. These energy policies, presented below, are the major themes of the Master Plan, from which the recommendations for legislative and administrative actions contained in the plan elements flow. Together, these policies provide clear direction to State efforts to fashion its energy future.

- The State's consumption of petroleum products must be reduced. The economic costs and vulnerability to disruption resulting from the State's continued disproportionate reliance on oil strongly support actions to shift to less costly and/or more secure energy sources.

The State's petroleum dependence exceeds the national average by 20 percentage points (66% vs. 46%). Over 70 percent of New York's petroleum is imported either as refined product or crude oil. Nearly 90 percent of the petroleum products consumed in the electric utility sector (primarily residual oil) are refined from foreign crude oil. New York consumes more OPEC oil than any other state. Thus, among all States, New York is most vulnerable economically to increases in world oil prices and the political instability of its supply.

This vulnerability is a clear threat to the health and welfare of the State's citizens. World crude oil prices increased 86 percent during 1979, and when coupled with decontrol of domestic crude oil, raised New York's oil bill $4.8 billion or 55 percent in 1979. This drain of wealth threatens the competitive economic position of the State and threatens prospects for growth in New York employment.

- Conservation and renewable resources must make a greater contribution to energy supply and will require substantial additional government support to do so, at least in the near-term. In many applications, conservation and renewables appear to be the least costly, most economically productive and environmentally benign means to satisfy a portion of the State's current and anticipated energy requirements. Government action must enhance the respective contributions to be made by conservation and renewables in meeting those requirements.

Conservation, which primarily involves increasing the efficiency of our energy use, represents, in many applications, the least expensive, quickest, environmentally safest and most economically beneficial method for reducing New York's dependence upon petroleum. Estimates of the costs of various conservation actions range from one-half to one-tenth of the cost of adding an equivalent amount of energy from new sources. Moreover, conservation can make a positive impact upon New York's economy by reducing the drain of wealth from, and creating jobs in, New York State.

- The State of New York and its agencies should encourage the increased efficient use of natural gas and stimulate efforts to secure additional supplies of natural gas from sources that are economic, and compatible with environmental, public health, and safety standards in order to reduce New York's dependence on oil. Natural gas is and will likely remain an economic and environmentally compatible alternative to oil. This policy will help insure that supply and demand remain balanced throughout the planning period.

New York's consumption of natural gas is relatively low (14 percent of our total energy consumption vs. 26 percent for U.S.). There are strong economic and environmental reasons for increasing the use of gas in New York. Natural gas is currently less expensive than oil ($4.41/MMBTU vs. $6.07/MMBTU) for space heating. And, the cost of gas is likely to remain below the cost of oil for equivalent uses during the planning period. (The real prices of gas and oil are likely to increase at the same annual rate (4.4 percent) during the planning period.) Also, combustion of natural gas results, on the average, in 1/50 and 1/1500th the SO_x emissions of fuel oil and coal, respectively, and 1/2 to 1/100th the particulates, CO, hydrocarbons and NO_x emissions.

Currently, there is excess capacity in much of the intrastate distribution network. Thus, more gas can be sold in many parts of the State without incurring significant additional distribution capacity costs. The system is underground and nearly fully automated. Additional gas mains can be installed with a minimum of environmental impact.

Interstate natural gas supplies will likely increase over the planning period, due to increased gas production, additional sales to the interstate market resulting from the gradual deregulation of producer prices under the Natural Gas Policy Act of 1978, and increased imports. Also, a diverse set of supplemental sources is likely to begin to make a contribution in the planning period. In addition, significant conservation by customers and conversions to other fuels by major boiler installations will help to bring demand into balance with available supplies. Competition among the states for available gas supplies will, of course, continue. New York should have a set of policies which allow its citizens and businesses to compete vigorously for those supplies.

- The increased use of coal must be promoted where economically feasible and consistent with applicable environmental standards. Compared to continued use of oil, particularly in the utility sector, use of coal will probably result in economic advantages, given current and forecast cost differentials between coal and oil, and signifi-

cant improvement in certainty of supply over the forecast period. Increased utilization of eastern coal is likely to stabilize regional energy costs and will stimulate regional economic development. A regional energy development entity like the Energy Corporation of the Northeast (ENCONO) can provide a vehicle for maximizing the region's existing and planned production and use of coal and other energy forms.

New York's consumption of coal is also relatively low compared to the national average (9 percent vs. 20 percent). Use of coal, while attractive because its price is much lower than oil, includes a significant environmental cost. Although the record supports increased reliance upon coal, site by site analysis of economic benefits, pollution control options and environmental impacts must be carried out before any major electric generating facility can be permitted to use coal.

The greatest opportunity for increased use of coal in New York State in the near-term is in electric generating facilities. Currently, State power plants burn 89 million barrels of residual oil per year. Many oil-fired facilities either have previously burned coal or were designed to burn coal. Conversion from oil to coal for many of these facilities appears to be technically and economically feasible. Electric customers, over time, are likely to pay less for electricity if conversion takes place. Currently, Eastern coal (1 percent sulfur) used in utility boilers costs $1.56 per MMBTU; residual oil for similar boilers costs $4.84 per MMBTU. If cost differentials of this magnitude continue, many conversions will clearly prove to be economically desirable.

The Energy Planning Board has indicated its concern, however, with regard to the cumulative environmental, social and health impacts which would result should the targets for coal conversion and new coal construction contained in the Plan both be realized. Although the Final Environmental Impact Statement associated with this Plan and related testimony on the record provide important information and guidance concerning these impacts, and were sufficient to allow the Board to endorse the above energy policy and coal conversion plan set forth herein, a more detailed and comprehensive study of the cumulative impacts of this coal conversion and construction program should be undertaken. In this connection, the Board accepted the offer to assign principal responsibility for preparation of this study to the Department of Environmental Conservation, who will work in consultation with the Department of Public Service and the State Energy Office. The Department of Transportation was asked to participate as well. Upon completion of this study, which should be submitted as soon as possible, consistent with the necessity to coordinate fully with related Federal studies, the Board will review its approval of the coal conversion targets recommended in the Plan.

- Regional cooperation, coordination, and action must be promoted to enhance the region's energy supply prospects. Interconnection of New York's electric system with neighboring systems should be pursued as a vehicle for reducing costs and oil dependence to the extent economic and feasible. Interconnection may also lessen the adverse impacts on the State's environment from construction and operation of new generation facilities.

The Energy Planning Board indicated a strong interest in the role that increased economic regional power sales might play in meeting capacity requirements at lowest possible costs of service, reducing New York's oil dependence, and minimizing environmental injuries to the State from power generation. The Board advocated increased economic interconnection of New York's electric system with neighboring and distant systems and all other necessary arrangements to increase purchases of non oil-fired capacity and urge Congress and the relevant Federal agencies to reduce constraints that may exist on economic power sales between regions. Further, the Board accepted the offer to assign to the Department of Public Service principal responsibility for preparation of a study of the potential for economic interconnection and the institutional and transmission system changes that may be necessary to increase economic power transactions. The Energy Office and the New York Power Pool are to provide DPS their full support and cooperation. This study should be completed within six months, and each Board member is to be kept informed periodically of the progress of the study. The Planning Board also called upon the State Siting Boards in their review of new applications for construction of facilities, to evaluate fully the potential for capacity contributions which might result from improved economic regional interconnection.

- New nuclear power plants should not be included in the State's electricity supply plan at this time. There is first a need to develop a fully adequate national nuclear waste disposal program, and a need to clarify substantial uncertainties associated with economic, safety and regulatory issues associated with the nuclear option.

The approved electric generation plan does not depend on any additional nuclear capacity during the fifteen year Plan period. It does, however, protect the successful completion and operation of two plants currently under construction at Nine Mile Point Two and Shoreham.

A majority of the Board indicated the belief that current uncertainties surrounding this fuel form, particularly the Nuclear Regulatory Commission's current policy regarding the licensing of new plants and the probability of significant changes in safety requirements, as well as Federal failure to establish firm policy and programs to solve the waste problem, make it inappropriate to rely on additional nuclear capacity in this Plan. At the same time, the Board recognized that nuclear power may offer economic advantages in the face of the deepening crisis associated with foreign oil. The Board, therefore, recommended that there be created by the Governor and Legislature a panel to evaluate fully and comprehensively the status of nuclear power development in the State of New York. This panel should review all pertinent information, including the reports of all Federal, State and local government entities which have examined issues associated with nuclear power and which reports can aid the work of the panel. Every effort should be made to obtain federal funds for this project.

The panel should consist of distinguished scientists, engineers, business persons, labor leaders, environmentalists and citizens. Upon its creation and funding, the panel should consider the following, insofar as New York State is concerned, and report to the Board, the Governor and the Legislature:

- •• Within six months, with respect to:
  - . . . Impacts of phase-down or elimination of existing plants and contingency plans to assure adequate electric supplies in case of federally mandated nuclear plant shutdowns;
  - . . . Adequacy of emergency evacuation programs; and
  - . . . Adequacy of arrangements for secure transportation of nuclear materials.
- •• Within twelve months, with respect to:
  - . . . Feasibility of Federal or other government responsibility for operation of existing nuclear power plants;

. . . Feasibility of Federal or other government responsiblity for construction and operation of new nuclear power plants; and

. . . Adequacy of current and proposed Federal nuclear waste management programs.

- All consuming sectors must be given increased choice among competing energy forms, including conventional fuels, conservation and renewable resources. Increased choice will benefit consumers by increasing price competition among energy forms and will benefit the State by stimulating innovation and efficiency improvements.

The lack of an array of competing choices among fuels for energy consumers will prevent the reduction in petroleum use that should occur in light of the steep increase in petroleum prices relative to other fuels. For example, where natural gas service is not available, residential space heating choices are limited in several areas to either oil-fired electricity or heating oil.

Accordingly, every reasonable effort should be made to stimulate conditions that allow all economic energy choices, including conservation and renewable resource technologies, to compete in the market.

- Government must act to remove any existing legislative and administrative barriers inhibiting the development of energy sources, competition among fuel forms and energy conservation, except where such action would clearly compromise public health or safety or environmental quality. Justification for any such institutional barriers must now be reexamined in light of compelling State energy needs.

The era of cheap energy ended in 1973. However, most of the laws, rules and regulations developed during that era and which well-served the public interest as long as the cost of energy remained low, still exist. These laws, rules and regulations must be reexamined and, as appropriate, modified so the government does not unduly impede changes that would increase energy efficiency or contribute to the development of new energy sources.

- The State's electric and gas utilities, as well as PASNY, should encourage and stimulate conservation and efficient use of energy by their customers. Consideration should also be given to inducing utilities to becoming active purveyors of conservation and renewable resource technologies.

The investor-owned utilities and PASNY must increase efforts to achieve, through rate design and other economic means, further conservation and efficient use of electric energy in order to minimize energy use and particularly oil use in electric generation. In addition, consideration should be given to encouraging the utilities to become purveyors of conservation and renewable resource technologies on a broad scale to achieve our goal. A task force from SEO, DPS, and DEC should be formed to assess the utility programs instituted elsewhere which broaden the service utilities have provided historically and, if a broader utility role appears advisable, the study should assess the proper institutional arrangements to best effect that new role. The task force should report the results of its study to the Board within twelve months.

- No person should be without adequate heat or should be forced to forego conservation improvements by reason of inability to pay. A commitment to protect public health and safety requires no less.

Since energy is a necessity of life, rising costs may force many low income households into the intolerable choice of staying warm or buying food. This presents for all levels of government a very serious energy and social problem which must be solved.

- The State's energy research, development and demonstration programs must continue to emphasize the development and demonstration of those technologies particularly suited for near and midterm commercialization and implementation in New York State. Coordinated efforts in advancing such technologies should be consistent with other State energy policies.

Research, development and demonstration (RD&D) in New York should focus on technologies that are most suitable to New York's particular needs, and research efforts must recognize the need to adapt the technologies and solutions being developed by industry and the federal government to New York's problems. The particular weather conditions, environmental restrictions, intra-state energy supply and distribution systems, and patterns of energy demand are some of the factors which require consideration in developing technolgoies to suit New York's needs.

Therefore, there must be a close relationship between energy policy and RD&D. Energy policy must guide RD&D priorities and new technologies emerging from RD&D efforts must guide policy development.

- In view of the extensive reliance on oil in the transportation sector, more comprehensive consideration of possible State actions in that sector should be undertaken as part of the Board's future review of the Plan.

Improving energy efficiency in the State's transportation sector is vital to reducing the State's dependence on petroleum products. Energy use for transportation in New York State accounts for almost one-third of total end-use energy requirements. More significantly—since petroleum products account for virtually all of that energy—the transportation sector accounts for over one half of the total end-use petroleum product consumption.

While the Energy Planning Board recognized that the State is limited in its ability to take conserving actions in the transportation sector—passenger auto efficiencies are within federal purview, many freight actions are constrained by inter-state commerce considerations, and the investments required to improve or expand transit systems are considerable—the Board indicated that far more comprehensive consideration needs to be given to possible State action in this sector.

The Board therefore recommended that SEO, in cooperation with the Department of Transportation and other appropriate agencies, develop a comprehensive list of legislative and administrative actions in the transportation sector that may be worthy of further consideration and study. This list of actions should be presented to the Board within three months.

SECTION V-B

Conservation

1. INTRODUCTION

Conservation is the first element of this plan. Energy conservation is the least expensive, environmentally safest, and most economically beneficial supply option available. The lead times necessary for development of renewable resources, synthetic fuels, and other supply expanding options inhibit their usefulness in the next few years. Efforts made now to extend the life of fossil fuel resources will make the future transition to other fuel supplies less urgent and traumatic to society and the economy than would otherwise be the case.

Conservation is treated in this plan as both a supply source and a demand dampening option. Conservation is treated as a demand dampening option because conservation is already occurring and will continue to have an impact on forecasted demand. As such, it is an integral part of the demand forecast. Conservation efforts to date and the strategies in place today are a function of the combined actions of the Federal and State governments, as well as private efforts. These strategies are defined in detail in Part 2 of this section and their impacts have been incorporated into the Forecast of Energy Requirements. Conservation's impact on the forecast is derived from a set of "base case" programs, policies, statutes, and regulations which were translated into quantitative terms and then projected into the future (i.e. over the forecast period). The constraint applied in this process was to assume a maintenance of the status quo in the non-economic factors affecting conservation during the forecast period. Laws and programs already enacted were included in the forecast. But no proposed policies or programs were allowed to impact the forecast.

At the same time, conservation is treated as a supply source in this plan. Conservation—making the most efficient possible use of energy in all its varied forms and end-uses—has the ability to extend the life of all energy supplies and provide more time to make the necessary transfer to a renewable energy resource base.

Presented here, using the supply source characteristics of energy conservation, are the two alternate scenarios that go beyond the base case: the proposed case and the potential case. The proposed case is based on those programs, laws, and regulations that are proposed in this plan as immediate actions to be taken. The demand impact of the proposed case is always stated in this plan in terms of additional savings over and above the savings of the base case or forecast.

The potential case is based on a set of programs, laws, and regulations which, while technologically feasible, are not proposed in this plan for reasons that will be discussed in Part 5. While not proposed, the potential case is assessed for two reasons. First, it shows the great potential for energy conservation. Second, it allows the reader to place the proposed case savings in perspective vis-a-vis that potential. The demand impact of the potential case is also stated in terms of savings over those of the forecast, but potential case savings are inclusive of proposed case savings.

The economics of energy justify energy conservation actions. From the standpoint of the individual or end-user, the important economic criterion is the simple payback period on an investment. The most common payback cut-off points employed since 1973 have been on the order of two to seven years, varying with the end-user and the size of the investment. However, rising energy prices are causing two things to happen simultaneously: more and more conservation investments are becoming cost beneficial within the above payback criterion; and end-users are beginning to relax their payback requirements, i.e., accept longer payback periods on investments.

In spite of the continuing, and likely increasing, level of conservation one might expect from the effects of rising energy prices, a need exists for some degree of regulated conservation as well. This is especially true when the principal beneficiary of an investment is not the investor, such as in the case of improvements made by owners of multi-family dwellings where the tenants pay their own fuel and utility bills. The owner is the investor; the tenant is the direct beneficiary. Other examples exist in the construction of new buildings and the manufacture of appliances. The builder or manufacturer produces what he can sell. Traditionally, this has led to low initial cost/high energy cost. products. Regulations have and will continue to intervene in such markets to ensure the production of low life-cycle cost products.

From a more macroeconomic standpoint, it should be noted that a dollar spent in conserving energy tends to achieve more than a dollar spent in energy production. Estimates of the costs of conservation measures range from one-half to one-tenth the cost of adding an equivalent amount of energy from new sources.[1]

Energy conservation is also beneficial to the environment. A reduction in the use of fossil energy results in a nearly one-to-one reduction in polluting emissions, both particulates and gases. The Environmental Impact Statement more thoroughly discusses the environmental impacts of conservation.

Conservation is one of the few energy supply options that can be used by a state such as New York to create economic benefits within the state as opposed to elsewhere. Consuming out-of-state or foreign oil tends to support jobs elsewhere and draw capital out of the state. Conservation activities create jobs locally, especially in the construction and service industries for the on-site installation of energy conserving materials and devices, even if the manufacture of conserving materials and devices occurs elsewhere. In addition, recently released studies[2] indicate that more jobs are created by investments in energy conservation than by equivalent investments in energy production of non-renewable fuels, though the specific trades and crafts may differ from one to the other.

In the past, it has been assumed that economic growth was inexorably linked to energy use growth in a one-to-one relationship. The truth of this assumption was irrelevant as long as adequate energy supplies were available at low prices. There is little doubt that the industrial revolution and subsequent development in industrialized nations were greatly assisted by the abundance of a cheap energy supply. But that same supply also allowed energy-for-labor substitution to occur. A shift in emphasis toward the efficient use of energy will allow continued economic growth to occur in the coming era of ever more scarce fossil energy supplies.

Unlike other options, opportunities to conserve cross all

[1] "Employment Impact of the Solar Transition", a study prepared for the use of the Subcommittee on Energy of the Joint Economic Committee of the U.S. Congress, U.S.G.P.O., April 6, 1979, p. 10.
[2] Ibid., p. 17.

fuel types and all end-uses. It is a multifaceted concept whose ability to succeed lies in public acceptance and understanding of its importance. Implicit in the nature of energy conservation is the fact that each and every person and entity has the opportunity to conserve. Except where end-use regulations are in force, it is up to individual decision-makers to decide which conservation actions are best suited to their situations. These decision-makers range from homeowners to industrial executives, to institutions, to government agencies at all levels. The economic characteristics of each are very different and the magnitude of investment needed to affect conservation varies widely.

Hence, conservation can disperse the responsibility for dealing with energy problems across all sectors of society and the economy—public and private, corporate and individual—so that the burden is shared and the total effort is magnified.

2. *CONSERVATION PROGRAMS IN PLACE*

Conservation has had a short but active life in New York State, as in the Nation at large. Prior to the 1973 oil embargo, conservation received little attention. The forced conservation experienced that winter introduced the potential of energy conservation on a continuing basis, rather than as a response to a crisis. Subsequently, the national conservation effort took shape.

The major conservation initiatives to date have been defined by three federal laws:

- the Energy Policy and Conservation Act of 1975 (EPCA),
- the Energy Conservation and Production Act of 1976 (ECPA), and
- the National Energy Act (NEA), or more specifically the National Energy Conservation Policy Act of 1978 (NECPA).

EPCA made planning and program administration monies available to the states for conservation activities for the first time. Use of funds was restricted to non-capital expenditures. States' plans had to demonstrate how each would achieve at least a 5 percent reduction in energy consumption in 1980 below the level of energy consumption forecasted for the State for 1980 in the absence of the EPCA plan. New York State is participating in this program and by the end of 1979 had received $7.2 million to implement its plan. EPCA also set the average fuel economy standards which each manufacturer of passenger automobiles must meet in its yearly sales.

ECPA made money available to the states for Supplemental Energy Conservation Plans. These funds were to be used for energy audits, intergovernmental coordination, and public education efforts to supplement the EPCA programs and enhance their energy conservation potential. By the end of 1979, New York State received $3.1 million under this program.

NECPA requires states to establish utility residential energy conservation programs similar to that already operating in New York under the Home Insulation and Energy Conservation Act of 1977. NECPA also provides administrative funds and grant monies for energy conservation programs for schools, hospitals, units of local governments, and public care institutions. The states are administering the funds.

While ECPA called for energy efficiency targets to be set for major residential appliances, NECPA calls for the establishment of efficiency standards for those appliances. NECPA also requires an investigation of the advisability and energy savings potential of standards for industrial equipment. Standards for large motors and pumps are expected to result from this inquiry.

Another part of the NEA, the Energy Tax Act of 1978 (ETA), provides tax credits for certain energy conservation investments. In the residential sector, a non-refundable personal income tax credit of up to $300 (15% of the first $2000 invested) is provided for installation of insulation and other qualifying equipment and materials in a principal residence. Business tax credits and rapid depreciation allowances are also available.

The states implement many federal initiatives, not the least of which are the mandatory measures required by EPCA. Under those mandates, New York State has implemented: the Energy Conservation Construction Code applicable to new and renovated residential and commercial buildings; lighting efficiency standards applicable to non-residential buildings; a statewide 55 mile-per-hour speed limit; a permissive right-turn-on-red law applicable everywhere except New York City; and inclusion of energy-efficiency considerations into state and local government procurement practices.

Figure V-B-5 outlines by sector the major statutory, regulatory, and programmatic energy conservation efforts to date.

Energy conservation must be undertaken and analyzed sector by sector, as well as by end-use within each sector. Hence, conservation actions and programs must be targeted to specific sector end-uses. The conservation programs presently in existence at the Federal and State levels reflect this approach.

While federal statutes and policies have been directed at all end-use sectors in general, the specific programs that have resulted have not shown a sectoral balance. For example, standards have been issued, or soon will be, covering residential appliances, passenger automobiles, and some industrial equipment. No similar attempt has been made in the area of commercial appliances or equipment.

Multifamily housing is not as well treated as single family housing. The majority of federal retrofit money is directed at units in which the government already has an investment (i.e., public and federally insured housing). Apartment owners are excluded from the use of the residential energy tax credits. Apartment renters are eligible for this credit but are obviously unlikely to take advantage of it since it is unusual for one to make a capital improvement to a dwelling one does not own. The list of allowable items for the business tax credit does not include the items most likely to be employed in multifamily housing retrofits, and rental housing is specifically excluded from the general investment tax credit.

Also within the residential sector is the federal program to weatherize low income housing. It would appear that the problems of low income households are being addressed, but at the current level of funding (New York State's FY '79 share is $18-million) it would take at least 17 more years to weatherize all New York State's low income homes. The level of effort is clearly insufficient.

In the commercial sector, the National Energy Conservation Policy Act (NECPA) provides administrative funds and grant monies for energy conservation programs for schools, hospitals, units of local governments, and public care institutions. Other than the weatherization programs for low oncome families, this is the first federal program to provide grants for energy conserving capital investments. The states administer the funds. New York State will receive approximately $75 million over three years for its program. Even within this program, an intra-sectoral imbalance is evident. First, the entire program focuses on only a subset of the commercial sector. Second, only schools and hospitals are eligible for actual capital improvements grants. Units of

local government and public care institutions are eligible only for energy audits and technical assistance.

In the transportation sector, the Energy Policy and Conservation Act (EPCA) set the average fuel economy standards that each manufacturer of passenger automobiles must meet in its yearly sales. While the individual states have no part in the administration of this program, it is the greatest single conservation factor in the transportation sector nationwide. At the same time, however, there is almost a total absence of programs affecting modal shifts and mass transit development. The removal of the 8 percent federal manufacturers excise tax on bus parts and on fuel, oil, and tires used with buses is the only concession to mass transit. No energy programs are directed at railway improvements or development.

In the utilities sector, conservation efforts are many and varied but primarily in the planning and study phases. Efforts underway are aimed at improving system efficiencies, leveling load, and establishing the relationship between utility rates and end-user conservation efforts. Left to be explored is the potential for an expanded role for utilities as energy service industries and financiers of large and small scale conservation efforts. The NECPA Residential Conservation Program, which will be similar to the program New York already has under the Home Insulation and Energy Conservation Act, is evidence of the growing federal interest in the utility role on conservation.

The federal government, then, has defined its role in conservation to set national standards for certain energy-using products (residential appliances and automobiles in particular) and to establish a framework within which the states may define their conservation efforts to suit local needs and constraints, with federal funding and incentives to assist in those efforts.

Consequently, and because of their regulation of the buildings and utilities sectors and management of the transportation and education systems, the states have an extremely important role in conservation.

Local governments are closer to the public than is state government, and so have a very large role in public education, information dissemination, and technical assistance programs. In addition, some federal/state programs can only be carried out with the cooperation and under the auspices of local governments. Implementation and enforcement of the Energy Conservation Construction Code is a prime example of the need for a state/local cooperative effort.

Also clear from the foregoing is that directions are often charted by the federal government but the means for the states and public to follow the course are not provided. For example, until the advent of the schools and hospitals capital grants program, funding to the states for energy conservation programs totally prohibited capital expenditures using federal funds. This confined state action to public education/technical assistance type programs that are totally dependent on voluntary, private sector cooperation and investments to have any impact. There was most assuredly a place for such programs in the conservation effort to date, and there will continue to be a need for such programs in the future to facilitate any course of action undertaken. But there is a limit to what voluntary actions and public education programs can achieve. Hence, a change in the direction of the conservation effort is called for. Its future direction will be discussed in Part 4 of this Section.

3. *CONSERVATION IMPACT TO DATE*

New York State's energy conservation effort is well underway in both the public and private sectors, and has already yielded impressive results. Great strides have been made through voluntary conservation, supported by the federal and State programs outlined in the previous section. As a result of these combined efforts, the following may be observed:

Residential Sector—

- A new single family home built after January 1, 1979, under the energy conservation construction code is expected to consume 15 percent less fossil fuel for space heating and cooling and water heating than would a comparable home built only a few years ago. In new multifamily buildings, up to 60 percent savings may be achieved through the code.
- As many as 60 percent[3] of the State's single family homes have undertaken first generation, i.e., common envelope retrofits, energy-conserving measures since 1973. Savings

[3]"New York State Residential Insulation Survey, Final Report," September, 1977.

FIGURE V-B-1

RESIDENTIAL SPACE HEAT FUEL REQUIREMENTS (MMBTU's) PER CUSTOMER IN REPRESENTATIVE SERVICE TERRITORIES

	Electric	Natural Gas	Fuel Oil & Kerosene
Long Island Lighting			
1973	50.174	161.30	193.56
1977	39.221	145.77	174.93
Niagara Mohawk			
1973	49.829	139.43	167.32
1977	47.102	135.49	162.58
Orange & Rockland			
1973	42.867	161.30	193.56
1977	41.640	145.77	174.93
New York State Electric & Gas			
1973	51.347	172.29	206.74
1977	48.895	168.80	204.74

per unit have averaged 12 percent of space heat end-use consumption. Figure V-B-1 illustrates the effects of these actions on space heat unit demands in New York State.

- While a number of laws have been passed in New York State affecting appliance energy use, and appliance efficiency standards will soon be issued by the federal government, none of these will have an impact before 1980. The effects of such measures have, however, been taken into account in future years in the residential forecast.

Commercial Sector—

- A new commercial building constructed after January 1, 1979, under the Energy Conservation Construction Code may be expected to consume up to 60 percent less fossil fuel for space heating and cooling and water heating than would a comparable building constructed only a few years ago. Improvements in lighting efficiency are also required under the new buildings Code.
- Existing non-residential buildings must, after April 1, 1981, comply with the State Lighting Efficiency Standard established under the Energy Law, Sections 8-101, 8-103, and 8-106. The precise energy savings that have resulted and will result from this Act are not yet calculable.
- New York State Government has contributed to the total conservation efforts and shown leadership by example with its Energy Management and Budgeting System (EMBS), energy efficient procurement practices, and a delamping program. In spite of an increase in heating degree days from 5813 in fiscal year 1977-1978 to 6195 in fiscal year 1978-1979, energy use in the State buildings monitored by EMBS fell from 288,200 BTU/ft² to 257,856 BTU/ft², representing 10.5 percent savings.

Transportation Sector—

- The average auto fleet efficiency in New York State in 1976 was 13.26 miles per gallon, according to New York State Department of Transportation estimates. The comparable figure for 1979 is an estimated 14.26 miles per gallon, a significant 7.5 percent improvement.
- A State operating assistance program has increased mass transit service levels for systems in New York State, other than the Metropolitan Transit Authority in New York City, from 76 million vehicle miles in 1974-1975 to 96 million in 1977-1978—an increase of about 27 percent. This increase is attributable to a substantial number of new private and small public mass transit operations in the State, as well as from increased service levels in existing systems.[4]
- The New York State Department of Transportation credits the fact that the per capita gasoline consumption in New York State is 33 percent below the national average to the State's extensive mass transit systems, especially in the New York City area. It is estimated that New York City's mass transit system presently saves 44 million barrels of gasoline per year.

Industrial Sector—

- Industrial energy use per value added (i.e. energy intensity) has dropped in New York State from 16.206 in 1974 to 14.375 in 1978, an average annual growth rate of -2.95 percent.
- Each industrial energy survey performed by SEO's Energy Advisory Service to Industry (EASI) program produces energy savings averaging 1 billion BTU. Fifty such surveys have been performed to date yielding 50 billion BTU savings in the industrial sector. Another 1800 surveys are scheduled over the next two years to help New York State's industries make further reductions in energy intensity while maintaining growth levels.

The vast majority of the impacts illustrated above may be attributed to the voluntary conservation efforts described in Part 2 of this Section.

4. THE DIRECTION OF CONSERVATION IN THE FUTURE

The experience to date in administering conservation programs has shown much in terms of who conserves, what causes conservation action, and which types of programs and government actions are most effective in bringing about conservation.

Conservation activities may be broken down into two major classifications of activity: price-induced and regulated.

Price-induced conservation is voluntary action taken because a direct economic benefit will be derived. The magnitude of the savings resulting from price-induced conservation is increased by public education and technical assistance programs that inform consumers of the economic benefits to be derived from conservation, as well as how best to go about conservation activities. Examples of price-induced conservation to date include the large number of residential retrofits that have taken place voluntarily and purchases of ever-increasing numbers of more energy-efficient automobiles. No government mandate has forced the public to retrofit its homes—this is clearly price-induced conservation. Public education programs, however, have enhanced the effects of price-induced conservation through cultivation of an informed public.

Regulated conservation refers to those actions taken because of a government mandate—law and/or regulation. A primary example is the construction of new, energy-efficient housing mandated by the New York State Energy Conservation Construction Code.

To date, the majority of conservation activities have been price-induced, encouraged by government public education and technical assistance programs, and facilitated by standards in some instances. Such programs will continue to have positive results, since rising energy prices will result in shorter payback periods for actions and investments. Thus, actions that presently exceed the acceptable payback period for individual energy investment decisions will become more attractive as energy prices rise. However, there are limits to what price-induced conservation can achieve; many end users might not make rational investment decisions because of the inertia of continuing present practices or inherent conflicts—as in the landlord-tenant relationship where the investor may not receive the benefits.

Regulated energy conservation has been used to ensure that cost effective end-use devices (on a life-cycle costing basis) such as air conditioners, hot water heaters, and automobiles are manufactured instead of lower capital cost and high operating cost devices. Also, the construction of new buildings has been regulated to meet specific energy standards. To date, however, little conservation regulation has been developed to deal with the retrofit of existing devices and buildings.

The inherent limits to price-induced energy conservation ever reaching conservation's full potential will lead to more emphasis in the future on energy conservation by regulation. However, the decision to invoke an end-use regulation warrants care in terms of individual variations. While the "average" payback period for a retrofit investment may be seven years, the range of payback periods over the affected end-use sector may be two to 14 years. To mandate an

[4]New York State Department of Transportation, "Public Transportation Operating Assistance Programs in New York State, 1978, Annual Report" December, 1978, p. II-1—II-2.

investment with such a wide range of paybacks for all end-users would not be sound public policy. Similarly, the individual's ability to meet high front-end costs must be considered before end-use controls are invoked.

The public desire to mandate a specific energy conservation measure will increase as the proportion of citizens not at this level of energy conservation declines. For example, the acceptability of mandating a measure affecting 80 percent of the public is considerably less than that of one affecting only 20 percent of the public. Thus as price-induced energy conservation approaches a saturation point, resistance to mandated conservation will decline.

Another new direction will be a significant increase in the scale of investments. The first-generation conservation era of ceiling insulation, caulking, housekeeping, maintenance, and delamping will be supplemented and replaced by second-generation conservation investments in wall insulation, furnace retrofits, and new heating,ventilating and air conditioning (HVAC) systems. Such major investments will have longer payback periods and in many cases require special financing. While financing was not a particular problem for the housekeeping era, it may well be for the emerging major retrofit era.

A major new factor in conservation in the future will be the advent of new conservation technologies. The impact of new technologies on energy consumption has only just begun. Many devices that will dramatically reduce energy consumption are in the testing stage or just entering the market. The actual impact of these technologies on future energy consumption cannot be measured at this time since neither their per unit savings nor market penetration can be measured. New and more efficient devices already on the scene—witness heat pumps and high efficiency electric motors, for example—are not yet in widespread use. On the other hand, some very old techniques are being rediscovered—for example, proper maintenance and scheduling of equipment to make them more efficient and extend their useful life.

Working within the economic and technological uncertainties and constraints discussed above to implement energy conservation actions and programs are the Federal government, the State and local governments, and private institutions and individuals.

The best available indicator of the future course of federal energy conservation policy is the Administration's proposed "National Energy Plan II" (NEP-II). The Administration's strategy is to stimulate consumers to use energy in the most cost-effective ways possible, taking into account resource, social, and environmental costs. The strategy also encourages fuel switching away from oil to more abundant sources. Implementing the strategy requires the following steps:

- Correcting price signals to energy users by moving toward replacement-cost pricing of fuels and granting tax credits and other incentives for installing energy-conserving equipment.
- Issuing regulations to reduce or limit energy use in new buildings, vehicles, and appliances.
- Supporting research, development, and demonstration of new technologies that will use energy more efficiently.
- Providing grants for energy-conserving improvements to low-income families, schools, hospitals, and other organizations not now benefitting from tax credits or other incentives.
- Supplying information on conservation and technologies, including comparative costs and results, so prospective users can make better choices (for instance, life cycle costing and mandatory labeling).
- Overcoming institutional barriers to conservation—for example, by reform of utility rates.

This indicates a continuation in the federal policy of relying on price-induced conservation and limited appliance and equipment regulation. NEP II did not make any major new conservation policy thrusts, such as increased federal funding for massive low-income weatherization retrofits or financial support for major housing, commercial, or industrial retrofit investments. NEP II does call for passage of the Energy Management Partnership Act to help states establish a way to integrate energy management and monitoring energy programs at the state level, thus continuing and strengthening the state and local roles in energy conservation.

The future role of state governments is thus defined in large part by the federal government and constrained by the limited availability of state funds for conservation efforts. New York State will continue its public education/ technical assistance activities, and will move further into the realm of end-use controls within the economic restrictions discussed above.

Increased attention to the potential role of energy utilities in conservation is warranted. Among the possibilities is the potential for eliminating declining block electric rates in the commercial and industrial sectors as a means to induce conservation. Another is the possible role of utilities as energy conservation investors rather than investors in new capacity. A changed role for energy utility companies from energy providers to total energy service industries is also a possibility.

The changing energy/economic situation of the past decade has had far reaching effects on utility companies, not the least of which has been the resulting changes in rate structures. The declining block structure may have been appropriate when energy was inexpensive and economies of scale were still operable. That situation has reversed and the declining block structure tends to reward consumption, not conservation. Hence, the utilities, in cooperation with the Public Service Commission through its rate regulation decisions, are moving away from the declining block structure toward marginal cost pricing and time-of-day rates to give consumers the appropriate conservation-inducing price signals. The move away from declining block rates for residential customers is well underway.

The role of utilities could be expanded to make them energy service industries and investors in end-use conservation. For example, the New York State utilities might be involved in programs such as that of the Pacific Power and Light Company, which retrofits electrically heated homes. PP&L is making interest free loans to home owners to retrofit where the cost in dollars per KWH saved is less than the marginal cost of additions to capacity. The loans must be repaid before the home may be sold. Public utility regulatory commissions in four states have already approved the program.

The future direction of conservation lies in a continuation of past policies with a growing reliance on end-use controls and an expanded role for the utilities sector. Also the impact of new technology on conservation could be very significant, especially if energy policies encouraged its introduction into the market.

5. CONSERVATION PROPOSALS AND POTENTIALS

Presented here are the measures that form the proposed case and potential case impacts of conservation.

Measures for the proposed case are presented as proposals for current action.

Another set of measures was evaluated for the potential case. The demand impact of these potential case measures over and above the forecast was quantified to give an estimate of the savings that would result from their implementation. The measures in the potential case should be considered only as illustrative means—not necessarily the desired means—for reaching that level of savings.

The decision to place any given measure in either scenario was based on the criteria and expectations discussed in Part 4 of this section of the Plan. Each measure was evaluated on the basis of: payback period on investment, size of investment; ability of the affected end-user to respond to proposed end-use regulations; the need for regulated vs. voluntary action in any instance; the appropriateness of alternate implementation, enforcement, and financing mechanisms; and the energy saving potential of the measure. Whenever a measure displays an uncertain payback period; too large or uncertain investment amounts; questionable ability of the end-user to make the investment required by a regulation; unclear justification for an end-use control; or the absence of sound implementation, enforcement, or financing mechanisms, that measure is placed in the potential case—unless a feasible proposal can be made to rectify the problem.

BTU savings estimates, when they can be determined for a specific measure, are based on a program-by-program calculation. To the extent that programs will overlap, double counting of BTUs would result from straight-line addition of the numbers. On the other hand, these calculations cannot take into account spill over effects or direct price-induced effects from other programs or from rising energy prices. These numbers then are shown only to give an appreciation for the relative impact among programs.

Figures V-B-2 through 4 show the additional conservation impact—over and above the base case impact already incorporated in the forecast—expected in 1994 from the proposed case and from the potential conservation case, respectively. It is broken down by sector and by fuel type, after eliminating double counting of BTUs and after including pricing effects from the forecasting models.

A. Proposed Case Measures

1) State Actions

- Amend the Energy Conservation Construction Code to reflect improvements in energy conservation, design and construction practices and equipment effectiveness.

As the state legislation now stands, the Energy Conservation Construction Code is based on Standard 90-75 of the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE 90-75), dated August 11, 1975, and the PSC residential standards, with amendments requiring legislative approval. The ASHRAE standard is periodically revised on the basis of changing energy prices and technological advances. But as the law stands, the SEO is unable to adjust to these changing, energy conserving standards, or to depart from them.

The original Draft Plan proposal was to amend the Law to allow the Energy Commissioner to amend the code. This proposal has been modified to suggest specific code amendments through direct legislative approval pursuant to Sec-

FIGURE V-B-2
1994 NET ENERGY DEMAND IMPACT—PROPOSED CASE

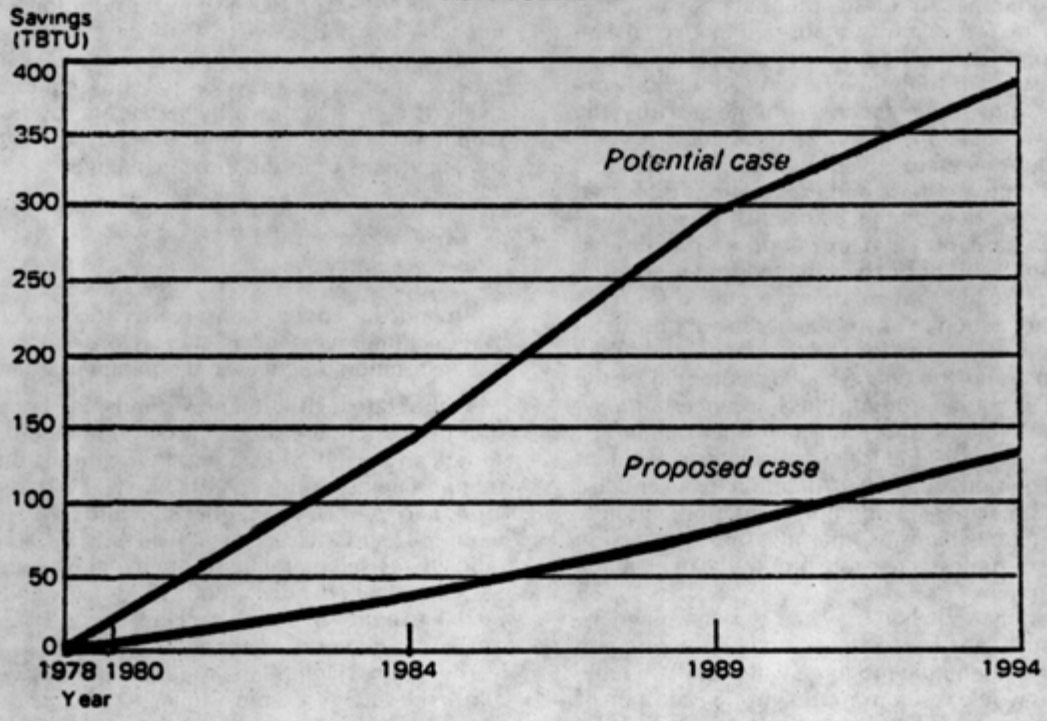
		Oil		Natural Gas		Electricity	
Sector	Total TBTU	TBTU	10^6BBL	TBTU	BCF	TBTU	10^9KWH
Residential	54.5	26.7	4.584	25.7	25.196	2.1	.615
Commercial*	49.5	34.1	5.424	7.5	7.353	7.9	2.308
Transportation	24.2	24.2	4.611	0.0	0.000	0.0	0.000
Industrial	0.0	0.0	0.000	0.0	0.000	0.0	0.000
Total	128.2	85.0	14.619	33.2	32.549	10.0	2.923

VIGURE V-B-3
1994 NET ENERGY DEMAND IMPACT—POTENTIAL CASE (INCLUSIVE OF PROPOSED CASE IMPACT)

		Oil		Natural Gas		Electricity	
Sector	Total TBTU	TBTU	10^6BBL	TBTU	BCF	TBTU	10^9KWH
Residential	102.7	44.1	7.571	54.2	53.137	4.4	1.290
Commercial*	151.4	108.3	17.226	19.4	19.020	23.7	6.939
Transportation	57.0	57.0	10.861	0.0	0.000	0.0	0.000
Industrial	40.0	10.5	1.673	10.0	9.804	19.5	5.709
Total	351.1	219.9	37.331	83.6	81.961	47.6	13.938

*Commercial sector end-use electricity savings numbers reflect the expected impact of passage of the mandatory lighting standard for all non-residential buildings. Previously a proposed case measure, the standard is now a base case (i.e., forecast) factor.

FIGURE V-B-4
NET DEMAND IMPACTS
NEW YORK STATE



tions 11-104(2) and (3) of the Energy Law. Additionally, the Energy Commissioner should be authorized to amend the code by regulation to assure that future necessary changes are made promptly.

Specifically the proposed bill would amend the State Energy Conservation Construction Code (Code) subchapter A, Chapter II, subtitle BB, Title 9 of the State of New York Official Compilation of the Codes, Rules and Regulations to permit building officials to accept the written statement of a licensed professional as evidence of compliance with the Code, to require that more detailed information be provided in plans and specifications to demonstrate compliance with the Code, to alter thermal transmittance values of components of the building envelope, to add a provision to require a thermal transfer value for the gross area of a roof assembly in a mechanically cooled building, to add a provision which requires energy performance requirements to be based on site delivered energy, to add a provision to limit the flow of water in showers to 3 gallons per minute rated at a pressure of 60 psi, to delete two provisions which required heated swimming pools to be controlled so that electric or fossil fueled systems do not operate when the outdoor air temperature is below 60°F, and to revise the procedures for determining task area requirements in the lighting power budget calculation.

These Code amendments could net another 5 to 10 percent energy savings on each new building, based on standard engineering analyses. Annual energy costs would be reduced further by approximately $50 per home, and approximately two cents per square foot per year on commercial buildings.

- A task force should be established to assess the utility Programs instituted elsewhere which broaden the service utilities have provided historically and, if a broader utility role appears advisable, the study should assess the proper institutional arrangements to best effect that new role. Consideration should also be given to inducing utilities to become active purveyors of conservation and renewable resource technologies.

The State's electric and gas utilities, as well as PASNY, should encourage and stimulate conservation and efficient use of energy by their customers. The investor-owned utilities and PASNY must increase efforts to achieve, through rate design and other economic means, efficient use of electric energy in order to minimize energy use, particularly oil use, in electric generation. In addition, consideration should be given to encouraging the utilities to become purveyors of conservation and renewable resource technologies on a broad scale to achieve the State's conservation goal. A task force for the State Energy Office, Department of Public Service and Department of Environmental Conservation should undertake this study.

Among the possible approaches for utility involvement in conservation is for electric utilities to provide end-user assistance in the form of interest free loans for installation of conservation and renewable resource devices in residences as an alternative to investments in new electric capacity.

The investment necessary to accomplish the proposed conservation impact for the residential sector is over a billion dollars during the forecast period. But the cost of energy conserving building envelope and device retrofits in the residential sector could be lower than the cost of providing expanded energy supplies—especially additions to electric capacity. The SEO economic analysis contained in this plan indicates that this is indeed the situation in New York State today for conservation investments vs. investments in electric capacity. If this is true, a cost savings would accrue to consumers if the electric utilities invested in conservation instead of large generating facilities. Also, investments in conservation in place of large electric generating units may help the utilities by reducing the financial

drain which normally accompanies large capital construction projects.

The Pacific Power and Light Company (PP&L) has found in its service territory that it is less expensive for the company and its consumers to invest in space and water heating energy conserving envelope and device retrofits than to build new electric generation plants. The utility audits each home at the owner's request, recommends conservation measures, estimates their cost, compares this cost to the marginal cost of new capacity, and decides on the basis of this home-by-home cost comparison whether the company should make the investment. If the cost comparison indicates the company should make the investment, and the homeowner consents, the project is opened for bids from local businesses. The installed cost of the retrofit then becomes, in effect, an interest free loan from PP&L to the homeowner. The homeowner must repay the principal amount to the company before selling the home. The principal and costs of the loan are placed in the rate base and depreciated like other assets.

The task force should study the feasibility of New York's utilities establishing this and other types of programs in their service territories. This study should analyze the economics of each program vis-a-vis investments on new generating facilities, as well as the concept of equitable treatment for all ratepayers.

- Enact a "Cost-of-Energy" disclosure act to require disclosure of a record of energy bills for existing homes at the time of sale.

Legislation has been introduced in each of the past three sessions requiring disclosure of a record of heating bills for existing homes at the time of sale. The requirement to disclose such information would induce the homeowner to invest in conservation to improve the marketability of the home. Realtors and others involved in the marketing of these units would be able to use the disclosed information as a selling point. Bankers and others involved in the mortgage business would be able to take the information into account in assessing the mortgage applicant's ability to pay. The SEO "Energy Efficient Home Program" would assist each party in evaluating and using the disclosed heating information.

The essence of the bill is to provide for disclosure of information that will be useful to the consumer in making a choice between homes on the basis of likely energy costs.

Since home energy use does vary substantially with the individual occupant's behavior and habits (e.g., practice of thermostat setbacks), information disclosed pursuant to this legislation must be used with care by the prospective buyer. However, this caveat does not detract from the usefulness of the information. Prospective buyers can utilize the information in much the same way that EPA auto efficiency ratings are used in automobile purchasing decisions.

- Amend the New York State Multiple Dwelling Law and Multiple Residence Law to establish a minimum temperature for hot water in multifamily housing at 110°F.

This proposed legislation would assure that owners of multiple dwelling units will be in compliance with legal reguirements to supply hot water to such dwelling units if the water has a minimum temperature of 110°F, and all other relevant requirements of the Multiple Dwelling and Multiple Residence Laws are met. The Multiple Dwelling Law applies to all multiple dwellings on cities with a population of 400,000 or more and to any other city, town, or village that has adopted its provisions. The Multiple Residence Law applies to cities, towns, and villages of less than 400,000. These amendments would supersede all local laws, ordinances, resolutions, or regulations which require a minimum temperature for hot water higher than 110°F. It would not, however, preclude a building owner from providing hot water at a higher temperature.

There is no provision in either law covering the minimum or maximum temperature of hot water. In contrast, the NYC Housing Maintenance Code (Section D26, Subdivision 17.07), which is applicable to multifamily and all tenant.occupied one and two family housing in New York City, sets a minimum temperature of 120°F for hot water in residential buildings. The federal administration's emergency order for energy conservation in buildings does not address hot water

The impact of the legislation will be twofold: 1) in New York City the minimum temperature standard for multiple dwellings as contained in the New York City Housing Maintenance Code will be reduced from 120°F to 110°F (the amended Multiple Dwelling Law would supersede less restrictive local codes); and 2) in areas of the State that are governed solely by the Multiple Dwelling Law or the Multiple Residence Law, and where, therefore, no mimimum temperature standard exists, a minimum of 110°F would be established. This standard would give building owners a minimum temperature against which to compare and adjust their current practices.

Substantial precedent for establishing a 110°F minimum exists. The New York State Energy Conservation Construction Code (Section 7813.26) states that the maximum temperature of hot water in restrooms open to the general public must be 110°F. This code is based on a consensus national standard issued by the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. Also, the New York State Health Code (Vol. C, Section 711.4ab) requires that the temperature of hot water for clinical purposes in hospitals be 110°F.

In the absence of a statewide minimum standard, building owners have often set hot water temperatures in excess of what is necessary. Therefore, the potential for energy conservation in the proposed legislation is substantial.

An analysis conducted for the Energy Office by the Polytechnic Institute of New York indicates that imposing such a minimum temperature could save an equivalent of 5,000 barrels of oil per day, or 1.75 million barrels per year. This would mean a dollar savings of approximately $36 million per year, based on the 1978 retail cost of heating oil.

- Amend Section 79 of the New York State Multiple Dwelling Law and Section 173 of the New York State Multiple Residence Law to establish minimum space temperature requirements of 68°F between 6:00 a.m. and 10:00 p.m.

Section 79 of the Multiple Dwelling Law provides that facilities be maintained in all multiple dwellings to meet the minimum temperatures required by local law, ordinance, rule, or regulation on all parts of a dwelling that are used or occupied for living purposes. That minimum is 68°F between the hours of 6:00 a.m. and 10:00 p.m. whenever the outdoor temperature falls below 55°F. It is 55°F between the hours of 10:00 p.m. and 6:00 a.m. whenever the temperature falls below 40°F. Presently local law, ordinance, rule, or regulation can establish higher minimum temperatures than those given above.

Section 173 of the Multiple Residence Law requires that every new dwelling be capable of heating all living rooms sufficiently to maintain minimum temperatures required by local law, ordinance, rule, or regulation, or by local public health officer. It does not establish specific minimum temperatures.

These laws have fostered a wide range of minimum tem-

perature standards varying by locality which are often in excess of what is necessary to provide adequate heat. Albany has adopted a minimum temperature standard of 68°F from September 15 through June 15 whenever the outside temperature falls below 55°F. Syracuse and Binghamton have adopted a minimum standard of 70°F. And Buffalo has a minimum standard of 70°F between 6:00 a.m. and 12:00 p.m. whenever the outside temperature is 55°F or lower.

This proposed legislation would supersede existing locally adopted standards. It would prevent local governments from adopting codes that establish higher minimum temperature standards than those contained in the Multiple Dwelling Law (unless those temperatures address specific health conditions) and establish a statewide minimum temperature requirement for space heating. The federal administration's emergency order for energy conservation in buildings does not apply to residential buildings.

The potential energy conservation of this proposed legislation is substantial. An analysis conducted for the Energy Office by the Polytechnic Institute of New York indicates that it could save approximately 600,000 barrels of oil annually—equal to $12.5 million based on 1978 retail costs for heating oil.

- Expand state public education/technical assistance programs with respect to energy conservation in, among others, the following areas
  - oil and gas burner retrofits,
  - water heater insulation and temperature reductions, and the use of flow restrictors,
  - purchase and use of energy-efficient appliances and automobiles,
  - the value of ridesharing (car and van pools),
  - increased use of mass transit (buses and railroads),
  - energy-efficient lighting and heating practices in residential and commercial settings, and,
  - programs to help industry and agri-businesses implement energy-conserving processes and technologies.

Burner retrofits and general furnace maintenance can often increase furnace efficiencies to over 75 percent for $200-$300, rather than the $1500-$2000 it would likely cost to purchase a new, efficient furnace. Likewise, water heater adjustments and retrofits can inexpensively reduce energy used to heat water by as much as 35-40 percent.

Appliance efficiency and automotive mileage standards result in the manufacture of more efficient goods. But the full potential of those standards can only be achieved by consumer purchases of the most efficient available models at any point in time. Public awareness is the key to reaching that potential. Similarly, public awareness is the key to successful ridesharing programs and maximum use of mass transit.

Mandatory programs such as the Energy Conservation Construction Code and Lighting Standards are more effective in achieving maximum potential savings if the building inhabitants take advantage of opportunities to conserve. For example, A. D. Little estimates of potential savings in new commercial buildings show savings from engineering/architectural changes alone of about 20 percent. If proper use is made of this altered structure (behavioral influences) total savings approach 60 percent. The savings differential will not be achieved without the cooperation of building managers and inhabitants. Public education programs geared towards achieving that cooperation are a must.

SEO programs to aid industry and agriculture conservation efforts will continue and be expanded through an agricultural information dissemination service and a personnel increase for the Energy Advisory Service to Industry (EASI) Program.

- Amend Section 210 of the New York State Tax Law to provide an additional four percent business tax credit for load management device investments.

Section 210 of the New York State Tax Law currently provides a business tax credit of four percent. The proposal would increase to 8 percent the credit for business investments in eligible load management devices. Eligible load management devices would include those devices which have the capability to limit electric demand by: load shifting, load shedding and/or load cycling. Selection of an appropriate load management method for a given business depends on the types of loads to be controlled and the magnitude of control desired.

Load management devices may be called load or energy management systems, demand controllers, demand limiters and/or load cyclers. Physically, the systems range from small devices controlling a few loads to computerized systems controlling thousands of loads with costs ranging from as little as $100 to $50,000 or more. Typical controllable loads on a commercial/industrial building include: air-conditioning units, compressors, electric strip heaters, escalators, furnaces, hot water heaters, incinerators, lighting circuits, oven recirculating fans, and snow melting equipment.

Enactment of this proposal would aid in the goal of reducing electric demand on the utility system, thus potentially reducing utility peak demand capacity or additions. Some New York utilities offer large commercial/industrial customers time-of-day rates which can make these load management devices more economically attractive. But even in the absence of special rates, with the utility demand ratchet these devices are already energy and cost effective.

2) Federal Actions

- Increase funding to the DOE weatherization program for low income dwellings from the current annual level of about $200 million to at least $1 billion.

The Department of State's Division of Economic Opportunity administers the DOE funded low-income weatherization program. Under the program, a dwelling unit includes houses, apartments and single rooms occupied as separate living quarters, and stationary mobile homes. Aside from basic weatherization improvements (insulation, storm windows, weatherstripping and caulking, etc.), the program only allows for minor repairs that are directly related to the weatherization process—leaking roof, broken or rotted sills, and jams on external doors.

To be eligible, individuals and/or families must have incomes at or below 125 percent of the Office of Management and Budget poverty threshold. For a family of four that level was $7,750 annually in 1978. Until recently, eligibility was limited to individuals and families at or below 100 percent of the poverty threshold.

As of March, 1979, more than $14 million had been spent in New York State creating over 500 jobs and weatherizing an estimated 13,000 houses. Weatherization cost per unit has averaged approximately $369 in the past due to an expenditure limit per unit of $400. As of July 1, 1979, the limit has been increased to $800 per unit ($1000 where a contractor must be called in to complete the work). The actual expenditure level per unit may be expected to increase proportionately.

New York State has been allocated an additional $18,442,400

for the FY '79 Weatherization Assistance Program. A sum of $1,210,000 will be set aside from the total allocation for training and technical assistance.

Out of the remaining $17,232,000, the Department of State (DOS) may retain up to 5 percent to meet its own administrative needs. The remainder will be allocated to the sub-grantees for their use as follows:

- — Program support costs not to exceed 30 percent,
- — Administration not to exceed 5 percent,
- — The remaining funds to be used to purchase weatherization materials.

There are approximately 570,000 households in New York State that potentially qualify for this weatherization program under the new eligibility criteria. FY '79 DOE funding to New York State should reach about 30,000 of those households if the previous expenditures level is maintained; 15,000 if the expenditure per unit doubles. Added to the 11,000 homes already reached, over 525,000 low-income homes will still be unweatherized after this fiscal year. Assuming funding stays at this year's level, it would take at least 17 years to weatherize all these homes.

Low-income households are severely limited in their ability to conserve through non-capital conservation by the physical constraints of their dwellings. This large potential savings cannot be tapped, nor the efforts of this population group rewarded, unless or until their homes are properly weatherized. A much greater effort in this area is clearly called for.

New York State therefore will press the Congress through the New York State delegation to greatly expand funding of the weatherization program to complete the task of weatherizing these homes on the next three to seven years.

- Amend the federal tax law with respect to energy conservation investments in multifamily housing to:
  - — extend the general investment tax credit to multifamily housing; and,
  - — extend the business energy credits to include conventional conservation technologies as well as the more sophisticated conservation and renewable resource items currently allowed.

Multifamily housing has fallen through the cracks of the federal conservation tax credits programs. Especially in New York City, this means a large conservation potential is being ignored.

The approximately 2.25 million multifamily units in New York State account for over one-third of the State's housing stock. In New York City, over 60 percent of the housing units are in buildings of five or more units. Multifamily housing accounts for approximately 8 percent of New York's total energy consumption. A 10 percent reduction in the energy New York's multifamily housing uses could save the equivalent of over five million barrels of crude oil annually.

The Energy Conservation Construction Code will eventually, as the multifamily housing stock turns over, bring substantial savings in this sector. But at present turn-over rates, a 90 percent replacement of the stock will not occur until after the year 2050.

The technologies needed to reduce energy consumption in existing multifamily housing are currently available. The most cost-effective of these measures is improved maintenance and operation procedures. New York State has begun a program to assist owners in undertaking these activities. Retrofitting technologies, such as insulation, storm windows, weatherstripping, and caulking, tend to be cost effective with typical paybacks of two to six years.

The overwhelming majority of federal retrofit money is being directed at units in which the government already has an investment (i.e.,public and federally insured housing). Apartment owners are excluded from use of the residential energy tax credits, while the list of allowable items for the business tax credit defies current technological realities in multifamily housing. The general investment tax credit available for employment-generating investments is not applicable to multifamily housing improvements.

In spite of the cost-effectiveness of retrofits in multifamily buildings, additional impetus is needed. Unlike homeowners, owners and tenants still face the issue of "who pays?" vs. "who saves?" It is expected that the proposed tax policies will supply that impetus in a large number of cases.

- Amend Title I—Federal Energy Tax Act of 1978 to include load management devices as items eligible for the residential energy conservation personal income tax credit.

The Federal Energy Tax Act of 1978 currently provides energy conservation equipment up to $300 or 15 percent of the first $2000 expended.

Load management devices show great energy conservation and peak reduction potential in New York State now that some utility companies are offering residential time-of-day and special rates (i.e., storage, wind, solar). Yet these devices have been excluded from any kind of special tax treatment. It is proposed that load management devices such as clock controlled load switching devices, interlocks and other load actuated, load limiting devices, and energy storage devices with control systems be included as qualifying energy conservation equipment for the federal income tax credit.

The installed costs for these devices range from approximately $80 for a time clock control to as much as $2000 for an energy storage system.

These load management devices will be offered as conservation measures under the Federal Residential Conservation Service Program (RCS) under provision of Title II of the National Energy Conservation Policy Act (NECPA) where off-peak residential rates are available. The purpose of the RCS programs is to encourage the use of energy conservation and renewable resource measures in residential settings.

New York would be well served by such a tax credit which would increase the incentive to encourage utilization of energy during off peak periods, during which utilities typically have lower operation costs.

- Amend the federal tax law to extend the general investment tax credit to investments by utilities in direct or indirect load management devices and/or equipment.

Direct load management may be accomplished with equipment, purchased either by the utility or by a customer, which is installed, maintained, and operated by the utility. In addition to partial control of customer loads, special rate forms such as interruptible rates may be used in conjunction with direct company control over customer loads. This direct technique allows the utility to control a predetermined amount of a customer's load at any time.

Indirect load management is accomplished through customer control of load. The implementation of special rates, such as off-peak storage rates, provides price incentives to make it advantageous for customers to install storage equipment and limit their on-peak electric consumption.

If a utility exercises load management, the electric system benefits are predictable and can be determined before implementation of the management program. Load management can reduce loads on a routine basis, aid in sched-

uling planned maintenance of the system, and provide load shedding capability. With all these advantages, it may be that in the future, managed load can be considered as part of utility reserves and be factored in as a reliability criterion.

It is therefore proposed that the general investment tax credit be extended to utility investments in direct or indirect load management devices and equipment for residential, commercial, and industrial control of end-use loads.

- Enact federal legislation to increase the EPA automotive mileage standards by one-half mile-per-gallon in each year from 1986 through 1990.

Under the Energy Policy and Conservation Act (EPCA), the Environmental Protection Agency (EPA) established fleet average mileage efficiency standards for passenger automobiles sold by car manufacturers each year. Under the current law, the standards are scheduled to reach 27.5 miles-per-gallon (mpg) in 1985.

Since passage of EPCA, the mileage standard has become the single most important factor in conserving transportation fuels. Auto manufacturers have demonstrated their ability to meet and to surpass these standards with existing and developing technologies. The 1979 Gas Mileage Guide (U.S. EPA, January, 1979) lists 37 car lines which demonstrate city mileage ratings in excess of the 1985 average mileage standard of 27.5 mpg.

It is therefore proposed that this trend toward better fuel economy be extended beyond 1985 with federal standards that increase the mpg requirement by one-half mpg in each year from 1986 through 1990. The standard would reach 30 mpg in 1990. The New York State Department of Transportation estimates that these standards would save 194 million additional gallons of gasoline in New York State in 1994.

- Increase Federal aid for mass transit development and operation from $1.25 billion to $2.5 billion annually.

Federal aid for mass transit is limited relative to the need for such funding, especially if modal shifts are to occur. There is a federal authorization (Section III Capital Discretionary Fund, Urban Mass Transit Act) that creates a nationwide discretionary fund to aid state and local mass transit efforts. The annual appropriation to this fund is currently about $1.25 billion. For several years, New York State's portion of this funding has been about 20 percent under the allocation formula which favored the large existing transit system. Recently, however, New York's share has been falling with the development of new mass transit systems in other states. Federal money has not been increased to meet this growing demand for matching funds. So New York is losing its ability to draw on federal funding. No matter how much New York spends of its own money, no more federal money is available unless or until the federal discretionary fund is increased.

Consequently, New York is facing an increasingly difficult problem in maintaining the present system, to say nothing of expanding it. In view of the important role mass transit should play in reducing energy consumption in the transportation sector, this is an unacceptable situation for New York State or any other state attempting to maintain or develop mass transit systems.

New York therefore will press the Congress to increase at least two-fold its authorizations and appropriations to the mass transit discretionary fund. The President has proposed a similar increase in mass transit funding.

- Expand federal funding for the Energy Conservation Program for Schools, Hospitals, and Buildings Owned by Units of Local Government and Public Care Institutions, and add flexibility to the State's use of such funds.

The Schools and Hospitals Program, as it is commonly referred to, is enjoying excellent progress, in terms of energy savings in affected buildings and in terms of the participation rate of the involved institutions.

Energy savings projected for the program in New York State have been pegged at 10.5 TBTU by 1983 at the original funding level (authorization of $965 million nationwide). This savings projection is based on potential for energy savings in buildings receiving assistance under the program, but is limited by the number of buildings that can be served by the program at the current funding level. The number of applications for program assistance and grants for schools and hospitals have far exceeded the number of buildings for which funds are available. In the first grant cycle of the program, the State Energy Office has received applications for $33.8 million for actual retrofit activities. SEO has only $6.9 million in funds for these activities.

In contrast, the audit and technical assistance funds for local governments and public care institutions exceed application amounts. This may be a reflection of the viewpoint of the building managers that it is not worth the effort to go through an audit and receive technical assistance from SEO—only to find that they are ineligible for capital grants. Unfortunately, SEO's excess funds in this area are constrained and cannot be shifted to the schools and hospitals grants program where they would be used.

There is a need for increased funding for the program, but unless the funds are made more flexible so that they can be used where needed, the increase in funding will not be totally effective. With such increased funding and flexibility, energy savings in New York State through the program could easily double.

- Enact the proposed Energy Management Partnership Act.

Presently, the States are administering a number of interdependent, often overlapping, energy programs under various federal statutes. These programs include the State Energy Conservation Plans (under EPCA), the Supplemental State Energy Conservation Plans (under ECPA), and the Energy Extension Service program. Various other energy planning and management activities have been undertaken by New York and other states without federal mandates or funding. In New York these include the Energy Emergency Plan and this State Energy Master Plan.

The administration has proposed enactment of its Energy Management Partnership Act (EMPA; H.R. 4382, S. 1280) to combine the various federally-funded energy efforts administratively and to assist the States in the development of energy planning and management activities. The Act would eliminate a number of programmatic and funding constraints presently imposed on the State's programs, but would impose new requirements in the areas of energy planning, emergency preparedness, and use of renewable resources. Furthermore, EMPA would support an expanded energy role for local governments by requiring States to pass through financial assistance to local governments for energy activities. The bill would authorize $110 million annually over five years.

Passage of EMPA would constitute a major step toward developing an integrated and cohesive approach to resolve the nation's energy problems by providing a framework within which States and local governments may work with each other and the federal government, while allowing each State and local government to deal with its own unique energy situation. New York should therefore strongly support this legislation.

B. Potential Case

As previously discussed, a number of measures were considered which for various reasons were deemed inappropriate at this time. For example, a specific proposal for cycling of air conditioning loads was not made because too little information is available at this time to make a sound prediction of the effect of such a proposal on peak demand. However, the load management incentive proposals presented in this Plan will have an impact on air conditioning, as well as other end-uses. No proposal for mandatory retrofits of existing dwellings was made because the measure would involve large and widely varying private-sector investments with uncertain payback periods.

Following is a discussion of those measures not proposed but promising large energy savings potentials over and above the forecast.

The greatest potential occurs in buildings. Construction of each new building for maximum space and water heating energy efficiency and retrofitting every existing building to the maximum extent feasible with current technologies offer a savings potential that lasts for the lifetime of the building. Possible means to achieve this potential are a stringent energy conservation construction code for new buildings and a mandatory retrofit program for existing buildings.

A stringent energy conservation construction code might incorporate stricter insulation standards and higher equipment efficiency requirements than the present New York State Code. The building envelope standards for new residential construction could include requirements for triple glazed windows, R-19 wall insulation, and R-38 ceiling insulation. High efficiencies could be required for furnaces, water heaters, and air conditioning equipment.

For commercial construction, radical departures might be necessary from the previous conventional practices of large window areas and little insulation. Computerized HVAC systems would often be necessary to comply with efficiency requirements for heating, cooling and ventilation. Shut down of heating and cooling equipment during off hours would be mandatory for compliance with energy budget requirements.

Air conditioning may be addressed more specifically in future codes in relation to, and in recognition of, its contribution to summer electrical peak loads. Since air conditioning is a major factor in creating peak loads that are met using inefficient oil-fired peaking facilities, conservation in air conditioning end use has the potential to reduce oil consumption and level electric load at the same time.

A stringent energy code could mandate several types of energy saving features having average payback periods of seven or eight years. Consequent energy savings for one family homes could be double the savings achieved by the present energy code. Initial construction costs would be approximately five percent higher than for homes built prior to the strict energy code. For commercial and multifamily structures, energy savings would be approximately 10 percent greater than those achieved by the present energy code. Initial construction costs would be only nominally higher than for previous construction. Savings from such a program would approach 50 TBTU by 1994.

A standard for mandatory retrofits could not be described in the same fashion as a construction code. The fact that a building is standing limits the possibilities for conserving and the constraints will be different for each building. A mandatory retrofit program for residential buildings could incorporate such basic measures as the installation of six inch attic insulation, storm windows and doors, weatherstripping and caulking, and could result in energy savings on the order of 12 percent of space heat end-use. The program could be implemented by legislation requiring the retrofit before sale of the building or by a certain date (say within 5 years after passage of the legislation), whichever occurs first.

The initial cost for mandatory retrofit of one-family homes would range from $300 to $2000 per home, depending on which, if any, mandatory measures had already been taken. For commercial and multifamily structures, the average cost would be three times the first year's energy cost savings for an average payback period of three years. Energy savings for a retrofit program would approach 50 TBTU by 1994.

Commercial buildings, both publicly and privately owned, new and existing, offer a large savings potential with efficient lighting. Again a more stringent mandatory standard could be used to achieve additional savings over the forecast period of about 15 TBTU or the equivalent of 769MW of generating capacity by 1994. A strict lighting standard would reduce lighting to minimum levels in all public buildings, and would mandate off-hours shut-down and radically restricted exterior lighting. The energy savings under a very strict lighting standard could be approximately tripled.

Much energy may be saved in buildings by device retrofits and replacements. For example, gas and oil space heating systems could be retrofitted to achieve a minimum rated efficiency of 75 percent. If a retrofit could not accomplish this efficiency, a replacement system of 80 percent efficiency would have to be purchased and installed. Derating heating equipment, installation of high speed flame retention burners, installation of automatic thermostat setback controls and automatic vent dampers are all measures that can raise the efficiency of oil and gas heating systems. The average cost for these measures is $200-$250. In the case of natural gas fired heating systems, replacement of the pilot light with an intermittent ignition device (IID) can save 4-7 percent of the gas used by the system. The cost of an IID conversion averages $132.[5] The cost to replace an inefficient heating system would average $1800 installed. Savings from such a program could reach 50 TBTU in 1994 in the absence of an envelope retrofit program.

Similarly, thermostat adjustments for lower space and water heating temperatures have long been recognized as effective energy conservation measures with no cost burden. Still their potential is not reached. In the case of space heat temperatures, most people are known to have adjusted their thermostats downward somewhat over the past few years in the daytime, and many also practice nighttime setbacks. But not everyone has made these adjustments, nor do setback practitioners always remember to dial down the thermostat whenever possible. If day/night or day/evening/night thermostats were installed and used in all residential and commercial buildings, another 30 TBTU could be saved annually. In the residential sector, the cost would be $50-$60 if installed by the homeowner, $100-$150 if installed by a service person. In the commercial sector, typical installed costs per thermostat are about $150-$200.

In the case of water heating, temperatures may safely be reduced from the present 140°-160°F range to as low as 110°F. In addition, tank insulation retrofit kits are available for about $20 and flow restrictors for showers and other non-volume-related hot water uses are available for about $1.50 each. The combination of lowered thermostats, tank insulation, and water flow restrictors can save 35-40 percent of current household water heating energy and 20 percent of commercial water heating energy where these measures

[5]"Energy Conservation and Performance Evaluation of Replacing Standing Pilots in Central Heating Systems," NYSPSC and Brooklyn Union Gas Company, March, 1979.

are not precluded by other requirements. Annual energy savings could reach 75 TBTU if everyone made these adjustments.

In the multifamily housing sector, mass metering of electricity was the rule for many years until January 1, 1977, when the Public Service Commission banned mass metering in new structures. Tenants of mass metered apartments are shielded from the true costs of their energy use in two ways. The building is generally on a commercial rate that is lower than residential rates. And generally the tenant is not responsible for his own utility bill—it is included in his rent. The PSC has estimated that the switch to individual metering, placing each tenant on a residential rate and making each tenant directly responsible for his own utility bills, would save 1500 KWH/unit/year. There are an estimated 450,000 mass metered units in New York State today. If all these units were mandated to convert to individual metering by a certain date (say within five years of passage of the law) or before sale of the building, whichever occurs first, then savings could reach 675 million KWH annually, or the equivalent of 118.5MW of generating capacity.

In the transportation sector, the EPA mileage efficiency standards are having a substantial conservation impact. But this effect will begin to level off in 1985 when the standards reach their highest point at 27.5 mpg. The previous proposal to increase that standard to 30 mpg by 1990 is a step toward continuing the average fleet efficiency improvements. But if the automotive technology of the future permits even greater efficiency improvements, the standard could instead be increased by one mpg per year from 1986 through 1990, and an additional one-half mpg per year from 1991 through 1995, attaining a standard of 35 mpg on 1995 and thereafter. NYSDOT pegs the additional savings in New York State from such a standard at 456 million gallons by 1994.

Measures to discourage the use of private automobiles would save transportation energy through modal shifts and reduced vehicle miles travelled (VMT). Such measures might include:

. . . higher tolls (an increase of $1.50 for single occupancy vehicles,

. . . decreased tolls (or elimination) for carpools and vanpools,

. . . maintain current mass transit fares, and

. . . limit (decrease by 50-60 percent) the available parking on cities.

If the total resulting reduction of VMT was 2 percent of the current New York State total, approximately 120 million gallons of gasoline could be saved annually. The economic impact on a city from such control measures must be weighed against the energy savings benefits. It is possible that the additional revenue from increased tolls for single occupancy vehicles would cancel the decreased revenue from eliminating tolls on carpools and vanpools. The increased use of mass transit would probably take care of any additional costs related to increased service. But the commercial private sector could lose substantial revenues. Decreased parking spaces could decrease the number of consumers, thus hurt business.

No energy efficiency standards have yet been issued affecting industrial sector equipment and processes. A potential of 30-35 percent reduction in the fuel consumed by industrial boilers could be realized if efficiency standards were established for new and retrofitted old boilers and their distribution systems. Ten to 15 percent of these savings can be accomplished without capital expenditure. The technology exists today to achieve them. The standards would require such things as mandated condensate return, high efficiency motors and pumps, high combustion efficiency burners, and insulation minimums with critical operating requirements. Improved efficiencies accomplished with the use of industrial plant waste heat would be encouraged and would be mandated in system efficiency calculations. Savings from these standards could reach 40 TBTU by 1994.

It is clear from this potential case discussion that the potential for energy savings in New York has only begun to be tapped. Some combination of price-induced and regulated conservation will eventually bring the conservation effort closer to its potential in the years to come.

FIGURE V-B-5

MAJOR ENERGY CONSERVATION EFFORTS TO DATE

Sector	Federal Actions	State Actions	Impacts/Comments
RESIDENTIAL	Energy Policy and Conservation Act of 1975 (EPCA) • Funds for State Energy Conservation Plans		Goal of 5% energy savings below 1980 projected levels, all fuel types
		Energy Conservation Construction Code	New buildings and major retrofits of existing buildings in residential sector—space heat, water heat, air conditioning; all fuel types
		Energy Outreach Programs	Public Education and Information Programs—all end uses, all fuel types
		Energy efficiency standards for room air conditioners (Chapter 826, Laws of 1977)	Air conditioning—electric energy use
		Energy efficiency standards for residential hot water heaters (Chapter 439, Laws of 1977)	Water heating—electric, gas, and oil
		Ban sale in NYS after June 1, 1980, of appliances with gas pilot lights (exception: hot water heaters) (Chapter 238, Laws of 1977)	Appliance energy use (furnaces, air conditioners, heaters, refrigerators, stoves, ranges, dishwashers, clothes dryers, clothes washers)—natural gas

Sector	Federal Actions	State Actions	Impacts/Comments
RESIDENTIAL (CONT.)		Require refrigerators and freezers sold in NYS after January 1, 1980, to be equipped with a manually operated switch to shut off heating unit; electric dishwashers must have a switch to eliminate heating phase of drying cycle (Chapter 750, Laws of 1977)	Appliance energy use—natural gas and electricity
	• Energy Efficiency test procedures, labelling, and improvement targets for certain residential appliances		Appliance energy use—all fuel types
	Energy Conservation and Production Act of 1976 (ECPA)		
	• Funds for Supplemental State Energy Conservation Plans		Energy Audits and Public Assistance
		Energy Hot Line	Assist private efforts to conserve all fuel types
	• Energy Conservation Standards for New Buildings	May preempt state conservation construction code	New residential buildings—all fuel types
	National Energy Policy Act of 1978 (NECPA)		
	• Energy Efficiency Standards for Home Appliances		Efficiency targets will be replaced with standards. May preempt state standards.
	Energy Tax Act of 1978 (ETA)		
	• Residential Energy Tax Credit (15% of first $2000 expended) for owners and renters in their principal residences		Since available to owners and renters, it affects entire residential sector, but favors single family dwellings as owners are more likely to make such investments than are renters. Envelope and device retrofits—all fuel types—mainly space heat end use.
		PSC order of January 30, 1973, bans natural gas use for new and existing outdoor and decorative lighting	Order had immediate effective date. Affects natural gas use for lighting.
		Series of PSC orders from 1974 through 1977 established minimum insulation standards for new and expanded natural gas and electric service.	Affects space heating and end use of natural gas, oil, and electricity in all new residential buildings or those requesting expanded service.
		PSC order of August 21, 1974, bans new natural gas connections for heating swimming pools.	Order had immediate effective date. Affects natural gas use.
SMALL RESIDENTIAL	EPCA		
	• Funds for State Energy Conservation Plans		Goal of 5% energy savings below 1980 projected levels, all fuel types
		Residential Oil Space Heating Program	Retrofits or replacements of oil space heat devices in existing small residential buildings
		Realtors Program	Envelope retrofits in existing small residential buildings—space heat; all fuel types
	EPCA		
	• Funds for Supplemental State Energy Conservation Plans		Energy Audits and Public Assistance
		Audit workbooks for one, two, and three family residences	Do-it-yourself audits to assist homeowners in residential conservation efforts—all fuel types and end uses.

Sector	Federal Actions	State Actions	Impacts/Comments
SMALL RESIDENTIAL (cont.)		Home Insulation and Conservation Act of 1977; amended in 1979.	Utility-administered home energy conservation programs (audits and financing) for one, two, three, and four family residences. All fuel types and end uses.
	Weatherization Assistance for Low-Income Persons	Administered through state plans (in NYS it is DOS)	Weatherizes homes and individual apartment units occupied by low income (less than $8375 for family of four in 1979) persons. About 11,000 homes have been weatherized to date in NYS. Affects space heat end use of all fuel types.
	NECPA		
	• Residential Energy Conservation Program	Utility-administered program for audits and financing of conservation investments in residences of four units or less.	Some changes in NYS Home Insulation Act may be required. Affects all fuel types and end uses.
	• Weatherization Grants for Low Income Families	State/Local-administered program	Continuation, expansion, and improvement of existing program. (See ECPA program above)
LARGE (MULTIFAMILY) RESIDENTIAL	ECPA		
	• Funds for Supplemental State Energy Conservation Plans		Energy Audits and Public Assistance
		Multi-family energy audit workbooks and seminars	Do-it-yourself manual to assist owners/managers of multifamily housing in their conservation efforts—all fuel types and end uses.
		PSC order of April 20, 1976, bans master metering of electricity	Effective April 1, 1977. Affects all end uses of electricity.
		PSC order of August 23, 1978, allows sub-metering of electricity in cooperatives and condominiums in Consolidated Edison service territory	Effective immediately. Affects all end uses of electricity.
	NECPA		
	• Authorizes HUD to make grants to finance energy conservation improvements to multifamily projects financed with Section 202 loans (for elderly and handicapped) or insured under Section 221(d)(3) or 236 (for low or moderate income families). HUD is also to establish minimum energy conservation standards for multifamily dwellings.		Limited applicability relative to NYS's large multifamily sector. Program remains unfunded.
	ETA		
	• 10% energy tax credit (available to apartment owners) for energy conservation investments.		Few, if any, of the qualifying investments will be practical for multifamily housing. Also, rental housing does not qualify for the general investment tax credit.
COMMERCIAL	EPCA		
	• Funds for State Energy Conservation Plans		Goal of 5% energy savings below 1980 projected levels
		Energy Conservation Construction Code	New buildings and major retrofits of existing buildings in commercial sector—space heat, water heat, air conditioning—all fuel types.

Sector	Federal Actions	State Actions	Impacts/Comments
		Lighting Efficiency Standards	Mandatory for all non-residential buildings. Affects electricity for lighting end use.
		Energy Efficient Government Procurement Practices	Energy conservation in State Government through energy-conscious purchasing practices. Affects all end uses—all fuel types.
		Energy Management and Budgeting System	To assist in proper operations and maintenance practices and identify areas of waste in State buildings. Affects all end uses, all fuel types.
		Energy Outreach Program	Public education and information—all end uses, all fuel types.
		Boiler Testing Program through DOL inspections; and boiler efficiency training seminars	Energy efficiency testing service for large commercial boilers. Affects all fuel types.
COMMERCIAL	ECPA		
	• Funds for Supplemental State Energy Conservation Plans		Energy Audits and Public Assistance
		Small commercial and Office Buildings Energy Audit Workbooks and seminars	To assist owners/managers of small commercial buildings in their efforts to conserve—all end uses, all fuel types.
		Energy Hot Line	Public information and assistance—all end uses, all fuel types.
	• Energy Conservation Standards for New Buildings		New commercial buildings—all fuel types.
	NECPA		
	• Energy Conservation Programs for Schools, Hospitals, and Buildings owned by Units of Local Government and Public Care Institutions	State-administered program	Energy audits and technical assistance for all, capital improvements grants for schools and hospitals only. All end uses—all fuel types.
	ETA		
	• Additional 10% investment tax credit for qualifying energy property		Incentive for investments in new energy efficient equipment in the business sector—all fuel types.
	EPCA		
	• Funds for State Energy Conservation Plans		Goal of 5% energy savings below 1980 projected levels
		Energy Advisory Service to Industry	Facilitate transfer of energy conservation technologies and practices from large to small- and medium-sized industries. Energy audit service. All end uses and fuel types.
		Boiler Testing Program through DOL inspections and boiler efficiency training seminars	Energy efficiency testing service for industrial boilers. Affects all fuel types.
INDUSTRIAL		Energy Conservation in Agriculture Program	Public information and education program for agri-businesses. Affects mostly electricity, gasoline, and diesel fuel.
	• Energy Efficiency Improvement Targets for Industries		10 most energy consumptive industries as defined. Affects all end uses and fuel types.
	ECPA		
	• Funds for Supplemental State Energy Conservation Plans		Energy Audits and Public Assistance

Sector	Federal Actions	State Actions	Impacts/Comments
		Energy Hot Line	Public information and assistance—all end uses, all fuel types.
INDUSTRIAL	NECPA		
	• Energy Efficiency of Industrial Equipment		Likely to result in performance standards for large motors and pumps, perhaps some other equipment as well. Affect electricity use mostly, other fuels to a lesser extent.
	ETA		
	• Additional 10% business investment tax credit for qualifying energy property		Incentive for investments in new energy efficient equipment in the industrial sector. All end uses and fuel types.
TRANSPORTATION AUTO & TRUCK	EPCA		
	• Funds for State Energy Conservation Plans		Goal of 5% energy savings below 1980 projected levels.
		55 mph Speed Limit	To prohibit the excessive speeds that reduce automobile efficiency. Saves gasoline and diesel fuel.
		Chapter 740, Laws of 1979	Exempts van pool drivers with 14 passenger vans from special licensing requirements for bus drivers.
		Energy Conservation through Improved Transportation State Bond Issue	Funds for maintenance of and improvements to mass transit systems in New York State.
		Right-Turn-on-Red	To reduce idling time. Saves gasoline and diesel fuel.
		Carpooling and Vanpooling Programs	To assist private efforts to conserve through ride sharing—move away from single passenger auto use. Saves gasoline and diesel fuel.
		Transportation Systems Management	State and local transportation system planning for energy efficiency. Saves gasoline and diesel fuel.
	• EPA Auto Efficiency Standards		To increase fleet auto fuel efficiences through purchases of new, more efficient passenger vehicles. Saves gasoline and diesel fuel.
	ECPA		
	• Funds for Supplemental State Energy Conservation Plans		Public assistance
		Energy Hot Line	Public information and assistance in private efforts to conserve. Saves gasoline and diesel fuel.
	NECPA		
	• Increased fines for non-compliance with EPA mileage standards		To insure compliance. Saves gasoline and diesel fuel.
	ETA		
	• Gas Guzzler Tax		Imposition of a graduated excise tax on auto manufacturers beginning in 1980 for cars whose fuel economy is far below mileage standards. Saves gasoline and diesel fuel.
	• 10% investment tax credit for vehicles used in employer vanpools		Vanpool service is not considered income to employee. Incentives to vanpooling. Saves gasoline and diesel fuel.

Sector	Federal Actions	State Actions	Impacts/Comments
TRANSPORTATION (CONT.) MASS TRANSIT	ETA • Removal of 8% federal manufacturers excise tax on bus parts, and on fuel, oil, and tires used with intercity, local, and school buses.		Incentive to development of mass transit systems. Saves gasoline and diesel fuel.
GENERAL		Chapter 740, Law of 1978: To establish and promote effective program to ensure the collection and rerefinement of used oil	A "recycling" program to save oil.
UTILITIES	EPCA	Utility Efficiency and Load Management Project (PSC-administered)	To increase generation efficiency and level load. Affects electricity and its price.
	ECPA • FEA (DOE) Electric Utility Rate Design Initiatives		Proposals to encourage energy conservation, minimize need for new electric generating capacity, and minimize electric costs to consumers. Affects electricity.
	Public Utility Regulatory Policies Act of 1978 (PURPA) • Requires FERC to adopt procedures for setting natural gas curtailments which do not penalize conservation activities.		To increase gas supply due to conservation efforts and eliminate conservation penalty within curtailment schedules.
	• Requires an 18 month FERC study of the implications of pooling on energy conservation, electric system optimization, increased electric system reliability.		Relationship of pooling to conservation.
	• Retail Regulatory Policies for Electric Utilities	Requires State regulatory authorities to determine within three years the appropriateness of implementing federal ratemaking standards concerning cost of service, declining block rates, time of day rates, seasonal rates, interruptible rates, and load management techniques. PSC recently rendered an opinion in the generic rate case (26806) in which many of these issues were addressed.	To bring about marginal cost pricing of electricity and factor energy conservation variables into electric ratemaking.

SECTION V-C

Renewable Resources

1. INTRODUCTION

A renewable energy resource is one that is capable of being replaced by natural ecological cycles and sound management practices. The term "renewable energy resources" includes a myriad of energy forms: active and passive solar energy, solar photovoltaics, wind, hydroelectric power, and biomass on all its forms (wood, refuse, agricultural waste, energy crops). Cogeneration technologies, while not by definition renewable energy sources, are included in this section because these technologies face many of the same barriers to their use as do renewables.

The energy contribution of renewable resources is presented on two cases. The Base or forecasted Case, which assumes maintaining the status quo of present public/energy policies and programs, is presented in detail at the end of Subsection 2. The Proposed Case, which assumes implementation of the programs, laws, and regulations proposed in this section, is presented in detail at the end of Subsection 3. A discussion of the contribution of small hydro, resource recovery and cogeneration to the State's future electric mix is contained on Section V-F. The methodologies underlying the estimates within each case for each renewable resource are discussed in Appendix D-1. Figure V-C-1 shows the energy contribution of each renewable resource currently, as well as projections of their further contributions under the Base and Proposed Cases.

Renewables will provide an increasingly significant contribution to the State's energy supply over the next fifteen years as the Base Case estimate illustrates. However, the importance of renewables can be enhanced through implementation of the recommendations that constitute the Proposed Case. There recommendations are directed towards the removal of the existing legal, economic and institutional barriers that limit the greater use of renewable resources in New York State.

Currently, New York imports 92 percent of its energy but the State contains a vast potential supply of indigenous, renewable energy resources. For example, an inventory conducted by the Polytechnic Institute of New York (PINY) for the New York State Energy Research and Development Authority (NYSERDA) indicates that 3000MW of undeveloped hydroelectric capacity currently exists in NYS. The processable solid waste disposed of in New York currently amounts to 18 million tons per year and contains a potential energy content of 160 TBTU. Furthermore, prudent development of the commercial forest land located on New York State could potentially provide approximately nine percent of the State's total energy requirements.

Besides providing new energy sources, the development of renewable resources will create new job opportunities in the State. For example, the manufacture and installation of solar units will make jobs for plumbers, carpenters, sheet metal workers, building architects, and engineers. The resultant increased energy supply from indigenous resources may also encourage industries to stay in or move to New York, thus enhancing the State's economic development and well-being. Furthermore, as conventional energy reserves are depleted and fuel prices continue to rise, the availability of indigenous supplies will enable New York to decrease its reliance on expensive imported supplies. It can then channel that capital into the State's own energy industries instead of exporting it out-of-state and overseas. Appendix E contains a more complete analysis of the general economic impact of renewable resource development.

Several factors, however, inhibit increased statewide use of renewable energy resources. Although renewable resources can help improve environmental quality by replacing polluting and hazardous conventional fuels, such as coal and nuclear, they are not without environmental problems. For example, wood burning creates particulates, whole refuse-fired facilities may involve the burning of plastics and the emission of heavy metals. The impact on the forest ecosystem of the intensive harvesting of timber are uncertain as the effects vary with specific sites and harvesting techniques. The Final Environmental Impact Statement approved by the Energy Planning Board reviews the general environmental impacts of renewable resources.

Some barriers to renewables are technological. These include problems centering around the durability of solar collectors, electric storage capacity for photovoltaic and

FIGURE V-C-1

ENERGY CONTRIBUTION OF RENEWABLE RESOURCES IN NEW YORK STATE

	Current (1979)	(Additions by 1994) Base Case	(Additions by 1994) Proposed Case (impact over Base Case)
Solar	.03 TBTU	.3	5.5
Wood/Biomass	29.1 TBTU	21.3	38.3
Resource Recovery			
Electricity	32 MW	266	292
Steam	—TBTU	24.0	15.8
Small Hydro	800 MW	725	325
Cogeneration			
Electricity	523.5 MW	221.6	337.4
Steam	35.4 TBTU	15.0	23.4

wind systems, and efficiencies of resource recovery boilers. Institutional problems, such as developing a secure market for a new energy resource, resolving issues associated with solar rights, and increasing the involvement of regulated utilities in renewable resource ventures, further hamper the development of renewables within New York State.

A basic problem, however, is the current price structure for conventional fuels. Today's energy prices generally reflect the average costs of producing energy. They do not distinguish the lower costs of older sources from the higher costs of new or yet to be discovered sources. Average cost pricing of new conventional energy facilities discriminates heavily against the renewable technologies that are not similarly treated. While renewables are able to compete economically with newly discovered conventional fuels, such as newly discovered outer-continental shelf oil, on a marginal cost basis, they are not generally able to compete with averaged costs of those same fuels.

Furthermore, the existence of a well established energy infrastructure, which will not be abandoned or torn down overnight, often weighs heavily in favor of the existing fuels. Hence, the initial impact of renewables will be to limit the need to add to that existing infrastructure. When a standing plant or system is retired, renewable technologies will begin to replace the existing infrastructure.

Each conventional energy system in use today also benefits from government subsidies, directly or indirectly. These subsidies generally are not recognized for making a technology economic. For example, oil subsidies include incentives for new oil production, and until recently, the Oil Depletion Allowance. Natural gas consumption has been subsidized for 25 years with price controls. Nuclear power is a heavily subsidized form of energy; the federal government has spent billions of dollars on nuclear research and development and uranium enrichment. The current Department of Energy's (DOE) research and development (R&D) budget requests $1.4 billion for nuclear R&D compared with only $646 million for solar R&D, for example.

Without comparable subsidies and efforts to reduce the environmental, technological, and institutional barriers to renewable resources, the rate of development and the beneficial impacts of these alternative technologies will be limited. Proposed incentives—such as increased tax credits, low interest loan programs, direct grants, stepped up government RD&D, public education programs, and the removal of government barriers to licensing and regulation—will let renewable technologies compete more successfully with conventional technologies.

2. *CURRENT STATUS*

A. Systems and Technologies

1) Solar

Solar energy has the potential to provide New York with a clean renewable source of energy, replacing natural gas, oil, and electricity as fuels for space heating/cooling and hot water. Currently, electricity, because of its high cost in relation to oil or natural gas for such end uses, is the fuel most frequently displaced by solar systems.

Solar technology as discussed in this section includes active, passive, wind, and photovoltaic systems. Active solar systems generate hot water and/or space heat with special collectors that capture the sun's energy in heated air or liquid. The energy is then distributed by fans, pumps, or other mechanical devices for appropriate end uses.

Passive systems supply space heat by designing and orienting buildings to use natural heat gains in the winter and heat losses in the summer—without benefit of mechanical devices.

A wind system captures wind energy through a propeller or blade configuration. This energy may be converted by a gear mechanism into useful electric or mechanical energy. Photovoltaic systems are composed of solar cells grouped into panels and arrays that convert sunlight directly into electricity. The ability to store electricity economically is an important consideration in the feasibility of wind and photovoltaic systems.

The cost of an active or passive solar system varies with climate, size, and type of application. The total cost for an active system that is capable of supplying 50 percent of all space and water heating in a new home may reach $20,000[1] A hot water system, alone, which supplies 50 percent of domestic water heating requirements can range from $1,400 to $3,400.[2] Costs for a retrofit instead of a new structure installation may be up to 10 percent higher.

Given the current pricing structures and tax treatment, to achieve a reasonable payback period of 6 to 10 years on a $2400 solar hot water system installed in a downstate residence, natural gas prices must rise from the 1979 level of under $4.00/MCF to $11.50-$23.00/MCF.[3] Similarly, oil prices must increase from the winter 1979-80 level of $0.95/gallon to $1.20-2.50/gallon.[4] Fuel prices must be substantially higher for such systems to become competitive upstate. The current economics of a hot water system installed in downstate homes using electricity, however, are favorable. With an average downstate electric rate of $.09/KWH, the payback period is 8.8 years.[5] Details of these findings are depicted in Figures V-C-2, V-C-3, and V-C-4.

The additional cost of a new house incorporating passive solar design satisfying 60 percent of space heat requirements may reach $6,000.[6] The costs for passive solar retrofit may be higher for a comparable energy impact. Frequently, however, the increased cost of renovating is offset by using an existing structure—walls, floor, roof—as thermal mass in the passive system.

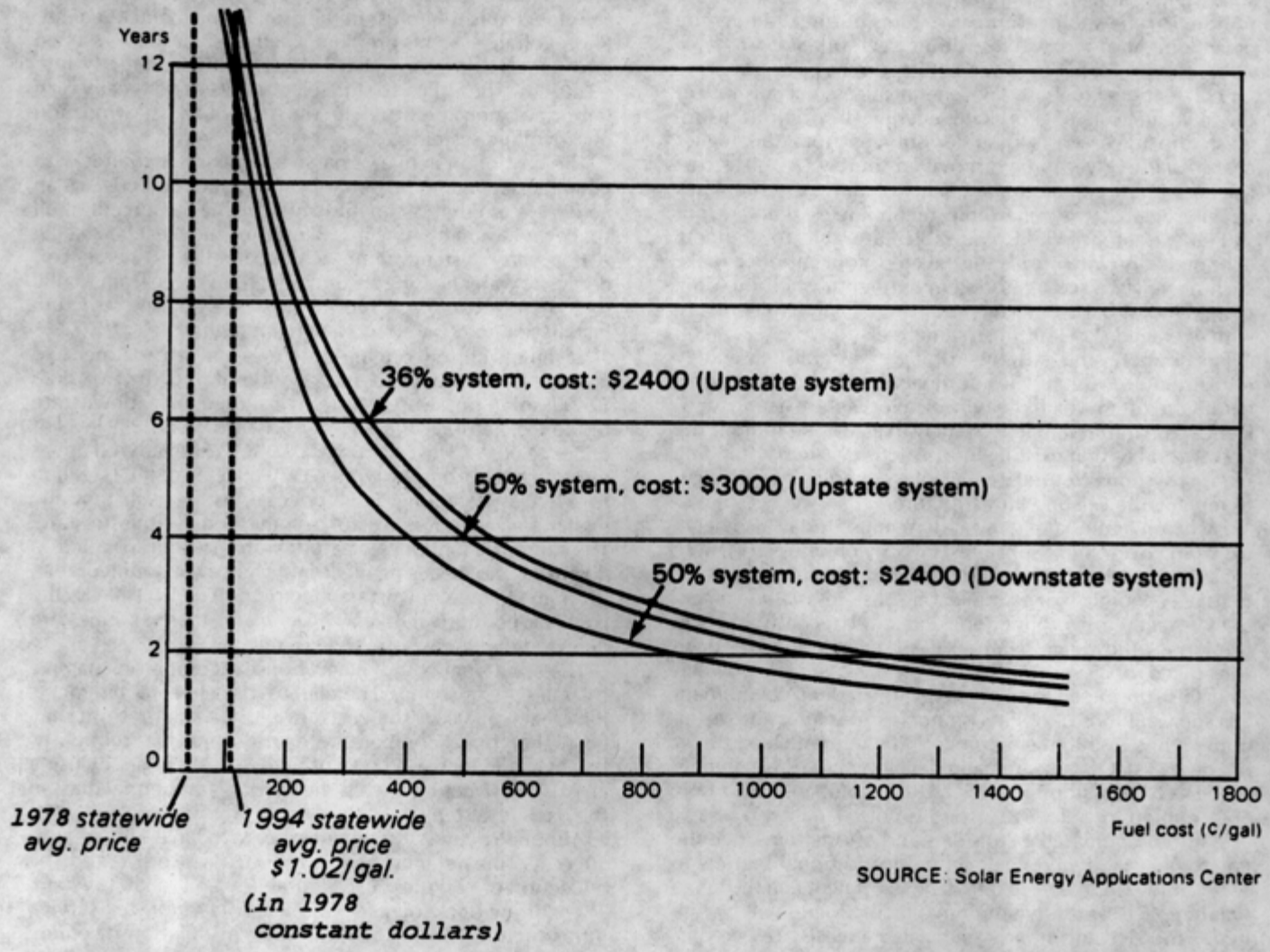
Although active systems are expectd to have a life of 15 to 20 years, the infancy of the industry has prevented the collection of comprehensive durability and reliability data. The current lack of a developed solar industry service infrastructure can lead to improper installation of equipment and poor system performance. For example, freezing and leaking of the liquid heat transfer medium and corrosion of system parts can cause significant problems.

Energy storage is an integral part of any active or passive system. Current practice, technology, and design allow for one to three days of thermal storage employing liquid, rock, earth or phase change materials. During extended periods of low insolation, therefore, back-up systems of sufficient capacity to carry the full building load are necessary.

Active hot water systems are expected to make their greatest contribution to the downstate region of the State primarily because of higher electric costs and higher levels of insolation in the region. The present economics of such

[1]Urban Systems Research and Engineering, Inc., *Estimates of the Costs of Renewable Energy Technologies for New York State*, May, 1979, pp. 3-17.
[2]Polytechnic Institute of New York, *Payback on Residential Solar Hot Water Systems Installed in New York State*, December, 1979.
[3]Polytechnic Institute of New York.
[4]Polytechnic Institute of New York.
[5]Polytechnic Institute of New York.
[6]Urban Systems Research and Engineering, Inc., pp. 4-26.

FIGURE V-C-2
PAYBACK PERIOD VS. FUEL COST, OIL
SOLAR HOT WATER SYSTEM



SOURCE: Solar Energy Applications Center

systems make their near-term penetration into the multi-family housing, commercial, and industrial sectors negligible. However, solar hot water systems could be feasible in some low density (2-4) units at a later date as fuel costs rise and installation costs decline. The current economics of active space heat systems make their penetration in the next 15 years minimal in all regions of the State.

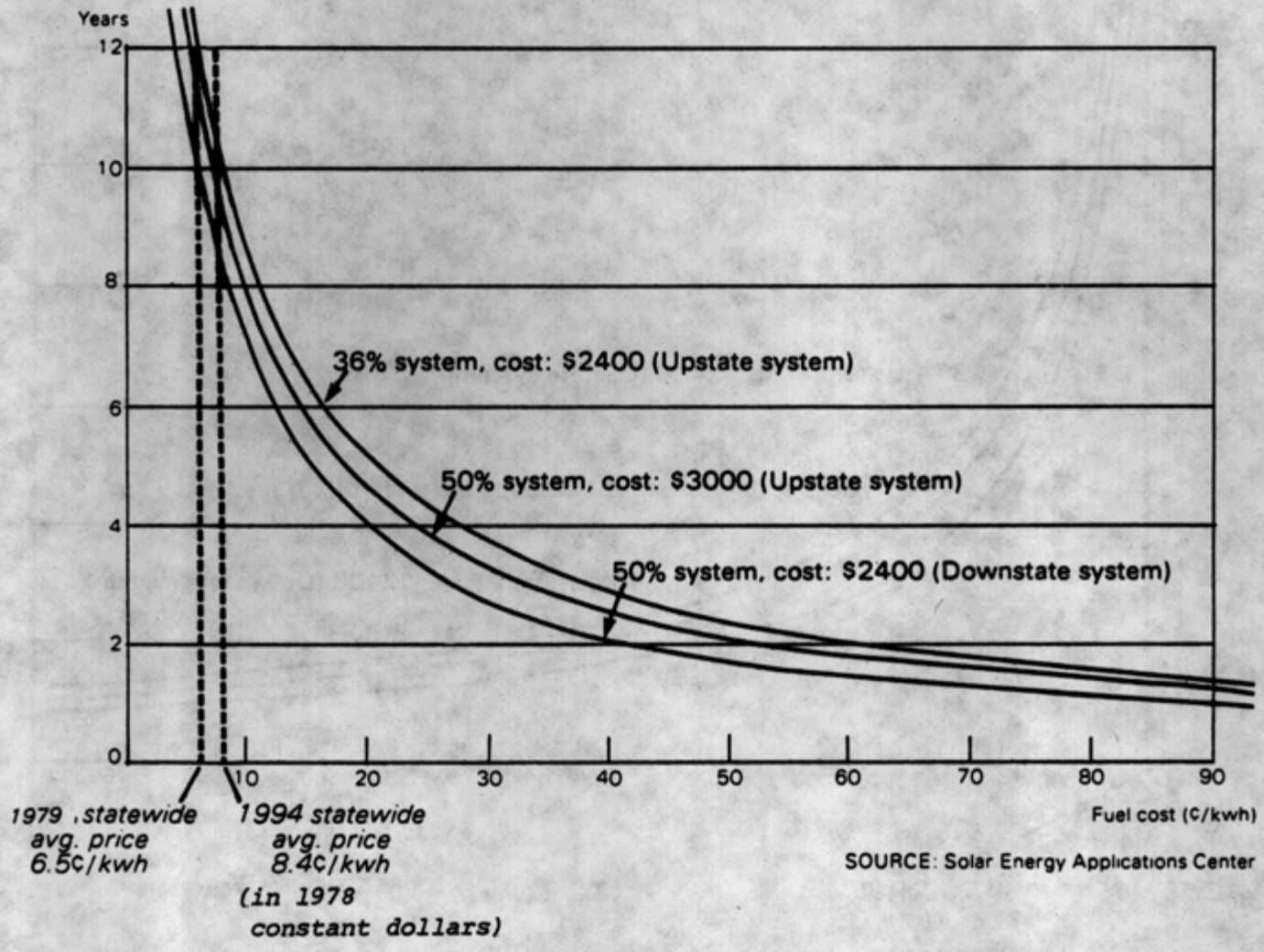
Passive solar, usually developed in new residential construction jointly with high conservation building techniques, could be a significant factor in residential energy consumption. Passive systems, with a high potential for meeting large portions of space heat demands, are expected to have an equal market penetration throughout the State. However, a passive system in the upstate region supplying 60 percent of space heat requirements will contribute more energy than a similar system installed downstate—because of higher heating requirements in the upstate area. These systems will be most efficient in new housing. However, many passive designs are appropriate for retrofit onto existing homes at higher per unit cost and/or lower efficiencies.

Solar photovoltaic technology is of great interest since it promises greater flexibility in siting electric generation facilities. The market for photovoltaic installations could be central station generation, decentralized grid-connected residential, commercial, and industrial applications with or without on-site storage. Or it could be used in isolated applications with on-site storage. Photovoltaics are still in the development stage; before they can be commercialized, it is necessary to scale down their current costs of $9.50 per peak watt to $.35-$.60 per peak watt. Comparable reductions in current electricity storage and array mounting-tracking costs must also be achieved.

The DOE is pursuing an aggressive research and development program. Private research, such as the Texas Instruments' efforts to redesign the surface of the photovoltaic cell, is making progress aimed at lowering costs to $.50 per peak watt. The most significant development occurred in August, 1979 with the Stanford Research Institute's (SRI) technical breakthrough in the manufacture of silicon, which is used in the silicon wafers which convert sunlight directly into electricity. It has been contended that this would reduce the cost to one-half the DOE target cost of manufacturing silicon at $10 per kilogram and is seven years ahead of schedule. SRI's breakthrough, of course, must be evaluated by the scientific community before one can confidently agree upon its significance.

If the SRI development is verified, photovoltaics could possibly be cost competitive with nuclear and coal fired

FIGURE V-C-3
PAYBACK PERIOD VS. FUEL COST, ELECTRICAL SOLAR HOT WATER SYSTEM



SOURCE: Solar Energy Applications Center

electricity generation by 1990. Questions must still be resolved, however, with respect to storage and integration with the utility grid.

Since cost competitiveness occurs so late in the forecast period, the energy contribution of solar photovoltaics by 1994 is assumed to be negligible.

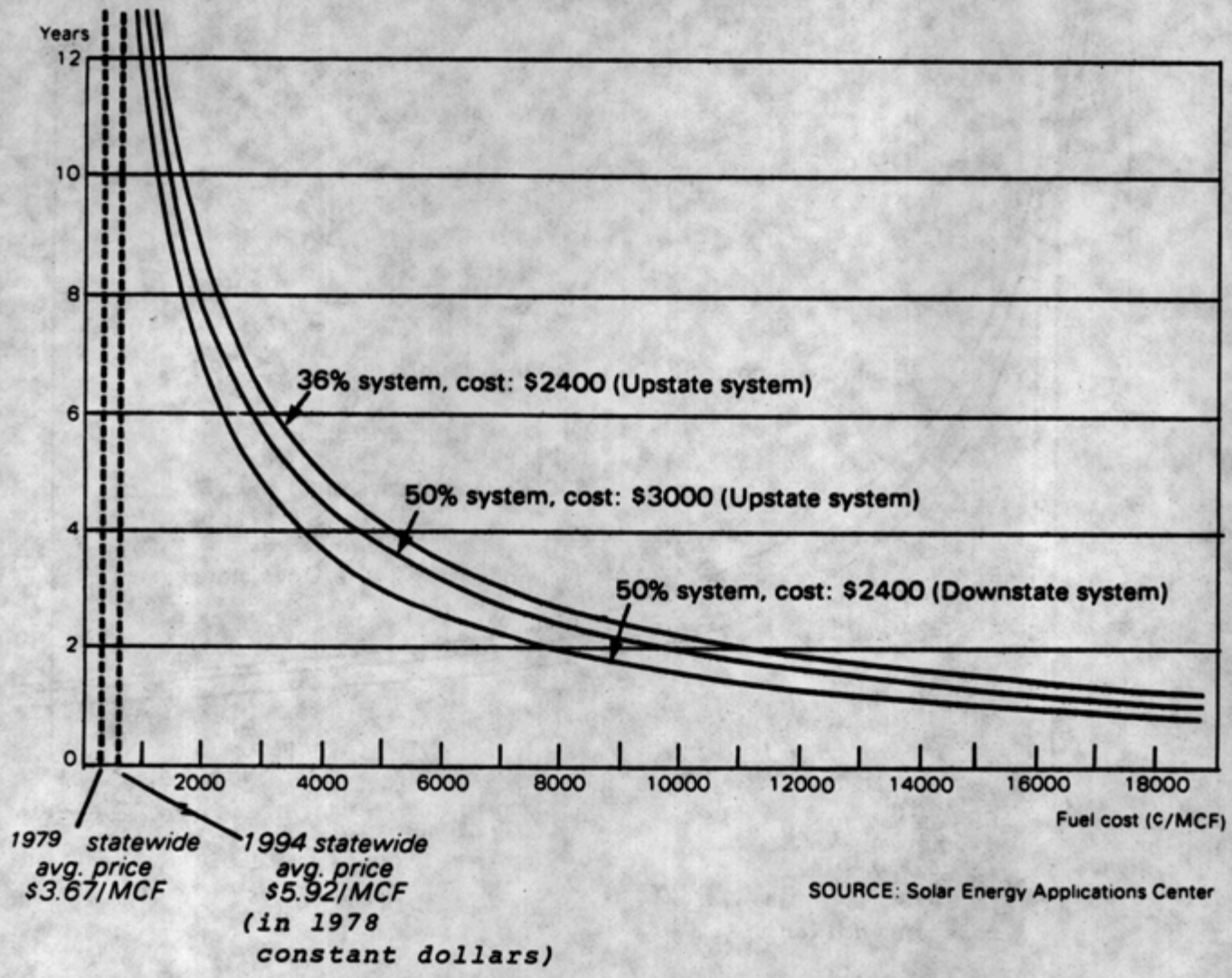
New York State has a wind resource well above the national average. The overall statewide annual average wind speed is 12 mph, compared with a national average of 10 mph. New York's wind resource is greater than 75 percent of the states in the nation. Therefore, on the basis of available resource, New York appears to be one of the most promising areas in the United States for wind energy use. Since the wind resource is quite sensitive to terrain roughness and exposure, the available wind resource may vary widely for sites separated by only a few miles. Hence, for any prospective wind turbine site, on-site wind speed measurements are needed to establish the actual magnitude of wind speed available at that location with confidence.

Potential applications of wind electric systems are quite numerous including rural residential, agricultural, commercial,and industrial users (i.e. consumer-operated distributed systems), as well as electric utilities.

The technical feasibility of wind energy systems has been established. Several experimental systems have been installed in the State already. These include three demonstration units sponsered by NYSERDA at Rensselaer Polytechnic Institute, New York University, and the Grumman Aerospace Company. However, before wind systems can compete widely on the market with existing electric systems, a number of technical, economic, environmental and institutional challenges must be met. Energy costs of currently available wind systems are still much greater than competing conventional energy forms. The cost of wind power must be reduced from the current $0.12-$0.15/KWH to about $0.07/KWH. Technical improvements, especially in electric storage, are necessary to increase the reliability of such systems. To help meet this challenge, research, development and demonstration projects are being carried out under federal sponsorship as well as by industry.

By the late 1980's, wind systems may become viable for certain agricultural, commercial and utility applications. These expectations are based on the continued relatively large increases in costs of conventional energy sources and in the anticipated cost reductions in wind systems due to R & D advancements and increasing production.

FIGURE V-C-4
PAYBACK PERIOD VS. FUEL COST, NATURAL GAS
SOLAR HOT WATER SYSTEM



SOURCE: Solar Energy Applications Center

While the wind resource in New York State is substantial and the technology is promising, the likely impact of wind systems during the planning period cannot be forecasted due to the lack of state specific empirical information and data on which to base such a projection.

2) Biomass

Biomass offers a vast renewable supply of material that may be converted into various types of liquid, solid, or gaseous fuels. Biomass includes agricultural wastes from crops and animal manure, biomass plantation crops grown specifically for energy production, municipal solid waste, sewage sludge, industrial waste, and wood and wood residues.

Collectible agricultural crop residues and animal manures can be converted to methane gas through anaerobic digestion. The gas produced may be used in its raw form for internal energy needs on the farm. It is also possible to convert crop residues to alcohol by simple fermentation. The alcohol may be blended with gasoline to produce gasohol—a transportation fuel.

Municipal solid waste can be converted to useful energy in a number of ways. Methane gas can be extracted from landfill garbage, upgraded, and distributed in the existing pipeline thus replacing or supplementing traditional natural gas. Research is currently underway to produce alcohol from the cellulosic content of municipal solid waste as an additional feedstock for gasohol. Sewage sludge and industrial solid wastes offer other large potential sources of methane, which may be used on site in its raw form.

Wood feedstocks, which include forest and mill residues and annual surplus growth, can be processed into chips, gasified, or used in bulk as sources of fuel for residential space heating, industrial processes, and utility generation of electricity. It would displace oil, natural gas, and electricity. The forms of biomass that show the most energy potential for the State are wood, municipal solid waste, and sewage sludge. Of the three, wood is the most promising.

a. Wood

Wood was at one time the major source of energy in the United States, and in New York particularly, because of its availability. Since the early 1900's wood has been relegated to a minor role, a situation created by an abundant and relatively inexpensive supply of fossil fuels. Now that these

"conventional" fuels are becoming increasingly expensive, wood is once again being considered as a viable source of energy.

The public has rediscovered the wood stove and the wood stove industry has expanded dramatically. In 1978, approximately one million wood stoves were sold in the United States. It is realistic to assume that about 4 percent were sold in New York. Industrial and institutional fuel users, also, have begun to test the feasibility of burning wood. Wood fuel feedstocks may be in the form of industrial and logging residues, or whole tree chips produced directly from cull trees in the woods.

Wood also has potential as a utility fuel for the generation of electricity. Currently, a 10MW wood fired powerplant is being operated in Burlington, Vermont and a 50MW unit is being planned. The New York State Energy Office and the Power Authority of the State of New York are studying the feasibility of a 10MW wood powerplant in Tupper Lake. This would be a completely new facility consuming about 150,000 green tons of wood per year or the equivalent of 3 TBTU of fuel. It would require a supply area of 150,000 acres,or more,of accessible forest. The capital cost of such a facility is expected to be about $18 million with net electric costs of approximately 30.6 mills/KWH.

The cost of a new industrial wood boiler including auxiliary systems—wood storage shed, stoking system, pollution control devices—is approximately $30,000/MMBTU/hr. This is the same price as a new coal boiler and approximately three times the cost of new oil boiler. Generalizations about the cost of retrofitting an existing coal or oil boiler to use wood are difficult to make. For wood to be mixed with or substituted for coal in an existing coal-fired system, additional costs for wood may include a storage shed, a new wood handling and stoking system, and often the expense of boiler deration. Oil boilers tend to be much smaller than wood boilers, making conversion impossible without the addition of an entirely new combustor section. Preliminary estimates do indicate that the cost to retrofit a coal or oil boiler to use wood can range from $5,000/MMBTU/hr. to $30,000/MMBTU/hr.

Fuelwood chips are available now for an estimated $12-$15/green ton delivered up to 30 miles. This is equivalent to about $1.20-$1.50/MMBTU, which is clearly competitive with the 1979 statewide average industrial prices for both coal and oil at $2.44 and $3.82/MMBTU, respectively. This large cost differential between oil, coal and wood fuel often makes the conversion to wood cost effective despite the sometimes higher capital costs for wood systems, especially in wood products industries that have a ready supply of free wood residue.

Wood can also be used to meet air pollution control standards. Wood, having virtually a zero sulfur content, can be burned with coal to satisfy sulfur emission standards for coal boilers, or alternatively, to permit the purchase of cheaper, higher sulfur coal.

The current cost of wood delivered for residential use ranges from $50 to $150/cord, with a mean of $70-$75 . When used in a wood stove with a net-efficiency of 50 percent; this is equivalent to $4.16-$12.50/MMBTU. When burned in a wood furnace with a 70 percent efficiency, it is equivalent to $2.97-$8.92/MMBTU. These-prices are competitive with the 1979 residential prices of oil and natural gas, which-are $8.34/ MMBTU and $4.81/MMBTU; respectively, assuming a 70 percent furnace efficiency. In addition, many families cut their own wood, thereby making wood fuel costs negligible.

Retrofitting a house with a wood-burning furnace requires placing a woodfire box next to the existing furnace and using the existing controls of the furnace to regulate the system. The purchase price for one of these systems ranges from $1300 to $1800, plus installation costs of approximately $500.

The price of most popular wood stoves varies from $150 to $1000. The explanation for this large range lies primarily in the heating efficiency, size, and design of the stoves. Installation costs can go as high as $700, making the total capital costs of such systems $500 to $1700. It must be noted, however, that many people install their own stoves and some wood stove retailers include installation for a minimal fee.

In light of these facts, it appears that the economics of wood fuel are currently favorable. The use of wood as fuel for residential space heating and industrial process heat will occur primarily in the upstate region of the State. It is more readily available there, hence, its transportation costs are lower.

b. Methane Production

The energy potential of landfill garbage and sewage sludge in New York State was ignored until recently despite the fact that these forms of biomass can be converted to methane by anaerobic digestion. Biogas from such digestion may be used on site in its raw form or upgraded and distributed through the existing pipeline.

Within the last year a project at Fresh Kill Landfill on Staten Island has demonstrated that it will be cost effective to collect and process gas from large landfills. Reserve Synthetic Fuels of California has contracted with New York City to produce methane for sale to Brooklyn Union Gas Company. The project will be in operation in late 1981.

Gas costs from this project will be about $2.75/MCF, which will be competitive with the expected wellhead price of domestic gas supplies. Capital costs will be $15 million to produce 2-2.3 BCF/yr. of pipeline quality gas. The New York Metropolitan Area is the location most likely to be attractive for such projects. The concentration of garbage is high, and the density of the existing gas distribution system allows for an inexpensive interconnection and maximum flexibility of gas use. In general, however, biogas can be utilized more easily and with less cost in its raw form. Hence, few projects, perhaps only the Fresh Kill project, will undertake to upgrade the gas for the pipeline.

Sewage sludge represents a large supply of methane, a significant portion of which is already being used. Anaerobic digestion of sewage sludge is one of the most common sewage treatment procedures, and many of the larger facilities use the gas internally. In New York City, present gas generation is about .81 BCF/year, of which 73 percent is used internally.

There are a number of prospects for increasing biogas utilization at sewage treatment facilities. The first is to use the gas presently flared. In the case of New York City it appears that this will be done in the near future. The second calls for modifying existing plants to increase gas generation as part of the requirement to raise the amount of biochemical oxygen demand removal from waste water from present levels between 0 and 50 percent to 85 percent (BOD—the demand for oxygen which is needed for the biological functions of respiration and decomposition).

c. Gasohol Production

Gasohol is usually a mixture of 10 percent alcohol and 90 percent gasoline (the proportion may vary). The alcohol may be produced from non-renewable feedstocks such as coal, however, it is more commonly produced by fermenta-

tion of agricultural feedstocks, primarily corn. With the constant rise of gasoline prices, gasohol is becoming increasingly attractive as an alternative transportation fuel. It is already being sold in Nebraska, Illinois, and Iowa at approximately 150 service stations, and has recently become available at a few locations on Long Island and upstate New York.

A number of factors must be considered, however, before gasohol production is justifiable in New York State on an economic and energy conservation basis.

A question of energy balance may be involved in the manufacture of grain based gasohol. Large amounts of non-renewable fuels are required to produce the agricultural feedstocks. This includes energy for fertilizer, farm machinery, and processing. The high energy input makes gasohol a less energy conserving alternative than would appear on the surface unless current waste products can be used in its manufacture.

Also, New York imports approximately half of its present food grain consumption from the Midwest. Hence, alcohol or grains from which to make alcohol would have to be imported and a potential conflict is possible between food prices and availability.

Despite the current four cents per gallon federal excise tax exemption, gasohol costs five to six cents per gallon more than unleaded gasoline because of the cost of the alcohol. It is about the same price as premium unleaded gasoline. Widespread gasohol marketing will probably not occur in the State without a real reduction in the cost of producing alcohol, a two to three fold increase in the price of gasoline, or a government subsidy.

It must be noted that with today's constant threat of gasoline supply shortfalls, gasohol provides a useful means of stretching that supply. Research must continue to increase available non-grain based alcohol feedstocks. In New York State, agricultural wastes such as cheese whey and blighted Long Island potatoes show promise as potential alcohol feedstocks. Also, research is currently being conducted at Cornell University in the production of alcohol from the cellulosic content of agricultural and municipal solid wastes, as well as the starchy by-products of food processing wastes. Successful development of these feedstocks could allow gasohol to become a viable alternative transportation fuel in New York State.

Resource Recovery

Resource recovery, as defined in this section, is the generation of energy from municipal solid waste. It provides a unique opportunity to match two pressing needs in our society—waste disposal and new energy production. The State's landfill areas are rapidly diminishing and disposal costs are high. It is the value of the disposal service in conjunction with the income from recovered energy that makes resource recovery systems economically attractive.

Unlike other energy sources, the supply of solid waste cannot be turned off or stored for any length of time. Energy recovery systems offer one way of reducing the quantity of waste that must be disposed of in landfills. The Federal Resource Conservation and Recovery Act of 1976 calls for all landfill sites to conform to stringent standards by 1983 or be closed. This adds a further incentive for the use of solid waste to generate energy.

A number of technologies for converting solid waste into usable energy are now available. Waste may be converted to a refuse derived fuel (RDF) to be mixed with coal or oil or burned directly. The energy output of the system may be in the form of steam, hot water, electricity or the cogeneration of both steam and electricity.

The amount of energy recovered from a given amount of refuse is dependent upon the technology selected for the particular resource recovery plant. Steam generation and cogeneration technologies make more efficient use of energy in solid waste than solely generating electric power.

Mass burning of unprocessed waste can be accomplished in large scale waterwall boilers or in smaller 25 to 50 ton per day modular incinerator units. Many energy recovery facilities using large scale mass burning have been operating in Europe for years. There are also a few modular incinerators and large scale waterwall incinerator facilities in the United States that are recovering steam from municipal solid waste. Saugus, Massachusetts, Nashville, Tennessee, Harrisburg, Pennsylvania, and Chicago, Illinois all have such facilities.

Several technologies are used to produce various types of refuse derived fuel (RDF). Generally this involves the prior separation of recyclable materials followed by some type of processing of the combustible fraction, either for burning on site or for sale as a fuel.

The unending generation of municipal solid waste offers a continuous, non-imported energy supply. However, with today's technology and prices it is not feasible to establish energy recovery systems that are based solely on the sale of energy recovered from mixed municipal solid waste. The economic feasibility of a resource recovery plant depends not only on the energy generated or the fuel produced but also the value of the materials recovered and the fees charged (tipping fees) to dispose of the refuse. Such fees range from $10 to $20 a ton. The economic feasibility also depends upon the outcome of negotiations between the facility and the electric company over the cost the utility will pay for either fuel or electricity.

The capital cost of constructing a resource recovery facility is a function of the amount of refuse to be recovered and the ability to sell the end product (steam, electricity, or fuel). Preliminary cost projections for resource recovery facilities to be constructed in New York State by 1984 range from $3.7 million for a 150 ton per day facility to $101.1 million for a 3000 ton per day plant. The delivered cost of steam, electricity, or RDF will depend on the facility characteristics and the utility although preliminary estimates have pegged the delivered cost of electricity to the grid to be about 50 mills per KWH in 1984. This compares with the Hempstead Resource Recovery facility's present arrangement which cost Long Island Lighting Company about 38 mills per KWH in 1979.

Because of the immaturity of resource recovery technology, it is not yet possible to adequately evaluate the durability of the hardware. Of the existing facilities that have been in operation, problems have been encountered in boiler efficiency, slagging and corrosion of boiler tubes, and air pollution control. The reliability of such resource recovery systems is presently not known. However, as experience with such systems grows, more accurate reliability rates can be projected.

Currently, there are three resource recovery projects under construction and one in limited operation in New York State. Also there are 16 projects throughout the State that are in active planning stages and for which the energy output is known.

Profiles of the four projects in construction or operation follows:

- Monroe County has completed over 95 percent of the construction of a resource recovery facility that will process up to 2000 tons per day (TPD) of waste to recover ferrous metals, aluminum, and glass. It will produce a refuse derived fuel that the Rochester Gas and Electric

Corporation will use as a coal supplement to generate electricity. The energy value of the RDF will be .99 TBTU per year, which can replace 39,000 tons of coal. The plant is expected on line in 1980.

- The City of Albany has started construction on a 730 TPD facility to recover ferrous metals and produce RDF to be used in boilers to generate steam for heating and cooling the Nelson A. Rockefeller Empire State Plaza. The complex currently is provided with low sulfur oil burned at the Sheridan Avenue electric generation facility. The energy recovered from this facility will be 1.18 TBTU per year or about 40 percent of the Plaza's heating and cooling requirements. The plant is expected to be operational in 1981.
- Hooker Chemical in Niagara Falls is constructing a facility to process up to 2200 TPD of waste and to recover ferrous metals. The RDF produced will be used to cogenerate steam and electricity to replace a substantial portion of the coal and oil the corporation now uses. The net peak electrical generation capacity of the facility will be approximately 48MW. The plant is expected to be on line by 1981.
- Black-Clawson Fibreclaim Inc. has entered into a full service contract with the Town of Hempstead to construct and operate a 2000 TPD resource recovery system. The plant is currently processing 500-1000 TPD and is on line about 70 percent of the time. It produces steam, which is sold to the Long Island Lighting Company to generate electricity at a total estimated cost to LILCO of 38 mills per KWH. The net peak electrical generation capacity of the facility is 32MW (which will back out oil).

4) Small Hydro

The concept of water power (i.e., mechanical energy from flowing water) is not a new idea. In fact, the industrial development of the Northeast was based on water power. In the 1800's, New York State was the center of American industry based on a plentiful, inexpensive supply of this form of energy. By 1910, however, coal and oil were producing electricity that met the needs of more sophisticated machinery. They replaced water power. While some sites were converted to generate hydroelectric power, most were simply closed. Their legacy is a wealth of abandoned or underused hydro sites.

With today's dwindling supplies of fossil fuels, small hydropower is re-emerging as a potential source of primary energy for the State's fuel mix. Small hydro, as discussed in this section, refers to installations with a capacity of 15MW or less as defined in Title IV of the Public Utilities Regulatory Policies Act of 1978. Currently, about 800MW of electricity are generated from small hydro facilities in New York.

The use of hydropower at small sites can be justified in several ways. Supplemental electricity production can help meet load requirements for the State. It can meet the specific incremental or replacement power needs of industrial, agricultural, and municipal developments. Hydro facilities are long-lasting and reliable and can help conserve fossil fuels for more appropriate uses. Once installed, maintenance is minimal. "Fuel" is "free" and renewable. Hence the cost of producing electricity at these facilities should be relatively insulated from inflation.

Small hydro plants have some notable advantages over thermal electric facilities. Hydro equipment tends to be highly reliable, allowing for extremely low operation and maintenance costs (except for manually controlled facilities where operating costs are much higher). Typically, hydro facilities have economic lives in excess of 60 years, compared to only 45 years for most thermal plants. Furthermore, while hydro facilities do create environmental changes, as discussed below, the negative impacts of their use are typically much less than the impacts from thermal electric plants.

The economics of small hydro power are very site specific, since the characteristics of each facility will vary widely depending on stream flow, available head (difference in elevation of the generator and the water level behind the dam) and the condition of existing civil works or equipment. A recent set of feasibility studies sponsored by the New York State Energy Research and Development Authority (NYSERDA) and the U.S. Department of Energy[7] identified 13 small hydro facilities which could be quickly rehabilitated for an average cost of about $350/KW installed capacity (1978$). Costs varied between a low at the Weavertown site of $50/KW, generating power at 1.5 mills/KWH, to a high at the Croton Falls site of $3626/KW, generating power at 75.5 mills/KWH.

In an effort to determine costs for small hydro developments in general, twelve hypothetical hydro sites were described in a study by Urban Systems Research and Engineering under contract to NYSERDA.[8] The twelve sites were based on a matrix of head sizes and average stream flows providing a range of installed output between 100 KW and 15600 KW. Each generic site was also analyzed for different assumptions about the condition of the existing civil works and the size of the equipment to be installed relative to average flow conditions. Costs ranged from a low of $644/KW, (generating power at 20.9 mills/KWH for a medium-sized facility at a dam in good condition) to a high of $3372/KW, (generating power at 109.3 mills/KWH for a small facility at a dam in poor condition).

In some instances a hydroelectric facility would be less expensive than either a coal or nuclear fueled powerplant. The current cost of the Shoreham nuclear plant in 1978 constant dollars is estimated to be $1146 per installed KW. The projected cost for the Somerset coal plant in 1978 constant dollars is estimated at $690 per installed kilowatt.

Thus,depending on the specific characteristics of the small hydro site chosen, the cost per kilowatt of installed capacity could be less expensive to bring on line than currently projected nuclear and coal plants.

The recent upsurge in interest in small hydropower by government, utilities, private industries, private cooperatives and individuals is reflected in recent federal and state action. Under provisions of the Public Utilities Regulatory Policies Act of 1978 (PURPA), Congress authorized a three year $30 million loan program for feasibility and licensing studies for projects at existing dams. Congress appropriated $10 million in FY '79 to be used for low interest loans to defray up to 90 percent of the cost of such studies. The Act also authorized a three year, $300 million loan program to defray up to 75 percent of the actual construction costs of hydro electric projects at existing sites equal to or less than 15MW. However, Congress has appropriated only $18 million for the construction program in FY '79.

Title II of PURPA authorizes the Federal Energy Regulatory Commission (FERC) to require a utility to interconnect with a small hydro facility if the facility petitions for it. The FERC

[7]Brown, R. S. and A. S. Goodman, Polytechnic Institute of New York, *An Assessment of Hydropower Restoration Expansion in New York State Volume 1*, Prepared for NYSERDA, August 1978.

[8]Urban Systems Research and Engineering, Inc., *Estimates of the Costs of Renewable Energy Technologies for New York State*, July 2, 1979.

is also authorized to initiate rulemaking to require any electric utility to offer to purchase and sell electric energy from any small hydro electric facility using the criteria contained in the statute.

In an effort to streamline the licensing procedure, FERC has adopted a short form license for sites less than 1.5MW. Before issuing any license under the Federal Power Act for the construction or operation of any small hydroelectric power project, the FERC is directed to assess the safety of the existing structures in any proposed project (including possible consequences associated with the failure of such structure), and to consult with the Council on Environmental Quality and the Environmental Protection Agency. Also the Council on Environmental Quality has promulgated regulations to help reduce the burden of governmental approvals on small hydro facilities by limiting the length of Environmental Impact Statements (EIS), providing for the joint preparation of an EIS for State and local government with similar-environmental review requirements, and establishing uniform prodedures.

NYSERDA has made an in-depth inventory of New York's small hydropower potential. A total of 5,300 dams were assessed. Of these, 1,672 potential small hydropower sites were identified within New York State. Each has a capacity of at least 50 kilowatts. From this listing it was estimated that New York has 3,000 megawatts of under-developed hydropower capacity from approximately 750 sites.

NYSERDA through its own initiatives has undertaken the first round of site selections for the redevelopment of existing unused small hydropower at nine sites throughout the State each with a potential of less than 1.5 megawatts. They are: Cornell, Auburn, Malone, Lake Placid, Rensselaerville, Wadhams, Potsdam, Wevertown and Oak Orchard. The sites have a combined capacity of 3.591MW and represent almost 18 million annual kilowatt hours that can be added to the State's energy mix. The physical work is underway and the sites will be operational by early 1980.

In addition, with matching funds from the Department of Energy and NYSERDA, feasibility studies have been completed at four other sites. They are at Croton Falls, High Falls, Lake Placid and Guilderland (Watervliet Municipal Reservoir). These sites have a potential of 4.5MW and could add a total of 20 million annual kilowatt hours to the State's energy supply. These sites could be fully operational within the next five years.

NYSERDA has also undertaken a second round of site selections for the redevelopment of existing unused hydropower sites. A total of eleven sites with a total potential capacity of 12.6MW are presently undergoing feasibility studies. They are: Ballston Spa, Troy, Ogdensburg, Altona, Caneadea, Wappinger Falls, Ausable Forks, Oneonta, Burt, Cairo, and Chateauguay.

NYSERDA is also anticipating that a third round of site selections will be undertaken in the near future, although no sites have yet been selected.

NYSERDA is engaged in an aggressive effort to redevelop small hydroelectric sites throughout New York State, by ensuring effective-coordination among government agencies, electric utilities and other interested parties through a State Task Force. NYSERDA is also committed to assisting developers with capital funding if necessary for the initial installation and the rehabilitation of sites or equipment.

The Power Authority of the State of New York (PASNY) has been granted legislative authority to develop small hydro facilities in New York State. At present, the Authority is working on protects at Ashokan and Kensico Reservoirs. These two sites have a capacity to generate 7.5MW. Presently PASNY is studying the potential for small hydro development at the Hinckley Reservoir, which supplies the City of Utica with water. PASNY feasibility studies show that the development could produce 3 to 5 megawatts of power.

A number of private utilities have also shown an interest in developing small hydro powerplants. Niagara Mohawk Power Corporation plans to develop 205MW over the next 15 years. The New York State Electric and Gas Corporation, the Central Hudson Gas and Electric Corporation, and the Rochester Gas and Electric Corporation are all evaluating the possibilities of developing small hydro facilities in their respective areas. A discussion of the impact of small hydro development on electric requirements is contained in Section V-F.

5) Cogeneration

Cogeneration covers a variety of specific technologies that produce electricity and/or mechanical energy in conjunction with other forms of useful energy, such as heat. These technologies are important for the State's energy future because they improve the efficiency of energy conversion and advance an alternative method of electric generation.

Cogeneration technologies can save up to 30 percent of the fuel that would otherwise be needed to produce given amounts of heat and electricity independently. The utilization of the energy currently wasted through central-station electric production will provide for the more efficient use of whatever fuel is burned by the cogenerator while simultaneously decreasing the need for the residual oils consumed in central-station electricity production as well as the distillate oils used for space heating and cooling in residential, com-

FIGURE V-C-5

TYPICAL ELECTRICAL POWER TO HEAT RATIOS FOR COGENERATION SYSTEMS

Cogeneration System	Electrical Output KW	Steam to Process at 15 psig lb/hr
Diesel Generator: Waste heat recovery steam boiler	1,000	2,100
Gas turbine generator: Waste heat recovery steam boiler	1,000	6,000
Back pressure steam turbine generator: Inlet conditions 600 psig 700° F	1,000	18,000

mercial, and industrial applications. The fuel savings inherent in cogeneration systems applies to a variety of fuel forms including natural gas, oil, coal, wood, and solid waste. Such systems, also, offer the possibility of providing incremental additions to the State's energy supply mix.

A variety of technical devices and institutional arrangements are included within the definition of cogeneration. Cogeneration systems can be generally classified into two major types of technologies—topping and bottoming cycles—depending on the initial application of the boiler steam. Topping cycles generate electricity first and recover the waste heat for other useful purposes, such as industrial process heat. Bottoming cycles use the waste heat from a process application for electric generation.

The selection of a cogeneration system is usually dictated by the process heat requirements of a facility and the coincidence of the heat and electric energy needs. The power to heat ratio for the conventional cogeneration systems is relatively inflexible and differs widely according to the types of facilities. Figure V-C-5 shows the power to heat ratio for the three major current types of cogeneration systems.

Diesel engine systems are normally used for small commercial applications rather than for industrial or large institutional premises. Gas turbines can be equipped with a variety of waste heat recovery systems for cogeneration purposes and burn either oil or natural gas. High pressure steam turbines require a large steam flow per kilowatt of electric output and are commonly utilized in large industrial facilities.

Cogeneration systems can exist with or without a physical tie to the electric distribution system serving a given geographic area. The term "Total Energy System" is normally used to define those facilities that exist independent of the electric system. Cogeneration systems that rely upon the local utility to satisfy a portion of their steam or electric demand are often described as "selective energy systems".

Cogeneration systems, like most of the technologies discussed in this section, are normally owned and operated by entities other than regulated electric and natural gas utilities. The major exceptions in New York State are portions of the Consolidated Edison system; the Rochester Gas & Electric system; and the Lawrence Park Heat, Light, and Power Company. Consolidated Edison and the Rochester Gas & Electric Company each operate and maintain steam systems within their respective service territories. Cogeneration equipment is employed by both companies on certain facilities that service their steam customers. The Consolidated Edison steam system is the largest cogeneration network in the free world. The Lawrence Park Heat, Light, and Power Company is a regulated public utility serving a major portion of the Village of Bronxville, New York, by means of cogeneration equipment.

Cogeneration is actually an old idea that is being rediscovered. When industries began to use electricity about 80 years ago, most factories cogenerated their own heat and electricity. As electric utilities grew and electricity prices fell, factories began to buy power rather than produce it themselves. Over 500MW of non-utility owned cogeneration capacity is currently operating throughout New York State. Most of these facilities are within the industrial sector.

Renewed interest in the use of cogeneration technologies nationally and in New York State has occurred within recent years. Increased energy prices coupled with a national energy policy commitment to cogeneration systems have helped stimulate this renewed interest. The National Energy Act of 1978, for example, provides a series of incentives for greater use of cogeneration systems. Section 212 of the Powerplant and Industrial Fuel Use Act exempts certain cogeneration facilities from the federal coal conversion mandate. Section 210 of the Public Utilities Regulatory Policies Act (PURPA) requires the Federal Energy Regulatory Commission to develop rules for State utility regulatory bodies with respect to such cogeneration issues as the establishment of non-discriminatory electric standby and purchase power rate mechanisms and exemptions from state and federal laws and regulations.

The economics of cogeneration systems are site specific. Equipment costs, for example, vary with the size and purpose of the particular configuration. An analysis done for the State Energy Office indicated that the installation costs for a cogeneration system can range from $600,000 for an 800 KW gas turbine/waste heat recovery boiler system to $6,270,000 for a 100,000 lb/hour, 2500 KW coal boiler.[9]

Operating and fuel costs are also site specific dependent on the type and size of the cogeneration facility and the fuel it burns. Together, the equipment, operation and maintenance, and fuel costs along with possible charges for back-up services account for the total cost of cogeneration. These totals can be compared with the price of buying electricity from the utility and producing steam separately to decide if savings are possible with cogeneration and, if so, the number of years which will be required to obtain a return on investments.

B. Government Programs and Subsidies

The Federal and State government have taken a number of actions to encourage the use of renewable resources. These actions include tax credits, direct subsidies, rules, regulations, and R&D and are summarized in Figure V-C-6.

Most of the legislation creating the federal programs and subsidies was part of the National Energy Act, signed by President Carter on November 9, 1978. The rules and regulations implementing most of these programs have not yet been fully promulgated. It is therefore difficult to gauge the effect the specific incentives will have on promoting the use of renewable and alternate resources. For example, it is impossible at this time to definitely quantify the impact of Federal Energy Regulatory Commission rules on New York State since proposed rules were issued in October, 1979 and comprehensive final rules are not expected until Summer, 1980.

It must be noted, however, that a study conducted by the Polytechnic Institute of New York, analyzed the effect of the Federal income tax credit for residential solar equipment. The study showed that the rate of return on investment on a $2400 domestic solar hot water system installed in downstate New York increased from 11.52 percent without the credit to 19.64 percent with the credit.[10] Hence, the credit enables solar hot water systems to compete more successfully with conventional systems downstate. The study also showed, that even with the credit, the economics of active solar systems are still unfavorable in Upstate New York.

C. Base Case Projections

Figure V-C-7 summarizes the energy contribution of renewable resources given the current barriers inhibiting technological penetration and the current level of federal and state government encouragement. The methodology used in preparing these estimates is described in Appendix D-1 while the impact of these technologies on future energy

[9]Acres American, Inc., "Survey of Cogeneration Potential of Selected New York State Industries," June 1979.

[10]Polytechnic Institute of New York, *Pay back on Residential Solar Hot Water Systems Installed in New York State*, December, 1979, Appendix E.

FIGURE V-C-6
GOVERNMENT PROGRAMS

RESOURCE	FEDERAL	STATE	IMPACTS/COMMENTS
SOLAR	ENERGY TAX ACT OF 1978		
	Non refundable income tax credit for residential installation of solar or wind equipment		Impacts residential space/water heating and cooling, displacing electricity, oil, and natural gas.
	The credit is 30% of the first $2,000 expended and 20% of the next $8000 expended.		In the case of passive solar, the credit applies only to the materials and components whose sole purpose is to transmit or use solar radiation; components that serve a dual purpose, e.g., they have a significant structural function, are not included.
	NATIONAL ENERGY CONSERVATION POLICY ACT OF 1978 (NECPA)		
	— Solar Energy Loan Program		
	$100 million program administered by HUD that will provide loans up to $8000 to homeowners and builders for solar equipment in residential units.		Impacts residential space/water heating and cooling, displacing electricity, oil, and natural gas. The financing program will be available for 5 years, with repayments due in 15 years.
	NECPA—Increased Mortgage Limits		
	The mortgage limits for housing insured by FHA or FMHA may be increased 20% to account for the increased costs of solar energy systems. (active and passive)		Impacts space/water heating and cooling in new residences displacing electricity, oil, and natural gas.
	NECPA—Residential Utility Conservation Program		
	Requires utilities to offer energy audits to residential customers identifying appropriate energy conservation and solar energy measures and to estimate the likely costs and savings. Utilities are also required to arrange financing of any such measures.	The NYS Home Insulation and Energy Conservation Act requires utilities to perform these activities for specified conservation measures, which include wood furnaces. To be consistent with NECPA, the Act may have to be amended to include solar technologies.	Impacts residential space/water heating and cooling, displacing electricity, oil, and natural gas. Draft regulations indicate NYS will have to audit and offer financing for active hot water, passive space heat, and wind energy.
	HUD SOLAR RESIDENTIAL DEMONSTRATION PROJECTS		
	HUD has sponsored 5 cycles of demonstration grants to builders/developers and local governments for installation of solar equipment (active and passive) in residential units and government buildings.	20 grants were made in NYS for hot water systems and 11 for passive design.	Impacts space/water heating and cooling, displacing electricity, oil, and natural gas.
	HUD RESIDENTIAL SOLAR HOT WATER INITIATIVE PROGRAM		
	Provides grants of $400 each for the installation of solar hot water systems to 867 downstate homeowners.	To date, 500 grants have been awarded in NYS.	Impacts residential hot water heating, displacing electricity, oil, and natural gas.

RESOURCE	FEDERAL	STATE	IMPACTS/COMMENTS
SOLAR (cont)		REAL PROPERTY TAX EXEMPTION LAW	
		Prohibits increased taxes by reassessing residential property after a solar (active or passive) or wind energy system is installed.	Impacts residential space/water heating and cooling, displacing electricity, oil and natural gas.
			To date, approximately 25 people have applied for the exemption.
		SOLAR ENERGY PRODUCTS WARRANTY ACT	
		Requires that every warranty for solar energy systems comply with regulations issued by the State Energy Office. If no warranty is offered, this must be clearly stated.	Impacts space/water heating and cooling, displacing electricity, oil, and natural gas.
		Solar Access Act	
		Requires localities to consider solar access as a valid public purpose in zoning regulations.	Impacts space/water heating and cooling, displacing electricity, oil, and natural gas.
WOOD		Certain State agencies are encouraging the use of wood at government facilities that presently burn coal and oil.	Impacts institutional space heating, displacing coal and oil.
			The action is designed to stimulate wood chip market development.
			The Department of Mental Hygiene is installing wood chip burning equipment at the Binghamton and Gowanda facilities. They will be operating in 1981.
		The State Energy Office and PASNY are studying the feasibility of a 10MW wood fired power plant in Tupper Lake.	SEO is investigating wood conversion at the Wilton Developmental Center.
		NYSERDA is compling a State forest biomass inventory. SEO will use this data to determine how much of the existing resource is actually accessible for fuel harvest at acceptable prices.	SUNY at Binghamton and Cornell are considering conversion to wood.
			Impacts utility generation of electricity, displacing oil.
			Impacts residential/institutional space heating, industrial process heat, displacing coal, oil, and natural gas.
GASOHOL	ENERGY TAX ACT OF 1978		
	Exempts from the $.04/gallon Federal Excise Tax, gasohol containing at least 10% alcohol produced from agricultural products or waste.		Impacts automobile use of gasoline.
RESOURCE RECOVERY (municipal solid waste)		ENVIRONMENTAL QUALITY BOND ACT OF 1972	
		Allocated $175 million to finance up to 50% of the cost of a resource recovery project.	Impacts power generation by utilities; industrial process heat; residential/commercial water and space heat, displacing coal, oil, and natural gas.
			$171.5 million has been reserved by legislative appropriation to 19 projects. The State has entered into contract for only $75 million of the amount allocated by legislative appropriation.

RESOURCE	FEDERAL	STATE	IMPACTS/COMMENTS
RESOURCE RECOVERY (cont.)		COMPREHENSIVE RESOURCE RECOVERY AND SOLID WASTE MANAGEMENT PLAN	
		A thorough treatment of the solid waste management problem of the State with recommendations to facilitate resource recovery projects.	Impacts power generation by utilities; industrial process heat; residential/commercial water and space heat, displacing oil.
SMALL HYDRO	PUBLIC UTILITY REGULATORY POLICIES ACT OF 1978 (PURPA)—TITLE IV		
	Authorizes $10 million per year for 3 years in the form of low interest loans to defray up to 90% of the cost of feasibility studies and licensing efforts for hydro projects (≤15MW) at existing dams.		Increases the contribution of hydro to electric generation mix, displacing oil.
	Authorizes $100 million per year for 3 years in the form of low interest loans to defray up to 75% of the cost of constructing hydro projects (≤ 15MW) at existing dams.		Municipalities, electric co-ops, industrial development agencies, nonprofit organizations, and "other persons" (defined in §3 of Federal Power Act) are eligible for loans. The question of whether electric utilities could be considered "other persons" under the act, and hence qualify for the loans is not specified.
	PURPA §212		
	Authorizes FERC to exempt conduit hydro facilities ≤ 15MW from hydro licensing requirements of the Federal Power Act.		Increases the contribution of hydro to electric generation mix, displacing oil.
	FERC has adopted a short form license for hydro sites ≤ 1.5MW.		Increases the contribution of hydro to electric generation mix, displacing oil.
	DOE has selected 4 undeveloped hydro sites in NYS to undergo feasibility analysis and one project has received a partial construction grant.		Increases the contribution of hydro to electric generation mix, displacing oil.
		NYSERDA has inventoried the State's small hydropower potential.	The data indicates there are 3000MW of undeveloped hydro power in NYS.
		NYSERDA is sponsoring 3 rounds of demonstration projects to redevelop nonoperating hydro facilities.	Increases the contribution of small hydro to the electric generation mix, displacing oil.
			Nine sites, each with a potential of ≤1.5MW have been selected for the first round. They are expected to be operational in 1980.
			Eleven sites, of which there are ≤ 1.5MW, have been selected for the second round.
		PASNY has been granted legislative authority to pursue development of low head hydro in NYS.	Increases the contribution of hydro to electric generation mix, displacing oil.
			PASNY is developing projects at Ashokan and Kensico Reservoirs, with a combined capacity of 7.5MW.
			PASNY is considering a feasibility study at one site at the Hinckley Reservoir near Utica.

RESOURCE	FEDERAL	STATE	IMPACTS/COMMENTS
COGENERATION SMALL HYDRO; RESOURCE RECOVERY; WIND; PHOTOVOLTAICS	POWER PLANT AND INDUSTRIAL FUEL USE ACT OF 1978-§212 Provides an exemption for facilities employing cogeneration technologies from federal coal conversion mandate.		Impacts utility/industry steam and electricity generation, displacing oil and coal.
	PURPA—TITLE II Authorizes FERC to order a physical interconnection between electric utilities and "qualifying" cogeneration and small power production facilities.		Impact all end users of electricity, displacing oil.
	Requires FERC to develop rules (by November 1979) for rates of purchase of standby power by cogenerators and small power producers from electric utilities and for sales of excess power to utilities. The final rules were issued in February 1980.		Leaves the ultimate determination of a "qualifying" facility to FERC within general guidelines: (a) Cogenerators—produces electricity and steam or useful energy that is used for industrial/commercial heating or cooling purposes; owned by a person not primarily engaged in generation or sale of electricity; falls under FERC rules regarding minimum size, fuel use, and efficiency. (b) Small Power Producers—produces electricity exclusively from biomass waste, water, and renewable resources, power production capacity not to exceed 80MW (except for exemption from Federal Power Act - 30MW); owned by a person not primarily engaged in generation or sale of electricity.
	Requires FERC to prescribe rules (by November 1979) for the total or partial exemption of cogenerators and small power producers from the Federal Power Act; Public Utility Holding Company Act; state laws and regulations relating to areas other than safety.		
SOLAR; WIND; WOOD; RESOURCE RECOVERY; GEOTHERMAL	ENERGY TAX ACT OF 1978— Business Investment Tax Credit Provides an additional 10% investment tax credit to businesses for investments in solar/wind/wood/geothermal equipment. Also applies to equipment for the recycling of waste materials.		Impacts industrial/commercial space heat/water heat/process heat, displacing oil and natural gas.

and electric supplies are described in Sections IV and V-F, respectively.

An estimate of the conventional fuels displaced by development of direct renewable resources, solar and wood, is presented in Figure V-C-8. This estimate has been incorporated in the base forecast of New York State End Use Energy Requirements in Section IV.

3. *ISSUES AND DIRECTIONS*

Federal and State initiatives such as those described in the previous section are expected to further the development of renewable resources, but much remains to be done. The existing barriers to new energy systems are complex but they are changeable. Specific issues must be addressed and evaluated for each renewable resource.

A. Solar

The scarcity of solar installations can be attributed to several factors. The penetration of solar into the water and space heating market depends heavily on the relative economics of solar energy compared to conventional fuels. One of the major market barriers to solar systems is high front end costs. The installed first cost of such systems is several times higher than that of conventional energy systems. In addition, a conventional energy system must be retained as a backup. Thus, the solar system cost is not a

FIGURE V-C-7

ENERGY CONTRIBUTION OF RENEWABLE RESOURCES
BASE CASE

	1979	1984	1989	1994
SOLAR (TBTU)				
: RES/Space Heat (Active)	.010	.018	.031	.05
: RES/Space Heat (Active and Passive)	.020	.040	.100	.27
WOOD (TBTU)				
: RES/Space Heat	22.0	32.7	35.3	37.9
: INDUST./Process Heat	6.5	6.8	7.1	7.3
BIOGAS (BCF)				
: Pipeline (Landfill)	0	2.0	4.5	4.5
: Sewage Treatment	.60	.7	.7	.7
RESOURCE RECOVERY				
Electricity (MW)	32	208	298	298
Steam (TBTU)	---	17.3	23.4	24.0
SMALL HYDRO (MW)	800	1002	1202	1525
COGENERATION				
Electricity (MW)	523.5	565.27	654.2	745.1
Steam (TBTU)	35.4	38.2	45.0	50.4

FIGURE V-C-8

CONVENTIONAL FUELS DISPLACED BY DIRECT RENEWABLE RESOURCES IN 1994 (TBTU)

	Oil	Natural Gas	Coal	Electricity
Solar	.21	.06	--	.055
Wood	37.0	5.2	.36	2.6
Total	37.2	5.3	.36	2.7

replacement for a conventional system cost, but an addition to that cost. The solar system must therefore show itself economical through life-cycle costing. This procedure establishes a consistent basis for comparing a solar system dominated by capital (equipment) costs and a conventional system dominated by operating (fuel) costs. Unfortunately, life cycle cost considerations are not the primary concern of most decision makers.

A proper cost comparison is difficult if not impossible. Rolled-in pricing of output from new conventional energy facilities discriminates heavily against solar technologies that are not similarly treated. Average pricing and price regulation of conventional fuels have in effect insulated the consumer from the true cost of conventional fuels and placed solar systems at an economic disadvantage. Solar would be able to compete more successfully with conventional fuels if subsidies in the forms of increased tax credits and low interest loans were made available.

No clear picture of the impact of solar use on utility loads and customer rates has been drawn. Load characteristics of electric utilities, together with certain weather conditions (periods of low insolation), require generation and transmission capacities to be in place to meet backup requirements for solar systems. Solar systems with electric backup may have a detrimental effect on utility system load factors and result in additional peaking capacity requirements. Special rate structures may be needed to recover the utility cost, thus adversely affecting the overall economics of the solar system. Fair rates for this backup energy must be established to encourage the development of solar technology in the State, while at the same time maintaining the system load factor and protecting the financial integrity of the utility company involved.

Widespread use of solar will continue to be impeded until user (homeowners, builders, architects) awareness and confidence in solar products is established. The availability of capital is also an important element in the development of the solar industry. Financing is required by the customer to purchase equipment and venture capital is required to establish the solar industry. The financial community has been reluctant to,make solar loans and investments because of their lack of detailed solar system knowledge. While this situation is improving with time and experience, a sound public education effort will speed its progress.

To this end, New York State has launched an education program aimed at informing consumers, builders, and the financial community of the benefits of solar technology. This effort has been dampened, however, by the lack of national standards for the performance (thermal, durability, reliability, and safety) and installation of solar systems. The establishment of such standards will help solar applications attain a level of public credibility, thereby facilitating issuance of loans, insurance coverage, and a general bolstering of private development efforts.

Research and development of improved solar systems is being supported by DOE and the solar industry. Product

improvement activities include the design of long term (several weeks or months) thermal storage systems capable of taking advantage of summer radiation; development of highly integrated retrofit systems; continued improvements in collectors, controls, and heat exchanger configurations.

Few negative environmental effects are foreseen from solar technology. Manufacture of solar components may increase existing emissions at industry locations as production levels rise, but current environmental control technologies will apply. Any increased emissions will be offset by the reduction of emissions later, as working solar systems lessen demand for conventional fuels.

Some potential on-site health and safety issues do exist, however. They are fire safety, toxicity of materials, structural safety, and aesthetics. Judicious application of existing design and analysis techniques and establishment of national performance standards will ease these concerns.

As solar applications become more numerous, action will be necessary to ensure solar access. Remedies to solar access disputes lie in appropriate land use and zoning provisions which protect solar access to consumers without lengthy and expensive legal proceedings. New York State has addressed this issue by requiring local governments to consider solar access as a valid public purpose in zoning regulations in a manner similiar to the way health and safety considerations are currently treated. Localities must now define the mechanisms to be used in their communities by individuals to obtain and secure access to sunlight.

B. Wood

High capital costs for equipment are associated with the use of wood as a fuel in the residential and industrial sectors. These costs have hindered the conversion to wood, despite the large price differentials between conventional fuels and wood fuel. Subsidies in the form of tax credits and low interest financing would help reverse this situation.

The growth of the woodchip fuel market is presently hampered by the reluctance of either producers or industrial consumers to enter into a small market. At present the only active market for woodchips is the supply of pulp chips to the paper industry. Because of the lack of a readily available supply of fuelwood chips, many potential customers are hesitant to make the financial investment required for wood conversion. At the same time, potential suppliers are hesitant to invest in whole tree chipping equipment or cannot obtain financing because there is limited demand. To overcome this problem, government supported industrial/institutional wood conversion demonstration projects are needed. Once a number of successful wood conversions are completed, others are more likely to convert voluntarily to wood fuel, hence, expanding the market for wood chips.

The informal harvesting of cordwood for residential use is often inhibited by landowner fears of liability loss. To date, no simple method has been developed to shield from liability a landowner who permits cordwood to be taken from his land.

The use of wood for fuel causes two main environmental impacts—those linked to the growth and harvesting of the resource and those arising from its use. The growth and harvesting of timber raise problems of zoning and land use planning, aesthetics, and conflict with recreational land uses. Removal of noncommercial wood will also remove substantial amounts of organic matter and nutrients from the forest ecosystem. Although wood has negligible sulfur content, particulates are released when it is burned. This poses an immediate air pollution problem as well as a subsequent disposal problem; large anounts of ash must be disposed of properly so as not to pose a threat to soil and water environments. It must be noted that wood ash is useful as a soil conditioner or fertilizer component and could be disposed of on agricultural land.

Finally, the use of wood stoves for residential space heating may increase the likelihood of home fires or serious injuries from burns.

C. Resource Recovery

New York State has taken several steps to promote resource recovery activities. The State Environmental Quality Bond Act of 1972 allocated $175 million to finance up to 50 percent of the cost of a resource recovery project. $171.5 million has been reserved by legislative appropriation to 19 municipalities submitting applications. However, the State has entered into contract for only about $75 million of the amount allocated by legislative appropriation. DEC is presently reviewing project allocations to determine what projects have proceeded to a point where the State will enter into contract with the facility to commit State funding for these projects. DEC anticipates that present legislative appropriations may be changed due to the feasibility of proceeding further based on the individual merits of each site.

The Department of Environmental Conservation has also prepared a Comprehensive Resource Recovery and Solid Waste Management Plan outlining the functions and responsibilities of the DEC in this area. Under the Plan, the DEC must administer funding from the Environmental Quality Bond Act of 1972. It must provide technological assistance to local governments on technology selection and review and approve plans for new and modified resource recovery facilities. It must also promote and develop new and expanded markets for recovered resources and develop and maintain a resource recovery market data bank of current market information. It must consult with private industry to find effective ways to encourage and optimize private financial investments in resource recovery in New York State.

The potential of resource recovery is currently inhibited by various barriers. Some, like the fact that resource recovery projects do not now possess a proven track record, are largely a result of the infancy of the technology and will be resolved as greater technical experience is gained. Others, like economic problems, can be changed by direct governmental and private action.

The economics of resource recovery projects are rather uncertain. Municipal and industrial officials are now reluctant to make long-term commitments to materials. Also, markets must be established before the technology is selected, because the market tends to dictate the technology to be used, since the recovery facility must be able to recover the products that meet the needs of the purchaser. Another consideration is the necessity to involve the private sector as much as possible by using revenue bonds and private equity (corporate credit) as a tool to secure the necessary financing. Most municipalities are not able to raise the financing required through a general obligation bond because they are either at, or approaching, their constitutional bond limits. The proposals portion of this section discusses specific recommendations for overcoming this barrier.

Environmentally, resource recovery units have negative and positive benefits. The reduction of municipal solid waste due to separation of recyclable materials and combustion of the remaining refuse is a benefit. The recycling of materials conserves our finite supplies of natural resources, as well as the energy used in mining and processing new metals and glass. The fuel is essentially renewable in large part so that precious fossil fuels need not be consumed. The

air quality emissions from refuse combustion differ from other fuels. Hydrogen chloride and other organic chemicals are produced in significant amounts due to the plastic content of fuels. Heavy metals are volatilized and are absorbed onto emission particulates. Since requirements for particulate control technology is less stringent for resource recovery units than for large fossil-fueled generation stations, both particulates and heavy metal emissions are proportionately higher for refuse than for these other fuels. The Federal EPA has proposed new source performance standards for emissions of particulates and smoke from incinerators. However, no emission standards have been established for chlorine or heavy metals (other than lead). SOx emissions tend to be low, reflecting the low sulfur content of refuse. NOx emissions are lower than emissions in a comparably-sized gas turbine generator. Demonstrated commercial equipment could control such emissions if standards are promulgated in the future. These impacts and other phenomena that are specifically associated with resource recovery plants are further discussed in Appendix F. The environmental benefits in waste reduction, non-renewable energy conservation, reclamation of recyclable materials, land use, and reduced SOx and NOx emissions far outweight the adverse effects of particulate and other emissions.

D. Small Hydro

Small hydro power development in New York State faces several barriers. They are: competing uses of water resources; environmental problems; licensing delays; difficulties of interfacing non-utility hydro projects with utility grids; and economic factors. These problems must be resolved to increase the contribution of small hydro to the State's energy supply. Recommendations with respect to the key economic and institutional barriers are discussed in the Proposals.

Since water is one of our most basic resources, there is frequently competition for any given water body. Municipal water needs, disposal of sewage and other waste, industrial uses (including powerplant cooling), navigation, recreation, agricultural uses, fisheries, aesthetics, flood control, and power production often all compete for the same water resources. Some of these uses, such as wilderness recreation and power production, can often coexist, but not without some compromises.

An example of such a conflict is the location of waste disposal sites (either a municipal sewage or industrial site) and a hydroelectric facility at an existing dam on the same stream. Each of these facilities reduces the dissolved oxygen content of the stream with adverse effects on fish and other aquatic life. The Department of Environmental Conservation in its issuance of a State Pollution Discharge Elimination System Permit (SPDES) and Section 401 certification under the Federal Water Pollution Control Act of 1972, as amended, allocates the amount of waste assimilative capacity (dissolved oxygen) of the stream which may be consumed by each polluter during low flow conditions to assure protection of a balanced population of fish and wildlife. Because hydroelectric facilities are not subject to SPDES permits, they are not allowed to deplete dissolved oxygen levels at low flows, and may be required to cease operation at low flow. Also hydroelectric facilities readily produce steady cash-flows and there has been a tendency to assign more of the cost of protecting the stream conditions to the hydro site (relative to other users) than is its "fair share". Many prospective hydro developers have argued further that these DEC requirements effectively mandate that a hydro site pay to clean up a stream polluted by others. It often appears to potential hydro site developers that the DEC tends to exact stiffer requirements from hydro sites than from other users of water resources.

During construction of dams, power houses, and other major civil works, the environment is changed—by impoundment or diversion of water and by the operation of generating facilities. The impoundment of water changes surrounding landscapes. Such changes may or may not be considered negative, but they could be significant. As recognized by the Federal Energy Regulatory Commission (FERC) in their new licensing procedures, stricter scrutiny will be necessary for projects involving new dams than for similar sized projects at existing dams.

Recognition of the importance of freshwater wetlands in the Environmental Conservation Law provides that new dam construction is unlikely to occur where wetlands would be destroyed. Agricultural lands, through the New York State Agricultural and Markets Law, are also afforded protection from flooding by dam construction. As the State's demands upon water resources have increased, conflicts over new dam construction have been acute. Therefore, it is likely that most of the new hydro development in New York will occur at existing dams.

The existence of a dam also continues to have environmental consequences. Andramous fish, such as salmon, are prevented from migrating unless a dam has a fish ladder or fish elevator and that increases the cost of such a facility. Also, the water quality, particularly the dissolved oxygen content, is affected by dams and by operation of power facilities at these dam's. The turbulence of flowing water, particularly over rapids, aerates the water, replacing the dissolved oxygen removed by fish respiration and by microorganisms that decompose dead organic matter. Dams reduce water turbulence upstream and aeration is severely limited. However, much, if not all, of the dissolved oxygen lost from the waters just upstream of the dam could be returned to the water if allowed to flow over the dam spillway rather than generating power. Maintenance of aeration is one of the problems with respect to water quality when installing or reinstalling generating equipment at existing dams. The need to protect water quality may dictate that a portion of the river flow be passed over the dam rather than through the turbines, thereby reducing energy generation and increasing costs.

Streams are also affected by the different modes of hydropower operation. The use of small hydro facilities for peaking power can cause problems of reservoir level. (In the extreme, peaking units might not release water downstream for up to 16 hours a day, including weekends, causing large changes in reservoir levels.) DEC has limited powers, under Article 15 Title 8 of the New York State Environmental Conservation Law, to require minimum release from reservoirs larger than one billion gallons of water located in eight downstate counties. In general, the required releases can pass through turbines and generate power. The compromise between these competing needs require little loss of energy generation, only a shift in the timing of generation, which may have economic consequences to the powerplant owner. This issue may play a role in establishing the potential for additional generation facilities on the New York City Water Supply System. In addition, the cost to use the water may be an important economic condition.

Federal and State government regulations have been frequently cited as one of the biggest constraints to hydro development. The time for licensing, and the numerous permits and other procedural requirements complicate the construction or rehabilitation of a hydro site. Delays in obtaining permits result while one agency waits for action by another. One of the most troublesome delays of this type

involves the Section 401 certification. The New York State Uniform Procedures Act prevents DEC from issuing a Section 401 water quality certification for a project until it has received a draft environmental impact statement or a negative declaration from FERC, the lead federal agency. However, the FERC as a matter of policy does not determine whether or not an EIS is required until after all state permits have been issued.

Presently the Council on Environmental Quality is promulgating regulations that are designed to help reduce the burden of government approvals on hydroelectric projects by reducing the accumulation of extraneous data, by limiting the length of EIS, and for joint preparation of EIS for state and local governments with similar environmental review requirements.

The maximum benefit to New York State from small hydro development can be realized by integrating hydro facilities with the existing statewide electric system. Connection with the systems allows for maximum use of their energy potential.

Hook-ups of non-utility hydroelectric sites with the utility system, poses some major problems. These problems include loss of generation capacity in late summer due to low stream flow, equitable pricing of electricity sold from small hydroelectric projects to the utility systems, tariff arrangements, the pricing of standby power and wheeling charges to nonutility hydro developers. PURPA addressed the last three issues and authorized the FERC to promulgate rules and regulations to facilitate the interconnection of small hydroelectric facilities to the grid and for utilities to wheel such power produced if so required.

Private industries, however, may find it economically feasible to develop some small sites which utilities could not justify. Since an electricity consumer will displace retail electricity, he may be able to justify a higher generation cost for self generation of power than the cost of a hydro site to other wholesale alternatives. The overhead costs for large utility corporations to supervise numerous small generating facilities may be considerable, yet it may be economical for a corporation situated at an abandoned mill site to operate generating facilities for in-house electrical needs with minimal additional overhead expenses.

Most of the economic factors curbing hydro development affect both utility and non-utility sites. Both have high initial costs for feasibility studies, environmental assessments, securing permits, licenses, and other approvals. However, selection of a consulting firm experienced in small hydro redevelopment may help minimize the cost of feasibility studies.

The costs of feasibility studies and environmental analysis at smaller sites tend to be disproportionately high compared with larger sites. The marginal economics of small sites therefore may tend to encourage their development by companies that can use their electricity on site. Transmission is another cost factor sometimes cited as a barrier to hydro development. In most cases, the existing transmission lines are adequate to carry excess power from these facilities into the grid, keeping transmission costs minimal. However, some hydro sites may be located away from the existing grid which increases transmission requirements and costs.

Another deterrent to small hydro development has been the insurance premiums for dam safety. These premiums have increased following the recent dam failures in Idaho and Georgia. The fact that dams have been in place for decades, have been certified as structurally sound by FERC before issuance of a license, and continue to be monitored and repaired as part of FERC's dam safety program have been overlooked by insurance companies in some instances.

State and local taxes can also be a significant burden to small hydro development. Low tax assessments on nonpower dams are typically increased substantially when generating equipment is installed. (The magnitude of the increase may not be proportional to the increased value of the site, but is based on the assumption that the added tax burden will not be significant to the project's consumers.)

Requiring a developer to pay for environmental mitigation measures, such as fish ladders, may become excessive and are a further barrier to development of sites, which no government agency has addressed.

It is not clear how willing the financial community is to support small hydro development. Those projects of at least moderate (2-3MW) size which sell their entire outputs to a utility under long term contracts appear to have ready access to long term loans. Those projects, particularly of less than 1 MW output, which are primarily self-generating units which will sell a portion of their outputs to a utility, appear to be less favorably viewed. Particularly with the uncertainty over how the states will interpret the new PURPA rules to set rates for pricing power sold between a self-generator and a utility, the economics of such projects are often marginal. Marginal projects can obtain financing from the DOE through the hydro loan program authorized in Title IV of PURPA. However, of the $100 million authorized for FY 1979 for construction assistance, only $18 million has actually been appropriated.

Another problem in financing economically viable nonutility small hydro projects is that most corporations require both shorter payback periods and higher rates of return on investments not directly related to their primary business product. Even if the corporation is willing to finance a hydro site for self-generation under the same terms it finances its other business investments, it will still normally require paybacks of 5-7 years compared to the typical utility practice of amortizing hydro facilities over 20 to 30 years to generate electricity at competitive prices.

Changing business, institutional, government, and environmental attitudes will be necessary to further promote and develop the State's hydro potential during the next 15 years.

E. Cogeneration

The New York State Energy Office has been investigating the barriers to increased use of cogeneration technologies throughout New York State. This investigation has involved the cooperation of other State agencies and interested parties. It has also used specific analyses conducted for SEO by professional consultants and staff. The major findings follow.

- The economics of cogeneration are highly sensitive to the prevailing cost of utility service. The primary incentive for a nonutility facility owner to enter into a cogeneration mode is the cost compared with the cost of purchased power. The costs of cogeneration remain relatively constant regardless of where the installation occurs. But the cost of purchased power varies widely. Therefore, the return on investment is much higher in the higher cost downstate electric service areas.
- High capital costs discourage possible investment in cogeneration equipment and often delay the return on investment beyond an acceptable limit. This is especially true in the industrial sector where a company is often reluctant to invest large amounts of capital for process equipment which would not directly improve the market for the company's primary product. As a consequence,

the company often establishes return on investment criteria higher than that applied to direct product investment.

- Current standby electric rate schedules for potential cogenerators are a primary roadblock to increased use of cogeneration in the State. If a cogenerator wishes to have back-up service from a utility, a demand charge of 100 percent of peak demand in the present or previous eleven months is required by five of the seven regulated utilities in New York State. The peak demand is the highest rate at which electricity is consumed in any 15 or 30 minute period. Thus a cogenerator who consumed his largest supply of utility standby electricity during a 15 minute period in January will be paying a rate based on that demand in November.
- Lack of a consistent policy among the New York State electric utilities on the proper price to be paid to the potential owner of a cogeneration facility for his excess power further blocks the development of cogeneration. Since the process heat and electricity needs of a cogeneration facility do not always coincide, situations often occur where the cogenerator has an excess energy product which cannot be used internally. These situations offer the cogenerator the opportunity to maximize his investment by selling the excess product. The most probable product is normally electricity and the most likely customer is usually the servicing utility. However, the experience of New York State utilities with such transactions has been limited largely to a few existing cases developed under conditions of mutual agreement involving a specific facility at a particular time. Consequently, some potential cogenerators are reluctant to further investigate cogeneration because of a lack of guidance from the utility with respect to such electric sales.
- The lack of recent involvement by regulated electric utilities throughout New York State in cogeneration projects has also constrained cogeneration development. Regulated private utilities in other states, like California and Texas, have become involved in the financing, ownership and operation of cogeneration facilities in partnership with other industries. New York State utilities possess the resources and skills necessary to enter into such viable cogeneration ventures. The utilities could integrate the electricity produced from cogeneration facilities among their total operating capacity thereby reducing reliability problems and improving the efficiency of the New York power system. Certain utilities, like Consolidated Edison, are already thoroughly familiar with cogeneration technology.
- A perceptual fear of increased environmental regulation as a result of cogeneration also limits such activity. The validity of these fears may be highly dependent on the technology employed, the fuel burned and the size and the location of the cogeneration facility. The Federal Clean Air Act, most recently amended in 1977, establishes National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO_2), total suspended particulates (TSP), carbon monoxide (CO), photochemical oxidents (O_3) and nitrogen dioxide (NO_2).. Facilities affected by these regulations are those which experience cumulative net increases in permissible emission rates of 50 tons per year, 1000 pounds per day or 100 pounds per hour of a specific air contamnant (50/1000/100) with each contaminant treated separately. One of the air quality conditions facing a potential cogenerator concern whether the facility's location impacts upon an attainment or non-attainment area. This is determined by an area's compliance with NAAQS. The achievement of the 50/1000/100 level for cogeneration facilities is highly dependent on the fuel burned, the size and the particular cogeneration technology used. Coal and residual oils reach these levels (assuming no emission controls) at relatively small capacities while the lower emissions of natural gas and distillate oils allow for the construction of larger facilities not affected by these regulations. Similarly, the higher NO_x emissions of a diesel cogeneration system may prove to be a barrier to this technology as compared to others.
- Perceptions by potential cogeneration facility owners that involvement in certain types of cogeneration ventures will necessitate the regulation of their business by the New York State Public Service Commission limits increased cogeneration use. The case by case basis used by the Commission in determining jurisdiction over aspects of the operation of a cogeneration facility owned by an otherwise unregulated business and the broad scope of the Commission's statutory authority has discouraged some potential cogenerators from exploring the possibility of investing in cogeneration. The new PURPA regulations may lessen this problem.
- New technology may make cogeneration more efficient and affordable. Fuel cells, which produce electricity and thermal energy from chemical rather than combustion processes, may become commercially attractive by the end of the century. The development of the Binary Rankin Cycle, a bottoming cycle with a potential for even greater efficiencies, would also open a wider market for cogeneration.
- Labor requirements for steam boiler facilities larger than 15 pounds per square inch guage (psig) bar certain New York State industries from getting involved. An upgrading of plant operating staff becomes necessary and operating costs can become an economic burden for small systems.

4. PROPOSALS

Figure V-C-9 summarizes the expected energy contribution of renewable resources based on implementation of the programs, laws, and regulations adopted by the New York State Energy Planning Board to alleviate the barriers discussed in the previous subsection. A detailed accounting of the methodology and assumptions made to obtain this energy contribution is found in Appendix D-I. Figure V-C-10 shows the conventional fuels displaced by solar and wood in the proposed case.

A. Generic Proposals

- Amend Section 210 of the New York State Tax Law to provide an additional four percent business tax credit for renewable resource investments.

Section 210 of the New York State Tax Law currently provides a business investment tax credit of four percent. A doubling of the existing credit for business investments in eligible renewable resource technologies to a maximum of eight percent is recommended. Eligible renewable resource technologies would include equipment used in active and passive solar systems, small hydroelectric projects, cogeneration systems, wood boilers, resource recovery systems, wind turbines and other types of equipment as specified by regulation of the Commissioner of the New York State Energy Office.

Enactment of the proposal would aid the elimination of financial barriers inhibiting business investment in renewable resources, directly and indirectly create additional jobs within New York State, reduce the flow of energy capital

FIGURE V-C-9

ENERGY CONTRIBUTION OF RENEWABLE RESOURCES PROPOSED CASE—IMPACT OVER THE BASE CASE

	1979	1984	1989	1994
SOLAR (TBTU)				
:RES/Water Heat (Active)	–	.04	.12	.20
:RES/Space Heat (Active & Passive)	–	.57	2.83	5.35
WOOD (TBTU)				
:RES/Space Heat	–	10.2	20.5	30.8
:INDUST./Process Heat	–	1.78	4.28	7.53
RESOURCE RECOVERY				
Electricity (MW)	–	–	65	292
Steam (TBTU)	–	–	4.6	15.8
SMALL HYDRO (MW)	–	73	198	325
COGENERATION				
Electricity (MW)	–	68.3	139.3	336.4
Steam (TBTU)	–	4.6	8.6	23.4

from New York State, displace the use of oil within New York business establishments, and aid Statewide business development.

- Amend the New York State Public Seivice Law to exempt certain non-utility owned alternate energy production facilities from Public Service Commission jurisdiction.

The Public Service Law should be amended to exempt certain energy production facilities, including those using conventional energy sources more efficiently and those using renewable energy resources, as well as their owners, from the regulatory jurisdiction of the Public Service Commission. These exemptions should ease the concerns of some potential alternate energy producers, who are reluctant to enter into production activities because of the possibility of PSC regulation. Although the primary business activities of potential alternate energy producers are unrelated to the furnishing of energy supplies, the breadth of PSC authority combined with the case by case nature of the exercise of jurisdiction create uncertainty which may well inhibit investments in alternate energy production facilities. And, most important, regulation is likely to be unnecessary because these producers will not have substantial monopoly power.

- Amend the New York State Home Insulation and Energy Conservation Act of 1977 to include as a minimum those measures necessary to bring the program into conformance with the Federal Residential Conservation Service Program.

The Home Insulation and Energy Conservation Act of 1977 currently requires regulated gas and electric utilities within New York State to conduct energy audits and provide low interest financing for specified energy conservation measures which includes wood furnaces, upon the request of residential customers. The Act should be amended to include active and passive solar systems and wind energy systems, as defined by the regulations implementing the federal Residential Conservation Service Program, as measures to be financed by the utilities and require that residential audits conducted by the utilities provide the cost, payback period, and energy savings of such equipment.

The National Energy Conservation Policy Act of 1978 establishes a Residential Utility Conservation Service Program requiring utilities to offer energy audits to residential customers identifying appropriate energy conservation and solar energy measures and estimating their likely costs and savings. Utilities are also required to arrange financing of any such measures. The regulations issued by the Department of Energy to establish this program indicate that the solar measures will include active solar hot water and space heat, passive space heat, and wind systems.

The proposed changes to the Home Insulation and Energy Conservation Act are in accordance with bringing the New York program into alignment with the Federal program as described by the regulations.

The proposed measure provides a mechanism for financing certain active and passive solar and wind systems thereby reducing the burden of heavy front end costs. This will result in an increased penetration of these systems into the residential space and water heating market.

- Amend the New York State Tax Law to exempt active and passive solar, wood, and wind energy systems from state and local sales taxation.

All solar, wood, and wind energy equipment sold within New York State is currently subject to imposition of a 4 percent State sales tax. Under the New York State Tax Law, localities in the State can include an additional sales tax of up to 4 percent on such systems. Therefore, up to 8 percent of the cost of solar, wind, and wood systems can concurrently be subject to the sales tax.

FIGURE V-C-10

CONVENTIONAL FUELS DISPLACED BY DIRECT RENEWABLE RESOURCES IN 1994—IMPACT OVER THE BASE CASE (TBTU)

	OIL	NATURAL GAS	COAL	ELECTRICITY.
SOLAR	4.80	.46	–	.30
WOOD	31.28	4.57	.38	2.1
TOTAL	36.08	5.03	.38	2.40

The New York State Tax Law should be amended to exempt active and passive solar, wood, and wind energy systems from State and local sales taxation. Elimination of the State sales tax will help reduce the high front end costs of these systems, and promote the increased use of solar, wind and wood technologies.

- Amend the New York State Public Authorities Law to allow the Power Authority of the State of New York to finance municipal investments in resource recovery and small hydroelectric projects.

Energy development in New York State must include resource recovery and hydro facilities to be owned and constructed by municipalities. There is a need for a centralized finance agency to channel funds into these projects. Some municipalities will be unable to arrange financing for these investments. For others, it would be more economical to issue large amounts of bonds on a centralized basis rather than have each developer arrange its own financing.

PASNY should be used as the centralized finance agency. PASNY could issue large amounts of bonds ($50-$100 million) to finance municipal energy projects. The projects could be presented to PASNY and if found to be feasible, be financed through the centralized fund. Municipalities desiring to construct waste-to-energy plants or small hydro projects would benefit from this proposal.

Changes to Article 5, Title 1 of New York's Public Authorities Law (Power Authority Act) would be required to give PASNY authority to finance municipal energy investments.

B. Solar Proposals

- Amend Section 606 of the New York State Tax Law to provide a refundable personal income tax credit for the purchase and installation of active and passive-solar energy systems for use in residences.

New York State should provide a personal income tax credit for the purchase and installation of residential active and passive solar energy systems in the amount of 25 percent of the first $2000 and 15 percent of the next $8000 expended. The State credit should be refundable so as not to unduly bias the credit toward higher income groups.

Title I, Section 44C of the National Energy Tax Act of 1978 provides a Federal income tax credit for solar systems in the amount of 30 percent of the first $2000 expended and 20 percent of the next $8000 expended. In addition, a number of states have passed income tax credits for solar. California has in effect a tax credit for 55 percent of the cost of purchase and installation of active and passive solar in residences.

This proposal is consistent with New York State's policy of assisting the development of solar technologies and improving their marketability. The proposed State tax credit would increase the overall effectiveness of the federal tax credit and make solar investments more attractive within New York State. A study conducted by the Polytechnic Institute of New York showed that the rate of return on investment in a $2400 solar hot water system installed downstate increased from 19.6 percent without a State tax credit to 46.1 percent with the credit. Passage of such a measure will make the economics of solar systems more favorable, thereby increasing their penetration into the residential space and water heating market.

- The New York State Public Service Commission should ensure that reasonable electric back-up rates are provided to customers using renewable resource technologies.

A major factor in determining the economic viability of a renewable resource technology is the cost of maintaining service during "down" times (i.e. periods of low insolation; low stream flow; lack of wind) for the system. Currently, there is little consistency between utilities regarding stand-by rates for such systems. These rates and regulations are so varied and intricate that the value of energy from renewable technologies will be different at practically every site. Generally, back-up rates have discouraged non-utility operators through the imposition of high demand charges. In some utility jurisdictions, this charge reflects 100 percent of peak demand during the present or previous eleven months, often unfairly exaggerating the cost of the service to the utility.

The Public Service Commission should encourage the creation of stand-by rates for all customers using renewable resource systems which reflect the marginal cost of back-up service while ensuring that the customers and the shareholders of the utility do not subsidize these energy systems. More realistic rates will encourage the use of renewable energy systems, accurately reflect the cost of service to the utility and make more efficient use of the State's available energy resources.

- Require the New York State Office of General Services to use solar technology in all new construction, where life cycle cost comparison with conventional energy systems and practices shows it to be economic and feasible.

New York State government should take the lead in stimulating the market for active and passive solar systems. It is recommended that the Office of General Services be required to use solar technology in all new construction, where life cycle cost comparison with conventional energy systems and practices shows it to be economic and feasible. Currently the Office of General Services uses life cycle cost analysis, in its energy efficiency procurement practices with respect to energy conservation in State buildings and operations. The use of life cycle costing for active and passive solar systems would be an extension of the procurement practices presently used by the State.

- Amend Title I, Section 44C(b) (2) of the Federal Energy Tax Act of 1978 to include all components of passive solar systems within the definition of solar energy property eligible for the Federal income tax credit.

Title I, Section 44C(b)(2) of the Federal Energy Tax Act of 1978 provides a Federal income tax credit for solar systems in the amount of 30 percent of the first $2000 expended and 20 percent of the next $8000 expended. While the Federal income tax credit for solar systems did not explicitly exclude passive systems, the subsequent draft regulations issued by the Internal Revenue Service severely limited their eligibility for the tax credit. According to the regulations, in the case of passive solar, the tax credit applies only to the materials and components whose sole purpose is to transmit or use solar radiation; components that serve a dual purpose, e.g., they have a significant structural function, are not included. As a result, the costs of roofs, windows (including clerestories and skylights), trombe walls, and greenhouses do not qualify as solar energy property eligible for the tax credit.

These structures are an integral part of a passive solar system and should be included in the definition of energy property eligible for the tax credit. Passive systems have the potential to provide the greatest energy contribution among the solar technologies in New York State over the next 15 years. The proposed measure will aid in the realization of that potential.

- Enact Federal legislation to require the National Bureau

of Standards to establish performance standards for active and passive solar equipment.

The Solar Heating and Cooling Demonstration Act of 1974 mandates development of interim performance standards for active and passive solar equipment used in all Housing and Urban Development and Department of Energy solar demonstration projects, and for active and passive solar systems financed under Federal Housing Administration or Veterans Administration mortgages. Eventually, these standards are to become permanent criteria for FHA and VA financed housing, but they will not be universally applied solar standards in other housing. Although much work toward the development of solar standards has been done by a number of government agencies and industry associations, no consensus has yet been reached on a standard for this program or for universal application. The incompleteness of national standards for the performance (thermal, durability/reliability and safety) and installation of active and passive solar energy systems is a barrier to the acceptance of such systems by both the end-user (homeowners, builders, architects) and the financial community.

National performance standards should be established for active and passive solar equipment installed in all buildings. The establishment of these standards by the Federal government will help solar systems attain a level of public credibility, thereby facilitating issuance of loans, insurance coverage, local code and zoning approval, and in general bolstering of private development efforts.

- Enact federal legislation creating a national Solar Bank funded at an initial annual level of $150 million to provide low interest loans for owners and builders of residences and commercial structures for installation of active and passive solar systems.

The Administration has proposed that federal legislation be enacted to create a national Solar Bank to provide low interest loans for owners and builders of residences and commercial structures for installation of active and passive solar systems. The Bank, which will be a government corporation within the Department of Housing and Urban Development, would pay upfront subsidies to banks and other lending institutions, which would in turn permit them to make home improvement and mortgage loans for solar investments at interest rates below the prevailing market rate. The Bank would be funded at $150 million in its first year, financed with monies from the Energy Security Trust Fund. The following ceilings would be set on the size of the loan or portion of the loan which would be subsidized: $10,000 for a single family residence; $5,000 for each unit in a multifamily residence, not to exceed $500,000 per loan; $200,000 for a commercial structure.

One of the major market barriers to investments in solar systems is the high capital costs for equipment. The proposed measure provides a mechanism for financing these systems, hence reducing the burden of heavy front end costs. This will result in an increased penetration of solar systems into the residential and commercial markets.

- Enact national legislation to provide a 20 percent tax credit for builders of new passive solar residences and commercial buildings.

The Federal Energy Tax Act of 1978 currently provides an income tax credit to homeowners who install residential active and passive solar systems in the amount of 30 percent of the first $2000 and 20 percent of the next $8000 expended. An additional 10 percent-investment tax credit is provided for businesses which install active and passive solar equipment. No special tax treatment has been given to builders of solar equipped buildings.

The Administration has proposed that a tax credit be provided to builders of new passive solar residences of one to four units. The tax credit will be in the amount of 20 percent of the cost of passive solar equipment for each unit, up to a maximum of $2000 per unit. A tax credit is also proposed for builders of new passive solar multifamily (greater than four units) and commercial buildings. The tax credit for these structures will be in the amount of $20 per million BTU estimated design savings per annum for a thermal performance at a specified level above the Building Energy Performance Standard baseline established pursuant to the Energy Conservation and Production Act of 1976. The maximum amount of this credit is $10,000 per building. The tax credits will be financed from revenues from the Energy Security Trust Fund.

This measure provides a significant new incentive for the use of cost effective designs and materials in new buildings to take maximum advantage of the direct heating power of the sun.

C. Biomass Proposals

- Fund a New York State Energy Research and Development Authority project for the production of alcohol for use in gasohol from the cellulosic content of agricultural and municipal solid wastes, as well as the starchy byproducts of food processing residues.

Present manufacturers of alcohol for fuel commonly produce the alcohol through fermentation of agricultural feedstocks, primarily corn. This poses a conflict between use of agricultural products for fuel as opposed to food, particularly in New York State which imports half of its food grain consumption from the Midwest. In addition, large amounts of non-renewable fuels are required for the production of the agricultural feedstocks.

Laboratory tests have demonstrated that it may be possible to convert cellulosic wastes into alcohol. Successful development of this technique would increase available alcohol feedstocks by allowing conversion of agricultural and municipal solid wastes, which have high concentrations of cellulose.

The State, through research and development funding from NYSERDA, should support this research. Manufacture of alcohol from current waste products would enable gasohol to become a viable alternative transportation fuel in New York State.

- Amend Title I, Section 44C(b)(1) of the Federal Energy Tax Act of 1978 to include wood stoves and furnaces as items eligible for the residential energy conservation federal income tax credit.

The Federal Energy Tax Act of 1978 currently provides an income tax credit for residential insulation and energy conservation equipment up to $300 or 15 percent of the first $2000 expended.

Wood systems show a great potential in New York State, much greater in the near term than solar systems, and yet have been excluded from any kind of special tax treatment. Residential wood burning equipment should be included as qualifying energy conservation equipment for the federal income tax credit.

The public interest, nationwide and especially in New York would be well served by such a tax credit which would increase wood use by lowering the capital costs of equipment, and decrease utilization of fossil fuels.

- Create a Federal industrial wood fuel research, development, and demonstration fund of $50 million.

The current Department of Energy RD&D budget calls for $58 million for biomass research, development, and demonstration. This money is directed towards design of an integrated biomass utilization system for the conversion of biomass into medium-BTU fuel gas. Little, if any, funding is available for research, development, and demonstration of wood as a direct combustion industrial fuel.

The lack of a sizeable industrial market for wood chips is a major barrier to the production of wood chips. Once a number of successful industrial wood conversions are completed, other industries are more likely to voluntarily convert to wood fuel, further expanding the market for wood chips. Therefore, it is recommended that DOE provide additional demonstration funding in the amount of at least $50 million, concentrating on industrial wood conversion retrofits.

- Enact Federal legislation to make the excise tax exemption for gasohol permanent.

A provision of the National Energy Act temporarily exempts gasahol from the 4 ¢/gallon Federal Excise Tax. This exemption should be made permanent in view of the long-term potential of gasohol as a supplemental transportation fuel. If land and capital investments for gasohol production are to be encouraged, a continuance of this special tax treatment must be assured.

D. Resource Recovery Proposal

- Enact State legislation to facilitate implementation of resource recovery projects.

State legislation should be enacted to remove existing impediments to resource recovery implementation and to provide new incentives for such projects. Passage of such legislation would provide municipalities with the flexibility needed to utilize the emerging technology of resource recovery in the manner most appropriate to each specific situation.

The proposed legislation should include provisions to:

1. Authorize municipalities to award contracts to resource recovery facilities through the evaluation of contractor proposals based on performance criteria, rather than solely on the comparison of bid prices submitted for a pre-selected technology;
2. Give sponsors of certain recovery facilities the option to obtain individual permits from separate state and local agencies, rather than through one approval through the siting procedures of the Public Service Law;
3. Provide for expanded state financial assistance for meeting the costs of resource recovery facilities incurred in early implementation stages, prior to construction;
4. Modify siting and tonnage restrictions placed on New York City by existing statutes;
5. Give New York City the authority to pass a local law governing the disposition of certain waste generated within its boundaries.

These and other similar provisions of legislation would give municipalities the ability to better implement resource recovery. The expanded procurement alternatives, the clear procedures for forming regional corporations, the ability to select the most expeditious approval procedure, and the availability of financial assistance should all facilitate more rapid implementation of resource recovery. These factors and the ability to form regional corporations should result in greater tonnage being processed. The availability of financial assistance and the encouragement of private financing through the regional corporations and the alternate procurement procedure should reduce the impact on local tax rates. By facilitating resource recovery in these ways, more energy can be recovered.

E. Small Hydro Proposals

- The Power Authority of the State of New York (PASNY) should expand its hydro program.

PASNY was given legislative authority in 1978 to pursue development of small hydro projects in New York State. PASNY is currently involved in developing two such projects on the New York City water supply system.

It is recommended that PASNY, because of its status as a corporate municipal instrumentality and political subdivision of the State of New York, become an extensive developer of small hydro projects in New York State. Due to its quasi-governmental status, PASNY does not pay federal income tax or local property taxes. Also, PASNY is able to issue tax free utility bonds to finance its plants. PASNY, through its own initiative, should become actively involved in the development of the potential of all existing dams owned by New York State.

- Amend Title III, Section 301(a) (3) of the Federal Energy Tax Act of 1978 to include small hydro equipment within the definition of items eligible for an additional ten percent investment tax credit.

Section 301(a)(3) of the Energy Tax Act of 1978, which presently gives an additional 10 percent investment tax credit for specific types of alternate energy property, should be expanded to include small hydro equipment, as defined in Title IV of the Public Utility Regulatory Policies Act of 1978 (PURPA) (facilities less than 15 megawatts). Enactment of this proposal would result in a 20 percent net federal tax credit for investment in small hydro equipment. This action would provide a further incentive for industries, local government, cooperatives, non-profit organizations and other persons to invest in small hydroelectric equipment by ensuring a more favorable rate of return on their investment than would otherwise be available.

- Enact Federal legislation to shorten tax lives on small hydro equipment to a seven year amortization period.

The current Federal tax law allows accelerated depreciation on hydropower equipment. However, hydroelectric equipment has a longer tax life than most electric generating property. For instance, under the Class Life Asset Depreciation Range System, hydroelectric facilities have a standard tax life of 50 years which can be shortened to 40 years to provide accelerated depreciation. These lives are long when compared to nuclear plants (20 years, 16 years accelerated) and steam production plants (28 years, 22.5 years accelerated) Furthermore, non-utility industries and other companies tend to require a shorter term payback on investments than do regulated electric utilities.

It is recommended that industries be allowed to accelerate the rate at which they amortize investments in small hydro facilities of less than 15 MW. As a result, the payback period will be made sufficiently attractive to private corporations and investors, and hence stimulate the development and construction of these facilities within the State. This measure is proper since other investments, which are in the national interest such as pollution control facilities, are amortized rapidly under Section 169 of the Internal Revenue Code. The proposed amortization period is seven years.

- Extend the applicability of Federal Energy Regulatory Commission (FERC) short license form to cover small hydro facilities up to 15MW at all existing unaltered dams or impoundments.

In September of 1978, FERC approved a short application form for development of small hydro sites (under 1.5MW). The purpose of the short form is to stimulate small hydro development through expedited licensing procedures which allows FERC to dispense with hearings on the need for environmental impact statement review for such sites. The FERC procedure should be expanded to include small hydro facilities under 15 MW at sites with existing impoundments and dams that will not be altered, except for the installation of generating turbines and minor repairs. This action will aid small hydro development within New York State and the nation by streamlining federal financial, environmental and safety reviews.

F. Cogeneration Proposals

- Request the Board of Trustees of the Power Authority of the State of New York to investigate the feasibility of PASNY ownership and operation of cogeneration projects.

High capital costs combined with the reluctance of many industries to invest in process equipment not directly related to the company's primary product has discouraged the development of potential cogeneration facilities. This barrier might be eliminated by the ownership and operation of cogeneration projects by PASNY.

A study should be conducted by PASNY to investigate its role in the construction and operation of cogeneration facilities. The study might also consider the implications of PASNY cooperation with municipalities, industries and other utilities in joint ventures. The Federal Bonneville Power Administration (BPA) has recently initiated a program to become actively involved in the financing and operation of cogeneration facilities. PASNY should investigate the BPA experience. If it proves feasible, this method of operation in New York State could demonstrate to other electric utilities the viability of cogeneration as a means of generating electricity.

- The New York State Department of Environmental Conservation (DEC) should develop a standardized Environmental Impact Statement (EIS) for cogeneration facilities under the State Environmental Quality Review Act (SEQRA).

Case-by-case review of cogeneration facilities by DEC under SEQRA would inhibit cogeneration development within New York State by imposing regulatory uncertainty and costly delays in the initiation of specific projects. DEC should avoid the consequences of site specific review by developing a standardized EIS applicable to all new cogeneration facilities within New York State.

This standardized application should take into consideration the inherent efficiencies of cogeneration by measuring emissions in relationship to energy produced rather than in comparison to total fuel burned, thus reflecting the fact that a cogeneration facility burns less fuel than would be required to produce heat and electricity outputs separately.

- Amend Title III Section 301(a)(3) of the Federal Energy Tax Act of 1978 to include cogeneration equipment within the definition of items eligible for an additional ten percent investment tax credit.

The tax portion of the 1978 National Energy Act provided an additional ten percent tax credit for business investments in certain energy conservation equipment. Although cogeneration technologies were included in the original version, the final act excludes such investments. Congress should enact corrective legislation to make investments in cogeneration equipment eligible for the ten percent investment tax credit. Such action will stimulate cogeneration within New York State by lowering the high initial capital costs associated with such equipment.

SECTION V-D

Natural Gas

1. INTRODUCTION

Currently, there is a surplus of natural gas. Furthermore, the prospects for increased natural gas supplies over the planning period are optimistic.

Claims of an abundance of natural gas, tend to be greeted with confusion and skepticism. Memories of the 1976-1977 gas crisis have not yet faded. Although this turnaround has occurred, a consensus does not exist about the size or duration of the present surplus.

More important than quantifying the extent of this surplus, however, is understanding the forces that created it. First, the shortfall of gas supply in the early 1970's pointed clearly to needed changes in Federal regulations that discouraged the sale of intrastate gas to the interstate market. This problem has been largely alleviated with enactment of the Natural Gas Policy Act of 1978 (NGPA). Second, significant conservation by existing customers has occurred. Third, there has been substantial customer attrition and fuel switching, because of restrictions on gas sales. Moreover, shaken confidence in supplies has dampened demand.

The NGPA will encourage future gas production and increased interstate gas flow, and conservation will continue if only because prices will continue to increase faster than the rate of inflation. Thus, the forces that have helped create the current surplus will be with us for some time.

Although the NGPA may stabilize conventional natural gas supplies that otherwise would have continued to rapidly deteriorate, growing demand will exceed supplies available from this source. Many supplemental sources of gas are on the horizon. Clearly, the U.S. will move toward diversification of gas supply sources during this planning period. Early recognition of this need through integrated energy planning and commitment to this goal will assure that the transition from reliance on diminishing conventional domestic gas resources to diversified gas supply will be smooth.

Aside from its availability, there are other factors that make natural gas a preferred fuel and that support policies to further stimulate demand:

- Gas is the cleanest major source of energy available today. Burning natural gas, on average, results in 1/500th and 1/1500th the SO_X emissions of fuel oil and coal respectively, and 1/2 to 1/100th the particulates, CO, hydrocarbons, and NO_X.
- Natural gas is the most efficient burning fuel in current use. It is also the most efficient way end-users can meet their energy needs. For example, the average efficiency of natural gas space heating burners is 68-70 percent compared to oil at 60-62 percent.
- The present capacity of the interstate and intrastate distribution networks is under-used in many cases. In 1970, the sendout in New York State totalled 802 billion cubic feet (BCF), some 33 percent higher than the 1977 sendout of 604 BCF. Gas use should, therefore, be capable of being increased without major capital expenditure for transmission and distribution facilities compared to increased electric and oil use.
- The natural gas delivery system also provides consumers with energy at a significant cost savings compared to other energy delivery systems. Use of this system can be increased, delivering more energy at an even lower unit cost. The system is underground, out of sight, nearly fully automated, and gas mains can be installed with a minimum of environmental impact.
- Future sources of natural gas are diverse and include the North American continent, conventional, unconventional, and renewable sources. While the outlook over the planning period for U.S. gas supplies shows increased dependence on foreign sources, the New York State Energy Office (SEO) predicts that by 1994, the U.S. will still satisfy approximately 82 percent of its total demand. Moreover, the vast majority of these imports will originate from Western Hemisphere sources.

New York State production of its indigenous natural gas resources will increase steadily over the planning period. While the contribution of this gas to the total gas demand in the State will remain at a relatively low level, a near doubling of production can be expected. New York State gas production is projected to grow from an equivalent of 2.6 percent of demand in 1980 to 4.2 percent of demand in 1994.

This Plan reflects a desire to promote and increase gas use beyond current trends in order to reduce New York's dependence on imported oil. Although they require development and stimulation through planning and policy initiatives, future supplies are available.

Natural gas use will increase from 604 trillion British Thermal Units (TBTU) in 1980 to 714 TBTU in 1994. In 1980, natural gas will account for 29.7 percent of the non-transportation energy used in the State. This will increase to 31.9 percent over the planning period.

Implementation of this Plan will result in significantly increased gas supplies above those supplies projected in the New York Gas Group supply forecast and above the SEO demand forecast. For every 75 TBTU/yr of additional gas that becomes available by 1994 and displaces oil in the residential sector, the estimated annual savings would be approximately $127 million, which equates to a total savings of approximately $950 million over the planning period (based on Energy Office 1980 fuel prices; savings in 1978 dollars). For a typical homeowner currently heating with oil, conversion to natural gas will save approximately $3,802 (in 1978 dollars) over the planning period.

Positive environmental impacts from increased use of natural gas will be significant. Reductions in atmospheric emissions will be most dramatic since natural gas burns cleanly and efficiently. Air pollutants from natural gas are orders of magnitude lower than those from other fossil fuels.

Since natural gas will primarily replace oil, the following net reductions in air emissions are projected:

PROJECTED REDUCTIONS IN AIR EMISSIONS FROM INCREASED USE OF NATURAL GAS*

Year	Increased Gas Use TBTU/yr	Particulates Tons/yr	SO_x Tons/yr	NO_x Tons/yr
1980	20.5	295.3	5250	1065
1984	39.9	189.3	5593	1107
1989	47.0	-178.2	2611	440
1994	75.6	-401.3	1736	189

These amounts represent a small percent of the State's air emissions from non-transportation sectors, however, such reductions can significantly improve local air quality in urban areas or in non-attainment areas which experience high ambient levels of air pollutants. Other changes in the environment, such as water use, thermal discharges, and land use, are expected, but will be minimal except on a site specific level (See Environmental Impact Statement for details).

The following sections describe the historic development of the gas industry; the curtailment era—the 1976-1977 natural gas crisis—and the current surplus; the institutional framework within which the gas industry operates; the current sources of supply; demand profiles; gas prices and rate structures; and future sources of supply. These considerations form a backdrop against which to plan for the future and to identify issues this Plan must address.

2. BACKGROUND

A. History

1) Early Development

Early use of gaseous fuels in the U.S. involved illuminating gas—gas manufactured from coal. The birthplace of the U.S. natural gas industry is generally considered to be Canadaway Creek in Fredonia, New York (southwest of Buffalo), where gas was discovered in 1821. However, natural gas did not rapidly replace manufactured gas because the pipeline technology needed to transport it in quantities and at prices that would compete with other energy forms was not yet developed. Manufactured gas, therefore, continued to dominate the gas market.

In New York State, gas companies began to develop during the first half of the 19th century. In 1823, gas (manufactured) street lighting was provided in New York City. By 1848, Buffalo and Rochester had such service and Syracuse was soon to follow. In general, street and house lighting markets were opened first, then cooking and refrigeration, and finally, the househeating market.

As recently as 1950, manufactured gas supplied over one half of the gas consumed in New York State. The transportation system for natural gas was created during pre- and post-World War II, when large diameter pipelines from the American Southwest were brought on line to eliminate wartime transportation of oil by coastal tanker. When the war ended and security of oil supply by coastal tanker was again assured, the need for more expensive oil pipeline transportation was eliminated. The rapid expansion of the natural gas industry commenced when Texas Eastern Transmission Corporation purchased oil pipelines from the government and converted them to natural gas use. Manufactured gas could not be delivered in quantities and at prices competitive with natural gas, which was being produced as a by-product of oil production, and its use was phased out during the early 1950's. Thereafter, New York State's dependence on gas from the Southwest grew, until it supplied virtually all of the gas load in New York State. This transition from heavy reliance on manufactured gas to natural gas is illustrated in Figure V-D-1.

Thus, the last quarter century—the era of Southwest gas—was marked by inexpensive, clean energy, rapid growth of the gas industry, and increased domestic reliance on gaseous fuel.

Production of natural gas in the Southwest has been declining since 1972, and the industry has found it necessary to develop supplemental supply sources. These include synthetic natural gas (SNG) and liquefied natural gas (LNG) for both base load and peak shaving purposes, as well as propane-air peak shaving plants.

2) Curtailments

Gas supply from conventional sources is a function of two factors—proved reserve level and deliverability (production rate). Proved reserves provide an indication of the current estimated quantity of gas recoverable. The term "deliverability life" is used to indicate how long production at a given rate can be sustained.

The ratio of proved reserves to production (R/P), usually quoted at years' end, describes the rate of production (consumption) in relation to the available resource base. The ratio of gas findings to production (F/P) is used to indicate whether reserve additions are keeping pace with production over a given time period (a ratio of one being break-even).

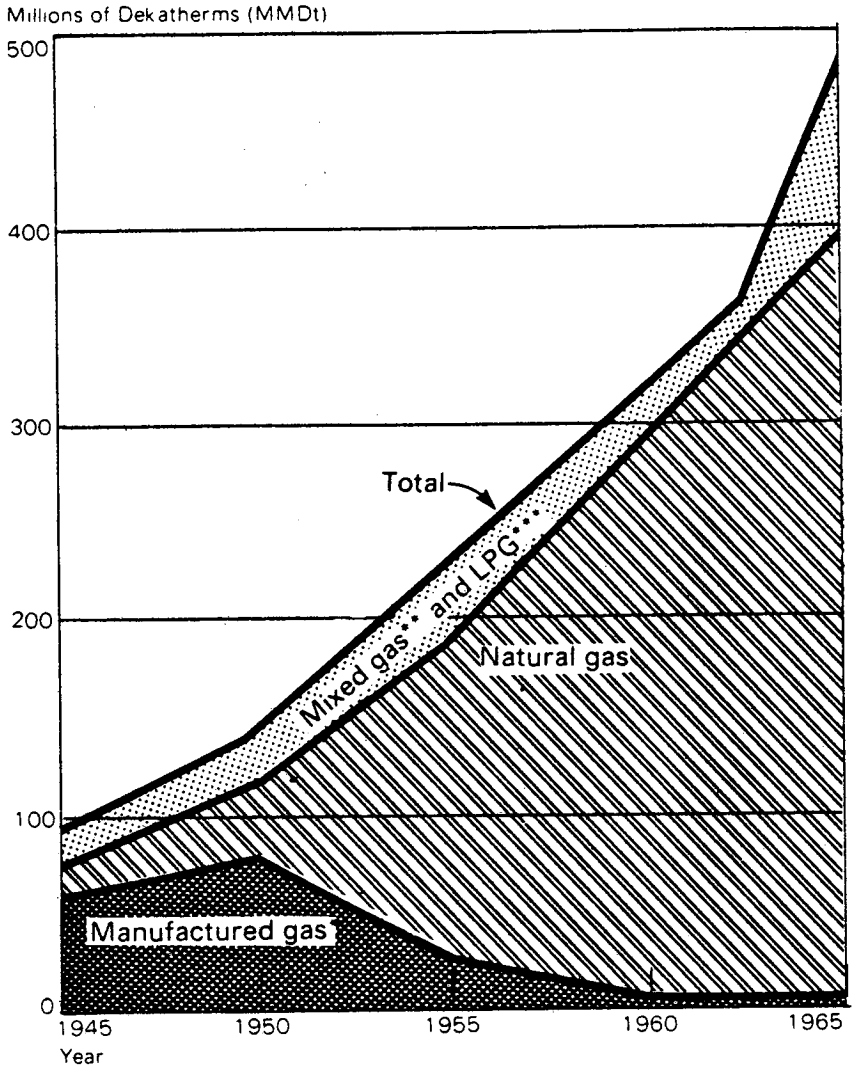
Total year-end U.S. proved reserves steadily increased until 1968; net U.S. yearly production had also been steadily increasing to meet the growing demand, and in 1968 exceeded reserve additions. From 1950 to 1968, gross additions to proved reserves in the lower 48 states averaged about 20 trillion cubic feet per year (TCF/yr). Since 1968, however, the average has been less than 10 TCF/yr. This situation is graphically illustrated in Figure V-D-2. Stated another way, the F/P ratio dropped below one for the first time in 1968 and since then has remained below one. The 1968 R/P ratio was 14.8, but has dropped steadily since—to 10.4 in 1978. In 1972, gas production reached a peak and has been declining steadily since. In summary, the gas shortage that affected gas customers and would-be consumers during the 1970's resulted from steadily growing demand and a sharp decline in reserve additions (discoveries).

Concerned over this situation and the outlook for future incremental supplies of gas, the New York State Public Service Commission (PSC) in October, 1971, took the following actions:

- imposed restrictions on the attachment of new customers and on increased sales to existing customers;
- established an order of six priorities for curtailing customers when necessary; and
- prohibited sales promotions to attract new or additional load.

*This is based on increased gas use, per the SEO demand forecast, using the NYGAS demand forecast as reference. The NYGAS forecast includes approximately 20 BCF more of industrial load in 1994 than the SEO forecast, which strongly influences the emission reductions. Since the lower SEO demand forecast implies more oil consumption in this sector, emission reductions decline over the planning period as these two forecasts diverge. In fact, particulate emissions are shown as increasing. It must be recognized that these results are predicated on a comparison of demand forecasts which differ with respect to the heaviest contributor to air emissions and *all such impacts from increase gas as use are positive.*

FIGURE V-D-1
GAS UTILITY SALES IN NEW YORK STATE BY TYPE OF GAS



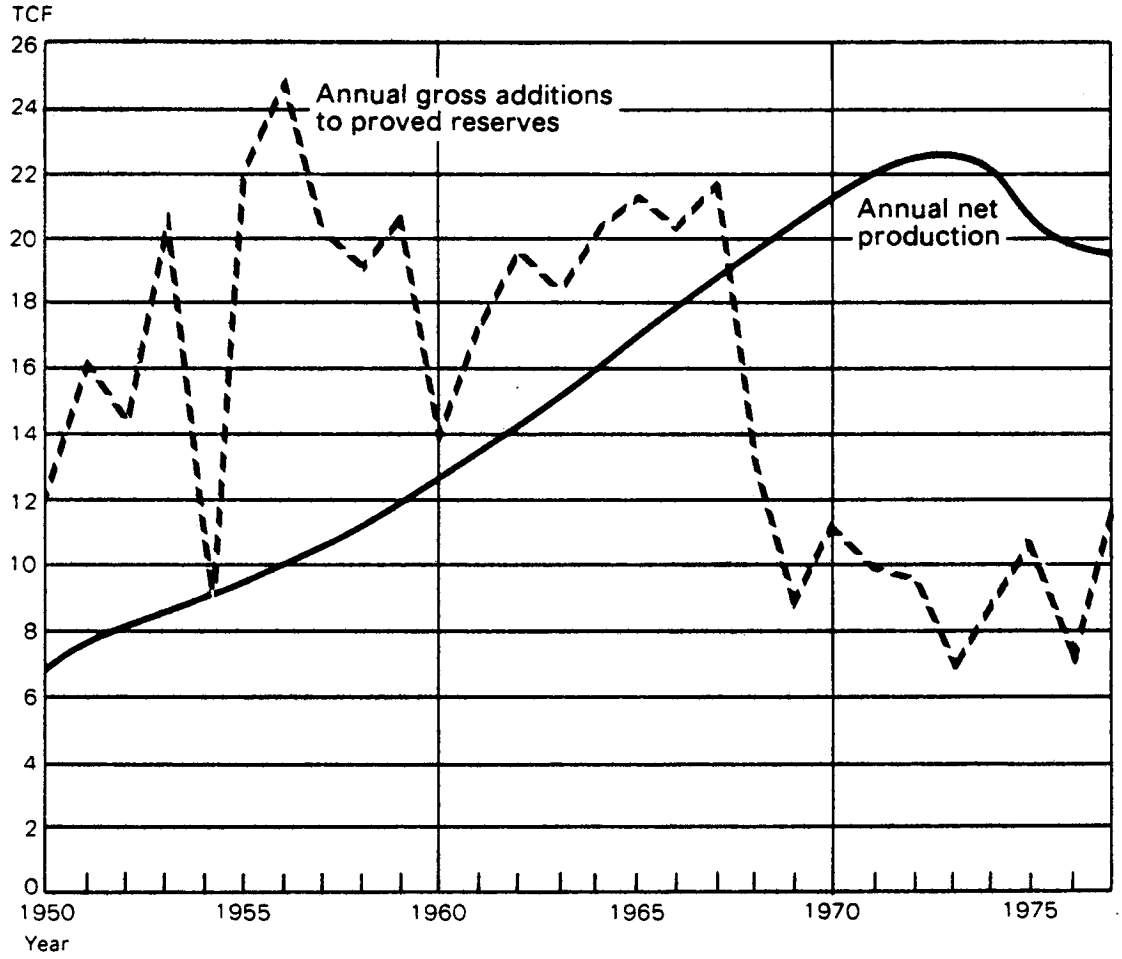
*Gas resulting from the destructive distillation of coal or thermo decomposition of oil or by reaction of steam and heated coal or coke

**Manufactured gas enriched with natural gas or LPG

***Liquified Petroleum Gases

SOURCE: A.G.A. Gas Facts

FIGURE V-D-2
U.S. PRODUCTION AND ANNUAL RESERVE ADDITIONS



SOURCE: A.G.A. Gas Facts

At the same time the Federal Power Commission (FPC), required interstate pipeline companies to file curtailment plans, and in March, 1973, the FPC established end-use oriented, priority of service categories, for curtailment periods.

Essentially interstate pipelines were required to categorize and rank ultimate customers by class in order of importance as follows: residential, process use, and large volume boiler fuel use. This meant that New York enjoyed a distinct advantage over some other states in that a larger percentage of its requirements were high priority. Thus the State suffered less from the effects of curtailment. While utilities in other states suffered curtailment from contract entitlements of up to 70 percent, New York on the average was curtailed approximately 22 percent; the entire curtailment was met by switching large volume boiler fuel customers to oil.

In March, 1977, the PSC expanded its former priority of service categories to 15, further refining this system based primarily on end-use. Later in the same year, the PSC issued a long-range attachment policy. This policy is currently effective in New York State.

In 1977, six New York gas utilities petitioned for relief from these restrictions based on increased ability of their supplier to meet projected demands. The PSC granted such relief. Since that time, nearly all the utilities in the State have petitioned for similar relief. This turnabout occurred for a number of reasons:

- Since early 1972, conservation and accumulated attrition[1] reduced demand by approximately 15 percent.
- New York has a superior end-use profile compared to other states, which means even under a moderate curtailment, all firm requirements can be satisfied.

In addition, a number of self-help programs, including synthetic natural gas (SNG) and liquefied natural gas (LNG), have helped to offset pipeline curtailments. Accordingly, these companies were authorized by the PSC to add certain levels of residential, commercial and industrial loads.

3) The 1976-1977 Crisis

The public's attention to declining gas supplies was not really captured until the crisis of the severe 1976-1977 winter. Estimated U.S. weekly unemployment reached 1.2 million, with total direct and indirect losses estimated at $5.5 billion. New York's peak unemployment was in excess of 100,000, including school closings, factory layoffs, and reduced hours of operation for many commercial establishments. This crisis was, of course, directly a result of the

[1]Attrition meant conversion to oil in many cases.

unusually severe weather experienced that year—an uncommonly cold fall coupled with an exceptionally cold January and February. Underground storage[2] was drawn to an excessively low level problem during the winter months. That is, although supplies (reserves) were available, the gas consumption rate could not be maintained because of the reduced ability to deliver gas from storage.

4) The Current Surplus

Since policies affecting the use of the current surplus or "bubble" are in flux, it is difficult to project exactly what effect this surplus will have on supplies over time. The current gas "bubble" that the natural gas industry is experiencing is likely to occur many more times as new supplies enter the marketplace. This will happen because gas supply projects will tend to be developed and dedicated in blocks; for example, the current surplus is due largely to intrastate gas becoming suddenly available to the interstate market. Future surges such as Mexican, Canadian, or Alaskan gas will produce the same result. Reserve levels could be built up, but Federal policies have shifted toward gas as a swing fuel, to be used for reducing our reliance on foreign oil. Consolidated Edison alone has tentatively been given permission to burn up to 60 BCF over the 12 months ending June, 1980, to displace approximately 11 million barrels of imported oil.

Demand growth, competitive fuel prices, and the duration of the current surplus will influence the development of unconventional gas supplies and increased imports. Based on the future projected available supply from imports and conventional sources and the projected cost advantages of natural gas, the acquisition of all supplemental sources is desirable and their pursuit should not be influenced by the current surplus. The tendency to focus on acquisition of one potential source, at the expense of neglecting others, must be avoided. Various potential sources will result in gas deliveries in differing timeframes. Development of all sources must proceed in a cohesive fashion.

B. Institutional Framework

1) Private Sector

a. U.S.

The gas industry consists of over 10,000 producers (including the major oil companies), 141 interstate pipeline suppliers and about 1,600 local utility distributors of pipeline gas. The flow of gas from producer to end-user is not restricted to the producer-pipeline-distributor sequence. In fact, in each of the three sectors of the industry there are gas suppliers selling directly to end-users. There are 26 major gas supply companies, with collective production totalling 11.1 TCF in 1976, about 57 percent of total U.S. production.

The U.S. gas industry serves over 45 million customers through extensive underground transmission pipelines that span the country, and local distribution systems totalling one million miles nationwide. This underground pipeline network represents a tremendous capital investment, roughly $54 billion, and is, therefore, a valuable asset to all energy consumers. Because the bulk of this gas delivery system is not visible, its scope and vaiue are easily overlooked and unappreciated by the general public. Decreases in natural gas customers and/or sales will result in increased cost to remaining customers as the fixed costs of owning, operating and maintaining this system are recovered from a smaller sales base. Therefore, the existing gas distribution network must be used to the fullest practical extent to assure that the future costs of gas, and other energy forms, will be minimized.

b. New York State

There are 21 gas distribution companies operating in New York State. However, 14 of these, represented by their trade association, the New York Gas Group (NYGAS), deliver about 99 percent of the gas within the State. Seven of the NYGAS member companies are combination gas and electric utilities[3] with the remaining seven serving only gas.[4]

There are about 4 million natural gas customers in New York State, representing service to approximately 13 million of the State's population of 18 million. These customers are served by over 40,000 miles of pipeline. Thus, New York State has about 8.7 percent of the customers and about 4 percent of the pipeline mileage in the U.S.

Two of the nations's 13 SNG plants are located in New York State, while only three of more than 50 U.S. operational LNG peak shaving facilities are located in the State.

2) Federal Role

a. Agency Functions

The United States Department of Energy (DOE), with its various branches, establishes and implements Federal energy policy and programs that shape our future energy supply picture. The Office of the Secretary is its administrative seat, providing overall coordination and policy direction. Eight assistant secretaries function in specific program areas. DOE's role in international affairs is likely to increase, taking on increased importance in the national gas supply future as the transition from reliance on domestic resources to diversified supplies, particularly gas from Canada, Mexico, and imported LNG occurs.

The Economic Regulatory Administration (ERA) is the branch of DOE that administers allocation and pricing regulatory authorities as well as fuels conversion authorities, both primarily affecting petroleum and coal—but also including gas. ERA develops, recommends and implements energy policies in conjunction with other branches of DOE. Specifically affecting natural gas, ERA is responsible for approval of energy import projects and development of curtailment strategy.

The Federal Energy Regulatory Commission (FERC) is an independent branch of DOE that implements policies and most directly affects our gas supply through regulation of producers and pipeline companies. Its powers include: authorization for the transportation of gas by interstate pipelines, including price; implementation of curtailment strategies; ratemaking; and rulemaking implementing the provisions of the NGPA of 1978 as well as the Natural Gas Act of 1938.

b. National Energy Act

With enactment of the National Energy Act, there now

[2]The utilization of subsurface geological formations for storing gas which has been produced at another location, for the primary purpose of increasing deliverability during periods of peak system demand.

[3]Central Hudson Gas & Electric Corp., Consolidated Edison Co. of New York, Inc., Long Island Lighting Company, New York State Electric and Gas Corporation, Niagara Mohawk Power Corp., Orange & Rockland Utilities, Inc., and Rochester Gas and Electric Corp.

[4]The Brooklyn Union Gas Co., Columbia Gas of N.Y., Inc., Corning Natural Gas Corp., National Fuel Gas Distribution Corp., The Pavilion Natural Gas Co., Syracuse Suburban Gas Co., Inc., and St. Lawrence Gas Co., Inc.

exists a base case from which not only price, but conventional supply, can be projected. In the short term, surplus supplies of intrastate natural gas previously bottled up in the producing states will be released. In the longer term, the economic incentives offered American producers will ensure an aggressive exploration program, thus stabilizing long-term supplies. If projections are correct, gas consumers can have an assured supply at prices lower than alternatives such as fuel oil and electricity, thereby reducing reliance on imported oil.

The centerpiece of the Act is a scheduled deregulation of wellhead prices that will allow producers to plan free of the uncertainties that have evolved from past regulatory practices. Additionally, the elimination of the interstate-intrastate price distinction will induce surplus gas to flow from the producing states to help fill unsatisfied demand in states such as New York. The average wellhead price for new onshore gas as of June, 1979, was $2.06/MCF contrasted to an average of $1.16/MCF for all gas supplies purchased from domestic producers. Between now and 1985 the price of gas will rise steadily through an escalation mechanism and continue upward thereafter when prices for approximately 60 percent of all supplies will be deregulated.

i. *Incremental Pricing*—One of the more controversial sections of the Natural Gas Policy Act of 1978 (NGPA) is Title II, which establishes incremental pricing rules for newly discovered or higherpriced natural gas sold to certain industrial users. Implementation of the incremental pricing provisions of the NGPA will occur in two stages. Within 12 months of enactment, FERC must promulgate regulations for the pass-through of cost to large industrial boiler fuel users of natural gas. Within 18 months of enactment, FERC must amend its regulations to expand the category of industrial facilities subject to incremental pricing and seek Congressional approval to implement those regulations. These incremental pricing provisions, intended to protect residential consumers from sharp increases in price, may actually have the opposite effect since they may drive industrial customers off line, leaving only high priority customers to absorb the cost of new gas and the fixed system costs.

ii. *Additional Sections of the NGPA*—Additional Authorities and Requirements, Natural Gas Curtailment Policies, Administration Enforcement and Review, and Coordination with the Natural Gas Act and Effects on State Laws are in various stages of review and implementation. FERC has yet to sort out the various relationships of certain sales, transportation agreements, and co-mingling of the inter- and intrastate gas market. Further, natural gas curtailment policies have been modified to the extent that interstate gas supplies for certain essential agricultural and industrial uses generally will not be curtailed unless high-priority[5] customers are threatened with interruption of service. This is a major departure from the in-place curtailment plans that have been litigated since early 1971, both at FERC and in the courts.

3) State Role

The New York State Public Service Commission (PSC) regulates the New York gas distribution companies under the authority of Public Service Law, Article 4, Sections 65, 66, and 66A. PSC's responsibilities include ratemaking (including approval-of end-user prices and rate designs, as well as approval of supply project capital expenditures in rate base); safety, consumer service; load attachment approvals; establishment of curtailment priorities; and siting approvals for major pipelines and facilities.

The New York State Department of Environmental Conservation (DEC) issues certifications for well drilling onshore and offshore in New York State waters, including responsibility for implementing the wellhead pricing guidelines in accordance with the NGPA. Additionally, DEC has the authority, and will soon issue regulations governing the siting of LNG facilities within the State.

4) International

The top producers of natural gas in 1977, in free world countries were, in order, the U.S., Canada, Netherlands, Iran, United Kingdom, Romania, West Germany, and Mexico. In terms of proved and probable reserves (from conventional sources), Mexico and Canada combined are roughly equal to the U.S. About one half of free world gas reserves are located in the Middle East, with almost 1/4 of that gas in one country—Iran. Due to the unstable political conditions in that part of the world, and the pricing philosophy of those countries, these sources do not appear attractive at this time. Acquiring gas supplies from significant producers in the Western Hemisphere, (i.e., Canada and Mexico) is therefore, a logical and desirable strategy. The U.S. is the natural marketplace for these sources and should aggressively pursue their acquisition.

As the U.S. gas industry,diversifies its supply sources to include such imports, the role of the Federal government i.e., negotiating a price with Mexico, Canada, and import licensing for LNG projects by the Economic Regulatory Administration (ERA)will increase.

C. Current Supply Sources

1) Gas Supplies

The U.S. is nearly self-reliant in meeting its demand for natural gas—the largest current domestically produced energy source, accounting for about 40 percent of total domestic energy production. In 1977, U.S. gas supply source components were: domestic production at 93.8 percent; imported Canadian Mexican[6] and LNG (Algerian) at 4.8 percent; .01 percent, and .05 percent, respectively; and SNG at 1.3 percent. Also during 1977, the U.S. exported .055 TCF, almost double Mexican imports, LNG imports, and SNG combined.

New York State depends almost entirely[7] on interstate supply companies for its natural gas, however, SNG, liquefied petroleum gas (LPG), and LNG do play an important role in our gas supply picture— especially during peak periods. For the 1977-1978 sendout year, the contribution to New York State supply from each source was: interstate supply companies, 93.6 percent; pipeline imports (Canada), .7 percent; SNG, LPG, and imported LNG, 4 percent; and New.York State production, 1.7 percent.[8] Contracts between interstate suppliers and distribution companies fall into two general categories: demand-commodity, where the user has

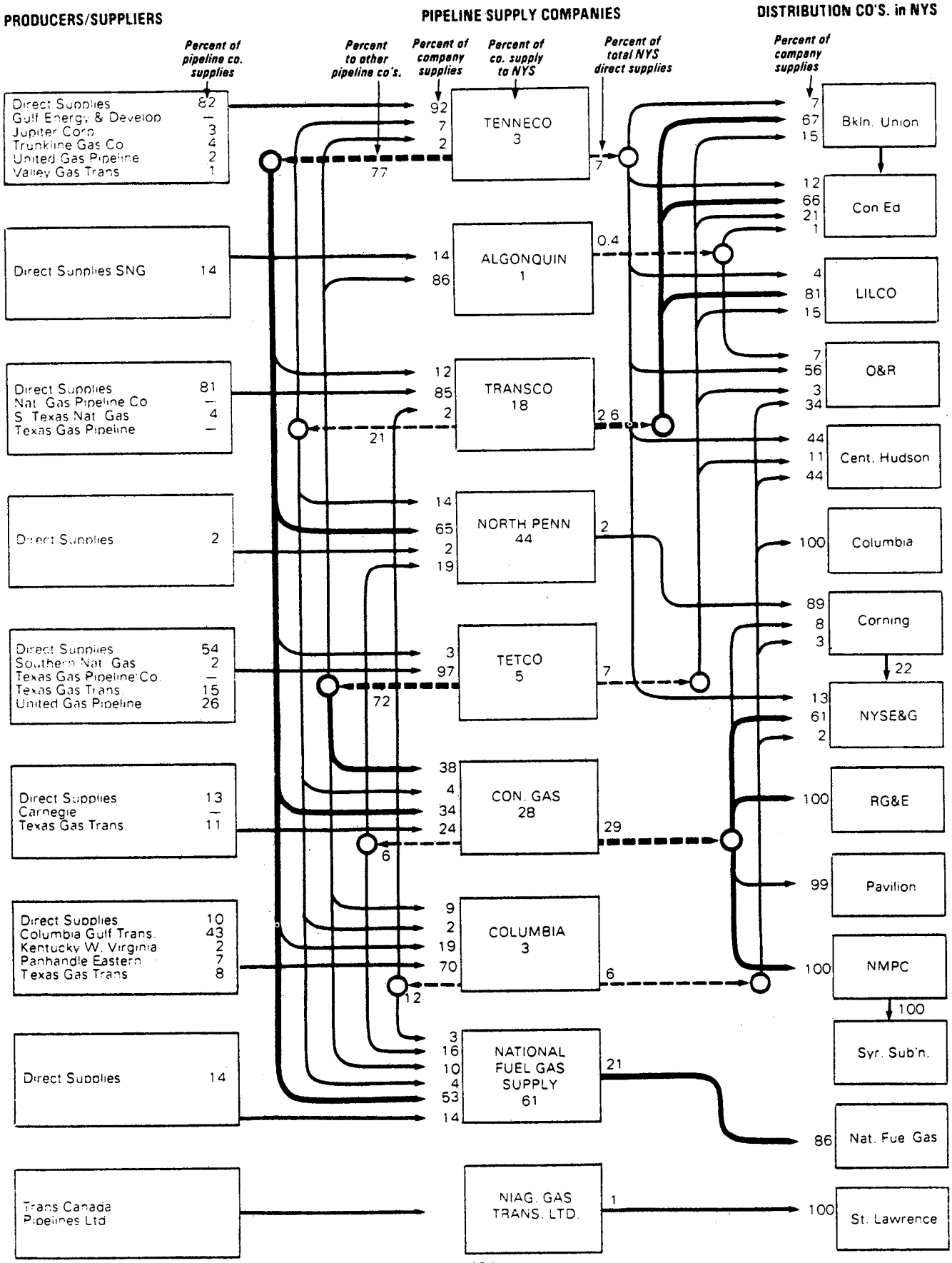
[5]High-priority user is defined as gas use in a residence, small commercial establishment, schools, or hospitals.

[6]The U.S. exported, however, more gas to Mexico in 1977 than it imported from that country.

[7]One New York State distribution company, St. Lawrence Gas Co., depends solely on Canada for its gas supply.

[8]This 1.7 percent only includes local production purchased directly by NYGAS member company systems. While total NYS production equalled about 2.7 percent of New York State total requirements, some of that gas flows into the interstate pipeline network, and was not traced back to New York State but is included in the 93.6 percent from interstate supply companies.

FIGURE V-D-3
FLOW DIAGRAM: ULTIMATE SOURCES OF NATURAL GAS SUPPLY, NYS



Footnotes to Flow Diagram
Figure V-D-3

(1) Figures do not necessarily add as they were obtained from several sources; the relative proportions give a good indication of flow volumes.
(2) Percent of Company Supplies: indicates the percentages of *total* sources for that Company and percentage of total available sources supplied to other pipeline companies. (All of these companies also supply other states.)
(3) Percent of Company Supply to New York State: indicates the percentage of available supplies which that company supplies to New York State. (The difference between the percent of supplies to other pipelines plus the percentage to New York State and 100 percent is the percentage of that companies requirements for other states.)
(4) Percent of total New York State direct supplies: indicates the percentage of total New York State direct supplies which come therefrom. Reliance on these figures, however, could be misleading because considering the interconnections between supply companies, actual major *indirect* supplies to New York are somewhat different (see Figure V-D-4).

New York State Distribution Companies

Brooklyn Union—The Brooklyn Union Gas Company
Central Hudson—Central Hudson Gas & Electric Corp.
Columbia—Columbia Gas of N.Y., Inc.
Con Ed—Consolidated Edison Co. of N.Y., Inc.
Corning—Corning Natural Gas Corporation
LILCO—Long Island Lighting Company
National Fuel Gas—National Fuel Gas Distribution Corp.
NYSE&G—New York State Electric and Gas Corp.
NMPC—Niagara Mohawk Power Corp.
O&R—Orange & Rockland Utilities, Inc.
Pavilion—The Pavilion Natural Gas Company
RG&E—Rochester Gas and Electric Corp.
St. Lawrence—St. Lawrence Gas Co.; Inc.
Syr. Suburban—Syracuse Suburban Gas Company, Inc.

Interstate Pipeline Supply Companies

Tenneco—Tennessee Gas Pipeline Company
Algonquin—Algonquin Gas Transmission Company
Transco—Transcontinental Gas Pipe Line Corporation
North Penn—North Penn Gas Company
Tetco—Texas Eastern Transmission Corporation
Con Gas—Consolidated Gas Supply Corporation
Columbia—Columbia Gas Transmission Corporation
NFG Supply—National Fuel Gas Supply Corporation

call on specific volumes each day or season; and, full requirements contracts, where the user can purchase all the gas needed to satisfy requirements. Generally speaking, much of upstate New York receives its gas under full requirements contracts from one supplier. Downstate is supplied gas under demand-commodity contracts.

The interstate pipeline companies that supply New York State also supply several other states, and are extensively interconnected among themselves and with other pipeline companies. Figure V-D-3 is a flow diagram showing the producers/suppliers for these interstate companies, the relative portions of the gas delivered to the New York distribution companies by each supplier, and the flow through these interconnections. Figure V-D-4 identifies the approximate percentage of each interstate supply company's supplies, delivered to New York State and the percentage, both direct and indirect, of the total gas to New York State provided by each. The ultimate source areas[9] of the pipeline gas flowing to New York State are:

Offshore Louisiana	51 percent
Onshore Louisiana	22 percent
Texas Gulf Coast	14 percent
Appalachian-Illinois Basin	7 percent
Other	5 percent
Gross Imports	1 percent

2) Storage and Supplementary Sources

Demand for gas peaks dramatically in winter, which requires that substantial storage and other supplementary sources of gas be on hand to meet system load. This is accomplished by both interstate supply companies and local gas distribution companies maintaining large underground storage fields, LNG peak shaving facilities, and SNG plants.

Total U.S. capacity of underground storage currently used is about 5.2 TCF, of which 2.6 TCF is working gas.[10] The ultimate total capacity of these reservoirs is estimated at 7.2 TCF. In New York State, the ultimate reservoir capacity is about 147 BCF of which about 80 percent is currently utilized.

FIGURE V-D-4
INTERSTATE PIPELINE GAS SUPPLIES TO NEW YORK DIRECT AND INDIRECT

Interstate Supply Company	Percentage of Each Company's Supply, Delivered to New York State	Percentage of NYS's Total Supply	
		Direct	Indirect
Tenneco	3	7	23
Transco	18	26	29
Tetco	5	7	22
Con Gas	28	29	6
Columbia	3	6	3
National Fuel	61	21	14
Algonquin	1	0.4	-
N. Penn.	44	2	2

LNG facilities are used for either baseload (i.e., import projects) or for peak shaving. At peak shaving facilities, pipeline gas is liquefied during the off-peak summer months for use as needed during winter. Total LNG storage capacity in the State's three operational facilities is 3.0 BCF. Liquefaction capability totals 13.8 MMCF/day[11] for these facilities, and combined vaporization capability is 569 MMCF/day. The two SNG plants in the State are designed to deliver 60 MMCF/day each. One of these is operated at full capacity during winter months and at 60 percent capacity during the summer while the other is operated on a peak shaving basis 3-4 months per year.

D. Demand Profiles

1) Current Overview

U.S. demand for natural gas in 1978 totalled 19.4 TCF. The distribution of this consumption by end use sector was: residential/commercial, 37.5 percent; industrial, 41.9 per-

[9]National Gas Flow Patterns, FPC, February, 1977.
[10]The total volume of gas in an underground storage reserve that can be withdrawn for consumption during the winter season.
[11]1 MMCF = one million cubic feet = 0.001 billion cubic feet; 1 MCF = one thousand cubic feet.

FIGURE V-D-5
NEW YORK DEMAND COMPONENTS AS A PERCENTAGE OF TOTAL DEMAND

	Statewide[1]	Upstate[2]	Downstate[3]	Straight Gas Co's.[4]	Combination Gas/Elec. Co.'s[5]
Firm Demand					
Residential — Space Heat	51.0	51.4	51.0	54.0	49.0
— Non-Heating	6.0	1.9	10.5	5.0	6.2
— Total	57.0	53.5	61.5	59.0	55.2
Commercial — Space Heat	15.5	20.0	9.7	13.2	17.3
— Non-Heating	4.5	1.5	8.5	2.3	6.3
— Total	20.0	21.5	18.2	15.5	23.6
Industrial — Space Heat	3.8	5.4	1.8	4.2	3.5
— Process	9.1	15.3	1.2	13.7	5.5
— Feedstock	.5	.1	.5	.9	.2
— Other	.4	0	0	0	.7
— Total	13.8	21.8	3.5	18.8	10.0
Other[6]	4.8	2.3	8.1	4.5	5.1
Total Firm Demand	95.7	98.95	91.4	97.7	94.0
Terminable Demand					
Residential	.05	0	.10	0	.09
Commercial	.09	0	.20	0	.16
Industrial	.01	0	.03	0	.03
Total Terminable Demand	.15	0	.33	0	.27
Interruptible Demand					
Residential	.26	0	.6	0	.46
Commercial	1.09	.06	2.4	0	1.95
Industrial	2.77	.98	5.1	2.25	3.18
Company Plants	.07	0	.2	0	.12
Total Interruptible Demand	4.20	1.04	8.3	2.25	5.70

[1] All NYGAS Member Companies.
[2] Columbia, Corning, NFG, NYSE&G, Ni Mo, Pavilion, RG&E, St. Lawrence, and Syracuse Suburban.
[3] BUG, Central Hudson, Con Edison, LILCO, Orange & Rockland.
[4] BUG, Columbia, Corning, NFG, Pavilion, St. Lawrence, and Syracuse Suburban.
[5] Central Hudson, Con Edison, LILCO, NYSE&G, Ni Mo, Orange & Rockland, and RG&E.
[6] Exchange with Other Utilities, Unaccounted For, Company Use.

SOURCE: 1979 New York Gas Report (NYGAS).

cent; transportation (pipeline fuel), 2.7 percent; electricity generation, 16.6 percent; and other, 1.3 percent.[12]

2) *New York State End-Use Profile*

During the last 10 years, the distribution of end-use consumption statewide, has changed significantly. In 1968, firm requirements totalled about 81 percent of the total load (44 percent of total load was residential), interruptible requirements accounted for virtually all the rest, with negligible curtailable load.

By contrast, 1977 firm requirements totalled nearly 96 percent of the total load (57 percent of the total load was residential); interruptible, 4 percent; and terminable/curtailable, .15-percent. Basically, the level of firm requirements was expanded at the expense of the interruptible market. (A detailed breakdown of current demand components [energy use] is provided in Figure V-D-5).

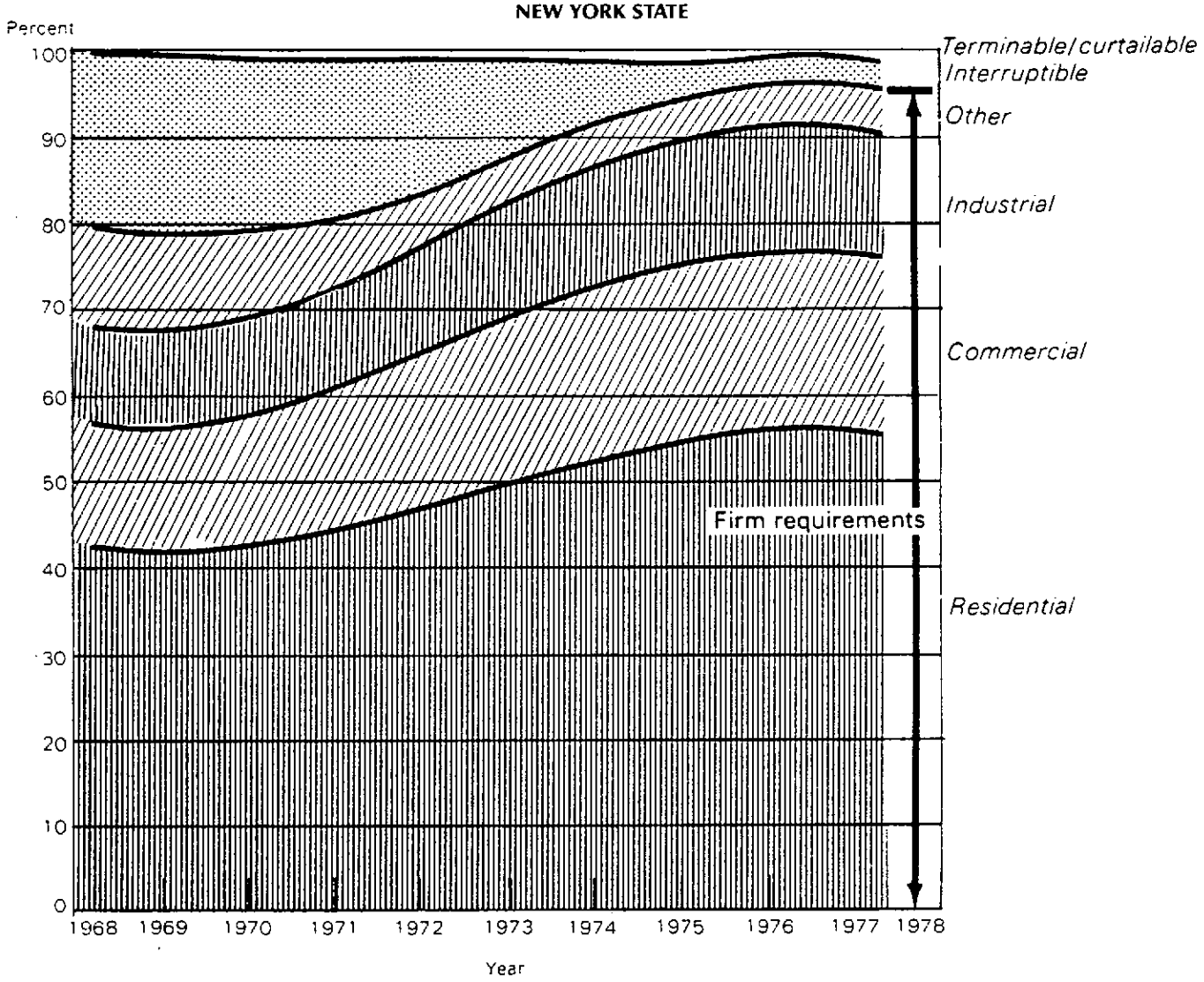
[12]EIA Annual Report to Congress, 1978, Vol. II.

The change in end-use profile over this 10-year period is shown graphically in Figure V-D-6, as changes in the percentages of each type of load.

While residential requirements have grown substantially, New York is still significantly behind its neighboring states and far behind the U.S. in penetrating the residential house heating market. Figure V-D-7, is a composite graph showing, for the years 1967 to 1977, the total number of residential gas house heating customers in New York, the percentage of these customers compared to the total number of residential gas customers in New York, and the same totals and percentages for the U.S., the Middle Atlantic Region, and the New England area. As illustrated, New York has the lowest penetration into the house heating market among existing gas customers.

The total number of house heating customers grew steadily over this period (except for a slight dip in 1972, probably due to restrictions) for the U.S. as a whole and the Middle Atlantic and New England regions. In New York, however, instead of this market being steady, it has been fluctuating,

FIGURE V-D-6
END USE CONSUMPTION BY SECTOR
NEW YORK STATE



SOURCE: New York Gas Reports (NYGAS)

reflecting both attachment policy and customer perception of uncertainties of gas supply and price.

President Carter has proposed a $2 billion dollar interest subsidy, financed through the windfall profits tax on oil, to provide loans to owners of oil-heated residential and commercial buildings to install conservation measures or convert to natural gas. This coupled with the large price differential between natural gas and distillate oil projected throughout the planning period, should result in substantial conversion from oil to gas-fired space heating. These factors will work to rectify the low gas house heating penetration which currently exists in New York State.

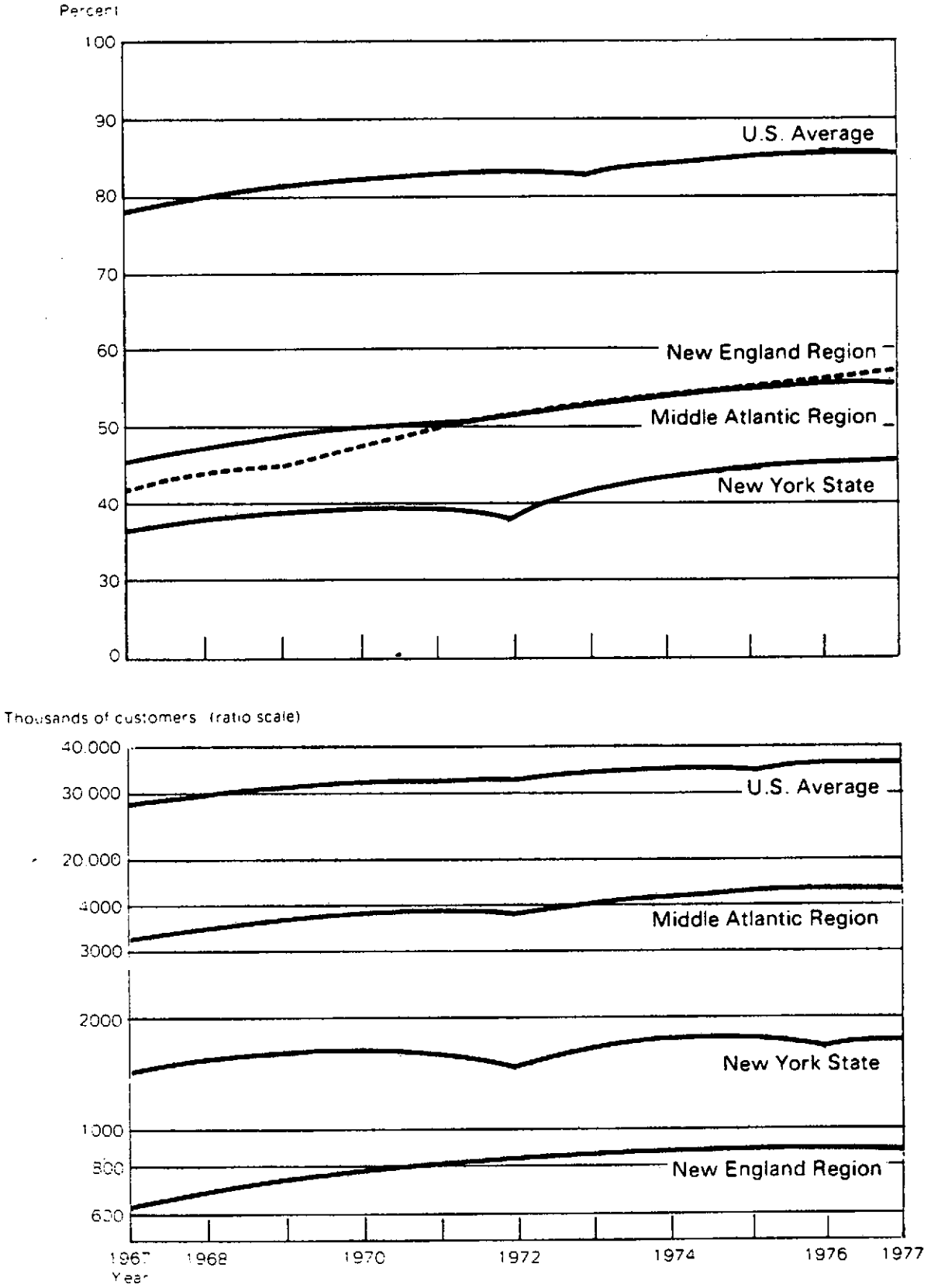
E. NYS Gas Prices and Rate Structures

Currently gas prices and rate structures vary widely across the State. For the purpose of demonstrating this variation, a comparison of the Brooklyn Union Gas Company (BUG), Niagara Mohawk Power Corporation (NMPC), and National Fuel Gas Distribution Corporation (NFG), is shown here. These companies were selected because they are representative of regions that have different energy resource attributes, (i.e., downstate, central, and western), because they each have different primary gas suppliers, and because their differing rate structures cover the extremes across the State. It is also noteworthy that BUG has the largest number of customers in New York and receives the largest annual revenues in the State; NMPC has one of the largest gas service territories in the State; and NFG has the largest sendout of the New York State gas utilities.

Figure V-D-8 shows the cost of gas, at specified consumption levels for residential, commercial, and industrial customers in each company's service territory. It is noted that the cost shown is exclusive of sales tax and surcharge where applicable. Figure V-D-9 compares the residential declining block rate structure for each company.[13] The major differences in price are the result of the fixed costs of distribution and transmission since the current average wellhead price

[13]The first block represents a flat charge paid by all customers, whether or not gas is consumed, based upon the installation of company equipment such as meters, regulators, service lines and including administrative and billing costs.

FIGURE V-D-7
RESIDENTIAL GAS CUSTOMERS USING GAS FOR HEATING



SOURCE: AGA Gas Facts.

FIGURE V-D-8
COMPARISON OF MONTHLY RESIDENTIAL BILLS OF THREE MAJOR GAS COMPANIES
(AT RATES IN EFFECT AS OF JANUARY 1, 1979)

Company	0 CCF $	20 CCF $	50 CCF $	150 CCF $	300 CCF $
Brooklyn Union Gas Company					
Base Rate	5.17	15.11	29.43	70.73	131.73
Gas Adjustment	0	.43	1.07	3.21	6.42
TOTAL	5.17	15.54	30.50	73.94	138.15
National Fuel Gas Distribution					
Base Rate	3.14	6.47	12.46	30.78	58.05
Gas Adjustment	0	1.73	4.33	12.99	25.98
TOTAL	3.14	8.20	16.79	43.77	80.63
Niagara Mohawk Power Corp.					
Base Rate	3.07	9.35	19.20	43.77	80.63
Gas Adjustment	0	.30	.76	2.27	4.54
TOTAL	3.07	9.65	19.96	46.04	85.17

FIGURE V-D-8
TYPICAL INDUSTRIAL AND COMMERCIAL BILLS
FOR THREE MAJOR GAS COMPANIES
(AT RATES IN EFFECT IN JANUARY, 1979)

Company and Service Classification		Amount for 1,000 MCF $	Amount for 10,000 MCF $	Amount for 100,000 MCF $
Brooklyn Union Gas Company	Base	4,092.57	39,552.57	393,212.00
S.C. 2	GAC*	214.00	2,140.00	21,400.00
General Service	TOTAL	4,306.57	41,692.57	414,612.00
Niagara Mohawk	Base	2,172.01	20,232.31	200,835.31
S.C. 3	GAC	143.32	1,433.20	14,332.00
Large General Service	TOTAL	2,315.33	21,655.51	215,167.31
National Fuel Gas Distribution Corp.	BASE	2,609.91	24,638.11	241,835.11
S.C. 1	GAC	118.40	1,184.00	11,840.00
(Buffalo Area)	TOTAL	2,728.31	25,822.11	253,675.11
S.C.3	BASE	2,475.68	23,807.48	235,361.48
(Jamesport Area)	GAC	40.20	402.00	4,020.00
	TOTAL	2,515.88	24,209.48	239,381.48

* Gas Adjustment Clause

of gas is $1.16/MCF. However, this mix of pricing components will begin to reverse itself when the impact of natural gas deregulation takes effect. Shown in Figure V-D-10 are estimates of final consumer prices through 1994.

Initially, the percentage increases to New York State will be modified somewhat because the current average burner tip price consists of an approximate 2/3 markup for transmission and distribution costs compared to 1/3 for the wellhead cost. However, by 1985 when approximately 60 percent of flowing gas will be deregulated, these fixed costs will have less of a stabilizing effect and increases in wellhead prices will have more of a direct impact on consumers.

F. Future Sources

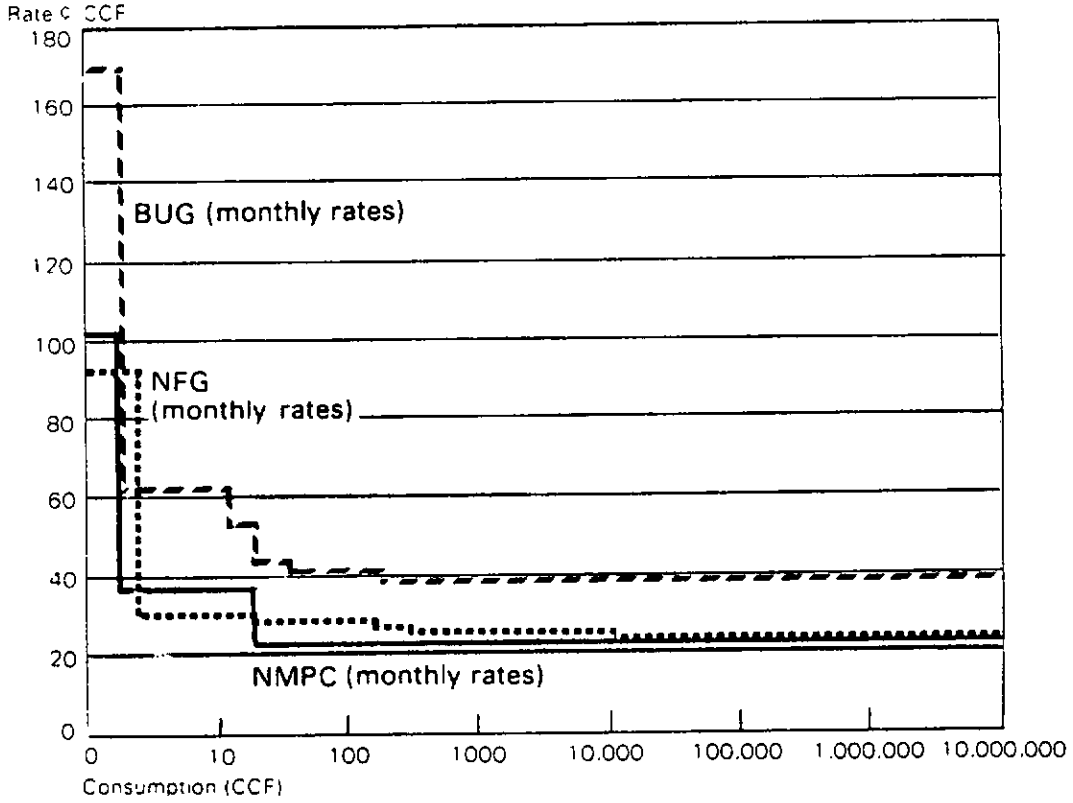
Potential future U.S. supply sources must be the prime consideration in projecting future New York gas supplies, which are almost completely dependent upon major U.S. pipeline companies.

In addition to conventional domestic sources, future potential U.S. sources include: increased Canadian imports, Mexican imports, Alaskan gas, SNG from coal gasification, LNG imports; and gas from unconventional domestic resources such as Devonian shales, tight sands, coal bed methane, and geopressurized zones. Natural gas has traditionally been developed with minimal environmental impact, but the development of unconventional sources is not without environmental risks. (A further discussion of potential impacts appears in the Environmental Impact Statement). Acquisition of these supplies will require both a commitment to and from the gas industry as well as a solidification of federal policy. Clearly, in the future, the gas industry must rely more heavily on diversified supply sources. But with proper planning and investment, the transition from near total reliance on depleting Southwest reserves can be a smooth one.

Future gas supplies to New York State are, therefore, projected on the basis of potential future U.S. gas supplies,

FIGURE V-D-9

REGIONAL COMPARISON OF RESIDENTIAL DECLINING BLOCK RATE STRUCTURE



SOURCE. Utility tariffs on file at PSC as of April 1979.

FIGURE V-D-10

STATEWIDE AVERAGE FORECASTED PRICES OF FUELS DELIVERED TO END-USERS* (1978 $/MMBTU)

		Oil		Coal	Electric	Natural Gas
		Distillate	Residual			
1980	Residential	5.19	-	-	19.90	3.50
	Commercial	5.05	4.01	-	16.48	2.69
	Industrial	5.05	4.01	2.21	16.48	2.55
1984	Residential	5.91	-	-	21.69	4.10
	Commercial	5.77	4.61	-	18.17	3.33
	Industrial	5.77	4.61	2.51	18.17	3.28
1989	Residential	6.63	-	-	23.33	4.89
	Commercial	6.49	5.21	-	19.60	4.35
	Industrial	6.49	5.21	2.80	19.60	4.33
1994	Residential	7.35	-	-	24.65	5.70
	Commercial	7.21	5.81	-	20.72	5.58
	Industrial	7.21	5.81	3.09	20.72	5.65

* Prices are not reflective of efficiency losses at the burner tip.

by applying the historic share of U.S. gas that flowed to New York via interstate pipelines.[14] (Details of projected potential U.S. supplies and this forecast methodology are contained in Appendix D-2). The resulting New York State supply forecast is shown in Figure V-D-11. Also shown is the sensitivity of this forecast to loss of supplemental sources.

The potential of each supplemental gas supply source is discussed briefly below:

1) Alaskan Supply (North Slope)

Proved North Slope reserves total 26 TCF, with potential reserves estimated at 76 TCF. To deliver this gas to market, approximately 4,787 miles of pipeline (Alcan project) must be constructed, 2,759 miles in Alaska and Canada, with the remaining 2,028 miles in the contiguous States. Capacity of the line is projected to be 2.4 BCF/day (average) or .876 TCF/yr, with the potential to increase to 3.4 BCF/day by the installation of additional compressor stations, and possibly higher by increasing horsepower.

2) Canadian Supply

The Canadian National Energy Board (NEB) estimates remaining reserves of marketable gas from conventional producing areas at 66.1 TCF, with an ultimate potential for such gas at 147 TCF (with a range of 127 to 157 TCF). NEB has also estimated marketable gas discovered in frontier areas at 14.5 TCF, but has not estimated the ultimate potential of these sources, which the Geological Survey of Canada estimates to be roughly 163 TCF (with a range of 97-302 TCF).

The current reserve surplus (established reserves only, excluding frontier reserves) is calculated by NEB at 3.8 TCF. Authorization of additional exports from this surplus has been studied and the NEB considers three combinations of firm and interruptible volumes licensable. They range from a total of 1.6-2.0 TCF over 4 to 8 years, commencing in 1980.

Aside from established reserves in conventional areas, significant gas reserves have been found in frontier areas such as Canada's High Arctic. The lack of a transportation mechanism has prevented delivery of this gas to market, and inhibited further gas exploration in this area. An LNG mode is being proposed for delivery to St. John or the St. Lawrence River area where conventional pipelines can then complete the link with the United States. New York State gas distribution companies could expedite development of such delivery by joining together, and possibly in combination with gas utilities in the greater Northeast area to arrange for direct purchase of gas from Canadian pipeline companies.

3) Mexican Supply

Proved and probable natural gas reserves in Mexico total 137.5 TCF, about two-thirds of which is associated with oil production, requiring that it be marketed, reinjected into oil fields to enhance oil recovery (to the extent possible), or flared as the oil is produced. Early wells have shown a gas/oil ratio of 1 MCF/BBL, while newer wells showed gas/oil

[14]A more desirable and logical approach is to develop a forecast for the specific interstate pipeline companies serving New York State. However, given the time and resource constraints associated with this initial plan, including such a forecast herein was not feasible. Accordingly, the goal is to develop the data and modelling techniques necessary to produce such a forecast for subsequent plans.

FIGURE V-D-11
NYS SUPPLY FORECAST
(ALL SUPPLEMENTALS INCLUDED)
(BCF/yr)

	Low	Expected	High
1980	641	686	698
1984	653	719	787
1989	681	786	951
1994	729	851	1039

SENSITIVITY TO LOSS OF SUPPLEMENTALS
NYS SUPPLY
(BCF/yr)
(expected case only)

	No Mexican	No Increased Canadian	No Mexican & Inc. Canadian	No Alaskan
1980	678	679	671	686
1984	699	708	687	719
1989	744	755	713	757
1994	810	802	760	798

	No Add'l LNG	No New Technologies	No High BTU Coal Gas	No Supplementals*
1980	686	686	686	671
1984	695	697	717	638
1989	755	741	771	593
1994	808	772	807	539

* Mexican, Increased Canadian, Alaskan, Additional LNG, New Technologies, and High BTU Coal Gas.

ratios up to 6. Delivery of the gas to markets will only require construction of a 90-mile pipeline between the U.S. interstate pipeline network and the 48-inch, 800-mile pipeline already constructed by PEMEX, the government oil company.

Six U.S. interstate gas pipeline companies have contracted with PEMEX to purchase up to .3 BCF/day. This supplemental source of new gas is beneficial to New York State in particular, because Tenneco, Tetco and Transco, who combined currently supply about 74 percent (indirectly) of this State's requirements, have a combined 75 percent share of the PEMEX gas.

4) LNG

Currently, there are three operational baseload LNG import projects in the U.S. These projects rely on the same source, Algeria, for a total of 407 BCF/yr of imported gas. An additional LNG project currently under construction will also receive its supply, 168.4 BCF/yr, from the same source commencing in 1980/81. The estimated average cost of gas to be delivered into the pipeline for all these projects is $2.4l/MCF (as of December 31, 1978).

As of December, 1978 eight additional LNG import projects were planned which could result in total (additional) deliveries of at least 1,695 BCF/yr. (Available cost estimates average $3.34/MCF.) The ERA has rejected two LNG projects but the applicants are seeking rehearings. In addition to increasing supplies, these projects would diversify LNG sources to include countries such as Ecuador, Trinidad and Tobago, and Indonesia.[15]

5) High BTU Coal Gasification

Adequate technology exists today to build first generation high-BTU coal gasification plants, and two such projects are in the active planning stage. The most significant constraint is economics, both in terms of attracting capital and price treatment for the final product. For example, a plant with output capacity of 250 MMCF/day (91 BCF/yr) is estimated to cost $1.2 billion, producing gas at a cost of about $5-$6/MCF. Therefore, Federal assistance for pricing arrangements (rolling in vs. incremental), loan guarantees, and perhaps direct subsidy of both research, development, and pilot plant construction may be necessary; as has been provided, for example, to nuclear power for the past 30 years. In the alternative, it may be necessary for the government to finance and own first generation plants that will demonstrate the technology on a commercial scale and provide the opportunity to refine technology so that investor owned second generation plants will produce a more competitive product. Considering the overwhelming percentage of U.S. fossil fuel resources represented by coal, this potential source of gas should be aggressively pursued.

The production of organic fuels from coal may cause significant environmental impacts. Irrespective of location, the siting process must be responsive to problems associated with land use, water requirements, air emissions, noise, aesthetic and other adverse impacts which may result from such activity. It is expected that the major environmental impacts will occur at the site of the conversion facility. The use of synthetic fuels in New York, especially if these fuels are cleaned during the process, may have a net positive environmental impact. SO_x, ash, scrubber sludges, and other environmental impacts from coal which would have been combusted in the State will be nearly eliminated by the use of these synthetic fuels. Any proposal of such a facility for the State, however, will require environmental scrutiny early in the consideration of such a proposal.

If the combustion facility employs cogeneration or another more efficient technology, the use of such synthetic fuels will represent a positive impact in that more usable energy is being generated per unit of resource used.

New York State gas distribution companies combined do not have the ability to finance a coal gasifications plant in the State.

An alternative to a high-BTU coal gasification plant is a multi-purpose facility that would co-produce several energy forms from coal. The core of this facility would be a medium-BTU coal gasification plant, a current proven technology. Three separate plants at the same site would use this gas:

- a combined cycle electric generation unit;
- a methanol plant; and
- a methane plant (perhaps even an ammonia plant).

Preliminary estimates place the total cost of this combination facility at $1.6 to $1.9 billion, for capacities of approximately 1000MW electric generation, 2000 to 2500 tons/day of methanol, and 50 to 60 MMCF/day of methane. That total cost is comparable to the cost of a 1000 MW nuclear (or coal) electric generation unit. Additionally, such a facility would allow a range of operations within which production of a particular energy form can be increased (and the others decreased) to meet demand. This is particularly suitable to the downstate area with contrasting summer-peaking electric and winter peaking gas loads, solving one of the limiting factors in a coal-fired unit operation, the requirement that such units be baseloaded.

Several financing possibilities exist: joint financing by electric utilities, gas utilities, and private industry; joint financing with the Power Authority of the State of New York (PASNY) involved; and perhaps financing through the proposed Energy Corporation of the Northeast (ENCONO).

A technical study is needed to generate basic data regarding such a project. Because of the complexity of such a project, a three-phase approach is required. The first phase would entail development of a preliminary plan estimating yields of products and costs for at least one plant configuration and capacity in addition to environmental constraints. A plan to stimulate interest in and solutions to the economic/political problems would also be developed during this phase. The second phase would entail identification of a very specific plant configuration, unit capacities, operating plan, environmental impacts, and capital and operating cost estimates. The third phase would be a detailed engineering study to provide data for the necessary go/no-go decision, including the environmental criteria for the selection of acceptable sites. These phases are estimated to cost $200-$300 thousand, several million, and tens of millions of dollars respectively.[16]

6) New Technologies

Tapping the vast potential resources of unconventional geologic formations requires the development of technologies for economically viable and environmentally compatible production of natural gas. The development of several of these resources are constrained for environmental reasons, and are presently the subject of evalution by the

[15]These countries have been identified as potential sources for certain LNG projects being planned (detailed in Appendix D-2, Figure D-2-3); natural gas reserves are: Ecuador, 5 TCF, Trinidad and Tobago, 8.5 TCF, and Indonesia, 24 TCF (Source: International Petroleum Encyclopedia, 1978).

[16]Such a study is recommended in the Coal Plan (Section V-G) and is supported by this Plan.

Office of Environment in the U.S. DOE. President Carter has proposed a one billion dollar tax credit for unconventional natural gas resources, financed through the windfall profits tax on oil. This tax credit would apply to gas from tight sands, shales, and coal seams, at a level of 50 cent/MCF of gas produced from these sources. U.S. supply projections in this Plan consider four of these potential sources:

a. Geopressurized Aquifers

Geopressurized resources consist of methane trapped in sedimentary rock at high pressures, either free or dissolved in brine. The resource (gas-in-place) base is estimated at 3,000 to 100,000 TCF. The estimated recoverable gas range is 150 to 2,000 TCF, with 160 TCF estimated recoverable at marginal costs up to $4/MCF[17]

b. Western Tight Sands

Tight sandstone formations in the U.S. are estimated to contain a total of 793 TCF of gas resources. It is estimated that up to 170 TCF of this resource is recoverable at marginal costs up to $4/MCF[17].

F. Eastern Shales

Eastern shales of the Devonian geologic era are estimated to contain 600 TCF of gas-in-place. Estimated recoverable reserves at ,marginal costs up to $4/MCF[17] are 30 TCF.

d. Coalbed Methane

It is estimated that 750 TCF of methane may be present in shallow and deep coalbeds in the United States. That is roughly equal to the total proved and potential natural gas reserves in this country. Estimated recoverable reserves at marginal costs up to $4/MCF[17] are 350 TCF.

7) New York State Production

New York State's contribution to the U.S. supply from its indigenous resources is expected to grow considerably over the planning period and consists of continued onshore production and development of offshore Lake Erie resources.

a. Onshore

Natural gas has been produced from onshore areas, primarily western New York State, for many years. Both the number of wells and production rate have increased dramatically since the early 1970's. In the past seven years (1972-1978) annual onshore production in New York State averaged 7.7 BCF. For the six-year period prior, annual production averaged 2.9 BCF. The average annual number of gas wells completed during these periods were 197 and 12, respectively. Production in 1978 was 13.9 BCF.

Major environmental concerns are the protection of fresh ground water from intrusion of brine, and contamination by other hydrocarbons which can co-occur with the gas, or by oils, greases, and other chemicals used in the drilling process. Major land use disruptions have not been a problem in western New York and previous land uses usually continue during and after gas drilling.

This trend of increased production will continue over the planning period due to several factors:

i. NGPA of 1978, provides an incentive for increased production in New York State. This is evidenced by a drilling program announced recently by Columbia Gas Transmission Company—the Pennsylvania-New York (PENNY) program. Under this program, a total of 3500 wells will be drilled over the next several years, about half of which will be in New York State. Approximately 550 wells are expected to be drilled this year. production is expected to reach 60 MMCF/day by 1985. Half a million acres are involved and over 500 miles of new pipe must be installed in New York and Pennsylvania to deliver the gas to market.

ii. Development of the Devonian shale resources in New York State should result from recently announced DOE programs to spur unconventional gas resources. While the portion of the potential United States Devonian shale supply that underlies New York State is small; the Devonian shale resource base for all states is very large, estimated at 600 TCF.

iii. The encouragement of unitization of as reservoirs. For each reservoir, maximum gas recoverability will result from careful planning in the placement (spacing) of wells. However, a given gas field may underlie a large area involving many royalty owners. Individual development efforts resulting in disproportionate well spacing over the field can upset the formation, decreasing ultimate recoverability. Unitization is a process whereby the limits of a reservoir are established and well spacing and field development are approached in a cohesive fashion so as to maximize production. Implementation of unitization by DEC can increase New York State production and such a policy should be pursued.

b. Offshore Lake Erie

New York offshore Lake Erie resources total 146 BCF. This represents about 14.6 percent of total resources (1000 BCF) under Lake Erie waters.[Ohio—66 percent and Pennsylvania—18.8 percent.] DEC expects to open bidding on the State's portion of Lake Erie in 1980. Drilling is expected to commence between spring and fall in 1981. The Canadian experience has been good in Lake Erie with an average 65 percent success rate, indicating a relatively low development risk. With the proper regulatory treatment, successful production can be rapidly developed. Physical restraints such as the availability of drilling rigs may, however, be a problem.

The production of natural gas from the portion of Lake Erie formations underlying New York has been evaluated by DEC and does not seem to be significantly constrained for environmental reasons.

In summary, the estimated contribution to U.S. supplies from New York indigenous resources is shown in Figure V-D-12 below. The total contribution equals about 2.6 percent of New York total requirements in 1980, but will grow steadily to about 4.2 percent in 1994—a significant amount.

G. Issues and Directions

Planning strategies to assure long-term gas supplies on a

FIGURE V-D-12

CONTRIBUTION TO U.S. GAS SUPPLY FROM N.Y.S. INDIGENOUS RESOURCES (BCF/yr)

Year	Onshore Production	Lake Erie Production	Total
1980	16.2	.3	16.5
1984	21.0	2.3	23.7
1989	22.9	4.9	27.8
1994	23.5	7.5	31.0

[17]1975 dollars.

regional or state basis must rest upon the foundation of National Policy. The gas industry is in a state of transition—moving towards diversified supply sources. This movement, however, has been impeded by changing federal energy philosophies and the resulting dismissal of a number of potential supply source projects.

Natural gas is not only the largest domestically produced fossil fuel, it is also the premium fuel. The environmental benefits of its use will bear more firmly on demand for this product in the future.

Domestic production currently accounts for about 94 percent of the U.S. supply. While the future of domestic production under the National Gas Policy Act of 1978 is uncertain, the prevailing wisdom is that this source of supply will decline in the future. However, many new potential sources are on the horizon to bolster the industry. These sources are divided into two categories as follows:

1) Near Term Potential Sources

- Mexico—with construction of a mere 90-mile pipeline, .73 TCF/yr can be delivered to the U.S. by 1982, some 4 percent of present U.S. requirements.
- Canada—Yearly imports can be increased from the current .9 TCF/yr to 1.3 TCF/yr in 1984.
- Alaska—Construction of a major pipeline is required, but gas deliveries will have growing significance by 1989 when up to .87 TCF/yr is expected.
- LNG—Imports can increase without construction of major new facilities in the immediate future, as many plants were designed so that additional storage can be added. LNG could contribute up to 1.3 TCF/yr by 1984.

All of these possibilities require agreements with foreign governments, U.S. federal approvals and pricing agreements (Alaskan gas will be priced rolled in pursuant to the NGPA). Assuming that the southern leg of the Alaskan pipeline is completed by 1985, these sources could contribute a combined total of nearly 4 TCF/yr to U.S. supplies.

There are those who are skeptical about increased dependency on imports. Yet the U.S. is currently nearly self-sufficient in natural gas production, and if Energy Office projections are realized, the U.S. would still be over 82 percent self-reliant in 15 years. By comparison, the U.S. is currently dependent on imports for nearly half of its oil consumption. Use of these energy forms and importation policies need to be balanced.

2) Long-Term Potential Sources

- Coal Gasification—Phase I Technology is being demonstrated and provides the opportunity to refine and develop a second generation process likely to yield a more competitive product at substantial volumes toward the end of, and beyond, the planning period.
- New Technologies—Western tight sands, Devonian shales, geopressurized aquifiers, and coalbed methane combined, represent a tremendous resource base. Economic and technological development is needed.
- Biomass—Can produce a low-BTU gas with limited applications. Improvements in both production and use of this gas-source can back out other,non-renewable fuel sources.

It is apparent that certain supply strategies fall in the unproven category—Devonian shale, high-BTU coal gasification, geopressured methane, etc. Clearly, two aspects of these programs must be considered when one reviews the financing of such projects: first, substantial research and development funds are needed to bring these supply sources on stream; second, private financing appears to be very expensive at best, especially considering the return on equity and other debt guarantees necessary. This problem can be alleviated if the Federal government provides price and sales volume guarantees, guarantees of securities issued by firms constructing facilities, or guarantees investments through direct subsidy as it has done for other U.S. industries in the past. Such a system could be financed in whole or in part by the federal windfall profits tax on oil companies.

As indicated herein, U.S. dependence on imported and frontier supplies will increase by 1990. Beyond that, frontier supply becomes critical if the gas industry is to survive. Ten years of planning time has elapsed during which conventional gas supplies have diminished and New York's dependence on imported oil has passed the critical stage; New York must support financing programs that provide public and private funds for R&D prototype plants and full-scale operations to ensure supplemental gas supplies in 1985 and beyond.

Policies affecting natural gas end-use must be carefully evaluated and balanced. Recognition of the environmental benefits of using gas in certain applications, discouraging gas use in others, and directing natural gas growth patterns, must be carefully coordinated with conservation efforts and policies affecting other energy forms. Additionally, a long-term natural gas sales policy must be developed to stimulate interfuel competition, maximize the in place delivery system, and ensure proper load balancing of natural gas distribution systems.

3. RECOMMENDED ACTIONS

- The New York Gas Group (NYGAS) member companies should from a consortium, possibly in combination with gas utilities in the greater New York-New Enqland area, to pursue acquisition of additional economic gas supplies, including Canadian gas. Competition with interstate pipelines serving New York for the same source of gas should, however, be avoided.

Significant new gas reserves have been found in Canada including frontier areas such as Melville Island. The lack of an adequate transportation system is one obstacle to delivering this gas to market. Another is the lack of confidence that a market exists. An LNG mode is being proposed for delivery of the frontier gas to St. John or the St. Lawrence River area where the gas would be vaporized and transported to the U.S. via pipeline. Additionally, a surplus of gas from conventional sources exists in Canada. As a result, development of these frontier areas, as well as further exploration for additional reserves, is demand-constrained. A blend of gas from different sources (i.e., conventional, high Arctic, polar gas) could be an economically acceptable and reliable supply source by about 1984. A major new market would provide Canada with the incentive to develop these sources and encourage further exploration. However, if supplies are to be secured by 1984, initial agreements with Canadian suppliers must be consummated by 1981. The northeast area represents the closest market to the proposed delivery points for LNG and already has existing supply connections to the Trans-Canadian pipeline.

- NYGAS, the State Energy Office (SEO) and Department of Public Service (DPS) should study the feasibility and desirability of, and if appropriate, develop a proposal to DOE for establishment of a strategic gas reserve. Its report should be submitted to the Board within 9 months of final approval of this plan.

Gas deliverability problems could recur. Similarly, an oil embargo could cause an oil crisis. The feasibility of developing a strategic gas reserve should be studied by NYGAS and the Energy Office as a means of ensuring against severe economic losses in the event of a crisis affecting either fuel.

Depending on the method of financing, a strategic natural gas reserve can be less costly, on a BTU basis, than storing oil. This is not to say that the strategic petroleum concept should be abandoned in favor of natural gas which can only partially replace petroleum in the marketplace. However, supplementing the strategic petroleum reserve with natural gas would in effect make the U.S. energy reserve a dual-fuel operation. This would benefit consumers of both fuels, protect jobs, and prevent economic loss in the event of a shortage of either fuel. SEO, NYGAS and DPS should carefully evaluate the development of a strategic gas reserve for New York State including costs, financing, oil displacement potential, and gas reserve potential.

Upon conclusion of the study, if warranted, a strategic gas reserve project proposal should be presented to DOE for funding consideration.

- Natural gas in New York should be priced to consumers in a manner that will (1) encourage New York consumers to rely on natural gas instead of oil in markets where use of gas is an economic alternative to imported oil; (2) encourage efficient use of gas by all gas consumers; and, (3) advance the policies and objectives of this plan.

Pricing may be far more determinative of the extent of interfuel competition than any other factor. This plan seeks to reduce New York State's reliance on oil, and therefore, pricing of gas supplies and supplemental gas supplies in particular, must, consider the interplay between price and consumption of alternative fuels and promote the pattern and extent of gas usage sought by this plan. Pricing schemes which will impede the expanded use of gas must be avoided because of the overriding need to reduce the State's oil dependency.

- Gas supplies should be acquired by New York gas distribution companies or interstate pipelines serving New York: they can be delivered to New York markets at a price that will be equal to or less than the delivered price of imported oil; or (2) whenever it is demonstrated that acquisition is in the public interest. Gas rates should be designed, consistent with the pricing policy expressed above to maximize the use of such gas.

Pricing policy and acquisition policy are closely related. Since gas and oil are directly-substitutable fuels in many applications and markets, the appropriateness of acquiring future gas supplies can be judged in reference to the price of oil. While this may raise rates to existing gas customers in the short-term, it will be in the State's long term best interest because it will both decrease oil dependence and spread the fixed cost of owning and operating the gas systems over a larger sales base as supplies are augmented.

Further, new sources of gas which cost more than oil may be beneficial to a particular region in the State when the interest of all energy consumers in the region are considered and all factors (i.e., job impacts, environmental impacts, security of supply, etc.) are considered. Thus, the application of a benefit-cost test is the only way to determine whether acquiring a new source of gas which is more expensive than oil is advisable.

- NYGAS, SEO, and the DPS should study and report on the potential for expanding gas facilities, especially into areas not presently served with gas. This report should be submitted to the Board within 12 months of final approval of this plan.

Increased availability of natural gas, greater interfuel competition, and pursuit of markets with load balancing potential will result from carefully planned expansion of gas facilities. In general, this will benefit consumers, increase choices of fuel types, and in the long-run, hold down price. Therefore, the potential long-run effects on all energy consumers must be the criterion for gauging the customer impacts of such market expansion.

- Any load attachment, curtailment or gas supply related expansion project proposed to be undertaken by a gas corporation should be ruled upon by the Public Service Commission (PSC) in a manner consistent with the policies and objectives of this plan.

This will assure that increased gas supplies are obtained and increased gas load attached in a manner that will insure the achievement of the primary objective of this plan—to decrease oil dependance.

- Utilities should be allowed to promote conversion from oil to natural gas so long as existing and projected supplies are adequate to meet existing and projected demand.

This simply would assure that all undue impediments to increased gas use are eliminated.

- Establish an intergovernmental task force under Energy Office leadership to coordinate government sector conversion from imported oil to natural gas.

Recent rules issued by FERC and ERA make direct purchase of gas by certain end-users possible. Oil consumption in New York State-owned facilities is in excess of 2 million barrels per year. Conversion and direct purchase of gas should be aggressively pursued in such facilities. SEO should assist New York State and other governmental users in determining if they qualify and in filing required applications.

SEO should also encourage the displacement of oil in the governmental sector by coordinating and encouraging the use of gas from renewable resources, as well as low and medium-BTU gas from coal.

- The New York State Energy Research and Development Authority (NYSERDA) and NYGAS should study and report on research and development expenditures needed to encourage commercialization of more efficient gas technologies and appliances, including the pulse combustion furnace. This report should be submitted to the Board within six months of final approval of this plan.

One of the more promising concepts for improved furnace efficiency is the pulse combustion furnace being developed by GRI and jointly sponsored by DOE. Steady State efficiencies in the 90-95 precent range have been obtained in laboratory testing. Additionally, since the pulse combustion furnace does not require a conventional chimney, flue losses are virtually eliminated. Commercialization of the pulse combustion furnace can result in fuel savings of up to 30 percent over the existing stock of conventional furnaces. New York gas companies should fully support commercialization of this furnace, as it represents a unique opportunity to save energy. These demonstration projects should be jointly sponsored by NYSERDA and NYGAS.

- New York State, through its Congressional Delegation and through agency intervention, should promote the following federal actions to improve U.S. natural gas supplies;

  . . . Expeditious development of a reasonable and comprehensive North American gas policy that will facil-

supplies. Other strategies also are available to the federal government:

- Expand the size of the national Strategic Petroleum Reserve and establish a Regional Petroleum Reserve for residual type oil in the northeast;
- Develop a policy that favors crude oil and petroleum product imports from more secure North American countries; and
- Expedite the siting and construction of west-to-east crude oil transport routes to deliver Alaskan oil and other new crude to inland and Gulf Coast refineries.

New York State energy policy cannot directly effect adequacy of petroleum supplies. State planning, however, can increase the flexibility of the State to respond to a wide range of unfavorable contingencies and minimize the economic burden on New Yorkers. Planning should include:

- An evaluation of extending the Colonial and Buckeye Pipelines to the Albany region. Compared to other transportation modes, pipeline shipments of petroleum products generally are less costly and less likely to be disrupted by accidents, weather conditions, and labor disputes; and
- State programs to meet the needs of petroleum users affected by supply dislocation, market withdrawals of major oil suppliers, and other emergencies.

The following sections describe national and State historical petroleum supply and price trends and explain the institutional structure of the oil industry, the growth of the OPEC cartel, the petroleum distribution system serving New York markets, and the outlook for conventional and nonconventional petroleum supplies in the forecast period. The recommendations that follow are intended to increase availability of worldwide oil, diversify the sources of oil available to the United States, diminish OPEC's power to set oil price and supply levels, and reduce the State's economic vulnerability to sudden interruptions in petroleum supplies.

2. *BACKGROUND*

A. History

1) United States Supply Trends

Before 1940, the United States produced more oil than it used; therefore, it exported crude oil and refined products. By the 1940's, however, the country had become a crude oil importing nation, and by 1950 it imported more refined products than it exported (see Figure V-E-2). Combined imports of crude oil and petroleum products doubled by 1960 and again by 1970. This rapid increase in volumes of imported oil occurred despite steadily expanding domestic production through 1970.

Domestic crude oil production declined in the 1970's and imports from foreign sources escalated even faster than in the previous decades. Total imports nearly tripled in a seven-year period (1970-1977). Only after deliveries of Alaskan crude oil arrived at domestic refineries, starting in late 1977, was the trend of increasing dependence on imports temporarily reversed. Imports have increased from 36 percent of total national supply in 1973 to 44 percent in 1978. The major sources of foreign crude oil (as shown in Figure V-E-3) are those Persian Gulf and North African nations which produce low to medium sulfur content oil. Imported products, principally residual fuel, come primarily from Central American and Caribbean refiners.

During 1973-1979, the group of countries supplying the bulk of this foreign oil became a less reliable source of petroleum because of their OPEC membership, dependence on OPEC crude oil, or their susceptibility to political and social unrest.

FIGURE V-E-2
PETROLEUM SUPPLY AND DEMAND BALANCES
1950-1978
(MMBBL)

	TOTAL* PRODUCTION		REFINED PETROLEUM PRODUCTS CONSUMPTION				TOTAL EXPORTS		TOTAL IMPORTS	
			Total		(%) Total Energy					
	U.S.	NYS	U.S.	NYS	U.S.**	NYS	U.S.	NYS	U.S.	NYS
1940	1353.2	NA	1334.0	NA	NA	NA	19.0 (net)	NA	-	NA
1950	2157.1	NA	2357.0	NA	39.6	NA	113.15	NA	310.35	NA
1960	2905.4	NA	3586.0	276.4	45.2	55.2	73.0	NA	664.3	NA
1970	4124.5	1.2	5364.0	458.3	44.2	61.0	94.9	NA	1248.3	NA
1973	3996.7	1.0	6317.0	483.8	46.7	65.3	84.3	NA	2248.9	301.9
1975	3653.6	0.9	5958.0	432.6	46.3	64.8	76.65	NA	2211.9	258.7
1977	3598.9	0.8	6727.0	462.2	48.6	65.6	87.6	NA	3215.6	324.5
1978	3733.9	0.8	6838.0	475.0	48.4	66.3	120.45	NA	2989.3	328.1

* Total Production includes: crude oil, natural gas plant liquids, lease condensate (generally blended with crude oil for refining, consists of pentanes and heavier hydrocarbons).

** U.S. total energy includes coal used for coking and "other petroleum" used in the industrial sector.

SOURCE: U.S. Data — Annual Report to Congress 1978—U.S. Department of Energy, Energy Information Administration.
— 1940 information, Petroleum Encyclopedia, American Petroleum Institute.
NYS Data — New York State Energy Consumption and Supply Statistics, 1960-77, State Energy Office.

FIGURE V-E-3

IMPORTS OF PETROLEUM PRODUCTS AND CRUDE OIL 1977 (% of total imports)

Country	Crude Oil (U.S.)	Country	Refined Petroleum Products (U.S)	(NYS)
Saudi Arabia	20.8	Virgin Islands	21.3	24.4
Nigeria	17.1	Venezuela	20.1	24.7
Libya	10.6	Canada	10.9	2.3
Algeria	8.2	Netherlands	9.6	12.5
Iran	8.0	Bahamas	7.8	9.4
Indonesia	7.7	Trinidad	7.1	7.9

SOURCE: U.S. data—Energy Information Administration, DOE, PAD District Supply/ Demand Annual Report, 1977.
State Data—Energy Office estimates.

The rapid growth in petroleum consumption between 1950 and 1978 occurred because of its economic, environmental, and institutional advantages over other traditional energy sources. These factors included:

- Cheap and apparently dependable oil supplies from foreign sources prior to 1974 gave oil a price advantage over natural gas for residential and industrial use.
- Ease of handling and relatively favorable. burning qualities allowed oil to displace coal in large volumes in the utility, industrial, and residential sectors.
- The national ambient air quality standards established pursuant to the Clean Air Act, as amended in 1970, further discouraged coal use because of the cost of equipment necessary to comply with the Act and its regulations.
- Large users converting from coal, because of environmental restrictions, were dissuaded from opting for natural gas due to supply uncertainties.
- The growing use of the automobile demanded more gasoline.
- Expanded air travel burned increasing amounts of jet fuel.
- Trucking captured a larger share of an expanding freight transportation industry as rail freight declined, greatly increasing the demand for both gasoline and diesel fuel.

2) New York State Supply Trends

Over the years, New York consumers have been disproportionately reliant on petroleum products in general and on imported petroleum products particularly. In 1960, petroleum accounted for 55 percent of total State energy needs, compared to 45 percent nationally (see Figure V-E-2). This higher reliance in New York State was partly a result of the State's proximity to the original oil-producing regions of Pennsylvania, Ohio, and Illinois, and a lack of indigenous coal.

By 1978, petroleum's share of energy sources in New York expanded to 66 percent—compared to 48 percent nationwide. Petroleum products manufactured from foreign crude oil, either at domestic or foreign refineries, accounted for 70 percent of the State's oil supplies. This has increased from 62 percent since 1973. Nationally, 44 percent of the total oil requirement is met by foreign crude oil, an increase from 36 percent in 1973.

New York State's foreign oil dependence is equally split between direct imports of refined products and indirect imports of crude oil processed at domestic refineries and later shipped into the State. Central and South American nations supply 84 percent of the imported petroleum products. Venezuela, the Virgin Islands and Netherlands Antilles are the largest individual exporters of these fuels. North American and European nations supply 6.5 percent of the refined oil—most of it from Canada and Italy. Nearly 90 percent of the imported crude oil refined domestically and shipped to New York originates in OPEC nations. Mexico and the United Kingdom (North Sea oil)7 combined, supply approximately 5 percent. The remaining crude oil arrives in small volumes from many sources.

New York State became dependent on foreign crude oil before the rest of the nation, when oil resources from Eastern U.S. production regions began to run out. The lack of an in-place delivery system to bring crude oil from the Gulf Coast and the increasing availability of foreign crude through New York and Philadelphia harbors also hastened the State's shift to foreign oil.

New York's increasing reliance also results from conversions of electric utilities and large industrial coal-fired boilers following enactment of the Clean Air Act (see Figure V-E-4). Regulations implementing the Clean Air Act have been enforced more strictly in New York State than other areas of the country because of the urban nature of the State and its environmental awareness. As a result, residual oil replaced coal burned in utility and industrial boilers.

Unlike foreign refineries, domestic refineries were built to produce as much gasoline and distillate-type fuels as possible, at the expense of heavier products. Consequently, to satisfy the increased residual requirement on the East Coast and the general rise in petroleum demand, oil companies built foreign refineries, primarily at Caribbean locations—where construction could proceed at a quicker pace in part because of less strict environmental regulations. These circumstances have deepened the State's dependence on foreign sources of refined oil products.

3) Organization of Petroleum Exporting Countries (OPEC)

In 1959 and 1960, worldwide crude oil supplies exceeded demand. The eight largest international oil producers,[4] in an effort to stimulate consumption, lowered their overseas posted selling prices. Because royalty payments to foreign governments were based on producer posted prices, this action reduced the revenue flowing to the treasuries of the producing nations. OPEC was formed in 1960 by Saudi Arabia, Iran, Iraq, Kuwait, and Venezuela to prevent further losses of revenue.

These member nations and those that joined over the next 13 years have different forms of government, different national interests and are at different stages of development. But they do share one common bond: large oil reserves and the need for oil revenues to sustain their economic well-being. This single overriding interest has enabled the cartel to successfully control prices despite many internal disputes.

The OPEC members in the early years of the cartel generally encouraged private international companies to develop their oil industry. However, as production capacities expanded steadily, the producing nations were less able to

[4]British Petroleum (BP), Compagnie Francaise des Petroles (CFP), Exxon, Gulf, Mobil, Royal Dutch Shell, Standard Oil of California (SoCal), and Texaco.

FIGURE V-E-4

OIL-FIRED POWERPLANTS WHICH PREVIOUSLY BURNED COAL

Plant	Company	Estimated Coal Consumption (MM tons/year)	Estimated Oil Consumption	Date of Conversion**
Danskammer	Central Hudson	0.917	10,126	1970
59th Street	Consolidated Edison	0.083	914	1967
74th Street	Consolidated Edison	0.157	1,737	1967
Arthur Kill	Consolidated Edison	1.137	13,551	1972
Astoria	Consolidated Edison	2.156	23,808	1972
East River	Consolidated Edison	0.485	5,353	1969
Ravenswood	Consolidated Edison	1.380	15,238	1971
Barrett	Long Island Lighting	0.454	5,013	1968
Far Rockaway	Long Island Lighting	1.141	1,563	1958
Glenwood	Long Island Lighting	0.355	3,915	1960
Port Jefferson	Long Island Lighting	0.808	10,026	1964-66
Albany	Niagara Mohawk	0.852	9,405	1970
Oswego	Niagara Mohawk	0.242	2,667	1971
Lovett	Orange & Rockland	0.542	5,981	1974
	TOTAL	9,709	109,297	

* Incremental demand for coal calculated by assuming 6.2 MM BTU/BBL of oil and 25 MM BTU/ton of coal.

** Oil savings estimated are from an ICF memorandum to Ken Woodcock, Federal Energy Administration, October 31, 1974. However, savings were never allowed to exceed average oil consumption over the 1975-1977 period at these plants.

*** Dates of conversion obtained from Fossil Fuel Fired Power Plants in New York State Report, Department of Environmental Conservation, 1978.

SOURCE: ICF, Inc., "Analysis of New York State Coal Supply, Demand and Price: 1979-1994. July, 1979.

control prices. Realizing this, host governments, particularly in 1966 and 1974, began nationalizing private oil company operations. Now the OPEC cartel owns a large proportion of the oil reserves and exercises complete control over production rates at its own price levels.

By 1973, OPEC had added eight members and increased its share of non-Communist world production to 68 percent (see Figure V-E-5). But marker crude prices[5] until then (see Figure V-E-15) had remained relatively stable—between $1.50 and $2.60/BBL. In October, 1973, after the outbreak of the Arab-Israeli war, OPEC unilaterally raised the marker price to $5.12/BBL. A further increase to $11.65/BBL followed in

[5]Saudi Arabian light crude oil is designated as the marker crude. The price of this oil forms the basis for establishing prices for all other grades of OPEC oil, and at present, for all oil sold in the international market. Each nation adjusts the marker price for several factors, including specific gravity and sulfur content of its oil and prevailing tanker rates.

FIGURE V-E-5

CRUDE OIL PRODUCTION IN OPEC* NATIONS
1960-1978
(10^3B/D)

Year	OPEC Production			Percent of Non-Communist World
	Arab Nations	Non-Arab Nations	Total	
1950	1,028.0	2,162.0	3,363.0	35.2
1960	3,879.0	3,914.0	7,793.0	43.9
1970	13,237.0	9,344.0	22,581.0	60.8
1973	17,985.0	12,980.0	30,965.0	67.6
1974	17,674.0	13,000.0	30,675.0	68.1
1975	15,965.0	11,170.0	27,135.0	65.6
1976	18,490.0	12,165.0	30,655.0	68.3
1977	19,060.0	12,100.0	31,160.0	67.3
1978	18,590.0	11,350.0	29,940.0	64.8

* OPEC members: Arab—Kuwait, Saudi Arabia, United Arab Emirates, Algeria, Libya, Qatar, Iraq; Non-Arab—Ecuador, Venezuela, Iran, Indonesia, Gabon, Nigeria, Neutral Zone.

SOURCE: 1950 to 1970 data—International Petroleum Encyclopedia.
1973 to 1978 data—Energy Information Administration, DOE, Monthly Energy Review, April, 1979.

FIGURE V-E-6

UNITED STATES DIRECT PETROLEUM IMPORTS FROM OPEC[a], 1960-1978
(10^3 B/D)

Year	Saudi Arabia	Iran	Venezuela	Libya	Indonesia	United Arab Emirates	Algeria	Nigeria	Other OPEC[b]	Total OPEC	Arab[c] Members of OPEC
1960	*84	*34	*911	0	77	0	1	0	208	1,315	111
1961	73	61	862	0	62	0	0	0	211	1,269	134
1962	74	49	906	*18	*69	0	0	0	149	1,265	121
1963	108	63	900	19	63	0	1	0	130	1,284	146
1964	131	66	933	40	69	3	6	0	114	1,362	200
1965	158	80	995	41	63	14	9	14	102	1,476	251
1966	147	89	1,018	69	44	13	4	11	67	1,472	259
1967	92	71	938	42	66	*5	5	5	35	1,259	149
1968	74	61	886	114	73	16	6	9	64	1,303	210
1969	64	46	875	134	89	14	*2	49	61	1,334	215
1970	30	39	989	47	70	63	8	50	38	1,334	148
1971	128	112	1,020	58	112	79	15	*102	47	1,673	291
1972	190	142	960	123	164	73	92	251	68	2,063	485
1973	486	223	1,135	164	213	71	136	459	106	2,993	915
1974	461	469	979	4	300	74	190	713	88	3,280	753
1975	715	280	703	232	390	117	383	762	121	3,601	1,383
1976	1,230	299	700	453	539	254	432	1,025	134	5,066	2,424
1977	1,380	535	690	723	541	335	559	1,143	287	6,193	3,182
1978[d]	1,134	545	631	641	530	378	630	903	221	5,612	2,912

a. Organization of Petroleum Exporting Countries.
b. Includes Ecuador, Gabon, Iraq, Kuwait, and Qatar.
c. Includes Saudi Arabia, Iraq, Qatar, Libya, United Arab Emirates, Algeria, and Kuwait.
d. Preliminary.

NOTE: Includes individual country data prior to their entrance into OPEC. Asterisk indicates year identified countries joined OPEC. Data include imports for the Strategic Petroleum Reserve which began in 1977.

SOURCE: Energy Information Administration, DOE, Annual Report to Congress, 1978, Vol. 2.

December. In the space of three months the world price of oil had risen two and one-half times and demand for OPEC crude had not declined. Indeed, despite the Arab Embargo imposed against the United States and the Netherlands, this country's 1974 direct imports of OPEC petroleum surpassed the 1972 level by nearly 60 percent (see Figure V-E-6).

The economic burden of these and subsequent OPEC price increases has disproportionately impacted New York State. An estimated 70 percent of all petroleum consumed in the State originates in foreign lands, where the costs of crude oil and refined products reflect OPEC prices. Nationally, only 44 percent of all petroleum consumed is foreign oil.[6] In theory, for every dollar per barrel rise in OPEC oil prices, the nation, on average, pays 1.0 ¢/gal more for its petroleum. In New York the oil bill should increase 1.7 ¢/gal—70 percent higher than the rest of the country.

In practice this price differential, when all petroleum products are considered, is reduced to some extent by DOE crude oil pricing regulations and market forces. Indeed, OPEC's impact on gasoline prices is probably equal at both the State and national level. New York is most severely affected by the price of heating fuels; the State's direct dependence on the import market for these products is approximately double the national level. Prices of foreign refined middle distillates, including home heating oil and residual fuels, are tied to the world price of crude oil. These range between $18 and $24/BBL (contract prices). Fuels refined from domestic crudes are based on a raw material composite cost of $9.83/BBL,[7] roughly half the OPEC price. As middle distillate and residual fuels[8] are no longer regulated the higher import cost is not necessarily distributed equitably across the nation. It more commonly impacts solely on the region where these supplies are sold.

Institutional Framework

The oil industry is comprised of companies competing in the international arena to obtain crude oil from which petroleum products are refined and sold. At times, the companies form joint ventures to undertake the high-cost, high risk exploration and development necessary to produce oil from foreign oil fields or from the Outer Continental Shelf.

The domestic operations of these firms, unlike those of electric and natural gas utilities, are organized to serve large groups of states or portions of many states, rather than designated regions within a specific state. Government intervention to assure equitable distribution of available supplies at fair prices, therefore,is potentially most effective at the national level. Regulation at a State level is best applied to a State's unique interests.

[6]State percentage developed by State Energy Office; national level obtained from Energy Information Administration, DOE, Monthly Energy Review, April, 1979.
[7]Foreign crude prices based on July, 1979 OPEC levels and domestic crude prices based on March, 1979 composite wellhead costs.
[8]Price differentials between domestic and imported residual fuel is only partially offset by benefits to importers under the Entitlements Plan (see page 33).

FIGURE V-E-9
DEPARTMENT OF ENERGY ORGANIZATION AND FUNCTIONS

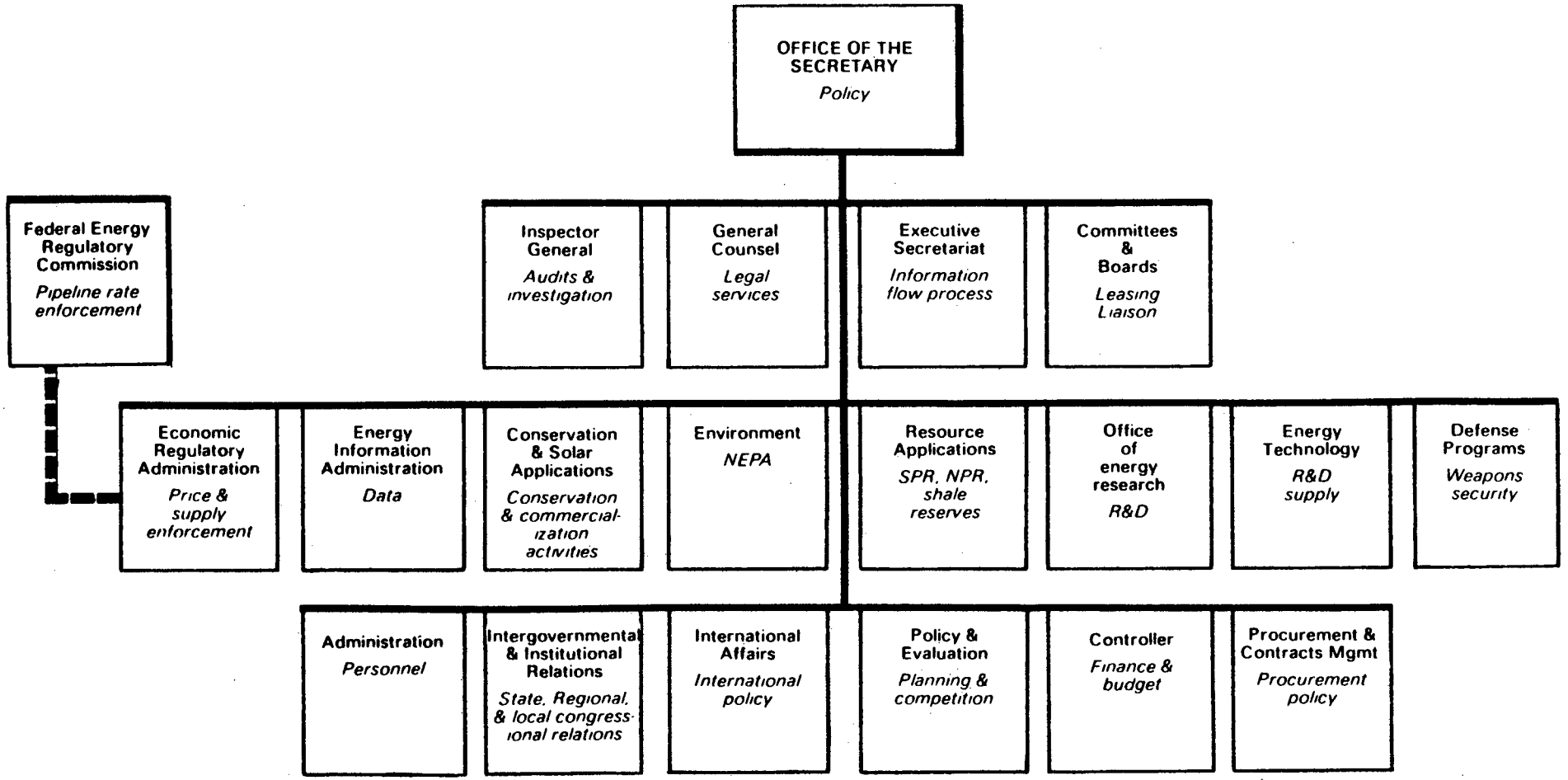
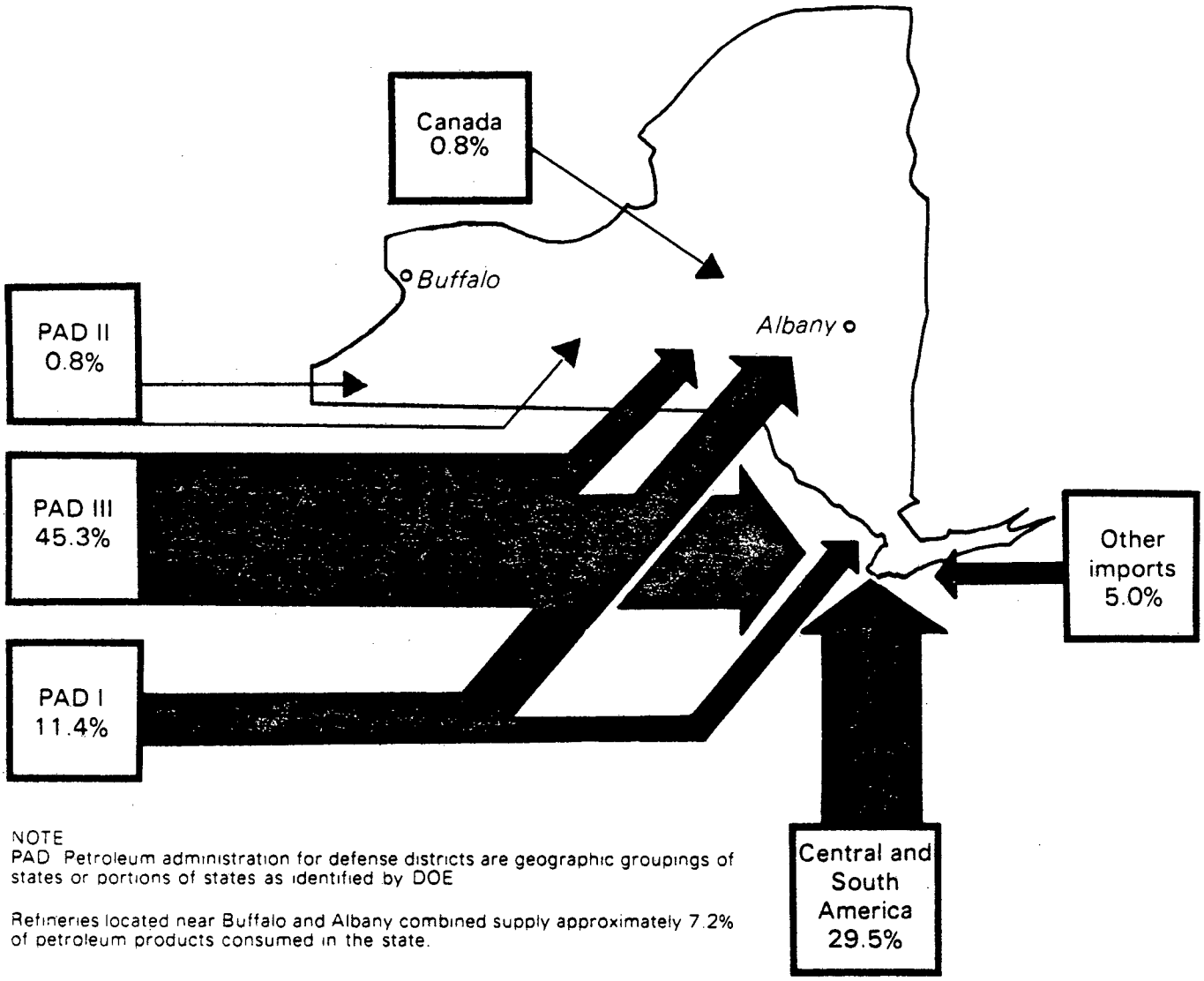


FIGURE V-E-10
FLOW OF PETROLEUM PRODUCTS INTO NEW YORK STATE BY PERCENT, 1977



NOTE
PAD Petroleum administration for defense districts are geographic groupings of states or portions of states as identified by DOE

Refineries located near Buffalo and Albany combined supply approximately 7.2% of petroleum products consumed in the state.

states (PAD I), and Canada (Figure V-E-10). Imports, however, account for the largest amount of products arriving in New York. Fuels enter through New York Harbor, Long Island ports, the St. Lawrence Seaway, and the Great Lakes by tanker and barge. Light products—gasolines, distillate oil, jet fuel, and propane—also arrive through major continental pipeline systems. Five pipelines deliver fuels throughout the State. A sixth, the Colonial pipeline, ends at Staten Island. Figure V-E-11 traces the routes of the five principal pipelines.

Once product arrives at the State's borders, it flows through an intrastate distribution system that is more extensive than any other in the Nation. This system consists of a network of pipelines, waterways, highways, and railroads (see Figure V-E-12). Terminals and storage facilities are located near major metropolitan areas and other centers of concentrated oil consumption.

Water routes, shown in Figure V-E-13, include the Barge Canal System, which is a series of canals and locks connecting the Hudson and Mohawk Rivers, Lake Champlain, and other lakes in the central region of the State. The system extends in a north/south direction from New York City to Plattsburgh and east/west from Albany to Buffalo. Short branch canals lead off the main routes into Lake Ontario and the Finger Lakes. The system does not operate during the winter, since much of it freezes or is drained.

A second water system is used to barge products from large terminals to resellers in Westchester, Bronx, Kings, Queens, Nassau, and Suffolk counties. It includes a series of inlets, the East River, the Great South Bay, Long Island Sound, and New York Harbor (see Figure V-E-13).

The State and federal highway network completes the delivery system, supplements other delivery modes, and ties into regions lacking alternative means of transportation. To move fuels over the roads, fuel distributors, major suppliers, large consumers, and truck leasing companies maintain several vehicles. These are supplemented by independent carriers.

shale located in the West. By 1994, however, coal, converted to liquid fuels, will likely account for synthetic oil products in quantities equal to these other resources.

2) Foreign Supplies

The forecast of foreign supplies incorporates the President's July, 1979, announced policy to reduce imports to 4.5 MMBBL/D below the 8.8 MMBBL/D volume of 1977. Petroleum imports are projected to decline 46 percent from 8.0 MMBBL/D in 1978 to 4.3 MMBBL/D by 1989. Over the following five years imports are held constant. Reaching these desired levels will require a moderate decline through 1984 and an accelerated decrease through 1989, because the rate of reduction must be related to the availability of substitute petroleum and non-petroleum fuels and to less use of residual oil, the nation's major product import. Both of these variables are expected to have their greatest impact after 1985.

During this period of declining imports, Canada and Mexico are projected to replace the OPEC cartel as the nation's major sources of foreign oil. This shift arises for two reasons. First, new Mexican reserve discoveries and a need for high petroleum revenues will increase Mexican crude oil production, in turn raising that country's export potential. Second, the Athabasca tar sand development in Canada, an American and Canadian joint undertaking, will reach a production level as high as 1 MMBBL/D. Some tar sand oil will reach refineries in the United States. The expected decline in OPEC imports from 70 percent in 1978 to between 12 and 16 percent in 1994 of total foreign supply represents a planned effort to disengage the national economy from the cartel's oil supply. It also reflects a general trend toward reducing petroleum use by shifting to alternative fuels and conservation. Increased production of crude oil in non-OPEC nations and the emergence of synthetic liquid fuels on a large scale also figure in this forecast. The change in imports in the "other" category reflects increases in supplies from lesser developed countries and China, and a decline in supplies mainly residual oil, from Caribbean refiners after 1984.

B. New York State Petrtoleum Demand Outlook

Null case and proposed case projections of New York State oil demand have been developed for the 1978-1994 period. Under either scenario, unfortunately,petroleum products remain the single largest source of energy in the State. The null case forecasts oil use in 1994 holding steady at the 1978 level of 1.3 MMBBL/D, but accounting for only 57.9 percent of total energy compared to 66.3 percent in 1978. The proposed case would reduce oil consumption to 1.1 MMBBL/D or 48.5 percent of the total State energy need in 1994.

1) Null Case Forecast

The null case represents a forecast of energy demand by end-use and a translation of the electric sector forecast into primary energy (see figure V-E-18). This forecast is based upon current laws, regulations and construction in progress,and does not include the actions recommended in the SEMP. Recent price increases in petroleum products are reflected in this forecast.

In the residential sector, demand for petroleum products will decrease steadily during the next 16 years. Actual consumption is projected to decline by 23.7 percent between 1978 and 1994. Real increase in home heating oil prices will accelerate conservation and encourage builders to install natural gas or electric (where gas is not available) heating systems in new dwelling units. The longer term impact of this surge in retail prices will be a major trend toward converting existing oil heated homes and apartments to natural gas and, to a lesser degree, electricity.

Industrial use of petroleum is expected to decline 5.7 percent between 1978 and 1994. Moderate economic growth through 1981, a limited number of conversions from oil to

FIGURE V-E-18
PROJECTED NEW YORK STATE PETROLEUM DEMAND
1978-1994

(Null Case)

	Volume (in TBTU's)				Percent of Total Sector Energy			
	Historic	Forecast			Historic	Forecast		
	1978	1984	1989	1994	1978	1984	1989	1994
End-Use Sectors	2111.7	1984.1	1962.1	2085.5	67.6*	63.4*	61.7*	61.2*
Residential	498.4	461.1	424.6	380.2	51.5	46.3	42.0	37.3
Commercial	395.2	388.7	397.6	432.3	58.7	56.0	55.5	55.1
Industrial	120.1	97.4	97.2	113.2	31.6	24.9	24.6	26.3
Transportation	1098.0	1036.9	1042.7	1159.8	99.3	99.0	98.8	98.9
Electric Utility	559.0	562.4	636.6	616.4	44.2	39.4	41.0	35.0
TOTAL	2670.7	2546.5	2598.7	2701.9	66.2**	61.3**	60.6**	57.9**

NOTE: 1. Refer to Appendix C for detailed discussion of the historic and forecast end use data.
2. In projecting the null case electric utility demand, the existing generation mix was assumed as modified to include: additional SEO small hydro and renewable resource generation (see Section V-C, Renewable Resources), units already under construction or approved for construction, and additional required capacity divided on an equal basis between coal and nuclear fueled facilities.

* Represents petroleum's share of energy required by end users, defined as consumption of primary energy resources plus electricity less fuel burned to generate electric power.

** Represents petroleum's share of total primary energy required in New York State.

coal, and price induced natural gas substitution will depress oil demand through 1989. Consumption will rebound slowly by 1994, as the difference between protected industrial natural gas and oil prices narrows.

Oil use in the electric utility sector will increase 10.0 percent during the 1978-1994 period. Consumption will expand steadily through 1989 because of the general growth in demand for electricity. In 1980, Oswego 6, a 850 MU capacity oil-fired generation plant, will come on line to supplement the existing capacity in meeting this increasing demand. After 1989, new coal and nuclear plants will reduce the need for oil. In 1994, utility oil use will decline 3.2 percent below the 1989 level.

Oil consumption in the commercial sector is projected to increase 9.4 percent between 1978 and 1994. Demand through 1984, however, will decline as high petroleum prices promote conservation and switching to natural gas and discourage installation of oil-fired furnaces in new construction. Petroleum consumption will increase through 1994, primarily because of the sector's economic growth. Commercial energy use over this 10-year period is projected to increase 11.2 percent.

Petroleum products will continue to dominate energy in the transportation sector. Between 1978 and 1994 petroleum consumption to transport people and freight will rise 5.6 percent, reflecting increased use of diesel oil, jet fuel and bunker fuel.[19] During 1978 through 1984, however, demand will fall 5.6 percent. New, higher efficiency vehicles coming into the statewide fleet will offset consumption due to expanded travel demands. After 1984, new vehicle performance will stay constant and further increases in travel will raise petroleum usage by 11.9 percent over the next decade.

2) Proposed Case

The proposed case forecast takes into account all recommendations (detailed in appropriate sections of the SEMP) relating to additional conservation—over the null case—renewable resource use, increased coal consumption—again, over the null case and the planned electric generation fuel mix. These recommendations have the combined potential to reduce the State's reliance on oil in 1994 to 47 percent of total energy need—approximately 19 percentage points below the 1978 volume and 11 percentage points below the null case forecast.

The greatest reduction in petroleum use will be in the electric utility sector. Overall electric utility oil requirements are expected to decline 85.5 percent between 1978 and 1994. Demand should decrease moderately through 1983 and then, decline more rapidly through 1989. Over the following years, oil consumption will remain relatively constant. Compared to the base case, the proposed case represents an 86.8 percent reduction in utility oil use by 1994.

New plants coming on line after 1984 will not burn petroleum fuels. Construction of new coal-fired plants and conversion from oil to coal will displace petroleum (primarily residual fuel) that otherwise would have been consumed for electric generation. The impact of conversion to coal and the lack of any new oil-fired plants will be especially apparent during the 1984 through 1994 period. Also, renewable energy sources, additional small hydropower, resource recovery and cogeneration, will combine to displace oil use during the 1980-1994 period.

The proposed case impacts oil demand to a lesser degree in the residential, commercial, industrial, and transportation sectors. Conservation will decrease petroleum use in all four sectors. Renewable resources, such as solar and wood, will displace oil needed for space and water heating in the residential and commercial sectors. These fuels combined with coal will reduce industry's oil requirement for space and process heat.

[19]A residual type fuel burned in large ships.

C. Significance of New York State Demand Forecasts

The availability of petroleum products for New York ultimately depends on the overall national supply level. Forecasts of U.S. oil supply indicate that, by 1994, supplies will not be adequate to satisfy the State's base case demand level. Therefore, it is critical that federal and State policies and programs be implemented to shift the State's oil requirement more in line with the proposed case.

At present, oil supplies in the U.S. and the national demand for these fuels are, at best, in a tenuous balance. For the 1978 to 1994 period, the nationwide supply of oil is projected in the low case, to decline at a 0.2 percent annual rate and, in the high case, to increase at a 0.1 percent annual rate (see Figure V-E-19). Under the null case, consumption of oil in 1994 remains at the 1978 level. Under the State's proposed case, however, demand for oil declines at a 1.7 percent annual rate. Only in this later case does the State's projected demand decrease more rapidly than supply in both the high and low national scenarios. Therefore, the recommendations contained in the SEMP to increase oil supply and decrease demand must be implemented to insure sufficient petroleum product availability to satisfy the State's needs through 1994.

4. ISSUES

The two critical issues confronting the United States are the amounts of oil imported and the dependence on OPEC nations as a source for that oil. High imports hurt the U.S. economy, because as oil imports increase, the balance of payments situation devalues the dollar, thus lessening the amount of oil and other foreign goods that can be purchased for that dollar. Therefore, greater amounts of capital leave the U.S. economic system, pushing up the price that must be charged for exports. The present U.S. economy is tied to oil, yet, federal policy has never dealt head-on with the OPEC cartel. It simply has accepted the OPEC price and then passed the resulting costs through the system. The high price that must be paid for OPEC oil is damaging the economy in still another way. The rapidly rising price of crude oil escalates all consumer prices and stimulates inflation.

With phased decontrol, the price of domestic oil will now rise to the price of world oil. These high oil prices will make alternative fuels more competitive. In 1972, the price paid for a barrel of synthetic crude was double that of imported oil.[20] Today the high world oil price is equal to the prices projected for certain substitute oils.[21] Synthetic fuels, such as those developed and processed from heavy oils, tar sands, oil shale, and coal have become, or will soon become, viable alternatives to OPEC imports.

The U.S. must also look to nearby North American nations as a way to diversify its import sources using nations whose interests are more closely aligned to ours. Canada and Mexico have oil and product surpluses beyond their internal projected demand.

At the same time, the U.S. also must expand domestic oil sources. Government regulation has overburdened the industry with inefficiencies. These regulations have caused

[20]"As Oil price Rises So Does Cost of Synthetic Crude", Spencer Rich, Washington Post, June 11, 1979, p. A-1.

[21]"Energy Economics: Financing Heavy Crude Oil Through Indexed Mortgage Bonds", Arnold Safer, First International Conference on the Future of Heavy Crude and Tar Sands, Report #88, p. 7.

institutional changes and discouraged U.S. investment. Laws and regulations designed to protect the nation have often had the opposite effect. These must be changed to permit and encourage further development. Also, the institutional changes, such as market withdrawals, will impact New York State. It is in the State's best interest to cushion the harsh effects of such changes.

Government policies, at both the federal and state levels, must recognize these problems and work in concert to solve them. Policies must also be shaped to ease the burden on the consumer. This can be done by a series of steps, which are outlined in the following section.

Timely adoption and implementation of these federal proposals are vital to commencing synthetic crude development, and to increasing domestic production both onshore and on the outer continental shelf. It is estimated that the technologies advanced by the recommendations will add approximately 6.2 to 7.4 MMBBL/D to the U.S. oil supply. In turn, these supplemental quantities alone will lower foreign imports by 36-48 percent from 1978 levels. They also will reduce the need for OPEC oil by 88-92 percent. Subsequently, New York State, which currently is most heavily reliant on foreign oil, would lower its dependence by an estimated 55 percent.

5. *RECOMMENDED ACTIONS*

A. *Federal Oil Policy Agenda*

New York State has little ability to directly influence oil availability. What leverage the State does have is best applied through active participation in national legislative and regulatory processes. Accordingly, the State must advocate at the federal level in support of policies designed to disassociate the nation's energy requirements and resulting economic well-being from insecure and excessively high-priced OPEC crude oil supplies. Specifically, New York State through its Congressional delegation, should ensure that the federal government:

- Challenges the power of OPEC to dictate worldwide oil supply and price.

The OPEC cartel has been able to replace conventional marketplace economics as the prime factor in establishing worldwide oil availability and price for two reasons. First, OPEC members account for approximately 60 percent of non-Communist world production and 60-80 percent of known recoverable crude oil reserves. Secondly, consuming nations have not developed approaches to challenging the power of the cartel. While the possibility of returning crude oil price and supply decisions entirely to the marketplace in the near term is small, a reasonable course of action to moderate the cartel's power over the longer run could include the following:

. . . Establish an extensive international and direct bilateral financing plan to accelerate exploration, development, and production of oil reserves in non-OPEC countries.

Non-OPEC developing nations currently produce only 6 percent of world oil but contain an estimated 40 percent of total prospective oil bearing geological formations. As a group, these nations are already burdened by high levels of debt and a continuing need to borrow heavily to pay for imports required to sustain present growth rates.

The oil reserves in the developing countries present a way for these nations to expand economically and a source of increased worldwide oil supplies, thus weakening OPEC. The United States can assist such nations in accessing current international sources of funding through the World Bank, International Development Association (IDA), Export-Import Bank, and United Nations development programs, to encourage oil exploration and production. Additionally, a direct bilateral assistance program of grants, loan guarantees, and technological exchange will further stimulate the search for oil, expanding global supplies.

. . . Amend present foreign income tax credit regulations to exclude OPEC production from benefit eligibility, but to allow favorable tax treatment to non-OPEC countries under a new and definitive royalty payment schedule.

The foreign tax credit was added to the U.S. Tax Code to avoid the inequities and disincentives to foreign investments by U.S. taxpayers that resulted from a domestic company having to pay taxes to two national governments. Income from oil extraction in OPEC nations should be ineligible for foreign tax credit treatment. OPEC nations have abused the procedure, as their taxing practices are not needed to assure oil production and exploration investment in OPEC countries, which by their political nature represent an insecure source of supply. Maintaining foreign tax credit eligibility on income earned from oil extraction and allowing exploration expenses as an offset against production revenues in all non-OPEC countries, would create two strong incentives for expanding and diversifying (among nations) worldwide crude

FIGURE V-E-19
COMPARISON OF PROJECTED GROWTH RATES FOR UNITED STATES PETROLEUM SUPPLY AND NEW YORK STATE PETROLEUM DEMAND
1978-1994
(PERCENT)

Case	1978-1984	1978-1989	1978-1994
U.S. Supply:			
Low	−1.0	−1.2	−0.2
High	−0.4	−1.0	+0.1
N.Y. Demand:			
Null	−0.8	−0.2	+0.1
Proposed	—	—	−1.7

Source: U.S. Supply . . . . . Figure V-E-17
N.Y. Demand . . . . Figure V-E-18

oil supplies. Revising the foreign tax credit segment of the Tax Code and formulating the definition of foreign royalty in a matter similar to the way domestic royalties are calculated, would offer a start in preventing future abuses of this procedure.

. . . Expand the Strategic Petroleum Reserve (SPR) from 1.0 billion barrels to 1.4 billion barrels. Expedite the purchasing schedule so that required storage levels are met.

Section 154 of the Energy Policy and Conservation Act of 1975, and subsequent amendments[22] directed DOE to establish a Strategic Petroleum Reserve Program to store one billion barrels of crude oil. However, Congress never authorized expanding the Reserve beyond 750 MMBBL by 1983. The intent of this legislation was to reduce the impact of interruptions in petroleum supplies or to carry out the U.S. obligations under the International Energy Agency[23]

Authorizing and requiring DOE to meet the expanded 1.4 billion barrel schedule could cushion the U.S. and, hence, New York State, for approximately one year in the event of total loss of OPEC imports.[24] A 12-month supply is necessary because many states rely heavily on residual oil as a boiler fuel in large multifamily and commercial buildings and to generate electricity. In several of these states the water systems relied upon for distribution of residual oil are usable for approximately eight months. In effect, during this limited time period, a full year's supply must be shipped through the delivery system to either end users or storage facilities. Further, the expanded reserve would be large enough to cause substantial economic losses to some countries that might impose an embargo and would better enable the U.S. to deal with the consequences of severe supply interruptions.

It is also in the U.S. interest to limit international access to these supplies in an emergency to countries having a similar in-place storage program.

As of March 31, 1979, only 82.5 MMBBL of crude had been purchased by DOE. The agency has rejected several bids for crude since January, 1979, because of the high cost of imported oil. Clearly, DOE has failed to meet even its own purchasing schedule. Problems of access to the crude stored in underground sites have also surfaced. This renders most of the 82.5 MMBBL supply unobtainable.

- Pursue an import policy that provides favorable treatment for neighboring North American nations.

Petroleum availability in Canada and crude oil reserves in Mexico exceed the needs of these countries. The United States, given its location and import requirements, emerges as the logical purchaser of excess supplies. The following actions are recommended to achieve this goal:

. . . Negotiation of an agreement with the Canadian government to make Canadian heating oil and crude exports available at prices competitive with domestic supplies.

Canadian policy to achieve energy independence and new discoveries of natural gas have combined to create a 30,000 BBL/D surplus in heating oils, equally split between distillate and residual fuels. The Canadian government also wants its refineries to retrofit to permit greater production of lighter end products— a process that will require an estimated five years. The Athabasca tar sands currently yield 50,000 BBL/D and under continued American and Canadian oil company development, are projected to attain a 1 MMBBL/D production level by the end of this century.

United States importers are discouraged from seeking product and crude oil supplies because of the present $5-$6/BBL Canadian fee on exports of petroleum. Additionally, the Canadian National Energy Board has implemented a plan to phase out crude oil exports after 1981. To promote trade that will benefit both nations, the federal government should permanently eliminate all import fees on oil products from Canada[25] and should strive through treaty or negotiation to eliminate or to reduce Canada's export stipend.

. . . Achieve a bilateral agreement with Mexico granting technical assistance in exchange for assurances that a large proportion of its crude oil output will go to the United States.

The national oil company of Mexico estimates proven crude oil reserves at 40.194 billion barrels.[26] The Mexican Government's self-imposed decision to limit annual production to no more than one-thirtieth of proved reserves is the primary constraint on extracting this oil. Therefore, present output is approximately 1.5 MMBBL/D with 500,000 BBL/D available for exports.[27]

Clearly, a bilateral agreement to exchange excess Mexican oil for American dollars and technology could benefit both nations.

- Ensure that a regional petrolem product reserve for the northeast is sited within New York State.

Section 157 of the Energy Policy and Conservation Act of 1975 requires the Strategic Petroleum Reserve Plan to site a Regional Petroleum Reserve in, or readily accessible to, each DOE region in which product imports equalled or exceeded 20 percent of the refined product demand during the preceding 24 months. For residual fuels, the northeast region exceeds this percentage by three-fold. DOE has assessed this region's reserve need at 20 MMBBL.[28] New York sites have been located studied and analyzed by a task force[29] and found to be suitable for reserve storage.

At present, if a severe petroleum product shortfall were to occur, New York would have to rely on Gulf Coast crude oil reserves to displace petroleum lost during the supply interruption. DOE analyses, to date, fail to demonstrate that Strategic Petroleum Reserve (SPR) crude oil could be moved from Gulf Coast storage sites to refineries and on to the Northeast in time to mitigate a supply disruption.

It is clearly in the best interest of New York to have nearby storage. Cargo terminals in the New York City area average

[22]*Strategic Petroleum Reserve Plan, Amendments No. 1,* "Acceleration of the Developments Schedule," Energy Action, No. 12, U.S. Department of Energy.

[23]*Strategic Petroleum Reserve Plan,* Strategic Petroleum Reserve Office, U.S. Federal Energy Administration, December 15, 1976, p. vi.

[24]Based on State Energy Master Plan 1984 forecasted OPEC import levels.

[25]Present Federal regulations require a 63¢/BBL fee for all imported refined petroleum. This fee is currently suspended until June 30, 1980. Current federal rules and regulations prohibit any subsequent waivers. Thus, by July 1, 1980, federal authority to suspend fees will lapse.

[26]U.S. Senate Committee on Energy and Natural Resources, *Mexico: The Promise and Problems of Petroleum,* March, 1979, pp. 17-18.

[27]Ibid., p. 26.

[28]*Expansion of the Strategic Petroleum Reserve, Amendment No. 2, Energy Action No. 1,*U.S. Department of Energy, Strategic Petroleum Reserve Office, March, 1978, p. 2.

[29]Comprised of the U.S. Department of Energy, the State Energy Office and the Departments of Environmental Conservation and Transportation.

4-5 days supply at any one time. The two proposed storage sites in New York State, Seneca Lake and Riverhead, would permit initial deliveries to users within 24 hours. Alternatively, DOE has determined that product stored in other East Coast locations (Virginia and Maine) could be available in 4-8 days; product stored on the Canadian East Coast would require 10-14 days to reach users; and Gulf Coast stored product could take 12-16 days, depending on weather.

- Expand domestic crude oil production and the distribution system.

The United States still possesses vast untapped resources that can supply a major portion of the petroleum products needed to preserve the Nation's economic health. The following measures will expand the domestic crude oil production and distribution system:

. . . Ensure that more federal land becomes available for oil exploration and development through appropriate regulatory actions. Ensure that regulatory agencies expedite the leasing and permit process associated with federal lands currently available for oil exploration and development activities.

An estimated 32-60 percent of all undiscovered domestic crude oil is located on the Outer Continental Shelf[30] but only 4-6 percent of this region has been leased for oil and gas exploration.[31] Despite time lags between leasing and production, these reserves can be delivered to end users well in advance of synthetic supplies dependent on new technologies (i.e., coal liquefaction, tar sands, and shale).

The Federal Elk Hills Reserves, located on the West Coast, are of premium quality. Accelerating their production would help offset California supply problems. California refiners now must blend the crude oils produced on the West Coast and much of the Alaskan supplies with low sulfur imports, primarily from Indonesia, to produce the desired product slate. Elk Hills oil is compatible with existing West Coast refinery capacity and could largely eliminate the need for importing vast quantities of foreign oil. One DOE report[32] concludes that time delays between the Department of Interior's request for resource reports on potential locations and the issuing of a lease, averages 35 to 44 months. If the site is in a new and sensitive[33] area, the delay may be extended by up to 30 months. Thus, if the program is not changed, there could be a potential six-year delay that would increase both the cost of oil when it is produced and present U.S. reliance on imports. In response to DOE production goals and the OCS Lands Act Amendments of 1978, the Department of Interior has recently issued a draft accelerated leasing program. This five-year plan, if approved, will offer new acreage and expedite exploration and development. Given the current and likely future oil supply situation, such a program must be adopted.

. . . Designating and expediting the siting of two distinct west-to-east pipelines to transport Alaskan oil from the West Coast to midcontinent and Gulf Coast refineries.

[30]U.S. DOE, Leasing Policy Development Office, *Federal Leasing and Outer Continental Shelf Energy Production Goals*, February, 1979, p. 2.

[31]American Petroleum Institute, *Energy Update: Unfinished Business*, November 27, 1978, p. 5, cites 4 percent and NEP indicates 6 percent.

[32]U.S. DOE, Leasing Policy Development Office, *Federal Leasing and Outer Continental Shelf Energy Production Goals*, February, 1979, p. 2.

[33]A sensitive area is one having a high probability of recoverable petroleum resources.

Alaskan oil, since its discovery, was considered a source of crude oil for refineries located throughout the United States, not just those on the West Coast.

At present, the TAPS line transports oil to the West Coast at 90¢/BBL. Current Alaskan production is 1.2 MMBBL/D, but only 700,000-800,000 BBL/D can be used by West Coast refineries including those in California. Tankers carry most of the rest, 300,000-400,000 BBL/D, through the Panama Canal to the Gulf Coast and East Coast at a cost of another $3.10/BBL.[34] As the transportation charges become a greater part of the selling price of the oil, the value of the oil the producers receive at the wellhead declines. This inhibits the producers from selling more to Gulf Coast refiners and from increasing overall production. Additionally, the combination of an existing surplus on the West Coast and no efficient west-to-east delivery route depresses crude prices, discourages production of California's crude supplies, and contributes to the declining interest in Alaskan exploration.

A northern pipeline route, connecting to the Lakehead Interprovincial pipeline, will better distribute the oil to refineries capable of processing it efficiently, including those in New York State. It will also bring the oil into other markets at a lower price.

A southern pipline route, would deliver Alaskan crude to Gulf Coast refineries at a lower cost and provide lower cost products to New York and other northeast states. These potential transportation cost savings will become particularly critical to refined product prices when present phased decontrol of domestic crude oil is complete and constraints to Alaskan wellhead prices are totally removed.

. . . Enacting a Federal program of grants, loan guarantees, preferential tax treatment and technical assistance to develop synthetic crude oil from non-traditional sources.

President Carter has already recognized the need for such a program. As one option, he announced plans to establish an Energy Security Corporation to accelerate development of alternative fuels, particularly synthetic oil. The major source of funds for this federal effort is the proposed industry windfall profits tax. These revenues will be supplemented with a small amount of public funds. Consequently, if Congress fails to adopt the windfall profits tax proposal, establishment of an Energy Security Corporation is seriously threatened.

To develop synthetic liquid fuels requires large amounts of capital. For example, one proposal, the Colony oil shale project, has already cost $70 million and was recently postponed.[35] To move this project into the second phase—field construction—more than $1 billion will be required. The plant, when on stream, would produce 48,000 BBL/D. To assure development of synthetic fuels in the Northeast, ENCONO financing, as discussed in SEMP Section V-I, should be adopted.

Since the Arab Embargo, synthetic crude oil costs have risen similar to OPEC oil import prices.[36] In 1972, the National Petroleum Council estimated the cost of shale oil at $7.75 to $8.25/BBL. In mid-1979, DOE priced oil from shale at $22 to $25/BBL, and oil from coal in the upper $20's/BBL. At that time, industry placed synthetic crude oil prices in the $20 to $25/BBL range. Even at these high prices, synthetic crude oils appear marginally competitive with spot market purchases from certain OPEC countries. As domestic prices rise

[34]National Energy Plan II, Section IV, pp. 11-12.

[35]Hearings before the U.S. Senate Committee on Energy and Natural Resources, February 16, 1978, "Oil Shale Technologies," p. 463.

[36]Price data represent a summary of a June 11, 1979, *Washington Post*, "As Oil Price Rises, So Does Cost of Synthetic Crude" article.

and as OPEC raises its prices again, synthetic oils could become more competitive with available traditional oil supplies. Consequently, it is essential that government financial assistance be extended to the industry in a timely manner to assist in meeting synthetic oil front end cost and expedite development of environmentally acceptable technologies.

B. State Oil Policy Agenda

Specifically, the following State actions are necessary:

- A task force consisting of the Energy Office, the Public Service Commission, the Departments of Environmental Conservation and Transportation, and a pipeline construction company representative, should be established to evaluate the economic and environmental impacts of extending the Buckeye and Colonial Pipelines to the Albany region.

The average cost per 100 barrel miles for transporting crude and products by pipeline in 1977 ranged from 2¢ to 12¢. This compares with 12¢ to 60¢ for rail shipments, 50¢ to 75¢ by truck, and 5¢ to 17¢ by barge.[37] Pipelines traditionally have environmental impacts less severe than alternatives. Further, the attractiveness of pipelines is also enhanced by their safety record. According to the National Transportation Safety Board, of the 52,154 deaths during 1977 that were related to all modes of transportation (highway, rail, marine, aviation, and pipelines) only 43 were attributed to pipeline accidents.

Shipment of petroleum through pipelines also is preferred over other transportation means because pipelines are less susceptible to supply disruptions such as severe weather conditions, labor disputes, and other transportation delays. Further, supply is generally more secure because pipeline companies often obtain throughput guarantees from shippers before constructing a line.

A feasibility study for extending both major petroleum product pipelines will be conducted. It should describe any present-day obstacles to expanding the existing pipeline network in New York State and make examination of appropriate routes, throughput potential and line size, construction costs, financing arrangements (both private and public), potential for using the line, markets within and outside the State (particularly the New England Region), and the impact on employment and revenues to the State. An assessment of the environmental impacts of constructing and operating additional lengths of pipeline must also be undertaken. Finally, if the extensions are deemed feasible and desirable, options should be identified to expedite the licensing and permit granting processes and the construction phase of such a project.

- Issue State Energy Office regulations to require petroleum product suppliers to notify the State Energy Commissioner prior to major market withdrawals.

Petroleum marketing changes in the State cause supply problems for distributors and retailers. Within the past two years, major suppliers, without prior notification to any State agency, have announced planned withdrawals from Northeast marketing areas, causing extensive confusion in the marketplace. More supplier withdrawals could disrupt supplies in the State, causing severe economic impacts in the affected localities. Prior notification would provide government an opportunity to assess the impact, develop alternative supply plans, and ease potential hardships.

[37]Association of Oil Pipelines, *Pipeline Orientation Speech—1978 AOPL Educator's Tour,* July 24, 1978, Houston, Texas.

SECTION V-F

Electricity

1. INTRODUCTION

Electric energy is unique in the overall energy supply/demand balance since it is not an energy source, but an energy form. The electric utility systems are both major consumers of primary energy resources and major suppliers of energy to end-users. In New York approximately 30 percent of the total primary energy consumed is used to generate electricity, which, in turn, supplies approximately 10 percent of final end-use consumption.

Electric *demand* is the rate at which electricity is consumed, and is measured in watts. It is generally expressed in either kilowatts (KW) or, in large systems, in megawatts (MW). Electric *energy* is the result of some electric demand existing over time and is usually expressed in kilowatt hours (KWH).

Large electric systems consist of a variety of electric generating facilities, transformers, transmission lines, local distribution facilities, and operational control and maintenance equipment.

The electric demand that must be met by any system varies considerably depending on the time of day, whether weekday or weekend day, and the season of the year.

To assure that varying demands are reliably met, provisions must be made for planned maintenance of equipment, for unplanned outages of equipment, and for the possibility of higher-than-projected demand because of temperature extremes. To assure reliability, systems are designed with a certain amount of installed generation capacity in excess of the projected peak demand. This excess capacity is called reserve margin. Reserve margins of 18-22 percent are generally considered adequate to provide generation reliability. Transmission reliability is generally provided by interconnections with neighboring systems and by installing parallel circuits to connect major load centers with generating plants.

2. OVERVIEW OF THE ELECTRIC SYSTEM IN NEW YORK

The electric system in New York State is composed of seven major investor-owned utilities, the Power Authority of the State of New York (PASNY), and 50 small municipal and cooperative systems. The seven private utility companies joined to establish the New York Power Pool (NYPP) in 1966. The Power Authority became a participating member of the Pool in 1967.

The New York Power Pool coordinates the flow of electrical energy into, out of, and throughout the State. This distribution system is to a large extent an integrated and automated system, directed by the local control centers of the individual utilities, with overall system control maintained by the Power Pool's Operational Center in Guilderland, New York. The system is monitored continuously to assure that it has adequate operating reserves of generation and transmission capacity. Central coordination of system oper-

FIGURE V-F-1
MEMBER SYSTEMS OF THE NEW YORK POWER POOL

Utility	Service Area: Square Miles	Service Area: % of Total State Area	Population	Population: % of State Total	Individual System Peak Demand — MW: Summer 1978	Individual System Peak Demand — MW: Winter 1977-78
Central Hudson Gas & Electric Corp.	2,600	5.4%	520,000	2.8%	614	618
Consolidated Edison Company of New York, Inc.	600	1.2%	8,300,000	44.0%	6,714	4,851
Long Island Lighting Co.	1,230	2.5%	2,900,000	15.3%	2,997	2,456
NYS Electric & Gas Corp.	17,000	35.1%	1,700,000	9.2%	1,729	2,034
Niagara Mohawk Power Corp.	24,000	49.6%	3,700,000	20.0%	5,002	5,284
Orange & Rockland Utilities, Inc.	1,350 (1,009 in NYS)	2.1%	438,200	2.4%	662	517
Power Authority of the State of NY					2,348	2,474
Rochester Gas & Electric Corporation	1,960	4.1%	868,000	4.6%	983	925
					TOTAL: STATE COINCIDENT PEAK DEMAND—MW*	
					20,418	18,921

* The sum of the individual system peak demands does not equal the statewide coincident peak demand due to diversity of peak demand occurrence among companies. The State system also includes the Village of Freeport and the City of Jamestown.

SOURCE: Report of Member Electric Systems of the New York Power Pool, 1979.

ations also ensures a generation mix that optimizes reliability , efficiency, and economy. In emergency or shortage situations, the control centers have procedures for load adjustment and energy conservation.

The Power Pool maintains the organizational structure by which the New York utilities participate in the Northeast Power Coordinating Council—which also includes Ontario, New Brunswick, and New England. Member companies of the Power Pool also cooperate in Research and Development (R&D) under the umbrella of the Empire State Electric Energy Research Corporation (ESEERCO). The Corporation supports research and development programs in generation, transmission, distribution,and consumption of electric power. It also helps plan and coordinate State utility R&D programs, and acts as a liaison between the New York State electric utilities and other electric utility systems, public R&D organizations, and regulatory agencies.

Figure V-F-1 presents basic demographic and peak demand information for each member system of the New York Power Pool. A map located inside the front cover of the 1979 Report of Member Electric Systems of the New York Power Pool (the Power Pool Plan) illustrates the geographic limits of the member companies of the Pool. It also pinpoints the locations of major existing and Pool proposed additions to the generation and transmission systems.

The fuel mix used to generate electricity in the State differs considerably from that of the nation. As shown in Figure V-F-2, 1978 resource requirements for electric generation are proportionately higher than the national average for oil (primarily residual) and hydro-electric,while considerably lower for coal and natural gas.

FIGURE V-F-2

ELECTRIC SECTOR RESOURCE REQUIREMENTS, 1978 (PERCENT OF TOTAL)

	NYPP	U.S.[1]
Oil	43.8%	16.5%
Coal	15.8%	44.3%
Nuclear	18.3%	12.5%
Hydroelectric	22.0%	12.7%
Natural Gas	0.1%	13.8%

[1]EIA Report on Preliminary Power Production, Fuel Consumption, and Installed Capacity Data for 1978, DOE.

Figure V-F-3 illustrates the changes in energy consumption by the electric utilities in New York from 1960-1977. Particularly significant in this illustration is the rapid decline of coal consumption in the late 60's and early 70's and the accompanying sharp increase in petroleum consumption.

A. Electricity Use

Nearly 70 percent of the end-use demand for electricity in the State originates in the residential and commercial sectors. The State's commercial/service sector demand for electricity has been increasing. Industrial demand for electricity in New York has remained fairly steady in recent years, and has even declined in some years. This trend reflects both a reduction in the level of industrial activity in the State and an increase in end-use efficiency in the industrial sector. Figure V-F-4 illustrates the pattern of electricty consump-

FIGURE V-F-3

PRIMARY ENERGY CONSUMPTION BY ELECTRIC UTILITY SECTOR NEW YORK STATE, 1960-1977

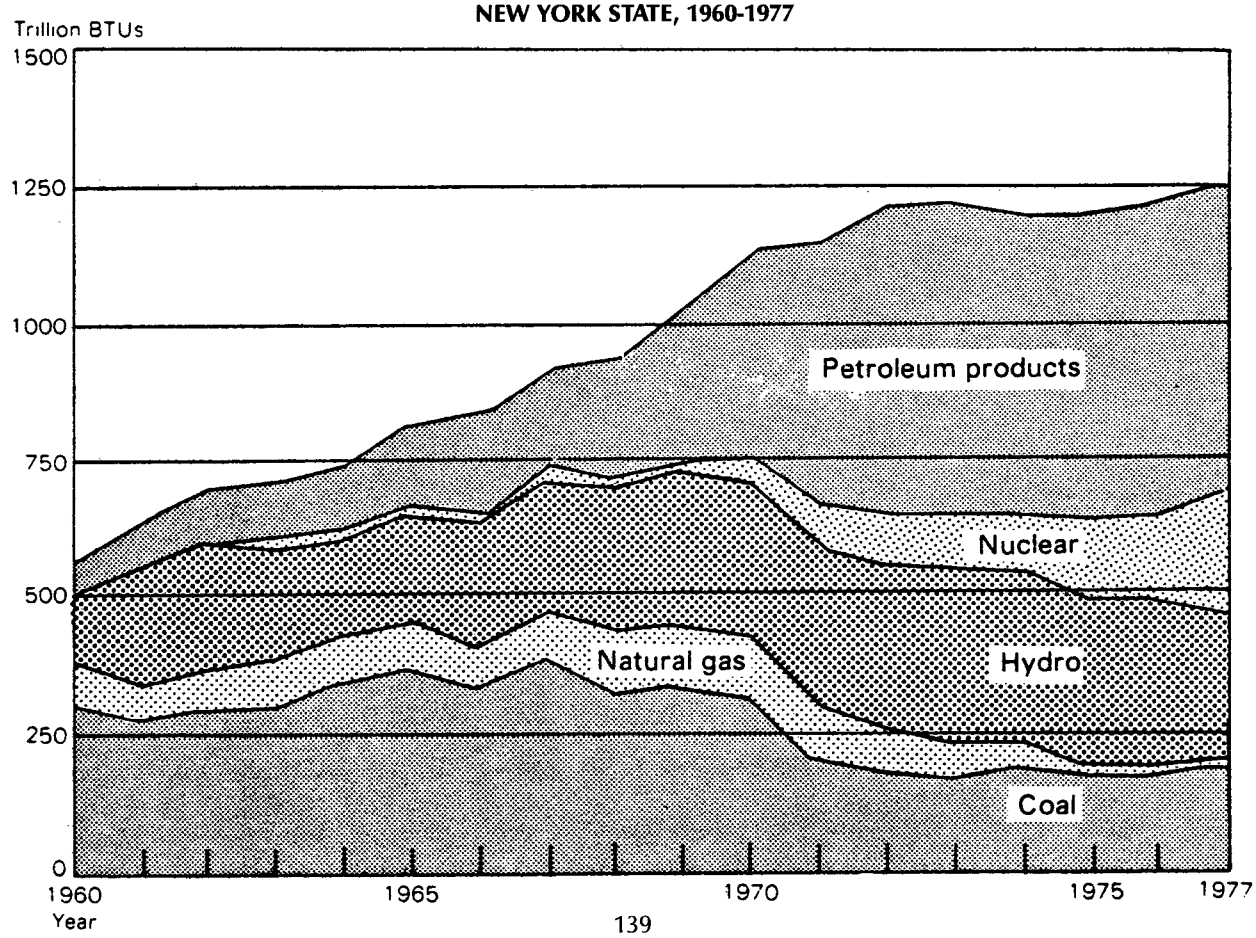
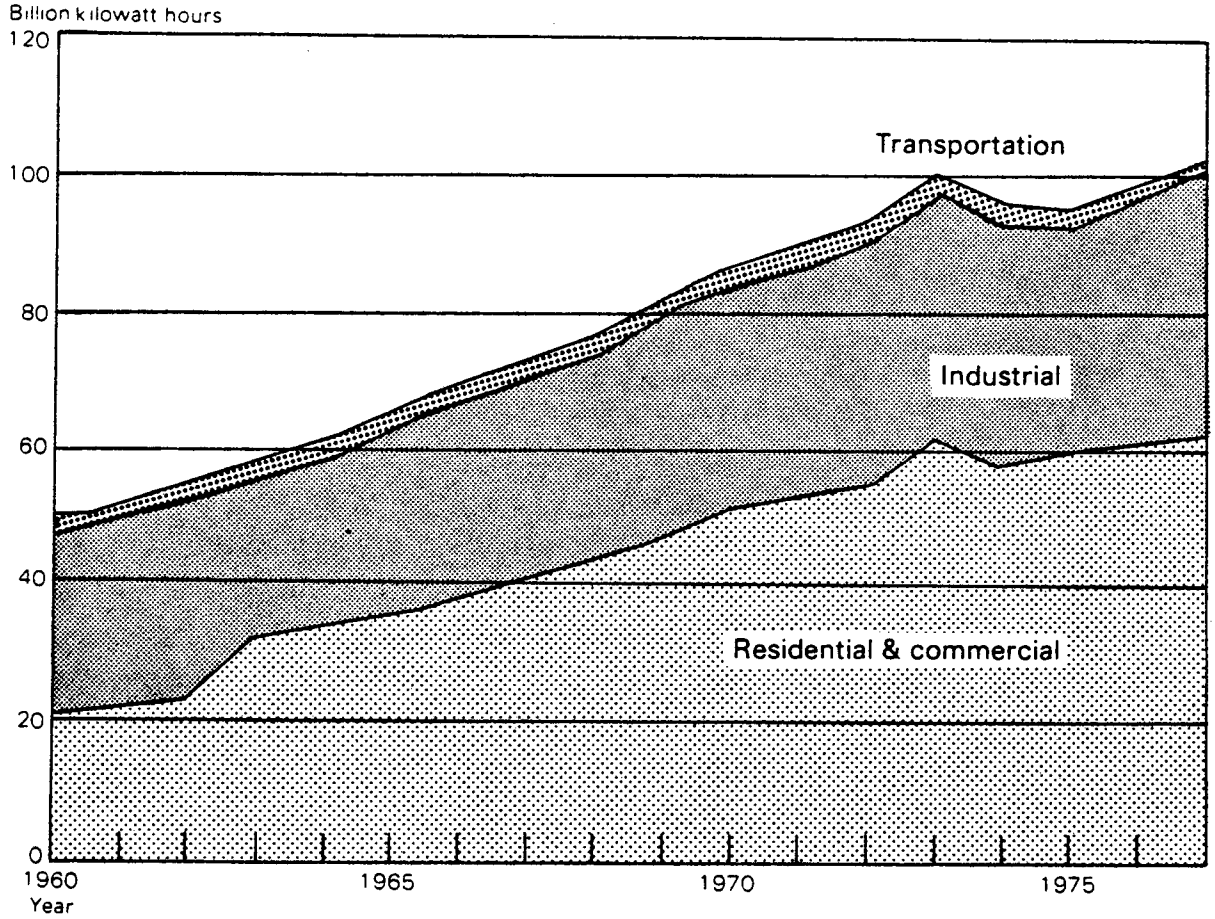


FIGURE V-F-4
ELECTRICITY SALES IN NEW YORK STATE, 1978
(MILLIONS OF KWH)

	Residential	Commercial	Industrial	Transportation	Total Sales by Company
Total New York State	32,525	46,403	28,069	4,472	111,469
Central Hudson	1,203	993	1,126	0	3,322
Con Edison	9,806	18,971	1,648	2,172	32,597
LILCO	5,559	5,403	1,312	164	12,438
NYSE&G	4,220	3,619	2,632	0	10,471
Niagara Mohawk	8,024	9,310	11,972	1	29,307
Orange & Rockland	1,081	1,061	727	0	2,869
PASNY*	930	5,163	7,134	2,135	15,362
RG&E	1,702	1,883	1,518	0	5,103
Percentage of Total Electricity Sales	29%	42%	25%	4%	

* Power Authority sales to municipal and cooperative customers were allocated to the residential, commercial, and industrial customer classifications based on the statewide percentile distribution of total sales to each of these classes. Sales to public bodies in southeast New York (SENY) were included in the commercial customer classification, with the exception of sales to the Metropolitan Transportation Authority.

FIGURE V-F-5
SALES OF ELECTRICITY BY END-USE SECTOR
NEW YORK STATE, 1960-1977



tion by sector in 1978, expressed in both millions of kilowatt-hours and as a percentage of total electricity sales, for each of the member systems of the Power Pool. Figure V-F-5 shows how this pattern has changed since 1960 and highlights the high relative growth of the residential and commercial sectors.

The New York State interconnected systems have been summer peaking since 1968. Figure V-F-6 illustrates the growth in summer and winter peak demand from 1969 through 1978. Four of the member companies experienced summer peaks in 1978; while the four remaining companies peaked during the 1977-78 winter season. (See Figure V-F-1). The historical statewide peak demand of 21,205MW occurred on July 21, 1977. Monthly peak loads for the New York interconnected system in 1978 are shown in Figure V-F-7. Hourly loads for the peak summer and winter days in 1978 are illustrated in Figure V-F-8.

B. Electricity Generation

The State's electric system includes a diversity of generating facilities. The level, and fuel mix, of generating capacity in use at any given time depends on such factors as total demand on the system, location of the demand, operating costs of each unit, transmission capabilities and costs and the need periodically to shut down generating units for maintenance. Baseload generation units are those with the lowest production costs; such units stay in continuous service except for necessary maintenance and repairs. Peak load generation units are those designed for use during periods of maximum loads and generally have relatively high production costs. Total installed capacity in the State includes 295 baseload generating units and 130 peaking units. Facilities most frequently used for baseload generation are oil and coal-fired steam turbines, nuclear reactors (both boiling water and pressurized water reactors), and conventional hydro. Peak generation units are generally diesel engines, combustion turbines and pumped storage hydro.

The following tables depict the State's electric generation mix, in terms of both installed capacity and energy generated. Figure V-F-9 lists megawatts of installed capacity for each type of plant by utility; Figure V-F-10 shows the energy generated during 1978 by method of generation and utility. It also indicates the percentage of total generation produced by each company during 1978. The data in these tables is drawn from the Power Pool Plan.

The Power Authority sells a significant part of the energy it generates to the State's private utilities, which then resell this power to retail customers. Sales of PASNY-generated electricity by the utility companies are reflected in the electricity sales data in Figure V-F-4. Figure V-F-11 shows the amount of electricity sold by PASNY to each utility in 1978 (including firm, non-firm, and Blenheim-Gilboa pumping power commitments), and the percentage of each utility's total electricity sales accounted for by electricity purchased from the Power Authority.

FIGURE V-F-6
NYPP COINCIDENT PEAK DEMAND
SUMMER/WINTER, 1969-1978

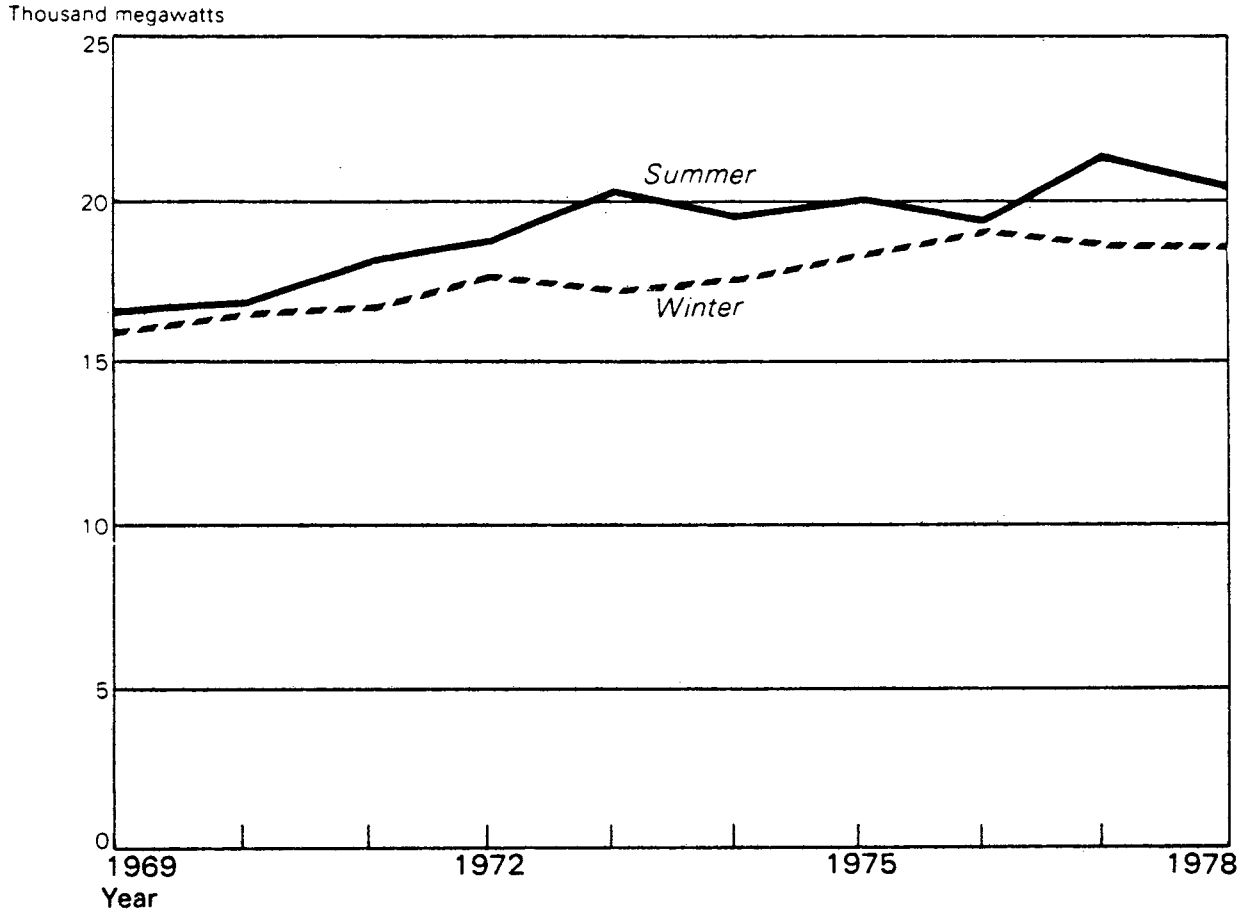
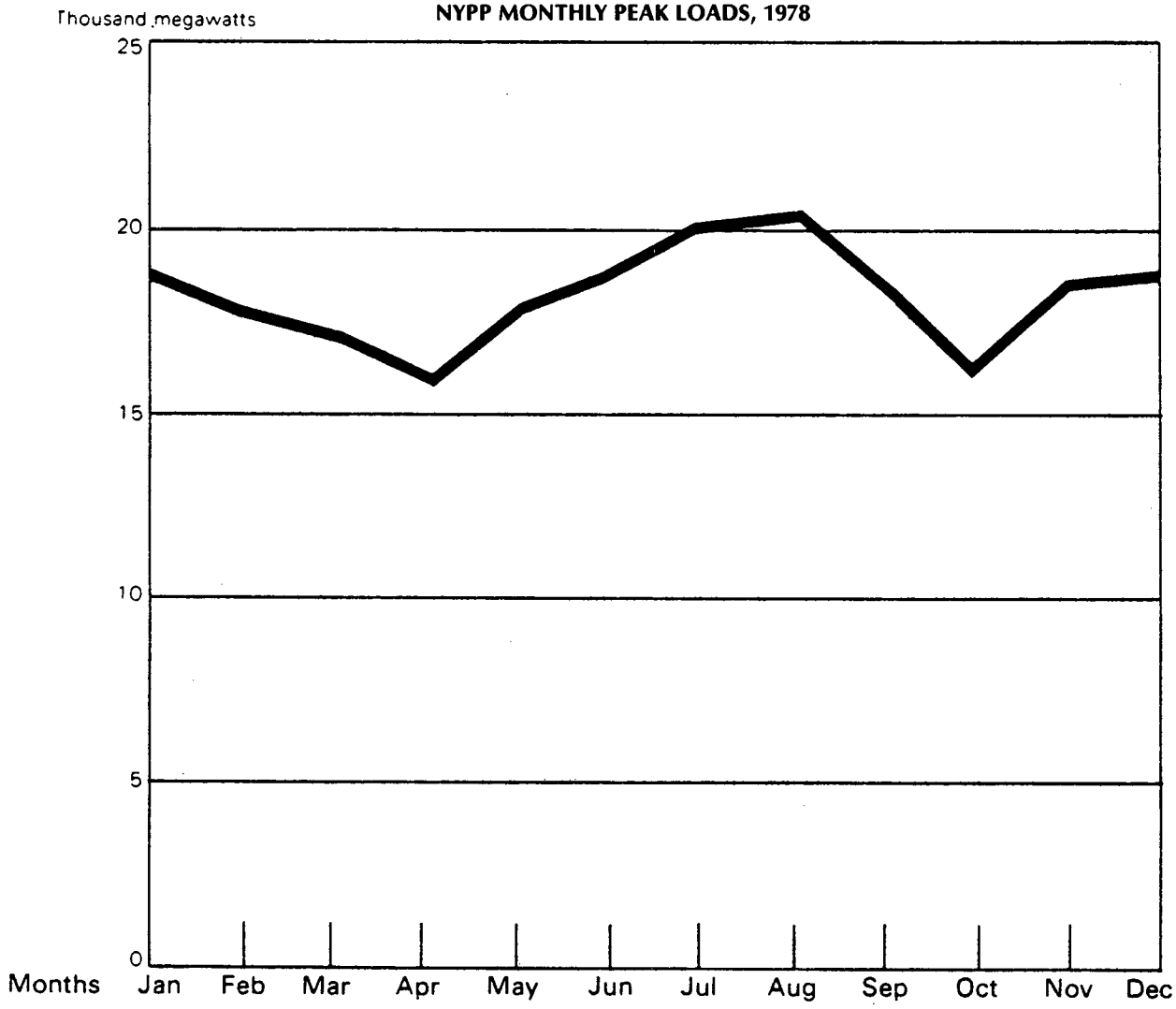


FIGURE V-F-7

NYPP MONTHLY PEAK LOADS, 1978



C. Electricity Transmission

The capability to transfer power among contiguous electric systems depends on several factors which, in turn, affect dispatch of generating units, transmission facility costs, environmental impact, and overall system reliability. These factors include load diversity, reserve capacity, and the problem of providing reliable service to low load areas on the fringes of a franchise territory.

Pooling diversified loads, as when one area experiences system peak during the summer and another during the winter, has several advantages. It means that substantially less generating capacity is required than if every system had to meet its own peak load and still allow for adequate reserve margins. Similarly, the ability to transmit a system's excess capacity over a more widespread area allows individual systems to maintain smaller emergency reserves.

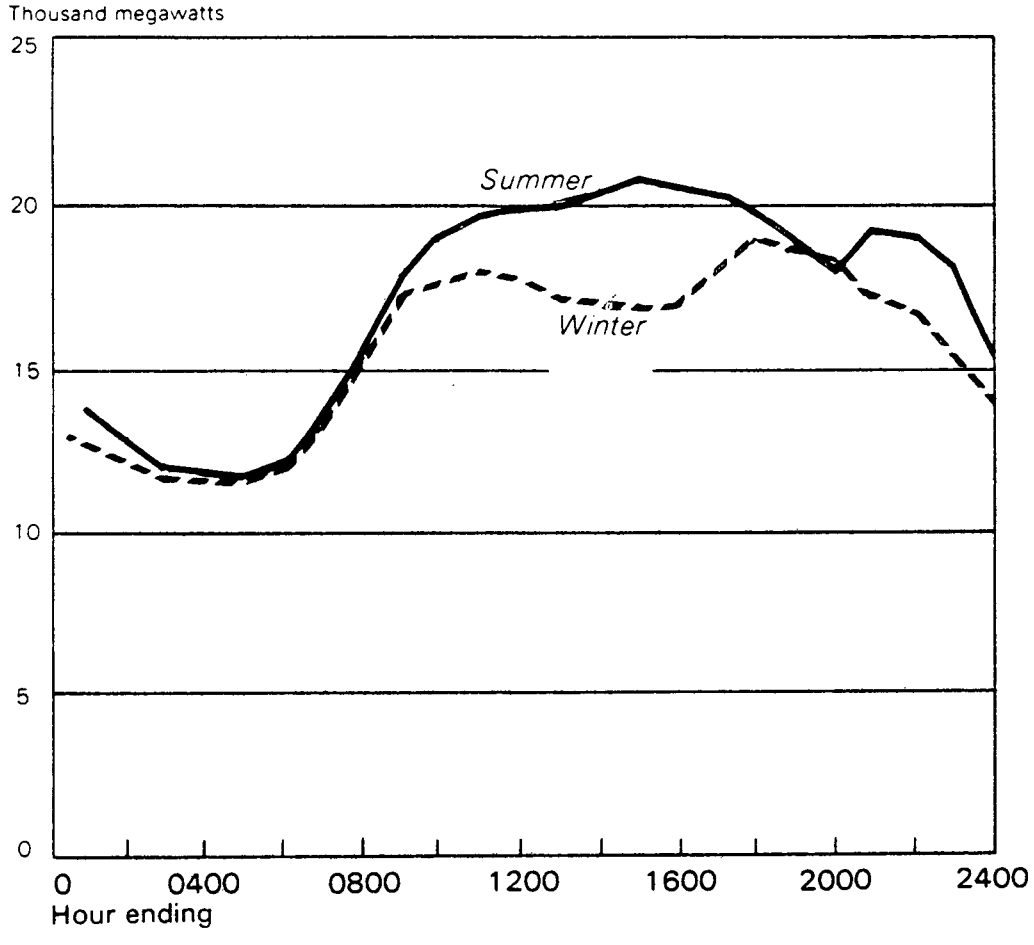
Utility companies are also faced with the problem of servicing relatively low load areas on the edges of their service territories. The low level of demand has made it difficult to justify economically the dual transmission capacity that system reliability generally demands. In such circumstances, interconnections between utility companies with adjoining service areas allows each utility to heighten system reliability with fewer economic and environmental costs.

The significance of these factors in transmission sharing applies to both intra-state and inter-pool transactions. The New York Power Pool provides the structure for coordinating transmission within the State. Initially, most interaction with out-of-state systems was carried out on a utility-to-utility basis. As pool-wide coordination by the NYPP, and by neighboring pools such as NEPOOL in New England has increased, interaction has largely been transferred to the pool level. Thus, although specific transmission facilities are owned individually or jointly by utility companies, responsibility for coordinating the actual exchange of power rests primarily with the Pool.

New York State's bulk power transmission system forms a link between major generation sources and the State's primary load centers, and allows for coordination of electric generation and transmission on a Statewide scale. It also connects the New York Power Pool with neighboring pools, thereby fostering coordination of planning and operation on a regional level.

The lowest voltages used for bulk power transmission are 115 KV and 138 KV. Generally speaking, the downstate utilities employ 138 KV transmission, and the upstate utilities use 115 KV. Power lines operated at these voltages comprise about two-thirds of the total circuit mileage of transmission facilities in the State, or nearly 6200 circuit

FIGURE V-F-8
NYPP HOURLY LOAD ON PEAK DAY
SUMMER/WINTER



miles. Facilities at 230 KV provide an additional 1075 circuit miles of transmission capacity, which are used primarily by the large upstate utilities and by the Power Authority.

The high voltage (over 230 KV) transmission system is a relatively recent development. Prior to the early 1960's, power transmission was carried out primarily within utility service areas, precluding the need for high voltage transmission capabilities. Although the New York utilities established ties with three neighboring pools (New England, Ontario Hydro, and Pennsylvania-New Jersey-Maryland) in the 1940's and 1950's, there was not a major emphasis on high voltage interconnections and inter-pool coordination. The decision in the late 1950's to construct a 345 KV transmission backbone linking the central State with the New York metropolitan area marked a significant juncture in the development of the State's present electric system. This development coincided with the enlargement of the State's transmission ties to neighboring systems.

Use of 345 KV for bulk power transmission expanded rapidly in the 1960's and 1970's to its current total of nearly 2000 circuit miles. This is supplemented by approximately 100 miles of 765 KV, which are being operated at 345 KV. Transmission facilities operating at 500 KV have not been used extensively in New York State. Con Edison's 5.39 miles of overhead line presently comprise the total 500 KV system, extending from Ramapo to the New York/New Jersey state line.

The decision to develop 765 KV transmission in New York was made in the late 1960's. The New York Power Pool determined that 765 KV transmission could assure the best balance of economy, reliability, and environmental compatibility. The first 765 KV transmission line began operating in the State in August, 1978. The line, which is owned by the Power Authority, is 134 miles long, extending from Massena to Marcy, near Utica. Another 21-mile stretch connects Massena with the Canadian border near Fort Covington. The line was built primarily to transmit hydro power purchased from Hydro Quebec.

The State's current transmission backbone, however, consists primarily of 345 KV and 230 KV power lines. It links major sources of hydro and steam generation at the northern and western rim of the State with major load centers in the Mohawk and Hudson River valleys and in the New York metropolitan region. The load centers connected by this transmission system are Buffalo, Rochester, Syracuse, Utica, Albany and Westchester/New York City. Supplementing this major transmission corridor is an east-west connection consisting of a 230 KV line extending from Buffalo to Binghamton. A 345 KV line originating in Homer City, Pennsylvania, overlays this line from Elmira to Binghamton, with exten-

FIGURE V-F-16
OPTIMIZED PLANNING PROGRAM

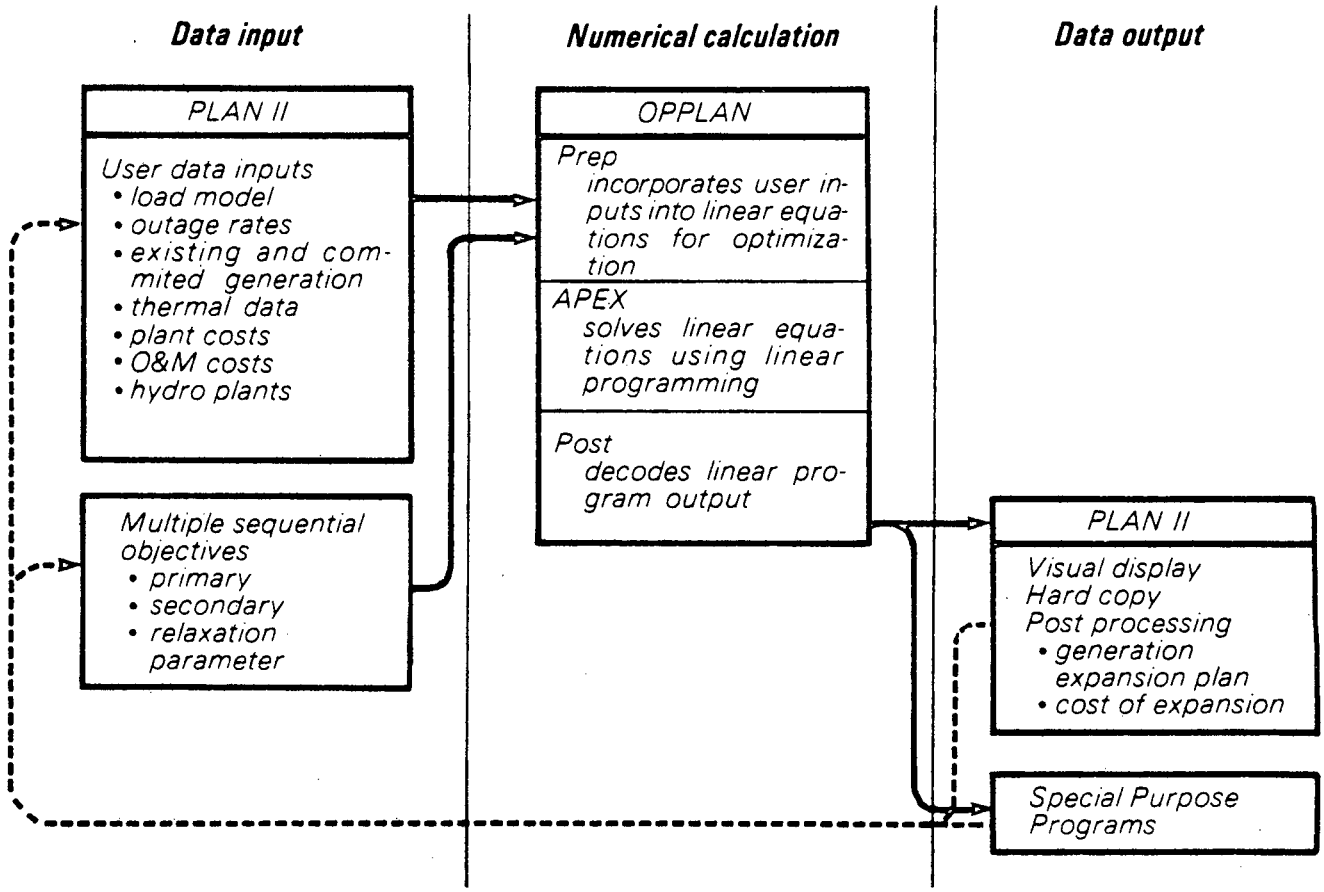


Figure V-F-3 illustrates the trend of increased oil consumption by electric utilities over the past ten years. The electric utilities in New York consumed over 89 million barrels of oil in 1978, approximately 90 percent of which was imported. In fact, over 25 percent of the State's dependence on oil imports in 1978 was the result of imported oil consumption by the State's electric utilities. An "energy strategy" which satisfies reliability criteria, but which is directed toward reducing oil dependence, is the proper objective of electric system planning in New York.

* * *

In Section IV, the development of the forecast of energy demand, by sector, end use, and fuel type is discussed.

Figure V-F-18 depicts the actual New York State interconnected systems summer peak for the years 1970-1978 and the forecast of that peak from 1979-1994. Figure V-F-19 presents the electricity sales-forecast by sector and end-use.

Figure V-F-20 shows the projected electricity sales (KWH) and peak demands (MW) for 1994, and growth rates over the 15 year forecast as utility. Statewide summer peak demand grows slower than sales, reflecting the projection that weather normalized pool-wide load factor will improve. Load factor is the ratio of average demand to peak demand on a utility system. It is projected to improve on a statewide basis as a result of load management and implementation of peak responsibility pricing. This forecast takes into account base case conservation impacts discussed in Section V-B and base case development of biomass and solar energy as discussed in Section V-C.

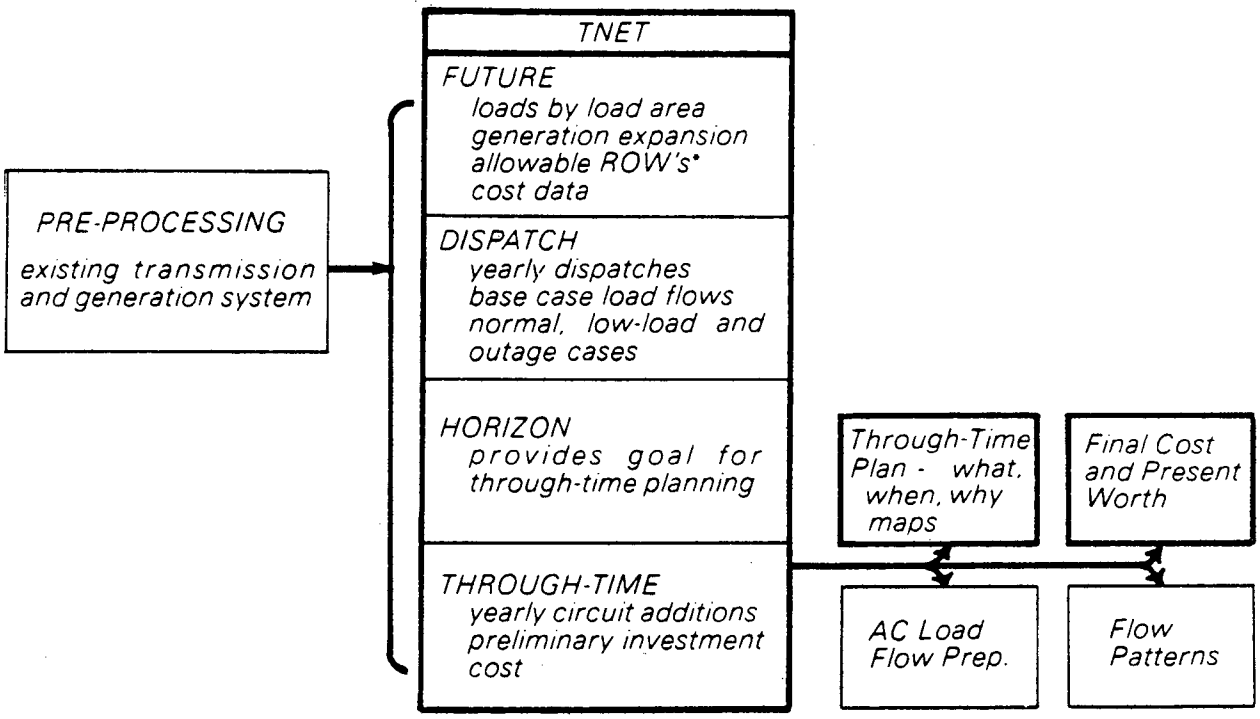
In the remainder of this section, those facilities expected to be retired or derated, and those facilities currently under construction will be discussed. This sequence of treatment will develop the amount of additional new generating capacity or additional load reduction necessary to satisfy reliability criteria for the electric generation system. Subsequently, generation and transmission plans will be presented and discussed.

A. Retirements and Deratings

As generating facilities, especially steam generating facilities, increase in age, they become less efficient and are derated. Eventually, when the costs of continued operation exceed the economic benefits, the units are retired. Conditions late in a unit's life, such as the failure of a major component, may precipitate a quick decision to retire the unit rather than repair it. However, for planning purpose, a retirement policy of 45 years for steam units is considered reasonable and has been adopted in this Plan.

The Energy Office has included, in the generation mode used in developing this Plan, the retirements contained ir the Power Pool's OGP data base plus the non-redundant specified retirements contained in the Power Pool Plan (Exhibit 4, Volume 2). This results in 1094MW of specified retirements, plus 765MW of additional retirements from the OGP data base, for a total of 1859MW retired by 1994. In arriving at this retirement projection, the Energy Office has not conducted a detailed, case-by-case, engineering anal-

FIGURE V-F-17
TRANSMISSION PLANNING (TNET)



*Right-of-Ways

FIGURE V-F-18
INTERCONNECTED SYSTEMS ELECTRIC DEMAND FORECAST
NEW YORK STATE (1979-1994)

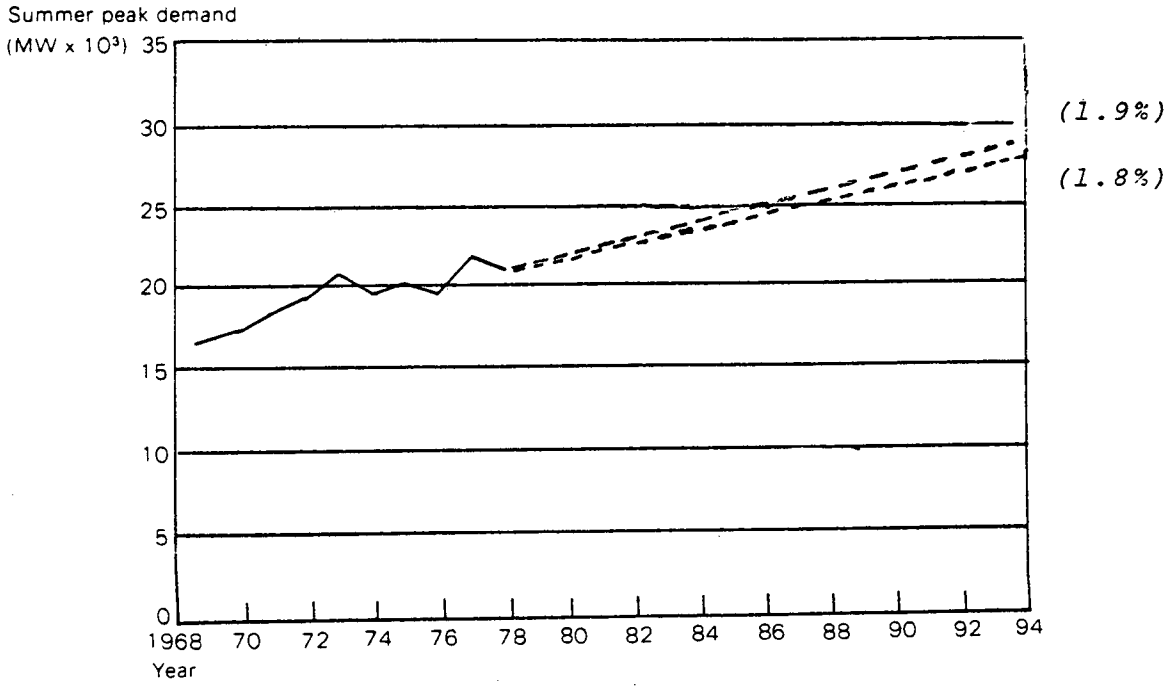


FIGURE V-F-28
ELECTRICITY GENERATED BY PRIMARY ENERGY SOURCE
NEW YORK STATE (1979-1994)

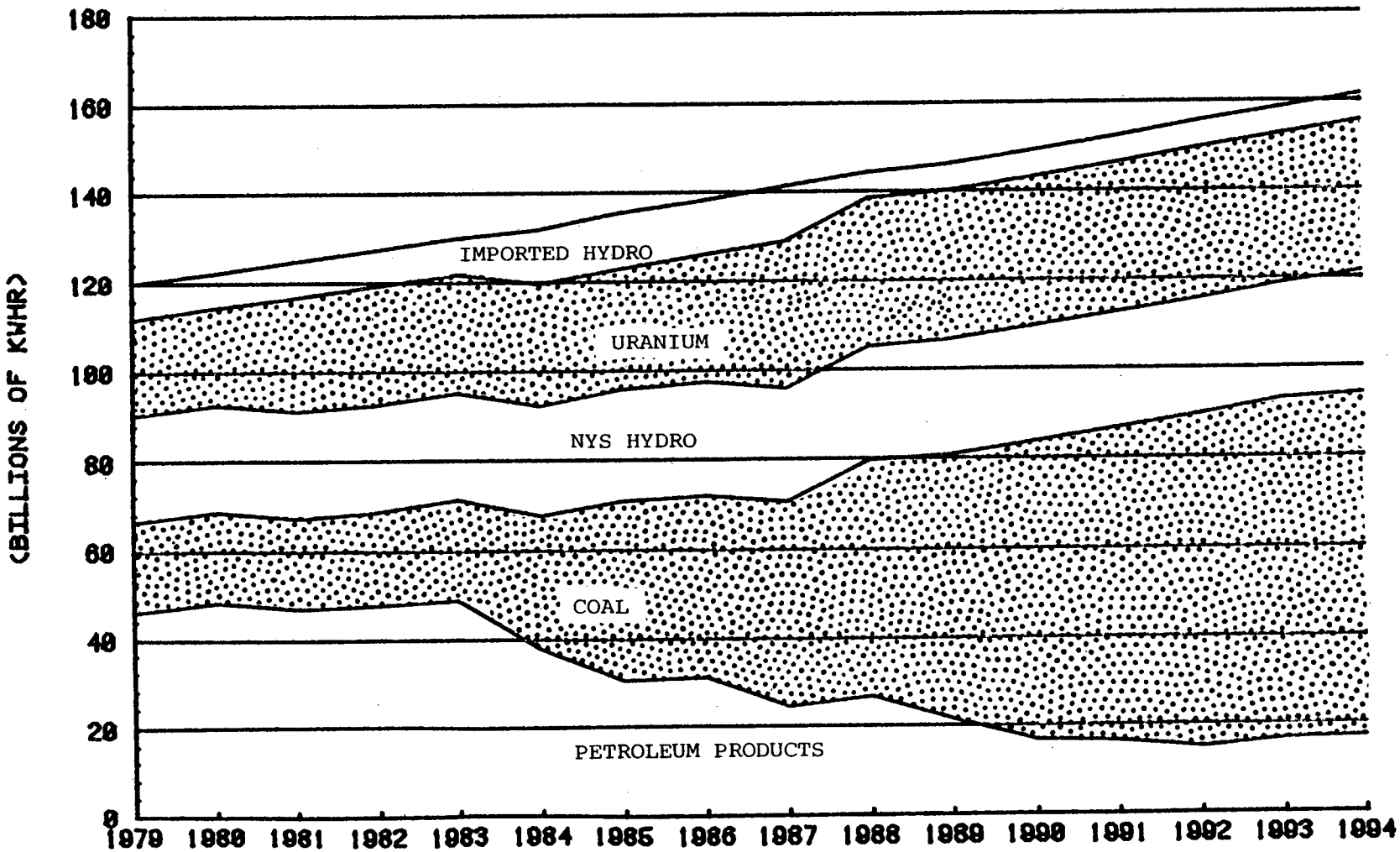


FIGURE V-F-29

IMPACT OF ELECTRIC GENERATION PLAN ON ENVIRONMENTAL RESIDUALS

	1978	1984	1994
Non-Radiological			
SO_X (10^5 tons)	5.520	5.527	6.619
NO_X (10^5 tons)	2.687	2.412	3.221
CO (10^4 tons)	1.418	1.344	1.904
Particulates (10^4 tons)	4.698	5.403	8.320
Hydrocarbons (10^3 tons)	4.953	4.573	6.180
Solid Waste—Ash[1] (10^5 tons)	8.340	17.26	44.17
Solid Waste—Sludge (10^5 tons)	— —	1.607	40.30
Solid Waste—Land Use (acres)	15.85	35.91	161.2
Thermal Rejection—Air (10^{14} Btu)	1.505	1.371	2.290
Thermal Rejection—Water (10^{14} Btu)	6.390	6.172	7.587
Radiological			
Liquid Effluents[1] (10^2 curies)	17.64	18.79	21.29
Atmospheric Gaseous[2] (10^3 curies)	67.32	69.54	82.41
Atmospheric Particulates (curies)	5.694	4.891	7.491
Low-level Waste, Volume (10^3 cubic meters)	3.817	3.646	4.829
Low-level Waste, Activity (10^4 curies)	1.618	1.548	2.046
Spent Fuel, Volume (cubic meters)	73.20	73.38	90.78
Whole Body γ Dose (10^2 Man-rem)	3.547	3.560	4.397

[1]Tritium and non-tritium.

[2]Tritium, C-14, Radioiodine, Noble Gases (Krypton-85 and others).

FIGURE V-F-30

ENVIRONMENTAL RESIDUAL FROM GENERATION OF 1000 KWH ELECTRICITY

	Fossil							
		Coal[a]			RDF-	Oil[b]		
	Wood	1	2	3	Coal	1	2	3
Water-Thermal (10^6 BTU)	6.0	5.0	4.7	5.0	5.2	5.1	4.4	-
Atmospheric								
Particulates (lbs)	.38	2.24	.3	2.3	.32	.94	.66	.6
NO_X (lbs)	7.52	7.64	5.87	7.64	5.54	7.64	2.78	8.26
SO_X (lbs)	.92	30.18	5.87	16.24	6.50	11.58	7.40	1.70
HC (lbs)	3.1	.12	.12	.12	-	.1	.1	.68
CO (lbs)	3.1	.42	.4	.42	-	.36	.32	1.88
Thermal (10^6 BTU)	- -	2.0	1.7	2.0	-	2.2	1.4	11.7
Solid Wastes								
Ash (lbs)	52.9	108.0	102.0	108.0	178.0	-	-	-
Sludge (lbs)	-	-	342.5	-	298.1	-	-	-

	Nuclear[c]		
	1	2	3
Radiological			
Liquid Effl.-Tritium & Non-H_3 (10^{-6} curies)	12.2	11.9	59.2
Low-level waste volume (10^{-4} cubic meters)	1.4	1.4	0.6
Spent Fuel Volume (10^{-6} cubic meters)	1.7	1.7	1.7
Atmospheric Gases[d] (10^{-4} curies)	10.4	10.2	19.2
Atmospheric Particulates (10^{-8} curies)	3.5	3.5	0.8
Dose—Whole Body—Population (10^{-6} Man-rem)	8.5	8.3	8.5
Thermal—Atmospheric (10^6 BTU)	6.8	-	-
—Water (10^6 BTU)	.12	6.7	6.7

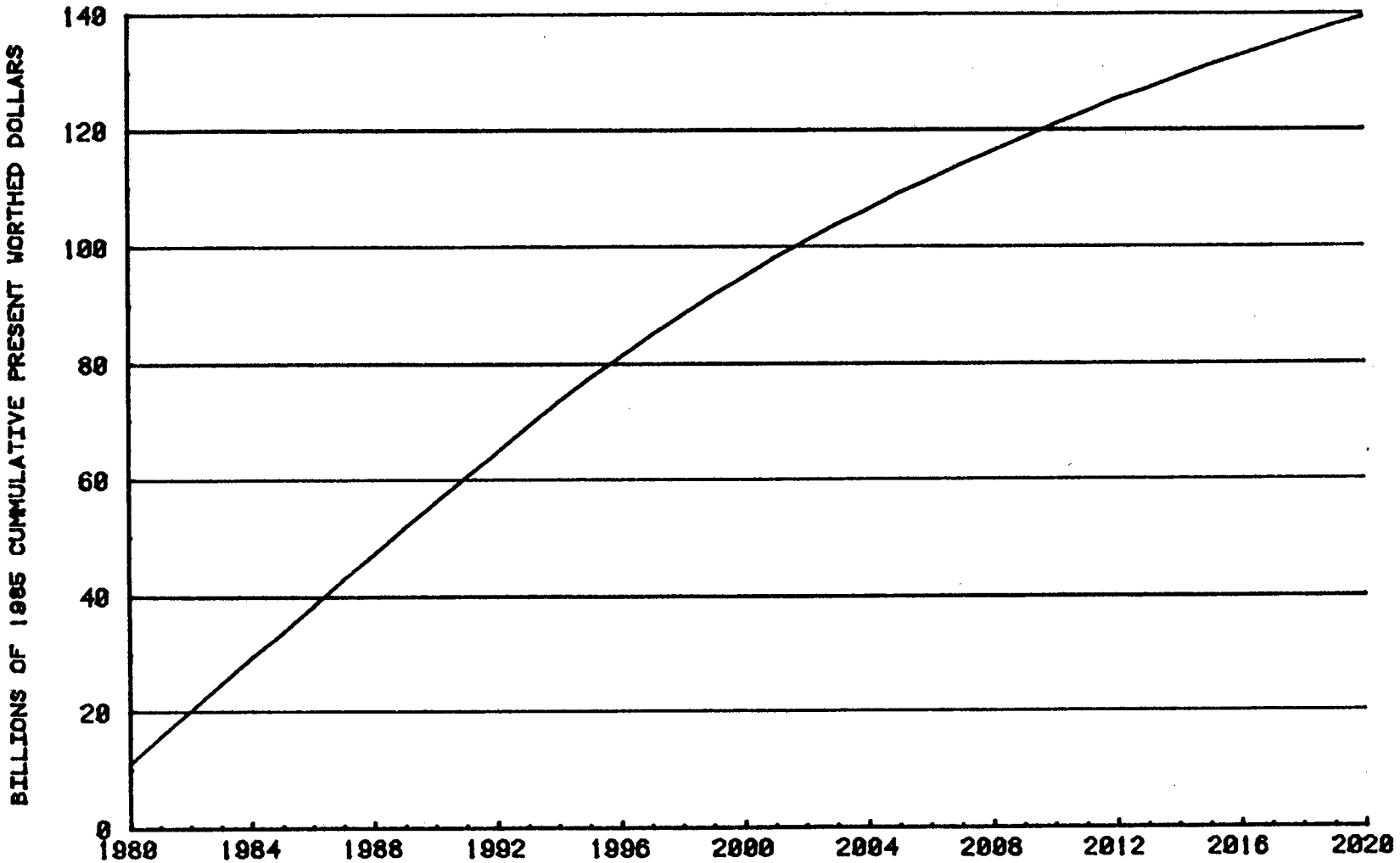
[a]Coal Plants: 1—Existing; 2—New Source Performance Standards; 3—Conversions from oil.

[b]Oil Plants: 1—Existing Steam; 2—Old NSPS; 3—Gas Turbines.

[c]Nuclear Units: 1—BWR, Cooling Towers, New; 2—BWR, Once Through, New; 3—PWR, Once Through, New.

[d]H_3, C_{14}, Radioiodine, Krypton-85, Other Noble Gases.

FIGURE V-F-31
COST IMPACT OF ELECTRIC GENERATION PLAN
NEW YORK STATE (1980-2020)
CUMULATIVE REVENUE REQUIREMENTS



for an adequate period of time to determine acceptability, is many years away. Moreover, at the present time there exists no federal nuclear waste disposal program capable of providing answers to critically important questions, such as:

- How will the wastes be disposed of?
- Where will the wastes be disposed of?
- How much will disposal cost?

Major uncertainty also clouds nuclear facility costs. Capital costs of nuclear facilities have spiraled dramatically in recent years. Projections for the Shoreham facility, for instance, have soared from approximately $270 million in 1973, to well over $1.5 billion in 1979. Similarly, capital cost estimates for the Nine Mile Point Unit 2 facility have escalated from approximately $420 million in 1974 to almost $2 billion in 1979.[5] A recent report prepared by EBASCO[6] indicates that increasingly stringent statutory and regulatory changes over the past 10 years are a major reason for nuclear capital cost hikes. It is impossible now to predict the eventual impact of the recent Three Mile Island major nuclear accident. But it is reasonable to expect that statutory and regulatory requirements will tighten; design modifications will be required, obtaining public acceptance of nuclear plant siting, while difficult before, will become much more difficult; and inevitably, there will be additional costly delays in new facility licensing and construction. In the face of this uncertainty, nuclear capital costs are currently both unknown and unknowable.

Environmental and health and safety comparisons of coal and nuclear facilities generally conclude that during normal operation there are environmental and health advantages in favor of the nuclear fuel cycle over the coal fuel cycle.[7] Both cycles, however, can be and are operated within standards which have been adopted to protect both environmental values and public health. Analysis of the consequences of worst-case accidents, however, shows a decided advantage in favor of coal over nuclear plants.

The current uncertainties surrounding the nuclear fuel form, particularly the Nuclear Regulatory Commission's current policy regarding licensing new plants and the probability of changes in safety requirements, as well as Federal failure to establish firm policy and programs to solve the waste problems, make it inappropriate to rely on additional nuclear capacity in this Plan. At the same time, nuclear power may offer economic advantages in the face of the deepening crises associated with foreign oil.

2) Location of New Generating Units

The final selection of a specific site for planned generation facilities can only be made after evaluation of the economic, environmental, social, health and safety impacts associated with detailed construction proposals. Such impacts are addressed within the siting process established under Article VIII of the Public Service Law. Final decisions are made by the New York State Board on Electric Generation Siting and the Environment (Siting Board).

There are several key system planning issues associated with plant location. Currently, in the New York electric system, a substantial transmission reliability problem exists as a result of the densely packed and highly loaded Hudson Valley transmission corridor.

Power is transferred, through the operation of the statewide economic dispatch system, from upstate to downstate through this corridor at a rate of approximately 2000MW to offset oil-fired generation. Completion of new generating facilities at Oswego, Nine Mile Point, and Somerset, as well as additional imports of Canadian hydropower, will result in even greater power transfers in this corridor. In the absence of other system or operational changes, susceptibility to widespread interruptions of service in downstate New York, resulting, for example, from severe electrical storms, would be increased.

New generation in the downstate area, either in New York City or on Long Island, will tend to reduce transmission loading in the Hudson Valley corridor approximately on a megawatt for megawatt basis.

The two major problems associated with the current State electric system are an over-dependence on oil-fired generation and reliability of the transmission system in the Hudson Valley corridor. Location of needed new coal-fired generating plants in the downstate area will help solve both problems.

Within the downstate area, several sites have been subject to extensive review pursuant to powerplant siting proceedings, including Arthur Kill, Shoreham West and Jamesport, and appear to be feasible locations for one or more of the proposed facilities.

On the other hand, some new capacity should be constructed upstate to meet projected load growth of upstate utilities. Advantages of upstate sites result from the remote locations in relation to major population centers and the reduction in health and safety risk associated therewith; the generally lower ambient levels of air pollution; relative ease of delivery of fuel and removal of waste; and lower construction costs due primarily to lower wage rates.

Within the upstate area, several sites have also been the object of detailed review pursuant to siting proceedings, including sites at Pomfret and Sheridan on Lake Erie and at Sterling and Ginna on Lake Ontario.

3) Timing of New Generating Units

As previously discussed, the State's electric system currently has a substantial amount of installed capacity in excess of that required to provide an adequate reserve margin. However, the projected rate of growth in peak demand will eventually require additional capacity to be constructed in order to maintain adequate reliability. Additionally, the generation plan includes new capacity, beyond that required for reliability, for the purpose of reducing oil dependence.

From a statewide reliability standpoint, new capacity will be needed by the early 1990's in order to maintain a 22 percent reserve margin. Due to transmission constraints, certain individual companies may require new capacity for reliability purposes in the late 1980's. Moreover, to provide for contingencies such as higher than forecast load growth and slippages in construction schedules, it is prudent to target facilities two years prior to the date on which they are projected to be needed for reliability reasons.

In addition to reliability factors, however, the overriding need to reduce oil consumption rapidly in New York and nationally argues strongly for expeditious completion of

[5]Recent announcement by the Nine Mile Point Unit 2 sponsors has indicated a two-year delay in project completion which will result in even further substantial cost escalation.

[6]*Dramatic Changes in the Costs of Nuclear and Fossil Fueled Plants,* Bennett and Kettler, EBASCO, September, 1978.

[7]*Nuclear Power Issues and Choices* (Report of the Nuclear Energy Policy Study Group, Sponsored by the Ford Foundation and Administered by the Mitre Corporation), Ballinger Publishing Co., Cambridge, Massachusetts, 1977, *Health Evaluation of Energy Generating Sources,* Council on Scientific Affairs, Journal of the American Medical Association, Vol. 240, November 10, 1978: *Health Effects Attributable to Coal and Nuclear Fuel Cycle* Alternatives; NUREG-0332, September, 1977.

planned generating facilities. Computer simulations of the future electric system in New York show cost and oil savings associated with constructing both the planned pumped storage hydro plant and the planned coal plants prior to the dates they would be needed for reliability reasons.

These factors, along with projections of the time required to construct typical new pumped storage hydro and coal facilities, have been considered in determining the target dates for completion of the planned generating facilities indicated in Figure V-F-22.

4) New Electric Generating Capacity to Displace Oil

The devastating effects of New York's current oil dependence and the uncertainty associated with many aspects of energy planning, dictate a multi-faceted approach to reducing oil consumption in the electricity sector. A key element in such a strategy is the construction of new generating capacity, in addition to that required for the maintenance of adequate reserve margins for reliability purposes, specifically for the purpose of reducing the operation of existing oil-fired plants. Economic studies presented during the development of this plan have shown that such new capacity additions, if coal-fired, are economic for reserve margins up to almost forty percent. However, the financial risks associated with such new construction are serious. Accordingly, new capacity additions for oil displacement purposes should be limited, particularly without federal legislation in place to help ease the capital cost burdens and risks of a major oil reduction program.

The projected growth in demand for electricity, along with the need to retire certain existing units which will complete their useful lifetime over the next 15 years, results in the need for approximately 1900 MW of new capacity beyond that already under construction, or approved for construction, to maintain adequate reserve margins over the forecast period. In addition to this required capacity, it is appropriate to include plans for approximately 2200-2700MW of additional new capacity to reduce oil consumption. This amount of capacity represents a weighing of the need to displace oil, the need for planning contingencies, and the environmental, social and financial impact of building new generating facilities.

5) Coal Conversions

There is approximately 9,800MW of oil-fired capacity in New York State which was designed with coal burning capability. Over 7,300MW of this capacity has, in fact, previously burned coal. During the 1960's, many of these plants were converted to oil due to a combination of cost incentives and environmental regulations.

Current trends in petroleum and coal prices, and growing concern over petroleum scarcity, now dictate reconversion, where economically and environmentally feasible.

A reasonable coal conversion target, to be pursued within the overall strategy for oil reduction, is necessary to guide other planning decisions. Both coal conversion and construction of new capacity to displace oil are strategies which should be incorporated in New York's electricity supply plan such that uncertainty in any one area does not inordinately jeopardize achievement of the desired result. The units targeted for conversion in Figure V-F-22 are those considered to have the greatest potential, economically and environmentally, for conversion. These units, if converted, will result in oil savings of approximately 40 million barrels of oil per year and life cycle cost savings, using Energy Office estimates of fuel and capital costs, of over $4 billion.

It should be recognized, however, that the coal conversions listed in Figure V-F-22 are those considered appropriate for planning purposes. Conversions of all these facilities may prove unattainable due to environmental, engineering, economic or social constraints which will only be demonstrated during the detailed site-specific lecensing and permitting proceedings that must follow for each coal conversion. Conversion of these units is predicated on compliance with all environmental standards.

Nonetheless, the cumulative environmental, social and health impacts which would result should the targets for coal conversion and new coal construction both be realized may be severe. Although the Final Environmental Impact Statement issued in connection with this Plan and the related testimony on the record provide considerable information and guidance concerning these impacts, a more detailed and comprehensive study of the cumulative impacts of this coal conversion and construction program should be undertaken. Principal responsibility for preparation of this study should rest with the Department of Environmental Conservation, who should work in consultation with the Department of Public Service, the Energy Office and the Department of Transportation. Upon completion of this study, which should be submitted as soon as possible consistent with the necessity to coordinate fully with related Federal studies, the full range of coal conversion targets contained herein should be reviewed.

In addition to pursuing conversion to direct combustion of coal at those facilities where such conversion appears feasible, action should also be taken to reduce oil consumption at other oil-fired facilities. In this regard, NYSERDA, with support and cooperation from SEO and the Department of Public Service, should support projects to demonstrate the potential for use of coal-oil mixtures at baseload oil-fired generating stations where conversion to direct combustion of coal is infeasible.

6) Hydro Quebec Imports

The Power Authority currently has a firm commitment for 800MW of capacity from Hydro Quebec throughout the planning period. Agreements have also been reached that allow additional diversity energy imports. This energy is currently being imported at a rate of approximately 6.5 billion KWH per year.

The Hydro Quebec energy is flowing over the 765 KV transmission line that runs from the Canadian border near Massena to Utica.

Negotiations currently underway among Hydro Quebec, the Quebec Ministry of Energy, PASNY, and the State of Vermont, are likely to result in at least a DC intertie between the New York system and the Hydro Quebec system. These negotiations may well also result in plans for an additional major transmission interconnection, either wholly within New York or through Vermont to New York. The projection that energy imports will increase to 12.3 billion KWH by 1984 is based only on completion of a DC intertie and increased loading of the existing 765 KV transmission line. After 1987, imports decrease to 6.0 billion KWH to reflect current projections of energy available for import from Hydro Quebec.

These increased imports have not been used as an additional capacity credit towards achieving the 22 percent reserve margin, since they will likely not be firm capacity, but interruptible diversity energy.

An improved interconnection between the hydropower based, winter-peaking electric system of Quebec and the petroleum dependent, summer-peaking system of New York

will benefit consumers on both sides of the border. The Quebec consumer benefits from the revenues generated by high capacity, more efficient system operation. The New York consumer benefits with a better mix of lower cost, renewable and less environmentally damaging electric supplies.

5. THE TRANSMISSION PLAN

Transmission system planning is substantially different from generation planning. The overall problem of ensuring an adequate and reliable transmission system does not lend itself as easily to computer simulation and modelling. Transmission planning is more complex and also more dependent on experienced judgement. It involves many of the same variables related to the time and geographic variations in both demand and generating capability. But it also involves complex studies of the dynamics of system operation under various scenarios of both generator and transmission line outage conditions.

Conceptual plans, such as may be developed with the help of computer programs such as TNET, must be followed by detailed load flow and stability studies and right-of-way studies to translate conceptual requirements into more detailed line and system parameters.

A key objective of transmission planning is to provide adequate transmission capacity to transfer power from remotely located generators to the major load centers in the State when needed. It must also allow for both forced and planned outages of generators and transmission lines. And it must maximize the benefits of economic dispatch, minimize environmental impacts, and minimize cost.

Although transmission and generation planning are closely interrelated, the former must follow the latter. This is true because the timing and location of new generation, which is contingent on the outcome of long licensing proceedings, must be known before detailed transmission studies can be completed.

The existing transmission system in the State has been described in part 2.C. of this Section. Figure V-F-12, taken from the Power Pool Plan, tabulates the existing mileage of overhead and underground transmission facilities by voltage — from 115 KV to 765 KV. This table indicates that there are currently 9,505 circuit miles in service (8,943 overhead and 562 underground). They consist of: 155 miles of 765 KV; 5 miles of 500 KV; 2,108 miles of 345 KV (96 of which are capable of operating at 765 KV); 1,074 miles of 230 KV; and 6,174 miles of 138/115 KV.

The Power Pool Plan proposes to add 2,122 miles of new facilities — 1969 miles of overhead lines and 153 miles of underground lines. The proposed additions are summarized in Figure V-F-32.

These proposed additions are also charted on the map that appears inside the front cover of Volumes 1 and 2 of the Power Pool Plan. The Power Pool Plan will be the reference for changes discussed in this subsection.

Functions performed by the Power Pool's proposed additions include: generator leads for new generation; increasing the transfer capacity and reliability of the entire statewide grid; improving the distribution capabilities within service territories; and upgrading the bulk transmission system to 765 KV.

The majority of the proposed 765 KV construction — that not associated with generator construction — is planned by the Pool, but not scheduled. Final timing decisions are subject to completing studies in progress. The need for many of these facilities and the timing of many others are, to some extent, related to projected load growth and the generation plan that is followed.

TNET analyses using the forecast and generation plan contained herein indicate that transmission system improvements will be required in the Hudson Valley corridor and the Utica to Albany corridor.

TNET analyses also indicate the need to connect the major transmission lines that run through the Southern tier (Buffalo-Binghamton-Coopers Corners) with those that feed the New York City load area.

Detailed studies should address the timing of upgrading the two existing 765 KV lines that are currently operating at 345 KV and the reliability of the densely packed lower Hudson River corridor.

Lead times for certifying and constructing major transmission facilities are substantially shorter than for building generating plants (4-6 years versus 10-12 years). Siting decisions related to many of these facilities, therefore, will not be required for some time.

Another area which should be fully explored is the role that increased economic regional power sales might play in meeting electric capacity requirements at lowest possible costs of service, reducing New York's oil dependence, and minimizing environmental injuries to the State from power generation. Increased economic interconnection of New York's electric system with neighboring and distant U.S. systems and all other necessary arrangements to increase purchases of non-oil-fired capacity should be vigorously

FIGURE V-F-32
PROPOSED TRANSMISSION FACILITIES
(NEW YORK POWER POOL)

	765 kV		345 kV		230 kV		115/138 kV	
	Overhead	Underground	Overhead	Underground	Overhead	Underground	Overhead	Underground
Scheduled Facilities (Circuit Mile)	297	0	684	84	36	8	307	33
Planned but Not Scheduled Facilities (Circuit Mile)	455	0	96	28	0	0	148	0
Total Scheduled & Unscheduled Facilities (Circuit Mile)	752	0	726	112	36	8	455	33

pursued. Congress and the relevant Federal agencies should reduce any constraints that may exist affecting economic power sales between regions.

The Department of Public Service should have principal responsibility for preparation of a study of the potential for economic interconnection and the institutional and transmission system changes that may be necessary to increase economic power transactions. The Energy Office and the New York Power Pool should provide the DPS their full support and cooperation. This study should be completed within six months, and each Planning Board member should be kept informed periodically of the progress of the study. The State Siting Boards, in their review of new applications for construction of facilities, should also evaluate fully the potential for capacity contributions which might reasonably result from improved economic regional interconnection.

6. *ELECTRIC UTILITY FINANCING*

A. Financial Impacts of the Electric Plan on the State's Consumers and Electric Utilities

The electricity supply plan requires capital expenditures of approximately $27.3 billion between 1980 and 1994.[8] This includes $14.5 billion in new generating plant and $12.8 billion in other plants including electric transmission and distribution facilities.

New York's electric utilities will be required to raise approximately $20 billion in capital from sources such as earnings retained in the business and security issuances to finance the program. Included in this total are almost $11 billion in long-term debt, $1.4 billion in preferred stock, and over $8 billion in common equity.

Since the capital costs of the electric supply plan are high, and large amounts of new capital must be attracted, adequate cash flow may be a problem for some of the State's utilities. The FSP analysis measured two important cash flow ratios, interest coverage[9] and the amount of allowance for funds used during construction in common equity earnings (AFDC ratio). Currently, the State's composite electric utility group has interest coverage of about 2.9 times and an AFDC ratio of about 26 percent. FigureV-F-33 shows that these ratios, absent other forms of financial assistance, will slip somewhat, during the period. Interest coverage may decline to 2.5 times during several years during the planning period. Also, the AFDC ratio will increase from the 26 percent level during several years of the planning period.

B. Electric Utility Financing Methods

New York's private electric utilities raise capital through internally generated funds, such as retained earnings, and external sources, including long-term debt, preferred stock and common equity. During 1978, the seven private utilities issued $231 million in long term bonds, $84 million in preferred stock, and $312 million in common equity. These companies maintain a capital structure composed of approximately 50 percent long-term debt, 13 percent preferred stock and 37 percent common equity.

PASNY finances differently from the private electric utilities in that 100 percent tax-free debt is used as the financing vehicle. During 1978, PASNY issued $350 million in long-term debt.

FIGURE V-F-33
ELECTRIC UTILITY SUPPLY PLAN
FINANCIAL STATISTICS
INTEREST COVERAGE
1980-1994

Year	Interest Coverage	AFDC to Earnings
1980	2.8 X	30.7%
1981	2.8	23.3
1982	2.5	28.2
1983	2.6	33.9
1984	2.6	27.0
1985	2.5	30.9
1986	2.6	23.2
1987	2.5	21.3
1988	2.5	26.0
1989	2.6	16.7
1990	2.6	13.7
1991	2.7	10.1
1992	2.8	6.4
1993	3.0	6.3
1994	3.2	1.3

The major financial problem facing New York's electric utilities is the need to finance new high cost projects. The SEO generating plan proposes that ten large generation units costing approximately $15.2 billion be constructed by 1994.[10]

PASNY will undertake at least $2.5 billion of the construction, with the private utilities adding $6.6 billion of projects. Four coal units costing $6.1 billion have undetermined owners at this time.

Actions could be taken to reduce financing costs of large generating units. Utilities could be required to use project financing for larger projects, if the use of such a financing appears economical.[11] This financing can be structured to permit a guaranteed rate of return and assurances can be made to investors that the project will be completed. Also, project financing could provide rate of return incentives for projects completed on time without significant cost overruns.

The Power Authority has successfully financed several large scale energy projects using project financing methods. Due to the tax free status of PASNY's debt, and because the Power Authority is completely financed with debt, PASNY requires a much lower rate of return than the average utility.[12] Also, PASNY's power is less expensive than privately produced electricity, since it reflects lower tax collections.

Figure V-F-34 shows fixed charge rates for PASNY and a representative investor-owned utility in New York State.

Since PASNY's fixed charge rate is considerably lower than that of the private electric utility, a considerable cost savings will accrue to ratepayers if PASNY constructs large facilities. If PASNY and a private electric company were to construct separate facilities costing $1.5 billion each, and if

[8]This calculation, as well as those immediately following were compiled using a computer based, long-range financing model developed by the General Electric Company (the Financial Simulation Program (FSP)).

[9]Interest coverage is the number of times the earnings of a company exceeds interest expense.

[10]Four of the units, Oswego 6, Shoreham, Nine Mile 2 and Somerset are already under construction with accumulated costs of $1.8 billion at December 31, 1978.

[11]Project financing is a technique whereby revenues and expenses are assigned to specific projects. Revenues can be adjusted to permit the project to earn a desired rate of return.

[12]PASNY has a lower rate of return than comparable private electric companies because no high cost common equity or preferred stock is employed and interest rates on tax-free bonds are much lower.

these units were operated over 30 years with depreciation for the project reinvested into the business, a savings of $3.7 billion in customer rates would result. However, a portion of this revenue reduction — $1.1 billion — would represent taxes which would have to be collected by some other means. A reallocation of tax revenues would lower the true cost savings to $2.6 billion to state consumers.

FIGURE V-F-34

FIXED CHARGE RATES FOR PASNY AND A PRIVATE ELECTRIC UTILITY

	PASNY	Average New York Private Electric Utility
(1) Rate of Return	7.0%	10.6%
(2) Depreciation*	3.3	3.3
(3) Federal Income Taxes	-0-	2.5
(4) Insurance	.1	.1
(5) Decommissioning	.1	.1
(6) Local Property Taxes	-0-	1.5
TOTAL	10.5%	18.1%

* Although PASNY does not charge depreciation as such, it has been included here for comparison purposes.

In addition to constructing large electric facilities in New York State, the Power Authority could be expanded to act as a centralized finance agency to assist municipalities constructing alternate energy facilities such as small hydro and waste-to-energy plants. This may be needed since many projects will be too small to finance economically in the securities markets. Also, some projects will be too large to be financed by individual users. PASNY, as the centralized finance agency, should be able to minimize these financial difficulties by issuing bond offerings for use by all qualified users.

This change in PASNY's role would have to be accomplished according to Sections 103(b) and 115 of the Internal Revenue Code and New York's Power Authority Act. The Power Authority can maintain tax free status only if it provides most of its power to other tax exempt entities or if it furnishes power under a local furnishing provision. It is highly probable that bonds issued by PASNY for municipal end users would be tax free since the municipal end user is tax exempt, as is PASNY. However, since the IRS code is subject to interpretation, New York should urge the IRS to grant tax-free status to such financings.

Changes could be made in the role of the New York State Energy Research and Development Authority (NYSERDA) to help solve New York State's energy financing problems. Currently, NYSERDA can issue general facilities bonds up to a limit of approximately $9.3 million. At the present time, the full amount of authorized bonds is outstanding. The Authority also issues tax exempt pollution control bonds for use by the State's private electric companies. Like PASNY, NYSERDA could be used as a centralized finance agency. NYSERDA could be given expanded authority to borrow funds to be invested in small energy projects throughout New York State. Also, the pollution control facility financing program must be expanded to include all costs associated with conversions of oil generating plants to coal. This would enable NYSERDA to obtain low cost tax exempt securities for use by New York's private utilities. New York should encourage the Internal Revenue Service to grant tax exempt status to oil conversion bonds similar to pollution control bonds.

Several actions should be taken to reduce the cost impact of the coal conversion program. First, all coal conversion costs should qualify for tax-free financing similar to pollution control equipment. Second, the federal energy program as proposed by President Carter includes financial assistance to help utilities reduce oil use. Based on New York's substantial potential for oil reduction through coal conversion, it is reasonable to expect substantial financing of the coal conversion program with federal funds.

7. ELECTRIC SECTOR RESEARCH AND DEVELOPMENT

New York State electric sector research and development (R&D) should support State energy policy and the objectives of this Plan. As such, electric sector R&D emphasis is warranted in the following areas:

- energy conservation and load management;
- clean burning coal technologies such as fluidized bed combustion, advanced flue gas desulfurization, coal-oil mixtures, coal gasification and coal liquefaction;
- technologies which allow location of electricity generation close to the load, such as fuel cells; and,
- technologies using renewable energy resources such as solar, solid waste and hydropower.

The ESEERCO Research and Development Plan contains important research and development projects addressed to each of these areas. It further shows a planned shift in R&D funding emphasis away from nuclear-related projects and in the direction of those areas summarized above.

The previously mentioned studies of combined cycle coal gasification and coal oil mixtures will provide further emphasis in these directions.

Section V-H of this plan addresses research and development in general, and present State R&D plans in greater detail.

8. RECOMMENDED ACTIONS

- Implement the SEO Electric Generation Plan as outlined in Figure V-F-22.
- Increase Niagara Power Project Output.

Subject to the provisions of a 1950 treaty between the United States and Canada, at least 100,000 cubic feet per second (CFS) of water must flow over the falls during daylight hours from April through October. The flow at other times may be reduced to 50,000 CFS. The remaining water flow in the Niagara River, which has an average flow of 203,000 CFS, is available for use equally by the two countries to generate electricity.

Various proposals are currently under review which would reduce the falls flow during non-tourist sensitive periods. These proposals could, if mutually agreeable to both countries, increase the generation of electricity from the Niagara facilities by as much as a billion kilowatt hours. This is approximately the equivalent of the output of a 150 MW generating plant operating at a 70 percent capacity factor.

Development of proposals by PASNY should continue as should discussion with appropriate Canadian officials in pursuit of a mutually beneficial agreement to allow greater power production without jeopardizing the tourism value of the Falls.

- Study Future Out-of-State Sales of Hydropower

PASNY currently sells approximately 280MW of low cost hydropower to neighboring states—100MW to Vermont from St. Lawrence; 50MW to Vermont from Niagara; 107MW to Allegheny from Niagara; and 23 MW to Ohio from Niagara.

This power is sold pursuant to Federal Power Commission licenses and, for the Niagara facility, pursuant to federal laws. The law requires that a "reasonable portion"—*up to 10 percent* of the project power—is to be sold to neighboring states. Currenty the full 10 percent of Niagara power and over 10 percent of St. Lawrence power, is being sold.

Contracts for sale of Niagara power have recently been renegotiated, to expire in 1985, in a manner such that both firm capacity and electric energy sold to neighboring states is reduced compared to prior years. The St. Lawrence contract with Vermont also expires in 1985.

Since all current contracts expire in 1985, and since circumstances relating to the value of these resources have substantially changed and are continuing to change, a study should be undertaken by PASNY to determine appropriate and reasonable amounts of out-of-state power sales for the future. This study can provide a basis for renegotiation of the Niagara and St. Lawrence contracts in 1985.

- Expand NYSERDA's non-recourse tax-exempt revenue bond program to include financing oil to coal conversion projects to the extent permitted by the Internal Revenue Code.

The Authority is presently authorized to promote the construction of new energy technologies and pollution-abatement modifications on power generating facilities through the issuance of revenue bonds which are exempt from State and Federal taxes, but which are not obligations of the State. Under this program, the Authority has issued more than $136 million in pollution control bonds to date. This tax-exempt pollution control financing program is a form of Federal subsidy to the State, which ultimately reduces the cost of electricity and gas to consumers. This ERDA revenue bond program should be expanded (consistent with the provisions of the Internal Revenue Code) to include financing of utility oil-to-coal conversions. The extension of such financing to coal conversion can provide significant savings to New York consumers.

- The Governor and Legislature should create a panel to evaluate fully and comprehensively the status of nuclear power development in the State of New York. This panel should review all pertinent information, including the reports of all Federal, State and local government entities which have examined issues associated with nuclear power and which reports can aid the work of the panel. Every effort should be made to obtain federal funds for this project. the panel should consist of distinguished scientists, engineers, businessmen, labor leaders, environmentalists and citizens. Upon its creation and funding, the panel should consider the following, insofar as New York State is concerned, and report to the Board, the Governor and the Legislature:

—Within six months, with respect to:

  •• Impacts of phase-down or elimination of existing plants and contingency plants to assure adequate electric supplies in case of federally mandated nuclear plant shutdowns;

  •• Adequacy of emergency evacuation programs; and

  •• Adequacy of arrangements for secure transportation of nuclear materials.

—Within twelve months, with respect to:

  •• Feasibility of Federal or other government responsibility for operation of existing nuclear power plants;

  •• Feasibility of Federal or other government responsibility for construction and operation of new nuclear power plants; and

  •• Adequacy of current and proposed Federal nuclear waste management programs.

- Increased economic interconnection of New York's electric system with neighboring and distant U.S. systems and all other necessary arrangements to increase purchases of non oil-fired capacity should be vigorously pursued. Congress and the relevant Federal agencies should reduce any constraints that may exist affecting economic power sales between regions.

The Department of Public Service should have principal responsibility for preparation of a study of the potential for economic interconnection and the institutional and transmission system changes that may be necessary to increase economic power transactions. The Energy Office and the New York Power Pool should provide the DPS their full support and cooperation. This study should be completed within six months, and each Planning Board member should be kept informed periodically of the progress of the study. The State Siting Boards, in their review of new applications for construction of facilities, should also evaluate fully the potential for capacity contributions which might reasonably result from improved economic regional interconnection.

- A detailed and comprehensive study of the cumulative impacts of the coal conversion and construction program contained herein should be undertaken. Principal responsibility for preparation of this study should rest with the Department of Environmental Conservation, who should work in consultation with the Department Of Public Service, the Energy Office and the Department of Transportation. Upon completion of this study, which should be submitted as soon as possible consistent with the necessity to coordinate fully with related Federal studies, the full range of coal conversion targets contained herein should be reviewed.

- NYSERDA, with support and cooperation from SEO and the Department of Public Service, should support projects to demonstrate the potential for use of coal-oil mixtures at baseload oil-fired generating stations where conversion to direct combustion of coal is infeasible.

- As a matter of State policy, no transmission line importing power should traverse the Adirondack Park in violation of Article 14, or any other applicable environmental laws, or in such a manner as will cause degradation to the environmental quality and open space character of the Park.

SECTION V-G

Coal

1. INTRODUCTION

Coal is the only fossil fuel with known reserves capable of meeting both national and State energy needs for many years into the future. Despite the abundance of coal, its use in the seventies has grown only 14.5 percent nationwide and has dropped by 48.3 percent in New York State.

Coal has not been an attractive energy source for a number of reasons. The most significant has been its cost. Although the price of coal, on a heat content basis, may be as little as one fourth that of oil, additional equipment needed to move and handle coal, larger boiler requirements, and more extensive pollution control requirements can raise coal consumption costs beyond those of other fuels.

The greatest opportunity for increased use of coal in New York State in the near-term is in the generation of electricity. This should take place with the conversion of existing oil-fired units that are capable of burning coal, and through the addition of coal-fired baseload units to meet future growth in demand and to decrease the consumption of oil.

In the longer term, the greatest opportunity for increased coal utilization is in the development of a coal-based synthetic fuels industry. In both cases, direct coal use and coal-based synfuels will decrease our reliance on imported petroleum products. They will also enable the State to tap a more secure energy source at more acceptable, and more controllable prices.

Therefore, the following actions are recommended:

- Implement the electricity supply plan outlined in Figure V-F-22.
- NYSERDA, with support and cooperation from SEO and DPS, should undertake a feasibility study to investigate the potential for use of coal-oil mixtures at all baseload oil-fired generating stations where conversion to direct combustion of coal appears unlikely.
- Immediate action must be taken to develop a coal-based synthetic fuels industry in the Northeast.

Implementation of just the electricity supply plan contained in Section V-F will reduce the State's consumption of imported oil by over 60 million barrels per year by 1994.

Increased coal use in the State also increases the potential for air, water and land pollution. However, in all cases compliance with environmental standards must be achieved.

The direct use of coal and the development of synthetic fuels are the two key elements in a strategy of coal replacement of oil. Direct use of coal will replace oil more quickly, at less cost, and still permit achievement of environmental standards.

However, reducing the State's reliance on imported oil through increased coal use will not be accomplished solely on the basis of the incentives of economic benefits achieved through lower fuel costs.

Other incentives must be provided including options such as: allowing rapid tax depreciation for new equipment; offering additional tax credits; or directly paying a portion of the conversion costs as the President has recommended.

To achieve the synthetic fuels objective, the most promising technologies should be identified quickly and construction begun immediately. Furthermore, a market for full production of fuel must be guaranteed.

Federal and State energy and related policies must be molded to a clear, bold plan of action. The primary obstacle to greater coal use is the lack of a strong, consistent federal coal policy and the framework of uncertainty caused by this lack of policy. Procedures must be established to identify and resolve regional, State and local conflicts and reconcile competing interests within the federal government, and between federal and state governments, to enable the aggressive pursuit of a program of oil import reduction through increased reliance on domestic coal. A program must be developed, based upon strict adherence to adopted policies and implementation schedules, which will provide for increased coal use immediately.

The direct burning of solid coal is not the long-term solution to the State's or the Nation's energy problems. However, it is the best energy option to buy time to make the transition to a more secure energy future.

The following section summarizes coal[1] use in New York State and the outlook for its future as an energy source. The section also makes proposals and recommendations on how coal can be best used to move the State from the present period of unreliable and high cost imported petroleum to a more self-reliant energy future.

2. BACKGROUND

A. Coal Consumption—Past and Present

Coal consumption in the United States and New York State from 1960-78 is presented in Figure V-G-1. This data illustrates trends in coal consumption nationally and statewide and traces past consumption patterns.

1) United States

Total coal consumption in the United States has increased almost continually, except in strike years, from 375 million tons in 1960 to 600 million tons in 1978.

Since 1945 the proportionate share of coal consumed by the Nation's major users has changed significantly. In 1945 the largest users of coal were the manufacturing industries and the railroads. Sales for home heating was the third largest market, followed by the coking industry and electric utilities.

Today, coal is used primarily as a boiler fuel by electric utilities and in the manufacturing industries. In fact, nearly 90 percent of the coal now used as a boiler fuel is used for electric energy generation. Coal use by utilities has increased from 70 million tons in 1945 to over 480 in 1977—an increase of nearly 700 percent. Despite this growth, the coal share of the electric utility fuel market has actually dropped from 52 percent in 1945 to 47 percent in 1977. This decline is due primarily to the emergence in the 1930's of oil and gas as economically attractive, convenient, and easily obtainable fuels, to the stricter air pollution requirements in the late 1960's, and to the development of nuclear power for electric generation.

The slight movement by utilities in the Nation away from coal, however, stopped abruptly in 1973-74 with the sharp increases in oil prices following the oil embargo. Another factor was the growing concern over the availability of

[1]This includes bituminous and lignite coal. A discussion of anthracite coal may be found in Appendix V-G-2.

FIGURE V-G-1
COAL CONSUMPTION BY SECTOR, 1960-1978
(THOUSANDS OF SHORT TONS)

	Electric Utilities			Industrial			Coke Plants			Retail Sales			Total		
Year	NYS*	U.S.	% of US	NYS	U.S.	% of US	NYS	U.S.	% of US	NYS	U.S.	% of US	NYS	U.S.	% of US
1960	11,531	173,615	6.6	6,715	88,976	7.5	4,304	81,002	5.3	430	31,371	1.4	22,980	374,964	6.1
1961	10,525	176,490	6.0	6,351	87,566	7.3	3,781	73,028	5.2	435	28,596	1.5	21,092	365,679	5.8
1962	10,948	192,174	5.7	6,325	91,833	6.9	3,997	71,698	5.6	467	27,958	1.7	21,737	383,663	5.7
1963	11,235	208,790	5.4	6,789	95,003	7.1	4,020	76,478	5.3	373	25,168	1.5	22,417	405,439	5.5
1964	12,880	225,908	5.7	7,021	96,601	7.3	5,724	89,479	6.4	307	22,324	1.4	25,932	434,314	6.0
1965	13,835	244,747	5.7	6,578	96,791	6.8	6,244	95,034	6.6	368	22,020	1.7	27,025	458,594	5.9
1966	12,487	266,800	4.7	6,685	97,861	6.8	5,882	94,403	6.2	260	20,026	1.3	25,314	479,093	5.3
1967	14,330	290,756	4.9	6,825	96,723	7.1	5,980	94,112	6.4	165	18,298	0.9	27,300	499,891	5.5
1968	12,573	290,507	4.3	6,728	94,058	7.2	5,108	89,533	5.7	153	17,101	0.9	24,562	491,201	5.0
1969	13,047	303,961	4.3	5,894	88,989	6.6	5,449	91,829	5.9	90	15,083	0.6	24,480	499,863	4.9
1970	12,648	329,936	3.8	5,315	84,060	6.3	6,051	94,869	6.4	87	14,246	0.6	24,101	523,113	4.6
1971	8,291	332,435	2.5	3,981	70,889	5.6	4,188	80,383	5.2	54	10,776	0.5	16,514	494,484	3.3
1972	7,030	371,316	1.9	3,218	68,766	4.7	4,118	87,756	4.7	51	9,150	0.6	14,417	536,990	2.7
1973	6,741	374,492	1.8	2,318	62,466	3.7	5,444	89,891	6.1	59	7,708	0.8	14,562	534,558	2.7
1974	8,102	385,953	2.1	2,058	62,320	3.3	5,524	86,452	6.4	72	6,558	1.1	15,756	541,282	2.9
1975	7,157	429,758	1.7	2,121	52,554	4.0	3,491	84,953	4.1	77	4,828	1.6	12,846	572,093	2.2
1976	7,099	454,796	1.6	2,405	52,517	4.6	5,157	84,721	6.1	20	4,018	0.5	14,681	596,052	2.5
1977	7,606	480,729	1.6	2,541	59,447	4.3	3,818	78,477	4.9	30	3,036	1.0	13,995	621,689	2.3
1978	7,576	471,159	1.6	2,329	60,185	3.9	2,507	65,867	3.8	45	2,003	2.2	12,457	599,214	2.1

* N.Y.S. share of Homer City consumption included.

natural gas. In addition, Federal legislation such as the Energy Supply and Environmental Coordination Act of 1974 (ESECA), and the Powerplant and Industrial Fuel Use Act of 1978 (PIFUA), have effectively limited the choice of fuels for large baseload electric generation to coal and nuclear-fueled units.

2) New York State

Coal use in New York State has not kept pace with increases in the rest of the country—as Figure V-G-1 shows. Statewide coal consumption dropped from a high of 27 million tons in 1967 to a low of just under 12.5 million tons in 1978. Since 1975, the quantity consumed has held relatively steady.

Compared to total consumption in the United States, coal use in New York State has shown a relative decline from 6.1 percent of the total national use in 1960 to 2.1 percent in 1978. Several factors have contributed to this trend:

- Electricity demand growth in New York State has been relatively slow compared to national averages, and no new coal plants have been added since 1969;
- Industrial growth in New York State has increased at a slower rate than in other areas of the country;
- Because of the State's dense urban nature environmental regulations are enforced more stringently in New York than in other areas of the country; and
- High transportation costs have discouraged the use of coal to a greater extent in New York State than in many other areas of the country.

Figure V-G-2 shows coal consumption by end user in 1978. In the electric utility sector, total coal consumption in the State declined from 14,330,000 tons in 1967 to 6,741,000 tons in 1973. In the industrial steam sector, a similar pattern emerges. A sharp decline in coal use in the early 1970's in this sector in New York was followed by a reversal and slight increase in recent years. The decline is steeper and the increase is smaller than that of the utility sector, in part because economies of scale make coal more attractive to utilities than to smaller industrial users. A similar pattern exists for coal use by this sector throughout the country.

Coal use in coking plants shows no steady time-trend. Instead, coal deliveries tend to rise or fall with changes in the quantity of steel production. Coal deliveries to coke plants are greatest in "boom" years for steel (1970, 1973, 1974) and least in poor years.

The geographic location and size of facilities using coal is a key consideration governing the demand for coal. The precise location[2] of a consumer will dictate the most likely source of supply. It will also affect the mode and cost of transporting the fuel. The amount of coal a firm uses, in part, determines the price it pays, the applicable environmental regulations, and the economics of alternative fuel choices.

B. Coal Production—Past and Present

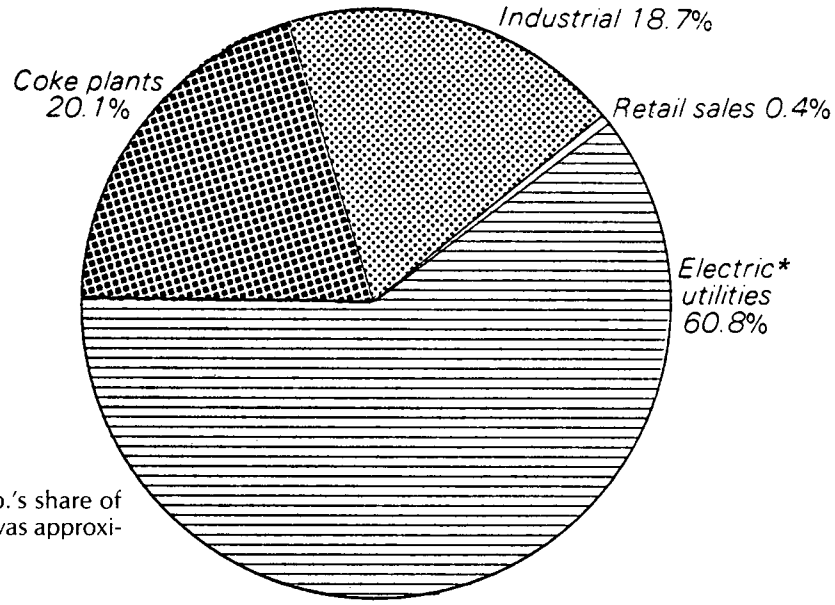
1) Origin of Coal—National Production

Coal production in the nation has varied from year to year since 1914 (the earliest year that reliable data is available), reaching a low in 1932 of 309.7 million tons. Since 1961, production gradually increased to a total of 686.6 million tons in 1977.

Coal production from the eastern region of the United States has fallen from 82 percent of national production in

[2]Further discussion of coal use by region and volume consumed can be found in Appendix V-G-1.

FIGURE V-G-2
COAL CONSUMPTION BY MAJOR END USED CATEGORY
1978



*Includes New York State Electric and Gas Corp.'s share of coal consumed at the Homer City Plant which was approximately one-half of 2.5 million tons in 1978.

SOURCE: U.S. Department of Energy.

1956, to just over 67 percent in 1977. Coal production in the West has increased by about the same percentage.

There are three primary reasons for the increased production of western coal. First, there has been an increase in utility coal consumption in the central and western part of the nation. Second, utilities prefer western coal because of the lower sulfur content that permits air quality standards to be met without expensive flue-gas desulfurization equipment. Third, mining costs are less. Western coal is extracted by surface mining methods while underground mines account for between 50-80 percent of eastern coal production, depending on the state. In recent years, the cost of coal produced at eastern underground mines has been approximately three times the cost of coal produced in western surface mines.

2) Current Coal Supplies to New York State

a. Origin

During the past decade, much of the coal consumed in New York State was produced in Pennsylvania and northern West Virginia. Significant amounts of coal also came from Central Appalachia, primarily eastern Kentucky and the southern part of West Virginia. Figure V-G-3 presents historical data on the origins of coal supply to each consuming sector in New York State. Northern Appalachia predominates as the major coal supply source for New York State. But Central Appalachia is also a significant source of supply to coking plants, where its quality characteristics make it indispensable.

FIGURE V-G-3
ORIGIN OF COAL CONSUMED IN NEW YORK STATE: 1970-1978
(THOUSANDS OF SHORT TONS)

	Electric Utilities			Coke Plants			All Other Industrial[a]			Retail Sales		
Year	Northern Appalachia	Central Appalachia	Total	Northern Appalachia	Central Appalachia	Total	Northern Appalachia	Central Appalachia	Total	Northern Appalachia	Central Appalachia	Total
1970	9,490	672	10,162	3,540	2,744	6,284	4,937	398	5,335	52	36	88
1971	6,544	434	6,978	2,139	1,286	3,425	3,561	407	3,968	29	20	49
1972	5,677	307	5,984	2,209	1,891	4,100	3,069	153	3,222	48	3	51
1973	5,125	273	5,398	3,362	2,082	5,444	2,151	195	2,346	59	--	59
1974	6,271	809	7,080	3,509	2,015	5,524	1,772	281	2,053	63	9	72
1975	5,581	574	6,155	2,528	963	3,491	1,831	290	2,121	45	32	77
1976	5,550	480	6,030	3,139	2,018	5,157	2,173	230	2,403	19	1	20
1977	5,979	542	6,521	2,325	1,500	3,825	2,366	177	2,543	30	--	30
1978	5,902	424	6,326	1,144	1,363	2,507	2,131	198	2,329	39	6	45

[a] Includes boiler and kiln applications.

SOURCE: Bureau of Mines, *Bituminous and Lignite Coal Distribution*, 1970-1978 Calendar year reports

Central Appalachian coal is also used in lesser quantities in the other demand sectors. The regional distribution of supply has remained relatively constant, with Central Appalachian coal supplying about 10 percent of the total. Central Appalachian coal has higher mine-mouth prices and transportation costs than other available coal and it is purchased to meet specific quality needs, particularly lower sulfur content.

b. Transportation

Data showing the mode of transportation of coal coming into New York State are presented in Figure V-G-4. In general, larger coal consumers rely more on rail than truck shipments. Large coal shipments by truck are much more expensive and are severely limited by environmental constraints (fugitive coal dust particles) and by highway weight limits. During the period shown, 78 percent of the coal consumed by the electric utility industry came in by rail. The figure is nearly 100 percent for the metallurgical industry, 92 percent for industrial users, and nearly 100 percent for retail users.

c. Quality

A strong relationship exists between the regional origin of the coal and its sulfur content. In general, low-sulfur coal is mined in Central Appalachia and medium to high-sulfur coal in Northern Appalachia. Electric utilities and coke plants are the primary consumers of coal from Central Appalachia. The large volumes permit more favorable transportation costs, allowing shipment over longer distances.

FIGURE V-G-4

MAJOR MODES OF TRANSPORTATION OF COAL DESTINED FOR NEW YORK STATE[a] (THOUSANDS OF SHORT TONS)

	Electric Utilities			Coke Plants			Industrial			Retail			Total		
Year	Rail	Truck	Total	Rail	Truck	Total	Rail	Truck	Total	Rail	Truck	Total	Rail	Truck	Total
1970	8,784	1,005	9,789	5,968	--	5,968	4,840	459	5,299	86	2	88	19,678	1,466	21,144
1971	5,776	1,068	6,844	3,242	--	3,242	3,713	216	3,929	49	--	49	12,780	1,284	14,064
1972	4,640	1,275	5,915	3,986	--	3,986	3,006	176	3,182	51	--	51	11,683	1,451	13,134
1973	4,368	967	5,335	5,398	--	5,398	2,137	163	2,300	59	--	59	11,962	1,130	13,092
1974	5,287	1,618	6,905	5,366	9	5,375	1,793	215	2,008	72	--	72	12,518	1,842	14,360
1975	4,778	1,367	6,145	3,424	14	3,438	1,952	137	2,089	77	--	77	10,231	1,518	11,749
1976	4,426	1,554	5,980	5,064	--	5,064	2,219	184	2,403	20	--	20	11,729	1,738	13,467
1977	4,501	1,989	6,490	3,720	32	3,752	2,334	209	2,543	30	--	30	10,585	2,230	12,815
1978	3,718	2,312	6,030	2,505	2	2,507	2,065	238	2,303	45	--	45	8,332	2,552	10,884

SOURCE: Bureau of Mines, *Bituminous Coal and Lignite Distribution*, 1970-1978 calendar year reports.

[a]These data do not include smaller quantities transported by river and Great Lakes barge.

FIGURE V-G-5

CHARACTERISTICS OF COAL CONSUMED IN NEW YORK BY SECTOR: 1978 (TONS)

High Btu (Btu/lb) (13,000 & Above)	Industrial Steam	Utilities	Coke Plants[a]	Cement	Retail	Total
Less than .7%S	--	--	--	--	250	250
.7 - 1.0%S	--	--	--	--	17,700	17,700
1.0 - 2.0%S	216,300	--	--	--	91,200	307,500
More than 2.0%S	766,650	--	--	--	58,000	824,650
Medium Btu (12,999-11,500)						
Less than .7%S	--	--	--	--	28,900	28,900
.7% - 1.0%S	30,000	--	--	--	12,000	42,000
1.0 - 2.0%S	132,000	845,000	--	137,900	64,400	1,179,300
More than 2.0%S	536,000	2,916,000	--	444,500	29,300	3,925,800
Low Btu (Less than 11,499)						
Less than .7%S	65,000	--	--	--	29,800	94,800
.7 - 1.0%S	--	--	--	--	--	--
1.0 - 2.0%S	--	2,337,000	--	--	--	2,337,000
More than 2.0%S	--	--	--	--	--	--

[a]No data obtained in survey for the coke plants.

SOURCE: Survey of 1978 Coal Consumption in New York State: (Jan., 1979).

For the coking plants, low-sulfur and other quality characteristics are essential to coke blends, necessitating shipment from Central Appalachia.

Figure V-G-5 shows a detailed breakdown of the sulfur and BTU content of coal consumed in the State in 1978.

d. Recent Prices

Prices utilities pay for coal in New York State vary widely and reflect the needs of individual plants for coal quality and transportation costs. In February, 1979, for example, coal purchased by Niagara Mohawk Power Corporation for the Huntley Station cost nearly $40 per ton. The cost for coal to New York State Electric & Gas Corporation's Hickling Station cost just over $21 per ton.

C. Institutional Background

Background on the nature of the coal industry and the labor movement and the impact of governmental coal policies are also an important prelude to a discussion of the future of coal in New York State.

1) Nature of the Coal Industry

Increasingly, since 1960, small independent coal operators are being replaced by coal companies that are part of larger interstate companies, conglomerates, and multinational oil and gas firms. Of the top 15 coal producers in 1977, only two were independents. Sixteen years ago, all major coal companies were independent except those owned by industries that burned coal. Many of the major companies belong to the Bituminous Coal Operators Association (BOCA), an industrial association that has negotiated as a unit with the unions, and in particular, with the United Mine Workers of America (UMW).

The labor movement has traditionally played a major role in the coal industry. Of the 237,000 coal workers in 1977, about 160,000 belonged to the UMW, the strongest union, which often sets the wage and benefit standard for the rest of the industry. The traditional strength of the UMW has been in the Eastern region where coal is mined in the more labor-intensive underground mines. Most of the coal consumed in New York State is from underground mines in this region.

2) Government Policies

Government environmental standards, coal mining safety, financial incentives, and transportation policies will influence future coal consumption. Numerous pieces of federal and State legislation and regulatory actions have affected coal production and consumption over the last 20 years.

Figure V-G-6 analyzes the major Federal laws that have affected coal production, consumption and/or costs, and that have the potential to do so in the future.

3. COAL OUTLOOK

A. Future National Demand

The use of coal will increase in absolute terms as energy demands increase. However, the extent to which coal demands increase will depend on a number of factors, including governmental laws and regulations, the costs and availability of alternative fuels, the availability of nuclear power as an option for electric generation, the rate of development of a coal-based synthetic fuels industry, and the degree of enforcement of the Energy Supply and Environmental Coordination Act (ESECA) and the Powerplant and Industrial Fuel Use Act (PIFUA).

Future coal demand in the Nation through the end of the century, will occur mainly in the three sectors currently accounting for the majority of coal consumption: electric utilities, industrial boiler fuel, and coke for iron and steel production. Additional demand should arise toward the end of the 1980's as a coal-based synthetic fuel industry begins production of gas and liquid fuels. These new technologies may provide the opportunity for coal, as an energy source, to recapture the markets once lost to natural gas and petroleum.

The Department of Energy (DOE), forecasts a 150 percent increase in national coal consumption by 2000, increasing from over 600 million tons in 1979 to between 1555 and 1835 million tons in 2000.

Figure V-G-7 shows production forecasts through 1995. The relatively constant production of coal in Appalachia through 1990 reflects the slow rate of growth in the metallurgical industry and a slow rate of growth in electricity demand in the northeast. For coal-fired utility plants for which construction commences after September 18, 1978, scrubbers will be required regardless of sulfur content resulting in increased production of medium to high-sulfur coal from this region. Production may also be increased as a result of strong implementation of ESECA and PIFUA.

Growth of coal production is expected to be most dramatic in the Northern Great Plains region. Because of its low-sulfur content and its relatively inexpensive mine-mouth price compared to Eastern coal, Great Plains coal will be particularly attractive to consumers throughout much of the country through 1995.

The total recoverable coal reserves in the nation in 1975 were almost 256 billion tons. The U.S. Bureau of Mines has estimated that 31 percent or about 78.9 billion tons can be used for direct combustion and will meet the Federal New Source Performance SO_2 emission standard of 1.2 pounds per million BTU heat input without being cleaned.[3] Of this total, 8 billion tons are located in the Eastern region, 0.3 billion in the Central region and 70.6 billion (89 percent) are in the Western region.

If the national goal of over 1 billion tons per year in 1985 were to be achieved, there is enough coal to last the Nation for over 250 years, and enough "clean" coal for approximately 80 years. The development of these potential coal reserves will depend on such factors as federal leasing policies, the cost of mining, the ability of the transportation system to move the coal, the price of coal, the rate of recovery of reserves (including in-site gasification), and the availability of capital for new mine development.

The factor that may limit future coal production the most will be the availability of labor with sufficient ability to be trained as miners—and with a willingness to pursue that occupation. Recruiting new workers for coal mining work may become increasingly difficult for several reasons: the poor public image of the industry, the hazardous nature of the work, adverse publicity stemming from mine disasters, the remote location of mines from readily accessible urban areas[4] and the potential for work stoppages and strikes. This will be especially important in the more highly labor-intensive underground mines of the east, where labor-management conflicts can cut into coal availability and

[3]This standard applies to affected facilities commencing construction after August 17, 1971, and up to and including September 18, 1978. Plants constructed after September 18, 1978, must employ some method of flue gas desulfurization.

[4]R.A. Schmidt, *Coal in America*, McGraw-Hill Publication Company, 1979.

FIGURE V-G-6
RECENT FEDERAL LAWS IMPACTING ON COAL

Federal Act	Implementing Federal Agency	Purpose	Impact on Coal Production, Consumption and/or Costs	New York State Administrative Jurisdiction
The Federal Coal Mine Health and Safety Act of 1976 (Amended (1977)	Department of Interior, Department of Health, Education and Welfare	To remedy unsafe conditions and practices and to reduce the number of mining fatalities and injuries.	Health and safety procedures add additional costs to coal production which may be offset by increased productivity. One estimate shows that 50¢/ton may be added to the cost of coal.	
The National Environmental Policy Act of 1969 (NEPA)	Environmental Protection Agency	To bring environmental factors into the decision-making process by requiring an environmental impact statement (EIS) for major Federal activities.	All coal-related activities that have a significant impact on the environment require an EIS; i.e. the leasing of federal lands for coal production.	Department of Environmental Conservation (DEC)
The Clean Air Act (and amendments)	Environmental Protection Agency	To improve air quality through the establishment of both National Ambient Air Quality Standards (NAAQS), and new source review requirements.	EPA regulations may make it more difficult or costly to burn coal in many instances. For a complete analysis, see Environmental Costs section under "Coal Outlook."	DEC
The Energy Supply and Environmental and Coordination Act of 1974.	Department of Energy	To reduce the use of natural gas in large boilers, and oil imports by substituting the use of coal.	Although ESECA appeared to grant broad powers for coal conversion, lack of financial incentives, lack of commitment and environmental problems have prevented large-scale impact.	DEC Public Service Commission (PSC) State Energy Office (SEO)
The Resource Conservation and Recovery Act of 1976 (RCRA)	Environmental Protection Agency	To improve waste disposal practices by controlling disposal of hazardous and non-hazardous wastes.	The determination of whether coal pile run-off, flyash and scrubber sludge is defined as hazardous is currently in the rulemaking process. Current costs of disposal are estimated to be between $1.30 and $5.00 per ton of waste. These costs may increase significantly depending on how the wastes are classified under RCRA.	DEC
The Surface Mining and Reclamation Act of 1977	Department of Interior, Office of Surface Mining	To change surface coal mining practices that generate severe social and environmental costs and to prohibit mining operations in areas that cannot be reclaimed.	Reclamation costs are estimated between $8.00 and $10.00/ton if the Act is fully administered or a 0.25% increase in the cost of electricity to the average customer in 1985.	—
The Clean Water Act of 1970 (and amendments)	Environmental Protection Agency	To control and eliminate water pollution and protect and propagate fish, shellfish and wildlife.	The principal coal-based activities to which this Act applies are steam electric generating stations. This adds an additional cost to the future use of coal for electricity.	DEC
The Powerplant and Industrial Fuel Use Act of 1978 (PIFUA)	Department of Energy	To prohibit the use of natural gas and petroleum as a primary energy source in new powerplants and major fuel-burning installations (MFBI's) with few exceptions, and in existing MFBI's and powerplants with more exceptions.	PIFUA's success in achieving coal conversions will be highly dependent on environmental regulations and future costs of using alternative fuels.	DEC PSC SEO

SOURCE: The Direct Use of Coal, Office of Technology Assessment Assessment, United States Congress.

FIGURE V-G-7
REGIONAL COAL PRODUCTION
(10^6 TONS)

Region	1975	1985	1990	1995
Northern Appalachia	178.6	153.1	189.1	243.2
Central Appalachia	195.1	231.2	207.7	214.3
Southern Appalachia	22.5	20.3	15.2	12.5
Total	396.3	404.6	412.0	470.0
Midwest	141.0	215.1	307.7	384.5
Total	141.0	215.1	307.7	384.5
Eastern Northern Great Plains	8.5	17.8	19.2	19.9
Western Northern Great Plains	46.3	229.5	360.4	483.1
Total	54.8	247.3	379.6	503.0
Central West	10.1	7.6	4.5	8.4
Gulf	11.0	51.8	71.7	61.7
Rocky Mountain	14.7	56.5	68.5	96.0
Southwest	15.8	34.3	42.4	50.0
Northwest	3.7	4.6	4.8	2.9
Alaska	—	—	—	9.5
Total	55.3	154.9	191.9	228.5
TOTAL U.S.	647.4	1022.0	1291.2	1586.1

SOURCE: ICF Incorporated

color potential customers' perception of the future reliability of supply.[5]

C. Future Demand in New York State

Over the next 15 years, electric utilities will continue to consume the major share of coal in New York. Future industrial consumption is forecast to increase between 1978 and 1994 at an average rate of approximately 0.8 percent per year and retail sales of bituminous coal for residential use will stay at the current level. Coal use in the commercial sector is expected to decline to negligible consumption over the forecast period. Increasing coal use in the State will have both economic and environmental impacts. A detailed discussion of these impacts may be found in Appendix E and in the Environmental Impact Statement associated with this Plan.

1) Demand Projections

Future projections of coal demand are dependent on numerous factors, which will influence consumption in the various sectors. Therefore, for each of the sectors, a high and low demand case will be presented to chart a projected range of consumption in 1984, 1989, and 1994. Figure V-G-8 presents the range of future coal consumption in New York State by each sector.

a. The Electric Sector

Future demand for coal for New York State utilities will hinge on several uncertainties:

- future growth in demand for electric energy;
- the use of nuclear power;
- environmental regulations, particularly sulfur emissions and coal waste disposal restrictions;
- the potential for voluntary conversion of oil-fired units that are capable of burning coal and the replacement of existing oil-fired plants with coal-fired units; and the degree to which conversions under PIFUA and ESECA occur.

The high coal demand case represents coal consumption as a result of implementation of the electricity supply plan contained herein. All new baseload additions except those currently under construction are coal-fired. All facilities which are targeted for coal conversion in Figure V-F-22 are assumed to be converted.

FIGURE V-G-8
RANGE OF FUTURE COAL CONSUMPTION
IN NEW YORK STATE
HIGH AND LOW DEMAND PROJECTIONS
(MILLIONS OF TONS)

	1984		1989		1994	
	HIGH CASE	LOW CASE	HIGH CASE	LOW CASE	HIGH CASE	LOW CASE
Electric Utilities	12.1	8.7	23.8	10.9	30.8	14.8
Industrial	2.4	2.3	2.5	2.4	2.7	2.5
Coke Plants	4.3	3.8	4.7	3.8	5.2	3.8
Retail Dealers	.03	.02	.03	.01	.03	0
New Technologies	0	0	2.2	0	4.4	0
TOTAL	18.8	14.8	33.2	17.1	43.1	21.1

Figure V-G-9 identifies conversions to coal and shows estimated coal consumption at these units, as well as the estimated oil consumption that will be replaced by coal. Also shown are new coalfired baseload additions and estimated coal consumption by these units. If western coal were to be used in any of those units, with an average heat content of 8,300 BTU's per pound, the consumption quantities would be increased by approximately 50 percent.

In projecting a low coal demand case, the existing generation mix was assumed as modified by the additional small hydro and renewable resource projections of this Plan. Units already under construction, or approved for construction were added, and additional capacity requirements were divided on an equal basis between coal and nuclear fueled facilities. Furthermore, no coal conversions are assumed to take place. As shown in Figure V-F-8, the projected coal consumption for the low demand case is 14.8 million tons in 1994 compared with almost 31 million in the high case.

b. The Industrial Sector

Factors affecting future consumption in the industrial sector are:

- the rate of economic growth generally and in the individual industry; and,
- conversions that may result from the Powerplant and Industrial Fuel Use Act.

In projecting the low demand case, industrial coal consumption is projected to increase at an average rate of approximately 0.8 percent per year through 1994. Furthermore, in this case it is assumed that no conversions to coal under PIFUA will take place because of the large number of exemption possibilities. This results in an increase in coal consumption for the industrial sector to 2.5 million tons annually by 1994.

[5]Office of Technology Assessment, *The Direct Use of Coal*, Washington, D.C., 1979.

FIGURE V-G-9
SUMMARY OF CONVERSIONS OF OIL-FIRED ELECTRIC GENERATING FACILITIES TO COAL AND NEW COAL-FIRED GENERATING FACILITIES

Conversions	Capacity (MW)	Conversion/ In Service Date	Estimated Coal Cons. (million Tons/yr)	1978 Oil Use (million bbl/yr)
Danskammer #3 and #4	342	1982	.9	2.2
Albany #1-4	400	1984	1.0	3.7
Ravenswood #3	928	1984	2.4	4.2
Arthur Kill #2 and #3	851	1984	2.2	5.0
Port Jefferson #3 and #4	380	1984	1.0	3.2
Lovett #4 and #5	399	1986	1.0	1.3
Ravenswood #1 and #2	770	1987	2.0	4.9
E.F. Barrett #1 and #2	380	1988	1.0	3.3
Northport #1-4	1532	1989	4.0	11.8
Subtotals	5982		15.5	39.6
New Plants				
Coal Units 1-5	600-850 ea.	1986-92	7.6	
subtotals	3100-3600		7.6	
			23.1	

For the high case the potential conversions under PIFUA are added to the low case. These are estimated on the basis that there are currently fewer than 100 Major Fuel Burning Installations using oil in the State. The total consumption for these units is approximately 20,000 BBLS of oil per day. Assuming that PIFUA-ordered conversions bring a decrease in oil consumption of 10 percent or 2,000 BBLS per day, there would be an increase in annual coal consumption of approximately 190,000 tons by 1994. This results in a high case annual consumption of 2.5 million tons for 1994.

c. The Coke-Making Sector

Growth in coal consumption in the coking industry will be closely tied to the demand for iron and steel and to economic growth. As a low case in this sector, the current consumption will be used. In the high case, a 2 percent annual growth rate will be applied, or a 35 percent increase over the fifteen year period. Applying this figure directly to current consumption results in an increase of coal consumption to 5.2 million tons in 1994, for the high demand case.

d. New Technologies[6]

Figure V-G-10 identifies new technologies that are being developed to provide innovative, more efficient or cleaner methods of using coal. The advantages and the barriers preventing their introduction are also listed. Figure V-G-11 shows the high and low demand case for coal use in various technologies.

The total potential for new technologies ranges from a high demand of over 4 million tons per year in 1994 to a low demand estimate of no impact.

D. Future Coal Supply for New York State

There are four major factors which will affect future coal consumption in New York State. The first, demand, has been discussed previously, On a national basis, the coal industry is generally viewed as a "demand constrained" industry. That is, if there is the demand for coal there will be adequate production to meet that demand. The other factors that must be considered in evaluating future consumption of coal in New York are as follows:

- Do adequate supplies exist?
- Can adequate quantities be made available to New York State?
- What will it cost to use the coal?

1) Adequacy of Supplies

Coal users in New York should not experience any problems obtaining coal from their traditional sources. Coal production can increase to meet the anticipated growth in demand.

2) Transportation of Coal

In 1975, railroads carried about 65 percent of the coal traffic in the nation and almost 80 percent into New York State. Railroads will be the principal mover of coal into the State in the foreseeable future as well. The waterway system is limited in its capability to expand by the present physical capacity of its locks and by ice in the winter in some areas. Trucks cannot compete in price, and coal slurry pipeline development is constrained by difficulty in getting needed rights-of-way.

Increased coal demand and production will call for adequate coal transportation that must be met by expanding and upgrading the existing system. The railroads anticipate that investments in hopper cars, locomotives, and road-beds will be required to handle the additional coal traffic. This is especially true in the northeastern areas served by Conrail, the federally subsidized consolidation of insolvent eastern and midwestern railroads. Conrail's rehabilitation requirements are substantial and the amount and timing of resource allocation to coal service could be critical to New York coal consumers.

As far as equipment is concerned, however, Conrail pres-

[6]Appendix D-4d contains a detailed discussion of new technologies and the basis for estimates of future consumption.

FIGURE V-G-10
NEW TECHNOLOGIES FOR COAL UTILIZATION

Technology	Description	Potential Uses	Advantages	Barriers
Coal-Oil Mixture (COM)	A mixture of coal and oil resulting in a liquid fuel.	COM can be used in oil-fired boilers with minor modifications in the commercial, industrial, and utility sectors as a replacement for traditional oil products	Allows replacement of oil in applications where direct coal combustion is not feasible.	Environmental—Particulate and sulfur emissions. Economic—A preparation facility would have to be fairly large to be economical
Fluidized Bed Combustion (FBC)	Coal is burned in a fluidized bed with dolomite or limestone added to capture sulfur. Steam is provided to drive a conventional turbine.	Can be used in large industrial and large institutional and utility settings to more efficiently burn coal.	In addition to efficiency, there are environmental advantages including less NO_x emission and sulfur emission and less water used.	Environmental—Potential solid waste problem. Economic—High cost of FBC unit Reliability—lack of demonstrated operating performance
Low-Btu Gasification (LBG)	Coal is converted into a gas by combusting coal with air and steam. The heating value is 100-180 Btu/SCF.	LBG can be used in either conventional gas-fired equipment or turbines for power generation.	LBG processes are technically proven and produce a clean fuel for end use.	Environmental—No current standards and future standards are uncertain. Economic—The low Btu content makes transport unprofitable.
Medium-Btu Gasification (MBG)	Produced in the same manner as low Btu gas except that oxygen is used in place of air. The heating value is 300-600 Btu/Scf.	MBG can be used in new and retrofit application in energy-intensive industries.	MBG is of a sufficient Btu level to make it movable by pipelines economically.	Similar to LBG. Economic—Costs of pipelines to transport Institutional—Barriers in securing permits for pipelines.
High-Btu Gasification (HBG)	Same as MBG except that a methanation stage is added.	Can be used for any gas application such as residential heating.	Substitute for natural gas and can be transported in natural gas pipeline.	Technological—Integration of hardware is still unproven. Economic—High capital investment.
Liquefaction	Coal is converted to a liquid through hydrogenation.	As a replacement for fuel oil in commercial, residential, industrial and utility sectors.	Allows easier transportation. avoids changeover of traditional burners and ensures domestic market for fuel-oil substitute.	Economic—Capital requirements are significant. Technological—Government support will be necessary to encourage commercialization.
Coal Gasification for Combined Cycle Electric Generation (CGCC)	Clean gas is fed to a gas turbine to drive a generator. Steam, derived from the waste heat, drives a second generator.	Utility companies are the most probable users of CGCC. However, this could be coupled with co-generation and penetrate the industrial and commercial sectors.	CGCC plants have less environmental impact than direct-fired plants and will be more efficient.	Economic—Costs are currently high. Technological—Higher temperature gas turbines are necessary to be cost-effective.
Coal Gasification for Fuel Cells	Hydrogen rich gas is produced by reacting water with coal at high temperatures in a gasifier. The gas is cleaned and passed through an electrode in the fuel cell. Certain processes take place and electricity is produced. Waste heat can generate steam to drive a steam turbine.	Utilities are most probable users.	This technology is environmentally attractive and is potentially very efficient.	Further technological development is required.

FIGURE V-G-11
INCREASE IN COAL CONSUMPTION IN NEW YORK STATE THROUGH NEW TECHNOLOGIES HIGH AND LOW DEMAND PROJECTIONS (THOUSANDS OF TONS)

	1984	1989		1994	
Technology	CASE	HIGH CASE	LOW CASE	HIGH CASE	LOW
Coal/Oil Mixture	0	975	0	1950	0
Fluidized Bed Combustion	0	105	0	190	0
Low-Btu Gasification	0	23	0	45	0
Medium-Btu Gasification	0	900	0	1800	0
Liquefaction	0	0	0	Unknown	0
High-Btu Gasification	0	0	0	0	0
Coal Gas for Combined Cycle Electric Generation	0	0	0	0	0
Coal Gasification Fuel Cells	0	0	0	0	0
TOTAL NEW TECHNOLOGIES	0	2003	0	3985	0

ently has an adequate fleet of mixed tonnage (70-75 ton) cars. Conrail is also one of the few carriers with any car fleet to spare: most railroads currently request that they be supplied with needed cars and locomotives for large tonnage, unit train movements.

Regardless of where coal users are located, the anticipated increase in coal consumption can be handled by rail. Some work may be required on connector lines or on portions of main lines. However, in the long run, this should not be a significant problem since adequate time for improving track or devising alternate routing is generally available.

There may, however, be a problem transporting coal to electric generating stations located in the New York City area and on Long Island. The most likely source of coal for these plants is Appalachia. Unit trains moving to the New York City area would be forced first to travel to the Selkirk Yard (outside of Albany) and then south. Unloading facilities, excessive passenger traffic, and other inadequate equipment could undercut the use of rail transportation significantly. Similarly, existing trackage and routes also limit the use of unit trains to ship coal directly by rail to Long Island. In both cases, the preferred alternate would be rail shipment from the coalfields to the coal dumper located at Port Reading (just south of Elizabeth, New Jersey) and then by barge to the New York City area or Long Island.[7]

3) Factors Influencing Coal Cost

Costs include the price of the coal, the cost to transport to the point of use, and the costs for pollution control and waste disposal. These are the "costs" that will be addressed at this time. However, there are other costs related to the use of coal (vs. the use of other fuels) that would have to be considered by a potential consumer. Coal boilers are bigger, coal delivery and handling equipment is more extensive,

[7]ICF Incorporated, *Analysis of New York State Coal Supply Demand and Price: 1979-1994*, Washington, D.C., May 1979.

FIGURE V-G-12
MINE AND TRANSPORTATION COSTS OF COAL CONSUMED BY EACH SECTOR IN NEW YORK, 1978

		Average Transportation Costs ($/ton)		
	Average Mine Cost ($/ton)	Railroad	Truck	Total Cost[a] ($/ton)
Industrial Steam	27.52	11.48	9.89	38.76
Utilities	—	—	—	27.54
Cement	24.00	10.00	—	35.16
Coke Plants	—	—	—	—
Retail	28.54	15.83	11.15	40.70
TOTAL				30.00

[a]Weighted averages.

SOURCE: Survey of 1978 Coal Consumers in New York State (Jan. 1979).

coal requires more land area for storage, and operation and maintenance costs are higher.[8]

a. Coal Prices

Figure V-G-12 (based on a 1978 survey of coal consumers in New York State) presents mine-mouth and transportation costs for current coal supplies to New York State users. Because utilities are the largest consumers and do not require extensively washed or sized coal, their price (delivered) is considerably less than other consuming sectors.

Transportation costs are also largely determined by quantity of coal purchased. The smaller retail users paid 50 percent more for coal shipped by rail than did large users. This reflects the difference in costs between single-car rates and multiple-car or unit-train rates. Surprisingly, the survey found that truck transportation was less expensive than transportation by rail on a per ton basis. However, truck transportation is generally much more expensive on a per-ton-mile basis, and this seemingly anomalous finding is explained in large part by the shorter hauls associated with truck deliveries.

This survey also found that most coal consumed by non-utilities was being purchased as needed on the open market and a significant amount of coal consumed by utilities was purchased similarly. This reflects the fact that the majority of users in the State consume only small quantities of coal and that even the larger users are reluctant to enter into longer-term contracts. This is due in part to a volatile market, the changing regulatory environment, and uncertainty about future electricity growth rates and capacity requirements. Sixty-seven percent of all coal consumed by the utilities was by contract and not on the spot market. However, there was little difference in the price paid for coal purchased under these different purchase arrangements.

Recent activity in the spot market for coal from Northern Appalachia is shown in Figure V-G-13. Prices are depicted for coal with four levels of sulfur content mined in the area. Since Northern Appalachia is the supply source for most of New York's coal, and much of New York's coal purchases are not under longterm contract, spot market prices should accurately reflect the price of a significant portion of the coal used in the State.

In 1976, the U.S. coal market experienced a surplus (supply exceeded demand), in which all types of coal were being sold on the spot market at close to the variable mining costs of existing mines. Through 1977, reported spot prices showed the effects of a tightening market by increasing above the low levels reported in 1976. These increases were caused in large part by a desire by consumers to build their coal inventory levels in preparation for the UMW strike that started in December 1977. For 1976, there was no appreciable sulfur premium for the four coals being evaluated. This indicated that the SO_2 regulations, which would create such premiums, had yet to impact the coal markets due to delays in enforcement and promulgation of legally binding standards. A balanced market existed through the first half of 1978 because of curtailed production accompanying the United Mine Workers' strike. For the second half of the year, there was a return to a soft market, particularly for the higher-sulfur coals in Northern Appalachia, because of post-strike increases in production. Spot market prices were expected to continue to show a price differential based on sulfur content, reflecting a price premium for lower-sulfur coals.

Figure V-G-14 is a more detailed breakdown of recent spot market price movement for the utility sector. Steam coal prices increased during the first half of 1978, reflecting artificially low supplies following the UMW strike. After resolution of the strike and a return to full production, prices for steam coal from Northern Appalachia dropped slightly. A far more dramatic drop in prices occurred for Central Appalachia coal. Prices for industrial coal from Northern and Central Appalachia during the past year have generally remained constant. This trend reflects the overall weak market for coal in this sector.

For the utility sector, long-term contract price forecasts describe the future price of coal. Figure V-G-15 presents forecasts made by ICF's CEUM for minemouth prices through 1995 for different sulfur content coals. These price forecasts assumed a 90 percent sulfur removal requirement (with credit for washing) as the new source performance standard for new coal-fired plants.

In general, prices will increase at a considerably faster rate for Appalachia coal and midwest coal than any other. The fastest rate of increase is seen in Central Appalachia low-sulfur coal, where limited supplies and strong demand rapidly push up the marginal costs of production. This trend reflects the higher cost of marginal production in these areas. Prices for coal from the Great Plains region are expected to remain constant or gradually increase.

b. Transportation Costs

To better understand the effect of location and distance on transportation economics, transportation costs were analyzed for coal moved by rail from six supply regions: three in Appalachia, one in Ohio, and two in the West. Each of these supply regions potentially can ship coal to New York State. Demand for coal from these regions would depend primarily on the required sulfur content to meet environmental

[8]United States Congressional Budget Office, *Replacing Oil and Natural Gas with Coal: Prospects in the Manufacturing Industries*, Washington, D.C., August 1978, pp. 11-12.

FIGURE V-G-13
SPOT MARKET PRICES FOR NORTHERN APPALACHIA
(IN DOLLARS/TON)

	YEAR		
Sulfur Content	1976	1977	1978
Low Sulfur (less than 0.7% S)	16	23-27	35-26
Low-Medium Sulfur (0.7-1.0% S)	16	21-26	34-26
High-Medium Sulfur (1.0-2.0% S)	16	20-25	33-26
High-Sulfur (more than 2.0% S)	16	18-22	26-20

SOURCE: *Coal Week*

FIGURE V-G-14
RECENT SPOT MARKET PRICES FOR STEAM COAL

	STEAM COAL (dollar/ton)		
	Btu/ lb	% Sulfur	f.o.b. Spot Price
January 1978			
N. Appalachia	11,908	2.4%	$18.87
C. Appalachia	11,733	1.9%	$23.58
February 1978			
N. Appalachia	11,900	2.5%	$20.31
C. Appalachia	11,733	2%	$25.42
March 1978			
N. Appalachia	11,800	2.4%	$23.56
C. Appalachia	11,366	1.9%	$27.08
April 1978			
N. Appalachia	11,800	2.4%	$23,87
C. Appalachia	11,633	1.9%	$26.92
May 1978			
N. Appalachia	11,800	2.4%	$23.56
C. Appalachia	11,633	1.9%	$26.92
June 1978			
N. Appalachia	11,700	2.4%	$22.81
C. Appalachia	11,633	1.9%	$25.33
July 1978			
N. Appalachia	11,700	2.4%	$22.81
C. Appalachia	11,633	1.9%	$22.66
August 1978			
N. Appalachia	11,700	2.4%	$21.87
C. Appalachia	11,633	1.9%	$22.25
September 1978			
N. Appalachia	11,700	2.4%	$21.88
C. Appalachia	11,633	1.9%	$22.67
October 1978			
N. Appalachia	11,700	2.4%	$21.87
C. Appalachia	11,633	1.9%	$22.67
November 1978			
N. Appalachia	11,700	2.4%	$21.87
C. Appalachia	11,633	1.9%	$22.50

SOURCE: *Coal Week*

regulations, the location of the coalburning facility, and relative mine-mouth and transportation costs. Facilities requiring low-sulfur coal will be required to purchase shipments primarily from Central Appalachia or from the West. Where sulfur content is not a consideration, selection of coal would be based primarily on a comparison of delivered costs and BTU content. The question that then arises is the delivered cost of western coal compared to the cost of coal available from the much closer coalfields of Northern Appalachia.

Figure V-G-16 presents the per-ton transportation costs of delivering coal from Appalachia and Ohio to sites near Lake Erie (Buffalo) and in the Hudson River Valley (Athens).

These rates are for unit trains (7-10,000 tons) with locomotives and cars supplied by the railroad. If equipment were supplied instead by the utility, costs would be reduced by $1-2 per ton. Costs to sites in the Hudson River Valley are significantly higher because of the longer distance and because the required route goes north through Buffalo and then east.

Because of its low sulfur content and relatively inexpen-

FIGURE V-G-15
MINE-MOUTH PRICE OF COAL
(DOLLAR/10^6 BTU)
(1978 DOLLARS)

Region	1985	1990	1995
Northern Appalachia			
High Sulfur	0.95	1.10	1.19
Medium Sulfur	1.08	1.15	1.20
Low Sulfur	1.48	1.54	1.60
Regional Average[a]	1.07	1.17	1.23
Central Appalachia			
High Sulfur	0.98	1.18	1.26
Medium Sulfur	1.13	1.30	1.37
Low Sulfur	1.44	1.52	1.58
Regional Average[a]	1.37	1.49	1.57
Midwest			
High Sulfur	0.92	1.06	1.16
Medium Sulfur	1.20	1.24	1.30
Low Sulfur	1.52	1.55	1.60
Regional Average[a]	0.99	1.10	1.19
Eastern Northern Great Plains			
High Sulfur	0.42	0.42	0.42
Medium Sulfur	0.42	0.43	0.43
Low Sulfur	0.42	0.42	0.46
Regional Average[a]	0.42	0.43	0.43
Western Northern Great Plains			
High Sulfur	—	—	—
Medium Sulfur	0.79	0.89	1.00
Low Sulfur	0.96	0.99	1.06
Regional Average[a]	0.90	0.95	1.04
Western Northern Great Plains (Subbituminous)			
High Sulfur	—	—	—
Medium Sulfur	0.43	0.39	0.41
Low Sulfur	0.54	0.51	0.54
Regional Average[a]	0.51	0.47	0.48
National			
High Sulfur	0.93	1.07	1.16
Medium Sulfur	0.92	0.93	0.94
Low Sulfur	0.79	0.71	0.74
Regional Average[a]	0.99	1.00	1.04

NOTE: Certain anomalies in the behavior of prices are apparent. This is due to the averaging (consumption weighted) associated with aggregating the 39 demand regions into nine larger regions, where expensive coal in one demand region is averaged with less expensive coal in another region and where the relative volumes of these coals change between scenarios. This can result in a situation where the price of each coal increases, for example, but the weighted average decreases because more lower-priced coal and less higher-priced coal is forecasted.

[a]weighted averages.

SOURCE: ICF, "Still Further Analyses of Alternative New Source Performance Standards" (Jan. 1979). p. E-III-14b. These estimates assume full scrubbing is required for new power plants. See page 39 for specifications of the full scrubbing option

FIGURE V-G-16
RAIL TRANSPORTATION COSTS
(1979 DOLLARS/TON)

ORIGIN	DESTINATION	
	Lake Erie	Hudson River Valley
Ellsworth, Pa.	$4.40	$10.44
Clarksburg, W. Va.	5.80	10.44
Cambridge, Ohio	6.85	11.37
Hazard, Kentucky	11.30	15.07

SOURCE: ICF, Inc.

sive mine-mouth price, coal shipped from the West has considerable market potential in the east and movement of western coal east across the Great Lakes may be economically attractive. Direct rail cost from Wyoming to Lake Erie would run approximately $22.00 to $23.50 per ton. Coal shipped from Montana by rail to Duluth/Superior and across the Great Lakes by collier to Buffalo would cost approximately $15.82.[9] This rate includes a cost of $9.82 for rail from Decker to Duluth, plus $6.00 for collier from Duluth to Buffalo. New lake colliers capable of handling 60,000 tons are currently transporting coal to Detroit Edison. Adequate loading facilities currently exist at the western terminus of the Great Lakes, but some capital improvements may be required to existing facilities on Lake Erie. In addition to Lake Erie and the Hudson River Valley, additional coal-fired utility plants are proposed for the downstate area on Long Island and in New York City. Figure V-G-17 estimates these costs from each of four supply regions in Appalachia.

There is also the potential for future rate increases. Coal carriers in the West have recently initiated sharp rate hikes. It was argued that these increases were necessary to compensate the railroads for the extensive track damage from unit train shipments; cars of all the same weight create a harmonic motion that is particularly destructive to the track. The San Antonio case, involving Wyoming coal rate increases of more than 100 percent in a relatively short time, is a prime example of increasing transportation costs. The Burlington Northern rates from Montana and Wyoming to Duluth/Superior currently have a 30 percent increase pending. In the east, Conrail estimates that its annual rate of increase will remain steady at approximately 8 percent per year.

[9]A potential 30 percent rate increase has been proposed for this route, which would increase costs to $18-$19 per ton.

c. Environmental Costs

The third major cost component of coal consists of the environmental costs primarily related to air pollution control and solid waste disposal. These two items are related to the extent that the waste disposal costs will be composed of the costs to dispose of the "bottom ash" and the wastes resulting from the operation of the air pollution control equipment.

i. Ambient Air Quality

The Clean Air Act Amendments of 1977 established a program to control the ambient air quality in specified regions. Based on a region's existing ambient air quality, it will be designated either a "nonattainment" or a "prevention of significant deterioration" area for each of five pollutants.[10] Any additional major facilities significantly impacting on non-attainment areas are required to purchase "emission offsets."[11], [12] This requirement allows for additional growth in an area without further degrading the air quality. Figure V-G-18 shows the areas classified in New York State as non-attainment areas. Of particular relevance to future expansion of coal-fired capacity is the designation of Lake Erie as a non-attainment area for the SO_2 standard. This may require plants seeking to locate in that area to purchase offsets. Similarly, existing violations of the primary or secondary TSP standard in several counties in the Hudson Valley region, in the Bronx, and surrounding Lake Erie may also limit future growth of coal-fired facilities in those areas.

ii. New Source Performance Standards

The most costly environmental regulations that coal-fired plants would have to meet are the New Source Performance Standards (NSPS) for total suspended particulates (TSP) and sulfur dioxide (SO_2). EPA has issued new regulations requiring that SO_2 emissions not exceed 1.2 lbs. per million BTU of heat input and 90 percent reduction of potential SO_2 emissions. If SO_2 emissions are less than 0.6 lbs. per million BTU 70 percent reduction in potential SO_2 emissions is required. If the 1.6 lbs.

[10]These pollutants are sulfur dioxide, carbon monoxide, photochemical oxidants, total suspended particulates (TSP) and nitrogen-oxide.

[11]As explained in 6NYCRR Part 231 (proposed), New York State DEC regulation for implementing the 1977 Clean Air Act Amendments pertaining to major facilities.

[12]The offset requirement is somewhat different for volatile organic compound pollutants.

FIGURE V-G-17
TRANSPORTATION COSTS TO NEW YORK CITY AREA
($1979/TON)

ORIGIN	to Long Island			to the South Bronx[b]		
	RR[a]	Barge	Total Cost	RR[a]	Barge	Total Cost
Ellsworth, PA	$14.00	$2.50	$16.50	$14.00	$1.25	$15.25
Cambridge, OH	16.00	2.50	18.50	16.00	1.25	17.25
Clarksburg, WV	11.75	2.50	14.25	11.75	1.25	13.00
Hazard, KY	17.00	2.50	19.50	17.00	1.25	18.25

[a]Railroad terminus in Port Reading, New Jersey.

[b]Used only for illustrative purposes in this analysis.

SOURCE: ICF Incorporated.

FIGURE V-G-18
NONATTAINMENT AREAS IN NEW YORK STATE
(AS OF 11/15/78)

Pollutant	County[a]	Standard[b]
TSP	Albany	Secondary
	Bronx	Secondary
	Chautauqua	Secondary
	Erie	Primary
	Greene	Secondary
	Kings	Secondary
	New York	Secondary
	Niagara	Primary
	Onondaga	Primary
	Queens	Secondary
	Rensselaer	Secondary
	Richmond	Secondary
SO_2	Erie	Primary

[a]Only parts of each county are in violation.

[b]Primary standards refer to violations of ambient air quality which affect health; secondary standards refer to violations relating to welfare.

SOURCE: EPA, "Counties Not Meeting the National Ambient Air Quality Standards".

level cannot be met with 90 percent reduction, the coal cannot be burned.

The new regulations that require sulfur cleaning of all coal may mean that western coal will lose some of its cost advantage over eastern low and medium sulfur coal, and that in almost all circumstances, eastern medium sulfur coal will be the lowest cost compliance strategy for new plants locating in New York.

A recent survey[13] sponsored by the U.S. Environmental Protection Agency, of costs for SO_2 scrubber systems, shows a wide variation in capital and annual costs. Average annual costs for the 21 scrubber units or groups in the comparative study were 5.5 mills per KWH with annual costs for scrubbers installed as part of new generating units averaging 5.2 mills per KWH and those retrofitted on old generating units averaging 5.8 mills per KWH. Annual costs varied from 2.58 mills per KWH to 12.73 mills per KWH. Capital costs for the units surveyed ranged from $56 per KW for a limestone-type system, to $145 per KW for a regenerative system (the only one in the group).

iii. Waste Disposal

In 1976 Congress passed the Resource Conservation and Recovery Act designed to improve waste disposal practices. Hazardous wastes fall under specific provisions of the Act (Subtitle C), which require more stringent regulations of generators, transporters, and treatment and disposal facilities.

In its December 18, 1978 publication of proposed rules in the *Federal Register,* EPA postponed a final decision to classify utility wastes. Instead it has proposed a subcategory of hazardous wastes termed "special wastes," which would apply to large volume generators of relatively low hazardous wastes. This classification scheme would allow EPA to place less stringent requirements on the disposal of utility wastes.

[13]Environmental Protection Agency, *EPA Utility FGD Survey: October-November, 1978,* February, 1979.

It is likely that any specific requirements imposed under RCRA will be directed at upgrading landfill techniques used to dispose of utility wastes to ensure that the surrounding groundwater is protected. Improved landfill techniques would probably include use of clay liners, leachate collection and treatment facilities, and some form of monitoring. Chemical stabilization of scrubber sludge may also be required. Figure V-G-19 estimates the costs of complying with possible requirements for improved disposal practices under RCRA for a model 500 MW plant.

Current costs of disposal are estimated to be between $1.50 and $5 per ton of waste. Assuming a conservative $5 per ton cost, the incremental expense ($20 per ton of waste) associated with RCRA for the 500MW model plant would be $4.96 million per year for eastern medium sulfur coal and $2.3 million for western low sulfur coal. Total compliance costs under RCRA would be $12.40 per installed kilowatt for high sulfur coal and $5.76 per installed kilowatt for low sulfur coal.

Other potential problems associated with RCRA include:

- Restrictions on potential sites for generating facilities near wetlands, aquifers, etc.
- Additional land at each site for onsite disposal facilities.
- Potential delays in licensing because of challenges filed under RCRA.

EPA expects to make a final decision on the classification of electric utility wastes by June, 1980, and to adopt specific regulations detailing acceptable disposal practices for this industry by 1982.

4. RECOMMENDED ACTIONS

- Convert existing baseload oil-fired powerplants to coal, where economically and environmentally possible.

  This action has been discussed in detail in Section V-F.
- NYSERDA, with support and cooperation from SEO and DPS should support projects to demonstrate the potential for use of coal-oil mixtures at baseload oil-fired generatings stations where conversion to direct combustion of coal is infeasible.

While there are many oil-fired units in New York where conversion to direct combustion of coal should be pursued, there remains a significant amount of oil-fired capacity which, due to engineering, economic or environmental constraints, may not be able to be converted. The potential for reducing oil consumption at these units through use of coal-oil mixtures as fuel should be explored.

Niagara Mohawk's Oswego generating station (Units #1-6) could be a potential candidate for this venture. If all units at Oswego were to utilize COM there would be an estimated savings of approximately 10 million barrels of oil per year.[14]

Converting to coal-oil mixtures is a quick and cost effective way to reduce the State's reliance on imported oil and to increase coal use. Converting requires minimal capital investment, and, compared to a total conversion, the capital costs for coal-oil mixtures are considerably less. Equipment requirements are "state-of-the-art" and do not need to be developed. This study could be undertaken by NYSERDA, in cooperation with the State's electric utilities.

Use of coal-oil mixtures is an immediate and short-term solution to some of our energy problems and can be used

[14]Based on a 50 percent coal-oil mixture using consumption estimates from OGP-5A with NYPP Energy Strategy and NYPP Assumptions; 1982 Yearly Summary.

FIGURE V-G-19
ESTIMATED COST OF COMPLIANCE WITH RCRA[a]

Sulfur Content[d]	COAL TYPE BTU Content	Ash Content	Percent Sulfur Removal	Total Annual[b] Quantity of Waste Generated (Dry Tons)	Total Annual[c] Cost of Disposal (millions)	Total Cost ($/kw)
3.5%	12,000	14%	90%	248,000	$6.20	$12.40
.8%	8,000	8%	90%	115,000	$2.88	$ 5.76

[a]Based on 500 MW model plant.

[b]Aerospace, Corp. "Controlling SO_2 Emissions from Coal-Fired Steam-Electric Generators: Solid Waste Impact" (1978). Totals assume that both sulfur sludge and fly ash are disposed of together.

[c]Costs assumed to be $25 per ton waste based on estimates by Fred C. Hart Associates.

[d]The low sulfur coal example results in a slightly higher cost than would occur because 90 percent sulfur removal would not be required under the recently promulgated New Source Performance Standards.

while longer term solutions such as synthetic fuels from coal and shale are being developed. Again, the utilities in the State recognize the importance of the use of alternative fuels and many are currently codsidering efforts to achieve these objectives.

- Encourage development of a coal-based synthetic fuels industry in the northeast by;
  - •• Enacting the proposed windfall profits tax.
  - •• Creating the proposed Energy Security Corporation.
  - •• Enacting the Regional Energy Development Corporation Act of 1979.

The potential for a coal-based synthetic fuels industry in the Nation is quite large in terms of natural resources and technology. However, there are several factors that introduce considerable uncertainty as to the levels of synthetic fuels production that will be realized during the next several decades.

Economic considerations and the availability of venture capital are perhaps the greatest inhibitors of coal-based synthetic fuels development in the country. Competing energy sources, as well as technology for direct coal combustion, are, in many cases, more attractive than synthetic fuel processes at present. There are also many other technological, environmental, socio-economic, and political factors that must be resolved before synthetic fuel production can become a reality.

However, as world oil production inevitably levels off and then falls, coal will have to make up this deficit in imports and also meet the normally expected increase in energy demands. Much of this makeup must be in the form of synthetic oil and gas.

New York State and the entire northeast region of the country is heavily dependent on petroleum products for meeting energy needs. Most of this petroleum is imported and subject to supply disruptions and rapidly spiraling price increases.

Substitutes for natural gas and petroleum need to be created, and because of the long lead times involved, this must be done immediately. While these efforts should also be taken at the national level, a regional program for commercializing a synthetic fuels industry, *with existing technologies,* must be pursued to move the northeast region into an era of more secure, reliable, and economic petroleum and gas supplies. To carry out such a program, the Congress should create the Energy Corporation of the Northeast (ENCONO), and the states in the northeast region should join it.

ENCONO would be authorized to design and execute a program to create synthetic fuels from coal. It would have authority to build facilities to produce synthetic fuels, which may be operated by private industry under leases or management agreements. ENCONO would analyze the feasibility of achieving its goals by employing various mixes of the sources, technologies, and financing options, and would then design a program and negotiate the appropriate contracts.

There are numerous existing technologies that should be considered under this approach. Each of these technologies should be given immediate and careful consideration and project implementation should begin as soon as possible thereafter.

One possibility would be a facility to produce liquid synthetic fuel from coal. Total capital costs for a coal liquefaction plant (in 1978 dollars) are projected to range from approximately $1 billion (SRC II) to $1.8 billion (H-Coal) for a plant with a product output of 50,000 BBL's per day. While the ultimate cost of such a program is significant, it must be considered relative to the trade deficit already being incurred at the rate of nearly $8 billion per year for each million barrels per day of oil now being imported. New York State alone used nearly million barrels per day of imported oil in 1978.

A second possibility that should be considered is a facility which has as its "backbone" a coal gasification/ combined cycle electric generation plant. If the coal gasification step is designed to make medium BTU gas, certain co-products can be produced under a mode of operation which would permit a relatively constant load factor for the gasification and clean up equipment. The clean synthetic gas could then be fed to the combined cycle electric generation unit, a methanol plant, a methane plant and possibly even an ammonia plant. This concept is particularly attractive for New York State because of the characteristics of the State's electric and gas systems: the gas system is "winter peaking" and the electric system is "summer peaking".

Financing such a facility could involve ENCONO, the Electric Power Research Institute, the Gas Research Institute, ESEERCO, the federal government, and also private interests including the State's electric utility companies as well as gas utility companies.

The New York State Energy Research and Development Authority should undertake a feasibility study to determine the optimum balance of power and products and the resulting overall economics, including costs for at least one suggested plant configuration and capacity. Thereafter, a plan can be developed to stimulate the necessary interest in overcoming the economic, political, and outstanding technical prob-

lems. It is estimated such a study would cost $200-$300 thousand and may take 6-9 months to complete.

Early in the next decade there will be greater competition for the capital required to undertake synthetic fuels production. The manufacturing capacity of the Nation to produce components for the production facilities is likely to become strained. Therefore, New York and the Northeast region must move immediately to take advantage of the technologies that now exist to produce synthetic fuels.

SECTION V-H

Research and Development Plan

1. INTRODUCTION

The State's energy research, development and demonstration programs must continue to emphasize the development and demonstration of those technologies particularly suited for near and mid-term commercialization and implementation in New York State. Coordinated efforts in advancing such technologies should be consistent with other state energy policies.

Within New York State, a vigorous and diverse energy research and development effort is being supported and carried out by a variety of participants. They include the New York State Energy Research and Development Authority (ERDA), the New York Gas Group (NYGAS), the Empire State Electric Energy Research Corporation (ESEERCO), and the individual gas and electric utilities.

This ongoing R&D effort involves private engineering and scientific firms, universities, industries, state agencies, and local government. The utility research organizations and ERDA also coordinate their work with two national energy research organizations—the Gas Research Institute (GRI) and the Electric Power Research Institute (EPRI)—and also with the United States Department of Energy (DOE).

The overall purposes of New York's collective energy research and development activities are to (1) establish ways to use energy more efficiently while reducing waste, (2) produce and distribute energy less expensively, and (3) improve the safety and environmental compatibility of energy production and use. It is recognized, however, that these goals are being pursued within New York with limited resources compared to the costs of creating new technological solutions to basic energy problems. New York utilities and agencies together spent an impressive $53 million on energy research and development in 1978; but only the federal government and industry command the scale of resources necessary to develop new coal conversion technologies, discover cost-competitive ways to tap renewable energy sources, unlock the natural gas potential in shale, and invent highly efficient transportation vehicles.

The State's energy R&D goal is to develop technologies that will apply best to New York State's particular energy situation. The research efforts here recognize the need to adapt the technologies and solutions being developed by industry and the federal government to solve New York's problems. The particular weather conditions, environmental restrictions, intrastate energy supply and distribution systems, and patterns of energy demand are some of the factors that require consideration in developing technologies to suit New York's needs.

A second aspect is to work with the federal government, industry, and the large research centers (GRI and EPRI) to bring their resources to solving the kinds of problems that exist in New York. This is done by professional interchanges at the staff level to develop programs and projects that can be performed in New York. In addition, New York utilities in 1978 contributed $743,000 to the Gas Research Institute and $13,213,000 to the Electric Power Research Institute. This gives New York considerable potential leverage in helping set priorities for these major national organizations.

Finally, in-state energy research and development must attend to those energy opportunities and problems that are unique to the State, such as the development of indigenous resources, the creation of technologies and strategies for energy conservation, and the effective dissemination of information on new, energy-efficient practices and processes as they apply within the State.

A natural division of responsibilities exists among New York research and development organizations. The gas and electric utilities individually fund projects that are of particular use to their own specific operations—such as environmental studies relevant to their own plant operations, experiments with time-of-day rates within their own service areas, studies of improved generation, transmission and distribution systems, and assessment of ways to decrease metering and billing costs. Consortium arrangements also exist for cooperative efforts among the utilities. ESEERCO has been created to develop statewide electric utility R&D strategies and to fund, contract for, and administer research and development programs dealing with problems or opportunities common to the New York electric utility companies. It also helps plan and coordinate State utility R&D programs and interaction among the State's electric utilities and other R&D organizations such as DOE, ERDA, EPRI, and universities.

The State's 14 gas utilities have formed a trade association, called the New York Gas Group (NYGAS), that provides a number of services to its members. NYGAS has established a special committee (NYSEARCH), that is responsible for developing specific R&D objectives and strategies. NYSEARCH has special responsibility for providing initiative on efforts that by nature or size involve several companies. NYSEARCH also provides a forum for interaction among the gas utilities and New York ERDA, GRI, and others.

New York is unique among the states in having its own energy R&D agency. The New York State Energy Research and Development Authority has a general mandate to find ways to improve New York's energy future through research, development, and demonstration of new technologies. The Authority's enabling legislation states that

> The purposes of the Authority shall be to develop and implement new energy technologies consistent with economic, social and environmental objectives, and to develop and encourage energy conservation technologies.

ERDA seeks to concentrate its resources in the several areas that potentially can meet this overall goal best. It works closely with the utilities, ESEERCO, NYGAS, the Public Service Commission (PSC), the Department of Environmental Conservation (DEC), and the State Energy Office (SEO) in identifying research program areas and works with them to set an energy R&D agenda for the State, The preparation of this State Energy Master Plan, with its comprehensive view of supply sources and user demands, provides a coherent vehicle for focusing future State R&D priorities and activities. While a fair amount of coordination and communication exists, in the past the major R&D organizations have pursued their research with a certain degree of independence. In areas where each organization must deal with special problems and needs associated with its particular role in the energy system, an independent style of conducting basic and applied research is appropriate. The long-term energy crisis in which the State is now immersed,

where liquid or solid fuels cannot be used. Thus, research and development also is being sponsored in coal gasification technologies.

New York is promoting the development of fluidized bed combustion of coal because it has the potential to improve combustion efficiency and simplify and reduce the cost of pollution control. (A fluidized bed boiler operates by suspending coal and mineral particles in an upward current of air in the combustion chamber.) Atmospheric fluidized beds appear especially applicable to industrial facilities. Pressurized fluidized bed combustion in a combined cycle mode has the potential to improve electrical generation efficiency. Thus, research to promote the development of fluidized bed technology is required. DOE, EPRI, and ERDA are making a major cooperative effort to assess the tolerance of gas turbines for effluent from pressurized fluidized beds.

One way to reduce the potential environmental impacts of coal use is to reduce the sulfur and ash content before burning. New York will continue to support long-term research to improve the efficiency of methods for cleaning coal. Most of New York's work in this area is being done cooperatively through EPRI or with federal support.

In summary, coal liquefaction, coal-oil mixtures, fluidized bed combustion, pollution control in conventional coal combustion, low and medium BTU gasification, combined cycle gas turbines, and physical coal cleaning research projects appear to be the most productive areas for coal research and development in New York State. In addition to direct research in these areas, considerable effort is also devoted to monitoring research conducted by others.

B. Conservation

R&D for energy conservation must be concerned with the development of new conservation technologies and energy management techniques, especially those that might be readily implemented. A comprehensive energy conservation program must build a working relationship between R&D organizations and decision makers in energy use sectors. Program targets include residential and commercial buildings—utility and customer load management, industries, and transportation. Consideration must be given to removing institutional and motivational barriers.

The residential and commercial conservation activities will focus on two areas: (1) the development of energy systems and equipment for buildings, including new thermostat arrangements and more efficient heating, cooling, and ventilating devices, (2) the development of more energy efficient building envelopes, emphasizing improved window design and safe, inexpensive insulation and infiltration barriers.

Load management calls for incentives that will lead consumers to change their pattern of using electricity so that energy use in peak periods is reduced. One of the major methods for pursuing this goal is to create "time-of-day" rates, so that electricity costs less during non-peak periods. Research and development should continue to be concerned with the adaptation of hardware, especially meters, that will promote the implementation of time-of-day rates. Modeling of the financial effects of load management will help assure that such measures achieve true savings. Studies of the consumer acceptance and life-style problems associated with these special rates are needed.

Industry can save energy in two ways: by better recovery and use of waste heat, and by more energy efficient industrial processes. Industrial conservation includes development of better ways to use waste heat, such as open cycle industrial heat pumps and stack gas heat recovery. Also under way are programs that will help develop more energy efficient industrial processes for New York businesses, such as efficient electric motors and furnace systems. One waste heat recovery system funded by DOE and ERDA that has potential for statewide applications has been successfully demonstrated at a municipal power plant on Long Island. Another project is aimed at developing an industrial-sized heat pump that will extract energy from a condensing liquid waste heat stream and produce low-pressure process steam.

The gas and electric utilities will be exploring a number of possible ways to increase the efficiency of energy generation. The electric utilities are exploring such developments as gas turbine reingestion and a variety of heat pump technologies. For example, GRI and ERDA are sponsoring development of an advanced gas-fired heat pump to reduce substantially the amount of gas required to heat a home.

Transportation is a critical sector in the economy, one that demands new technologies and systems for conserving energy, especially fossil fuels. Demonstrations are under way to test the prospects of using electric vehicles in New York. DOE has selected ERDA to demonstrate 45 electric vehicles, that will be used as part of the regular fleets of the New York State Office of General Services, the Port Authority of New York and New Jersey, and Westchester County. Many past programs to encourage use of mass transit have failed, and it is important to seek innovative ways to make this form of transportation considerably more attractive and available to the public. Other aspects of transportation conservation will also be considered, including energy recovery and more efficient operation of vehicle fleets.

The institutional and motivational barriers to conservation are difficult to handle. They include such things as building codes, which do not permit certain kinds of energy saving devices or designs; tax laws that discriminate against conservation measures; personal inertia that blocks change even if energy and money can be saved; and lack of access to the capital required to purchase conservation equipment. Research and development to overcome these problems would concentrate on the following kinds of activities: creation of financial mechanisms and contracts that will promote conservation, research on the nature of the resistance to such things as altering thermostats and insulating homes, examination of the way codes restrict conservation practices, and feasibility studies of the prospective impacts of different tax incentive systems.

C. Renewable and Indigenous Resources

Several renewable and indigenous resources appear promising for making significant contributions to the State's energy needs over the next 15 years and are reflected in the Master Plan. Energy R&D plans call for the long-term development of the following energy sources:

- solid waste
- hydropower
- solar energy
- wind energy
- biomass energy
- Devonian shale gas

Research and development to promote the use of indigenous and renewable resources must encourage the development of technologies for harnessing these sources and then match the methods with appropriate end uses.

Resources judged to hold the most promise at this time include hydropower, solar energy, biomass, Devonian shale gas, and solid waste.

ERDA and the utilities have begun an ambitious program

to develop small hydropower sites. For economic and environmental reasons, sites where dams already exist are being emphasized. They can be put into service faster than sites without dams. ERDA has identified 1,672 sites either dormant or never used that have potential for hydropower development. Of these, 20 have been selected for potential demonstration projects. The small hydropower program eventually could generate as much as 2 to 3 percent of the State's present electrical energy.

The solar R&D will focus on the application of passive solar design to the New York State setting with emphasis on winning the understanding and support of the public, builders, and architects. Active solar R&D will continue to emphasize domestic hot water supply, with the results of major demonstration programs being widely broadcast to prospective users.

A number of biomass options exist. Given New York's particular mix of resources, wood appears to be the best candidate for generating substantial energy. Wood may become economical as a source of steam-generated electricity, although its most efficient and widespread use may well be as a fuel source for space heat. Several projects are under way in this area, including assessing the potential for commercial tree farms and demonstrating community wood collection programs. Another project is investigating the possible formation of a non-profit wood fuel cooperative in Ulster County. Wood can be cheaper than oil or natural gas in many rural areas; but because of fears of increasing costs of wood and inadequate future supplies, people often are reluctant to rely on wood-burning stoves. If the demonstration is successful, cooperatives could be set up in communities across the State. In general, the technology for wood fuel use is simple, reliable, and highly efficient, A major R&D effort in this area is not currently envisaged.

As part of its long-term R&D agenda, New York will continue to develop those indigenous and renewable resources that may one day be important but that do not appear capable of making substantial energy contributions in the next 15 years. These include wind, active solar (including photovoltaic), non-wood biomass, and geothermal energy. These technologies offer some attractive individual applications in the near term, with far greater potential for the long term if considerable developmental effort is made.

D. Unconventional Gas Sources

Natural gas will continue to play a vital role in meeting the energy requirements of New York State. To help ensure adequate supplies in the future, unconventional sources of methane will need to be developed. An estimated 4.4 trillion cubic feet of methane are contained in gas bearing Devonian shale in New York. The gas is trapped in the shale and is dislodged only by fracturing the shale deposits, thus permitting the gas to flow to well shafts. New York ERDA has initiated the development of methodologies for locating the trapped gas and will work with DOE in the development of processes for fracturing the shale to release the embedded gas. Such projects require considerable capital and are being undertaken with the financial backing of the federal government.

The use of solid wastes has expanded recently, and several technology options are being evaluated. Methane can be recovered from sanitary landfills by extracting the gas produced through the natural anaerobic decomposition of refuse. Gas is mined by drilling wells into the landfill surface and applying a slight negative pressure to the wall. The landfill gas is approximately 60 percent methane with a heating value in the range of 500-600 BTU per standard cubic foot. It is estimated that three New York City landfills along could produce 7.7×10^{12} BTU per year of raw gas. This is equivalent to 1.2 million barrels of oil saved per year or about 2.5 percent of Consolidated Edison's annual oil consumption.

Two alternative uses exist for methane produced from biomass. The first approach is to upgrade the gas to pipeline quality for conventional distribution. The second approach is to develop an industrial, commercial, or residential demand close to the production site with burners and appliances that are compatible with the raw extracted gas. A number of waste sources and processes are being examined to determine which technologies are most cost-effective in producing low and medium BTU gas.

E. Transmission and Distribution of Electricity and Natural Gas

R&D on the transmission and distribution of electricity and natural gas is aimed at lowering the cost and improving the reliability and safety of transmitting and distributing energy from central facilities to customers. Research efforts range from attempts to achieve long-range goals of utilities nationwide to objectives of a highly local nature encountered by specific utilities.

The national research organizations, EPRI and GRI, are pursuing R&D that is applicable to a wide range of utilities. In addition to sharing in financing generic projects through general funding commitments to EPRI and GRI, New York's electrical and gas distribution utilities cooperate by participating in demonstrations of new transmission and distribution hardware.

For the electric utilities, distribution R&D will emphasize devices for controlling and monitoring electrical use. In particular, two-way communication systems will be developed to facilitate load management by utilities.

Transmission systems are critical not only for the movement of bulk electricity, but for the overall stability and reliability of the system. Transmission R&D will focus on the electrical and mechanical properties of insulators for both above and below ground lines, on improving towers and footing design, on new building designs for conductors, and on techniques for locating damaged underground cables. In addition, a 100 MW DC link, funded by EPRI, General Electric, and the New York utilities, is to be demonstrated in New York City.

The State's electric utilities also are concerned with solving transmission problems that are unique to New York. In particular, the siting of power lines requires research into the economic, engineering, health, safety, and environmental aspects of placements.

New York's gas distribution utilities will concentrate their efforts, both cooperatively and individually, on five research areas: construction and maintenance, metering and billing, piping system designs, operational safety, and system operations. Projects in these areas will include developing maintenance methods that do not require excavation, remote metering, energy value metering, leak detection, pipe location, and corrosion prevention. As with the electric utilities, environmental assessments of the siting of transmission lines will be conducted.

Transmission and distribution are research areas of primary concern to the electric and gas utilities. They are integral to the operation of their businesses and, therefore, emphasized in their research agendas.

3. SUMMARY

Meeting New York's energy needs requires the develop-

ment of all options open to the State. Conservation, renewable energy sources, and indigenous resources are the most attractive means of meeting needs because of their relatively benign environmental impacts and their availability. All resources must be explored, developed, and demonstrated, however, to ensure meeting these needs in an economical, safe, and environmentally sound fashion. The State's current R&D program has taken a comprehensive approach through the cooperative efforts of ERDA, SEO, PSC, ESEERCO, NYGAS, the utilities, industry, universities, local government agencies within the State, national organizations, and the Federal government.

All major organizations in energy R&D must continue to communicate and cooperate with one another to avoid duplication of efforts. R&D resources are limited; they must be used as advantageously as possible to promote the well-being of New York residents as well as the national interest. Furthermore, balance must be maintained in meeting short-term needs and longer-range goals. This strategy must meet energy requirements while remaining compatible with other economic, social, and environmental goals.

SECTION V-I

Energy Financing—Institutional Changes

1. INTRODUCTION

The next fifteen years will require institutional changes in the energy finance field. There will be both a limited number of billion dollar, high risk, new technology projects and a multitude of low cost projects that, summed over millions of projects, will require multibillion dollar financing. Although conventional securities will still be used to finance energy projects, new financing mechanisms will have to be used. For instance, the cost of developing a new energy source such as a major new coal gasification plant ranges from 1.5 to 2.0 billion dollars. The high risk of this type of new technology enterprise increases financing costs. Since financing costs are passed on to consumers, the price of energy also increases as the financial risks increase. In contrast, the emerging next generation of energy conservation measures will require financing by many homeowners, landlords, businesses, and industries. Traditional sources of financing such as home improvement loans will meet some but not all of these financing needs. For example, replacing millions of furnaces with much more efficient units will require billions in financing.

Moreover, to accomplish the objective of decreasing New York State's dependence on oil, new financial mechanisms will be needed to stimulate the necessary funding for increased penetration of conservation, renewable resources and coal conversions. The Congress, acting on proposals made by President Carter, is finishing legislation which would provide some of the necessary funding to enhance the penetration of these technologies and techniques as well as stimulate the development of a synthetic fuels industry. The Crude Oil Windfall Profits Tax presently before the House and Senate provides for a new means of financing energy projects. Some of the expected revenues, totaling $227 billion over the next ten years, may be dedicated to the development of synthetic fuels as well as funding for conservation, renewable resources and coal conversions. While the Senate and the House have not decided on the final funding levels for the various technologies and techniques, strong emphasis has been placed thus far on the development of synthetic fuels.

The Northeast is the largest population center in the country and the region most dependent on foreign crude oil. Unlike other parts of the Nation, the Northeast has little natural gas or crude oil production. This combination of population density, heavy dependence on foreign oil, and little oil and gas resources, makes the Northeast a prime energy problem area in the United States. This fact should be recognized by the federal government as federal solutions are formulated. A major new effort in energy development will have regional economic development implications. If a portion of such efforts occurs in the Northeast, the economy of the region will benefit; if not, the regional economy is likely to suffer. The President's synthetic fuel proposal could harm the Northeast's economy as funds are drained away to pay for synthetic fuel development in the West. One obvious solution for this problem would be a more balanced Federal funding level between energy conservation and synthetic fuel development. The Northeast would benefit from a massive Federally funded energy conservation program. Traditional financial mechanisms like the bond market will continue to play an important role in energy financing but will be supplemented by more innovative approaches on the national, regional, and state level if the Northeast and Nation are to decrease their dependence on foreign imported sources of oil.

New methods of financing will be needed to finance construction of energy production technologies including small hydro, cogeneration, resource recovery, solar, and coal conversion facilities. The existing capital markets view funds for constructing new energy projects as venture capital. New and innovative financing on a national, regional, and state level will therefore have to be designed to channel funds into the new technology areas and existing mechanisms will need improvement. In addition, energy conservation activities will require massive financing of many small scale projects. Utilities may find financing energy conservation more cost effective than construction of new facilities.

2. The New Financial Institutions

New York's energy future can be improved if new types of financial institutions and mechanisms are implemented. These include federal initiatives like the establishment of a Solar and Conservation Bank, a regional energy development entity (ENCONO), and a limited synthetic fuels industry, as well as a reorientation of existing State mechanisms such as the Power Authority of the State of New York and the New York State Energy Research and Development Authority to channel funds into renewable resources, conservation, and coal conversions on the State level.

A. Federal Financial Mechanisms

President Carter, in his Special Energy Message of July 15, 1979, called for the establishment of new financial mechanisms to stimulate the development of a synthetic fuels industry within the United States and for establishment of a Solar Bank to fund the development of renewable resources over the next two decades.

House and Senate bills establishing a Synthetic Fuels Corporation has passed both Houses of Congress and are now in Conference. The Conferees have decided on a preliminary 5 year, $20 billion program for development of synthetic fuels. The Corporation would use funding derived from the Windfall Profits Tax to finance private, public, and joint ventures as well as to give loan, market, and price guarantees to develop 2.0 million barrels a day of synthetic petroleum substitutes by 1992, to decrease the country's dependence on foreign imported sources of oil.

The technologies used by the synthetic fuels industry might include oil production from coal, shale, tar sands, heavy oil, and agricultural products; gas production from coal, shale, and sandstone formations, and from other sources such as agricultural biomass; and alcohol production form coal, grain, and wood.

The development of the synthetic fuels industry poses a severe financial problem. The technology, although proven on a small scale basis, is viewed by investors as high risk in nature. If conventional securities were used to finance these projects, the cost would be high and problems of attracting capital would persist. It is doubtful that securities could be floated by private enterprises unless price supports and/or loan guarantees were provided by the federal government. Private investments for synthetic fuels development could also be stimulated by providing low tax rates on income

produced from synthetic fuel operations and other measures such as investment tax credits and accelerated depreciation as recently suggested by an Electric Power Research Institute Study citation.

The establishment of a Solar Energy Development Bank and an Energy Conservation Bank have been proposed by the Congress as new mechanisms to distribute funding from the Windfall Profits Tax. These would provide subsidies for below market interest rate loans to owners or builders of commercial and residential structures for the purchase and installation of solar energy systems in such structures as well as financial assistance in the form of loan subsidies made to owners of existing residential buildings for the purchase and installation of energy conserving improvements in such buildings. The Solar Bank, subject to final conference agreements, is authorized funding of $485 million in the House version through Fiscal 1983 and $750 million in the Senate version. The House version of the Energy Conservation Bank is authorized $2.3 billion through fiscal 1983. The Senate version is authorized 3.35 billion through Fiscal '84.

B. Regional Energy Industry—Energy Corporation of the Northeast (ENCONO)

Although energy planning is being carried out at the National level and in various states, no coordinated energy planning is occurring on a regional basis. National policy and programs and the New York State Energy Master Plan's policies and programs can be implemented better if there is also corresponding regional planning.

Some portions of the Northeast have economies with limited growth prospects. To solve this problem, the Governors of seven Northeastern states met in New York during June 1976, and formed the Coalition of Northeastern Governors (CONEG). CONEG has made several proposals to lessen the economic problems of the Northeast. CONEG, recognizing the relationship between the Northeast's energy situation and economic problems, proposed creation of ENCONO late in 1976.

ENCONO is designed to be a multi-purpose entity to Northeast. ENCONO could be used to finance investments in conversion projects such as industrial cogeneration facilities, and renewable resource programs, such as hydroelectric facilities and solar technologies.

ENCONO would be a regional public corporation to finance energy projects for the Northeast. Funds would be raised by equity contributions from each member state at a rate of $1 per capita. New York would contribute approximately $18 million to ENCONO initially, based upon current population levels. In addition to this contribution, member states can make additional contributions and private industry can also provide capital for ENCONO. Thus ENCONO would be a finance vehicle for joint private, state, and federal funding of energy projects. Once the capital contributions have been received, bonds guaranteed by the Federal government up to 15 times the amount of the subscriptions can be issued.

ENCONO is needed to finance energy projects in the Northeast, especially major capital projects such as industrial cogeneration, small hydro, and coal resource development. ENCONO would develop facilities that will contribute to the Northeast's efforts to reduce its dependence on foreign oil. For example, ENCONO could finance improvements which may be required to upgrade the transportation system needed to carry increased amounts of coal. Financing could also be used to help develop coal mining in the region. ENCONO financing could also be used to assist industries with conservation, renewable resource, and coal conversion activities.

ENCONO would implement and coordinate energy planning in the Northeast. ENCONO could design and construct projects on a regional basis. For instance, the National energy policy stresses increased use of coal. ENCONO, working directly with coal producing regions such as the Appalachian states, could develop joint projects beneficial to both regions. ENCONO would develop energy solutions on a regional basis thereby coordinating mututally beneficial state and federal energy policies.

C. State Energy Financing Mechanisms

Financing will be needed within New York State for small power producers constructing renewable resource installations, for conservation investments, and for utility coal conversions. For example, municipalities will need financing for planned resource recovery or small hydro facilities. Also, end users will need funds to finance conservation improvements and small renewable resource items such as wood burning stoves and solar systems. Although some of these potential energy producers and users will obtain conventional financing, others will not. State financing mechanisms could be used to supplement traditional funding sources.

New York State must reorient existing institutions like the Power Authority of the State of New York (PASNY) and the New York State Energy Research and Development Authority (NYSERDA) to provide funding for conservation and renewable resources so that the conservation and renewable resource initiatives outlined in Section V-B and V-C, respectively, obtain the necessary funding for implementation over the planning period.

PASNY could participate more directly in conservation programs and the Statewide development of all forms of alternative electric generation, such as solid waste disposal/refuse-processing and cogeneration facilities. This could be accomplished through the issuance of bonds on a centralized basis or through the acquisition, ownership, completion, or financing of individual projects. In essence, the Power Authority could be given the tools it needs to commit its resources and its expertise to reducing New York's dependence on imported oil by developing New York's indigenous renewable resources.

The Power Authority could, for example, issue $50-$100 million in bonds to provide loans to qualified parties. Several municipalities in New York State will be developing resource recovery facilities that will be producing energy in the form of steam and/or electricity. As these governmental units attempt to arrange financing, some may find it impossible to attract funds at a reasonable cost. In a similar manner, municipalities owning small hydro sites but lacking sufficient financing could utilize PASNY financing to develop the sites to produce electricity.

The Power Authority could also be authorized to develop innovative programs in energy conservation. These programs would use PASNY's unique financing capability to develop a program of low cost energy conservation loans for residential and commercial properties.

PASNY could offer a new direction to the historical role that utilities have played in New York State by stimulating investment in residential, commercial and industrial conservation measures, as well as the development of renewable resources such as small hydro, resource recovery, and cogeneration.

The electric and natural gas utilities in New York State currently assist end users to finance conservation devices under the program established by the Home Insulation and Energy Conservation Act (HIECA) of 1977. This program

could be expanded to include other investments, such as solar and wood burning stoves. In addition to expanding the HIECA program, other actions could be taken by the utilities (including PASNY). The utilities could develop a program to install conservation devices on end users' premises. There investments could be placed in the rate base with the costs recovered through normal ratemaking channels. The specific end user would not have to repay the loan until the property is sold. This type of program is being used for conservation investments by the Pacific Power and Light Company. The concept behind the program is that it may be cheaper to undertake conservation investments for end users rather than to construct large, high-cost electric generating facilities.

NYSERDA could also act as a centralized finance agency to aid in developing renewable resources, conservation investments, and coal conversions. NYSERDA, in a role similar to PASNY, could finance renewable resource items through a centralized fund approach or by owning the investments. Since NYSERDA is involved in the research and development of renewable resource technologies, NYSERDA would be better qualified to evaluate renewable resource investments than institutions which are unfamiliar with the specifics of the renewable resource technology and investments.

Coal conversion is presently economic with respect to the specific plants recommended for coal conversion in the electric supply plan, Section V-F. However, electric utilities have argued that the costs to ratepayers will be increased temporarily rather than decreased if utilities convert to coal because of the increased costs of pollution control equipment. This temporary rate increase bubble masks the decreased costs of coal in relation to oil and the positive economics of such investments.

NYSERDA could be used to reduce or eliminate this temporary rate increase by helping to finance conversions of oil-fired electric generation stations to coal. Currently, NYSERDA has a pollution control facility financing program to obtain tax-free status for bonds issued by utilities for pollution control equipment. NYSERDA could use this program to obtain tax-free status for the portion of the coal conversion costs which represent costs associated with pollution control equipment. Since the coal conversion program is in the national interest, the Internal Revenue Service (IRS) should permit all bonds issued for coal conversions to be tax exempt. This could be done by including coal conversion bonds as tax exempt securities under Section 103(b) of the Internal Revenue Code.

3. PROPOSALS—Federal Actions

- Congress and the New York State Legislature should enact legislation authorizing the establishment of the Energy Corporation of the Northeast; the Federal Government should quickly implement ENCONO.

Legislation to authorize the creation of the Energy Corporation of the Northeast (ENCONO) is being considered by Congress. If passed, this legislation would authorize ENCONO to be established as a regional energy development authority whose purpose is to finance energy supplies for the Northeast. In addition to federal legislation authorizing ENCONO, the New York State Legislature must enact a bill enabling New York State to join ENCONO. For ENCONO to become operational, the federal measure must be passed, and at least three individual states must pass legislation authorizing them to participate. Once the appropriate legislation is passed, ENCONO will become operational after 1) the president appoints incorporaters to establish ENCONO, and 2) directors are appointed by the Governors of member states, representatives of private industry, and the President.

ENCONO is to be both a planning and a financing mechanism designed to own projects in the start-up phase. After initial development, ownership of the projects will be transferred to others. ENCONO will raise capital by subscriptions from each member state amounting to $1 per capita. States can increase their investments above the initial per capita contribution and capital can be invested by private investors. Once ENCONO's equity base is established, federally guaranteed bonds up to 15 times the amount of equity may be issued.

It is clear that ENCONO must be an integral part of the implementation of this energy master plan and major new federal energy development initiatives such as the synthetic fuels program. ENCONO is needed to finance energy sources indigenous to the Northeast such as development of coal resources. Other projects which would benefit from ENCONO financing include development of low head hydro projects, other renewable resource projects, cogeneration facilities, and conservation investments.

- Congress should enact legislation to provide financial assistance for conversion of existing oil-fired capacity to coal and for construction of new coal-fired capacity to reduce oil dependence.

The need for the United States to decrease its dependence on foreign oil is a national problem with national and international implications. Therefore, the conversion of existing oil-fired capacity to coal warrants Federal policies and funding. Federal legislation which mandates coal conversions should also provide for funding of those conversions. In addition, federal money should be available to utilities which wish to convert other powerplants to coal when such conversion appears to be in the national interest. Presently, the Carter Administration has proposed a two phase 10 billion dollar program for oil reduction in the utility sector by coal conversions and the stimulation of renewables to decrease utility oil use.

A 3.6 billion dollar proposal would be used to hasten the coal conversions ordered under the Energy Supply and Environmental Coordination Act (ESECA) and the Public Utility Fuel Use Act. This proposal offers New York State and the Northeast needed funding to convert those plants presently under federal coal conversion orders and to shield the ratepayers from the temporary rate increases incurred by the addition of expensive pollution control equipment. An additional six billion dollars has been proposed to stimulate the use of any other technologies, especially renewables, to back out oil use in the utility sector.

Such legislation should be enacted and funds appropriated expeditiously to decrease the use of oil in the utility, sector as well as to shield ratepayers from the increased costs of coal conversion.

State Actions

- Develop a NYSERDA pilot program of financing for utility, industrial and institutional coal conversion and prepare a program of incentives to private companies for conversion from oil to coal.

The increased use of coal to meet the State's energy needs is an essential component of the strategy to reduce the State's dependence on imported oil. It is essential to find methods of financing coal conversions that provide the proper incentives to encourage utilities and private companies to convert to coal.

NYSERDA should develop a pilot program to assess the

most economical and efficient methods of encouraging coal conversions which ensure the maintenance of environmental quality and the promotion of the use of coal. These conversions will ensure that New York State will be able to diversify the State's fuel mix and become less dependent on oil.

SECTION V-J

Impact of Rising Energy Costs on Low Income Households

1. INTRODUCTION

Energy expenditures for New Yorkers have increased dramatically since 1973. In the last seven years, the average price of a gallon of home heating oil in New York State has increased 334 percent from 20.4 cents per gallon in 1973 to 88.6 cents per gallon by January, 1980. The average price of residential natural gas rose 146 percent between 1973 and 1980 from $1.74 per thousand cubic feet (MCF) to $4.28 per MCF. Average residential electric prices jumped 103 percent from 3.5 cents per KWH in 1973 to 7.1 cents per KWH in 1980.

Recent OPEC and national oil pricing actions will drive energy prices higher for New York State residents. From December, 1978 to March, 1980, the OPEC countries have increased the composite world oil price by 131 percent from $12.60 per barrel to $29.06 per barrel. On June 1, 1979, the federal government began the 18 month process of decontrolling domestic oil prices to the world level. By the end of 1981, New Yorkers will spend an additional $6.0 billion on energy as a result of these actions.

The burden of higher energy costs falls heaviest on low income households. In 1978, the average low income household spent approximately 33 percent of its income on direct energy costs whereas the average median income household spent about 9.6 percent of its income on direct energy costs.[1] It has been estimated that the percentage of income spent by the average low income household on direct energy costs would increase to 40 percent as a result of a 25 percent rise in energy prices. The same price hike would increase the amount spent on direct energy costs by the average median income household to 11.5 percent of its disposable income.[2]

Since energy is a necessity of life, rising costs may force many low income households into the intolerable choice of staying warm or buying food. This presents a very serious energy and social problem for the federal and state governments.

It is of particular importance to the State of New York and other Northeastern states because low income households within these states are impacted more severely than similar groups nationally. Differences in climate, dependence on oil for residential heating, transportation costs, and the condition of the existing housing stock cause seasonal energy costs within the Northeast to exceed the national average. In New York, all households, including those classified as low income, pay about one-third more than the national average for energy.[3]

The following section discusses the impact of rising energy costs on low income households in New York State, reviews existing and proposed low income energy assistance programs and recommends specific actions to help alleviate the problem.

2. LOW INCOME HOUSEHOLDS

A. Overview

"Low-income" is defined as households with incomes below 125 percent of the Federal poverty level. In 1975, 19.8 percent of New York State's 4,676,000 families had incomes that qualified as low-income. For New York State in 1975, this level was $6,317 for a family of four, $4,262 for a two-member family and $3,237 for one person, according to the Office of Management and Budget. By 1979, the level had risen to $8,375 for a family of four. It is within these low-income households that the burden of rising energy costs will be most severe.

Housing stocks in New York State consist of three general types of dwellings: single and double family units, low rise structures of three and four family units; and multi-family structures of five or more units. Low-income households normally occupy rented dwellings. The major exception to this pattern is the low-income elderly, many of whom own their own homes. The most common housing-type for other low-income households is the multi-family dwelling.

Residents of multi-family dwellings normally do not control the temperature of their units. In fact, in New York State, 61 percent of all residents do not control their home space heating. This number rises to 83 percent New York City, where multi-family dwellings dominate.[4]

Implicit in the rent in buildings which do not require tenants to pay directly for energy use is a charge for fuel and utilities that increases as energy prices rise. A renter wishing to offset this price increase by decreasing the use of energy loses the ability to do so when there is no control over room temperatures.

Of the total 5,813,861 housing units in New York State in 1970, over 54 percent used fuel oil as the primary heating source. In some counties, dependence on oil heat far exceeded 54 percent, as Figures V-J-1 and V-J-2 show.

The New York State housing stock is generally energy inefficient as a result of its age. This is especially true with respect to multi-family units. Approximately 37 percent of New York's housing stock and 57 percent of the multi-family units were constructed before World War II. As of 1977, 21 percent of these pre-World War II dwellings had no attic insulation, 33 percent had no wall insulation, and 6 percent had no storm windows.[5]

B. Multi-Family Housing in New York State

The approximately 2.25 million existing multifamily units within New York State account for about 36 percent of the State's total housing stock. These units represent over 20 percent of the total multi-family housing in the nation and are located primarily within New York City.[6]

[1]Fuel Oil Marketing Advisory Committee of U.S. Department of Energy, "Low Income Energy Assistance: A Profile of Need and Policy Options," Draft of March, 1979, p. 8.

[2]*Ibid.*, p. 9.

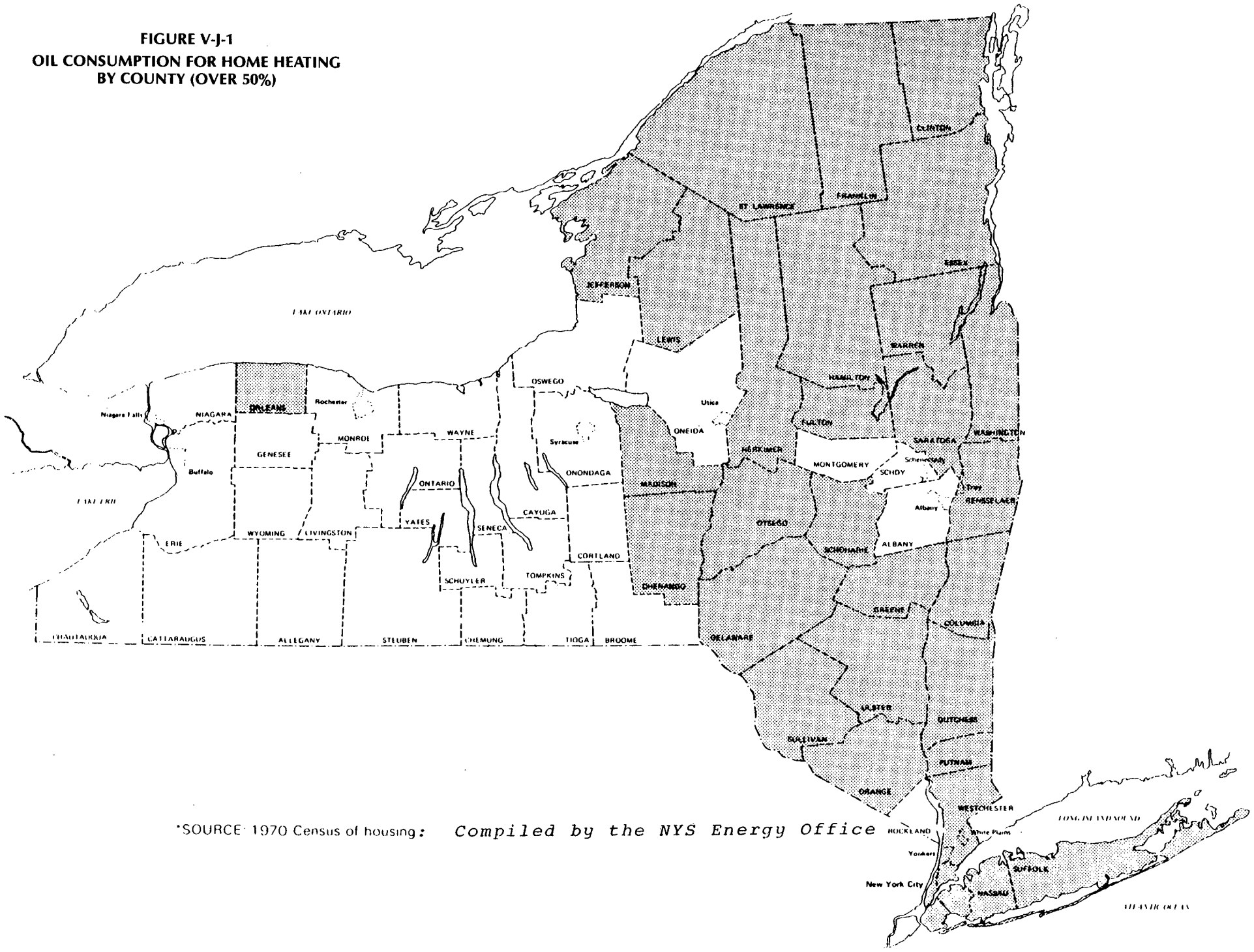
[3]Committee on the Budget, U.S. House of Representatives, *Rising Energy Prices and Alternate Energy Policies: Burdens and Benefits*, November, 1977.

[4]Center for Governmental Research and Services, *Survey of New York State Energy Attitudes*, June, 1979, p. 24.

[5]New York State Energy Office, *New York State Residential Insulation Survey*, pp. 16, 20 and 24.

[6]Center for Urban Policy Research, Rutgers University, *Energy Conservation in Multi-Family Housing: A Framework for Policy for New York State*, New Brunswick, NJ, p. 3.

FIGURE V-J-1
OIL CONSUMPTION FOR HOME HEATING
BY COUNTY (OVER 50%)



*SOURCE 1970 Census of housing: *Compiled by the NYS Energy Office*

FIGURE V-J-2
TYPES AND PERCENTAGES OF HOME HEATING FUEL BY COUNTY FOR ALL OCCUPIED HOUSING UNITS*

New York Counties	All Occupied Housing Units	Fuel Oil Kerosene, etc. %	Utility Gas %	Electricity %	Wood, Coal, and Bottled Gas, All Other Fuels %
Albany	94,004	45	51	2	2
Allegany	13,437	16	77	3	4
Bronx	497,222	67	26	1	5
Broome	69,458	27	63	2	3
Cattaraugus	24,878	22	73	2	3
Cayuga	22,987	35	57	2	6
Chautauqua	47,685	10	84	1	5
Chemung	31,230	13	82	1	4
Chenango	13,839	75	14	2	9
Clinton	19,168	82	3	8	7
Columbia	16,292	75	17	2	6
Cortland	13,773	33	60	0.8	6.2
Delaware	13,910	72	13	3	12
Dutchess	62,495	80	15	3	2
Erie	346,374	9	88	1	0.2
Essex	10,660	89	2	3	6
Franklin	12,907	89	1	1	9
Fulton	17,618	52	41	0.3	6.7
Genesee	17,589	34	59	2	5
Greene	10,750	83	4	6	6
Hamilton	1,567	86	—	3	11
Herkimer	21,466	51	41	2	4
Jefferson	27,435	56	36	2	5
Kings	876,119	63	33	0.7	3
Lewis	6,593	89	1	2	8
Livingston	15,130	44	46	5	5
Madison	17,741	53	38	2	7
Monroe	220,554	30	65	3	2
Montgomery	18,812	45	48	2	5
Nassau	401,056	82	16	1	0.4
New York	687,283	66	23	2	8
Niagara	71,881	46	50	2	2
Oneida	82,080	43	52	2	4
Onondaga	145,322	16	78	3	3
Ontario	23,748	35	56	2	7
Orange	65,607	56	37	3	4
Orleans	11,320	59	31	3	7
Oswego	29,179	42	49	3	6
Otsego	16,785	75	14	2	9
Putnam	15,995	90	1	6	3
Queens	690,056	64	33	1	2
Rensselaer	47,322	56	38	2	3
Richmond	86,192	49	48	2	2
Rockland	60,359	9	88	2	1
St. Lawrence	30,354	71	22	2	5
Saratoga	35,686	56	36	4	5
Schenectady	53,472	44	51	2	3
Schoharie	7,266	91	0.3	4	4.7
Schuyler	5,075	49	33	3	1.5
Seneca	9,853	38	53	1	7
Steuben	30,751	28	63	1	8
Suffolk	295,587	75	21	2	4
Sullivan	16,865	89	0.4	3	8
Tioga	13,375	66	21	3	10
Tompkins	22,614	30	59	5	7
Ulster	43,533	79	10	5	6
Warren	15,394	60	32	4	4
Washington	15,314	70	21	3	6
Wayne	23,553	49	42	2	7
Westchester	282,629	68	28	2	3
Wyoming	10,586	30	64	0.1	8
Yates	6,076	49	38	3	10

*Source—1970 Census of Housing: Compiled by the New York State Energy Office

Note: Percentages listed for a county may not total 100% because, (A) figures are given as nearest whole per cent; (B) a small number of households reported no home heating consumption.

The major energy features of the State's multifamily housing stock compound the energy pricing problems of the low income persons who inhabit these dwellings. In general, the multi-family housing stock is old, energy inefficient and overly dependent upon oil as a primary heating fuel.

According to a recent State Energy Office study conducted by the Rutgers University Center for Urban Policy Research:[7]

- 57 percent of New York State's multi-family housing units existing in 1974 were built before 1939.
- 74.6 percent of the State's multi-family housing units use oil as their primary fuel.
- Multi-family housing accounted for 8 percent of New York State's energy consumption in 1974.

The age and home heating oil dependence that characterizes the multi-family housing stock impact low income energy prices in two ways. First, the older units lack energy savings measures, such as adequate wall insulation, thereby engendering greater fuel consumption per unit. Second, the cost of home heating oil in New York State has increased significantly since 1973. The average price of heating oil exceeded 95¢ per gallon during the 1979-80 heating season. As a consequence, the low income households which inhabit New York State's multi-family dwelling units have faced the intolerable situation of choosing between such necessities of life as food and heat this heating season.

C. *Low Income Elderly*

The impact of higher energy costs on the low-income elderly tend to be severe because they:

- have relatively fixed incomes in a period when all costs (food, housing, medical care, in addition to energy) are rising.
- are affected by poor or declining health or perceptual abilities, often requiring additional heat or lighting.
- often live in inadequate or poorly insulated housing.[8]

In New York State, out of a total population of 1,948,000 persons sixty-five years and older in 1975, 20.8 percent had incomes below 125 percent of the poverty level. Sixty-nine percent of the dwellings occupied by this group were at least thirty-one years old.

Low income elderly in the State own their own homes more often than other low-income groups. The New York State Office for the Aging reports: "In New York City in 1978, one-third of the residents 65 and over owned their own homes, and 44 percent of these homeowners paid 40 percent or more of their income for housing utilities and fuel, regardless of income level."[9]

Welfare Research, Inc., in a study conducted for the New York State Energy Office reached the following conclusions concerning the energy problems of the elderly poor:

- The energy-related problems of the elderly poor in New York State are already severe, and will probably become worse. The elderly poor are experiencing extreme financial hardships as a result of increasing energy costs. Moreover, these hardships are reducing the quality of living of this group, causing negative changes in lifestyle, behavior, mood, health and safety.
- These impacts are found among both elderly homeowners and renters. Homeowners appear to be more severely impacted, however, because they must pay their own heating costs. Still, the most important predictor of severity of impact appears to be income.
- The potential for conserving significant amounts of energy by encouraging the elderly poor to conserve is minimal since this group currently consumes only that which is necessary to satisfy basic needs, considering their poor housing stock. In fact, many experience difficulty in purchasing even that minimum amoung of energy necessary to meet basic needs.
- Although the majority of the sample surveyed indicated that they considered their homes well insulated, analysis of available data indicate that many of the dwellings occupied by the elderly poor are, in fact, substandard, and/or poorly insulated, and could benefit substantially from an expanded weatherization program.
- Intervention programs designed to mitigate the negative impacts of rising energy costs on the elderly poor have had mixed degrees of success. Many have had "image" problems (an association with welfare); all have been underutilized.
- Those intervention programs that are viewed as "entitlement" rather than "welfare" programs and that utilize effective outreach techniques receive greater acceptance among the elderly poor.
- Intervention programs alone will not solve those problems associated with rising energy costs and changing energy policy. Long-range economic solutions are required.
- Energy policy cannot be separated from, nor can it be implemented without regard for, larger socioeconomic concerns. Thus, the need for interagency coordination of energy policy with other socioeconomic policy is clear.[10]

3. *CURRENT FEDERAL AND STATE PROGRAMS AND INITIATIVES*

In an attempt to reduce fuel and weatherizing costs the Federal and State governments have initiated several programs aimed at low-income households and individuals. Figure V-J-3 summarizes these programs.

4. *Recommendations*

Recent Federal and State actions have begun to address the problems of rising energy costs of low income households. However, further steps are necessary. The following actions are recommended to improve the energy situation of low income households within New York State.

- New York State, through its Congressional delegation, should seek increased funding for all Federal programs, including CIP (now the Federal Energy Crisis Assistance Program), which assist low-income households in meeting energy costs, through the use of revenues to be derived from the proposed Windfall Profits Tax and other sources.

The level of funding from the federal assistance programs, although helpful in easing the burden of low-income households, is inadequate to ensure that these households will be able to afford their essential energy requirements. Increased funding for these programs at the federal level from funds derived from the Windfall Profits Tax and other sources should aid this problem.

- The Energy Conservation and Production Act should be

[7] *Ibid.*, pp. 1-43a.

[8] Welfare-Research, Inc., *The Impact of Rising Energy Costs on the Elderly Poor in New York State*, January, 1978.

[9] Speech by Mrs. Lou Glasse, Director, New York State Office for the Aging to the Conference on "Energy Advocacy for the New York City Elderly," June, 1979.

[10] Welfare Research Incorporated, *Op Cit*, pp. 7-8.

FIGURE V-J-3

EXISTING FEDERAL AND STATE SUPPORTED LOW-INCOME ENERGY ASSISTANCE AND INCOME MAINTENANCE PROGRAMS

Program Title	Program Description	Program Administration	Impacts/Comments
Weatherization Program—as established in 1975 under the Community Service Administration Act of 1974, the Energy Conservation and Production Act of 1976-Title IV, as amended by the National Energy Conservation Policy Act of 1978.	Weatherizing of low-income owned or renter (private) dwelling units. Weatherizing includes physical repairs to the dwelling unit to help improve its thermal integrity. Weatherizing services may include, but are not limited to, weather-stripping and caulking around doors and windows; the addition of or introduction of insulation; replacement of storm windows and/or external doors. As of February 19, 1980, the maximum expenditure per dwelling unit is $800. Program eligibility is limited to individuals and/or families at or below 125% of the Office of Management and Budget poverty income guidelines.	The program, in the past, has been funded jointly by the Department of Energy (DOE) and the Community Service Administration (CSA). As of 1978, CSA was no longer a funding source for the program. The program is now being supported by DOE. Administration within New York State is through the Department of State's Division of Economic Opportunity (DEO). Locally the Community Action Agencies administer the program. DOE allocated an estimated $18 million for FY 1979 in New York State.	As of March 1979, approximately 13,000 units have been weatherized in New York State through the local community action agencies with the assistance of DEO. Over 525,000 households remain to be weatherized. Assuming that the program continues at this year's funding level, it would take approximately another 17 years to weatherize all eligible homes. Comprehensive Employment Training Act (CETA) labor available to perform weatherization activities is inadequate. A nationwide survey conducted by CSA showed that while the projected FY 1979 need is for 21,772 CETA workers, only 41 percent (8,875) of these workers will actually be obtainable. Moreover, the Department of Labor's budget for FY 1980 proposes over a 50 percent cut in the number of CETA workers.
Aid to Families with Dependent Children (AFDC)—as established under the Social Security Act of 1939-Title IV-A.	Financial assistance is given to a family with minor children without sufficient means of support because of the absence, death, incapacity of a parent or unemployment of either parent. Individual determinations are made on a case-by-case basis to establish whether a family has sufficient means of support before an AFDC is given. AFDC recipients receive monthly assistance, benefit levels set by the State. In New York State, benefits reflect established cost standards for family maintenance needs. Monthly allowances for fuel for heating vary according to family size, county, and type of fuel used. Allowances do not vary according to actual fuel payments of the family.	Department of Health, Education and Welfare provides 50 percent of total program funding to New York State Department of Social Services. The State and the county governments share the remaining 50 percent of program funding.	Approximately 360,000 households receive assistance each month under the AFDC program. The last increase in benefit levels (allowances for fuel for heating included) for AFDC recipients was in 1974. Approximately $140 million was certified as payments in January, 1979. Monthly fuel for heating allowance for a family of four in Nassau County, using a fuel other than natural gas, is $42. For a family of four in Essex County, that amount is $69 monthly. Social Services offices can authorize additional fuel allowance payments if special circumstances are met. Determination must be made on an individual case basis. During the 1978/79 fuel season, only 34 counties in New York State provided this type of assistance to AFDC recipients.

Program Title	Program Description	Program Administration	Impacts/Comments
Emergency Assistance to Needy Families with Children (EAF)—as established in 1967 under the Social Security Act of 1967—Title IV-A, as amended.	Emergency financial assistance is given to low-income families with children below the age of 21. Assistance is provided to a family to avoid destitution of children or to provide living arrangements in a home in crisis situations where resources are not immediately available to the family to pay for such items as fuel or utility bills. The amount of payment under the program varies from case to case depending on the family's financial situation and the nature of the emergency, but payments are in accordance with PA standards. Individual determinations are made on a case-by-case basis to establish program eligibility.	Department of Health, Education and Welfare provides 50 percent of total program funding to New York State Department of Social Services. The State and county governments share the remaining 50 percent of program funding.	Program currently serves approximately 19,000 families per month. Approximately $14 million was certified as payments to eligible families in New York State in 1978. Only 34 counties provided assistance to AFDC recipients during the 1978/79 fuel season. The fuel heating allowance is removed from the recipient's AFDC grant when a determination has been made that a family qualifies for EAF funds. Direct payment is then made to the fuel vendor with EAF funds.
Supplemental Security Income (SSI)—as established in 1974 under the Social Security Act of 1972—Title 16, as amended.	Financial assistance is given to low-income individuals and couples who are aged, blind and/or disabled. These persons may be eligible for monthly payments if they have little or no regular cash incomes. An individual may have assets worth up to $1500 and qualify for SSI. The amount for a couple is $2250. The maximum monthly payment amount as of July 13, 1979, for an individual living alone in New York is $271.41. The amount for a couple is $391.78. The program is a "flat grant" program; grants do not vary in amount to take into account the differences in living cost within the State and across the nation. But SSI benefit levels are adjusted once a year to compensate for federal cost of living increases. This adjustment started in 1975.	The Social Security Administration Office administers the programs. The State of New York provides a supplemental payment which increases the total benefits paid to eligibles.	Program serves approximately 350,339 individuals and 25,283 couples. Household energy costs are not reflected in the grant amount. Statewide average shelter grants are given to all eligible individuals and couples. Under Aid to Aged, Blind and Disabled, the program which preceded SSI, shelter allowances varied according to counties and type of fuel used. Varied shelter allowances ended in 1974 when SSI was established.

Program Title	Program Description	Program Administration	Impacts/Comments.
Emergency Assistance for Adults (EAA)—as established in 1974 under Social Services Law-Section 300-309, as amended.	Financial assistance given to SSI recipients to cover emergency needs or situations. New York State instituted the EAA program to cover such needs which cannot be met by the SSI recipient's regular monthly benefit. EAA can be utilized to meet the excessive fuel cost incurred by SSI recipients. Individual determinations are made on a case-by-case basis to establish program eligibility and grant amount is determined in accordance with PA standards.	New York State Department of Social Services administers the program statewide and most county social services offices are given this responsibility locally. The entire cost of the EAA program is borne by the State (50%) and local districts (50%).	During the 1978/79 fuel season, 38 counties provided assistance under this program. There are approximately 12,050 persons receiving assistance each month and an estimated $142,000 is given out each month in assistance.
Home Relief (HR)—as established in 1937 under Social Services Law-Title III, as amended.	Financial assistance is given to intact families, childless couples and single individuals. Individual determinations are made on a case-by-case basis to establish whether a family or individual has sufficient means of support before HR is given. HR recipients receive monthly assistance, benefit levels set by the State. Benefits reflect established cost standards for maintenance needs. Monthly allowances for fuel for heating vary according to family size, county, and type of fuel used. Allowances do not vary according to actual fuel payments of the family.	New York State Department of Social Services administers the program statewide and most county social services offices are given this responsibility locally. The State and counties share HR program costs.	Approximately 140,000 households receive assistance each month under the HR program. The last increase in benefit levels (allowances for fuel for HR recipients was in 1974. Approximately $29 million was certified as payments in January of 1979. Monthly fuel for heating allowance for all family and individuals are the same for both HR and AFDC recipients. Social Service offices can authorize additional fuel allowance payments if special circumstances are met. Determination must be made on an individual case basis.
Examination of Retail Regulatory Policies for Electric Utilities—as required under the Public Utility Regulatory Policies Act of 1978-Title I and monitored by the Federal Energy Regulatory Commission.	Requires state regulatory authorities to determine in November, 1980, the appropriateness of implementing federal standards for termination of electric service, information to consumers, master metering, and automatic adjustment clauses. Statute exempts "lifeline" electric rates from the cost of service standard and requires a state regulatory determination by November, 1980 on the appropriateness of adopting lifeline rates, if none are in place.		Several "lifeline" proposals were rejected as unworkable by the New York State Public Service Commission (PSC) in Case 26806. However, Consolidated Edison has introduced a lifeline experiment in Case 27029.

Program Title	Program Description	Program Administration
Hardship Procedures— as established by the Public Service Commission Case 27332, September 7, 1978.	Requires gas, electric and steam utilities to attempt personal contact with customer or other adult resident at the home before termination of services when residents requires utility service for heating or operating a heating system. A utility cannot terminate service unless the utility has first offered the customer a monthly installment plan. Final notice must then be given before actual termination of services. If termination of services has occurred, the utility may still be forced to restore services if a serious impairment to human health exists as a result of such actions. In situations where the utility is unable to make personal contact with an adult living in the house, and has no reasonable grounds to believe that the customer has vacated the house, the name and address of customer are referred to the local commissioner of social services. The local social services office may then look into energy assistance programs on behalf of the customer.	Public Service Commission monitors utility action under this law.
The Home Heating Oil Loan Program as established in 1979 under the New York State Tax Law-Article 32, as amended.	Program authorizes commercial banks, savings banks and savings and loan institutions to lend money directly to individual residential customers or dealers (for customer use) for the purpose of permitting customer to belatedly enter into budget plan.	The New York State Energy Office and Banking Department are given the responsibility to promote and facilitate the utilization of the loan program by consumers, fuel dealers and banks.

Program Title	Program Description	Program Administration
Regulations for Notice of Refusal, Suspension or Termination of Heating Fuel Deliveries— as established in 1979 under the New York State Energy Law of 1976—Sections 3-101(1), 5-101(5), 5-102(2) and 5-105(4).	Requires distributors of heating fuel (other than electricity or natural gas) to: screen customer accounts by December 1, 1979, or before November 1 yearly thereafter for severe or hazardous health cases and ask these customers to designate a third party to be notified if fuel deliveries are cutoff; reach payment agreement or, if one cannot be reached and cutoff occurs, notify customer; notify third party of cutoff if customer cannot be reached or if cutoff may involve an impairment to human health; notify local social services agency of cutoff if neither the customer nor the third party can be reached, or, if a severe or hazardous health situation is involved and social services cannot be reached, distributor should notify a designated local emergency agency. The local social services office or emergency agency may then look into energy assistance programs on behalf of the customer and/or take such actions as necessary to prevent loss of life.	The New York Department of Social Services monitors fuel distributor action under this regulation and is responsible for designating local emergency agencies.
Local Sales Tax Reductions —as established in 1979 under the New York State Tax Law-Section 1210, as amended.	Authorizes certain cities, counties, and school districts to reduce or eliminate the sales and use tax on residential energy sources.	
State Sales Tax Elimination — as established in 1979 under the New York State Tax Law-Section 1105-A.	Eliminates the sales tax on residential energy use, effective October 1, 1980.	

Program Title	Program Description	Program Administration	Impacts/Comments
Energy Crisis Assistance Program (ECAP)—as established in 1979 under the Economic Opportunity Act of 1964-Title II, and the Community Services Administration Act of 1974-Title II.	Financial assistance to low income families and/or individuals used to pay outstanding energy bills or to establish a line of credit with fuel suppliers. Assistance can also be used to provide temporary shelter, electric space heaters and warm clothing. A maximum of $300 in assistance is given to eligible persons who pay directly for heating cost, while a maximum of $100 is given to eligible persons, who do not pay directly for heating cost, for the purpose of paying utility bills. Program eligibility is limited to individuals and/or families at or below 125% of the Office of Management and Budget poverty income guidelines. If certain qualifications are met, assistance may also be provided to renters living in New York City privately owned multiple family dwellings. Such assistance is in the form of fuel payments to the vendor on behalf of the owner of the building.	Community Service Administration provides program funding to the New York State Department of Social Services (DSS). The State DSS received $42.4 million for the winter 1979-80 ECAP. At the local level, county social services and the Unemployment Offices are taking applications. In addition, in many counties, the local Community Action Agencies and Area Office of Aging are taking applications.	It has been estimated by DSS that there are 338,000 nonpublic assistance households in New York State: 96,070 who pay for fuel for heating directly and 241,930 who only pay directly for utility costs. In order to provide these households with the maximum $300 and $100 assistance, an additional $10.6 million would be needed.
Supplemental Energy Allowance Program (SEAP)—as established in 1979 under Public Law 96-126 of 1979.	Direct cash payments by the Department of Health and Human Services of $150 to recipients of Supplemental Security Income (SSI). Direct cash payments by the New York State Department of Social Services (DSS) of $250 to families with children currently receiving Aid to Dependent Children (ADC) or Home Relief (HR) assistance. DSS also provides direct cash grants of $125 to single persons and childless couples receiving HR and to single ADC cases. All direct cash grants issued by federal and state governments are to be used for the payment of energy or energy related needs.	Department of Health and Human Services provides program funding for state and federal cash payments. The New York State DSS received $103 million for payment to ADC and HR cases.	Under ECAP public assistance (PA) and SSI recipients cannot be denied assistance but DSS, as of February 19, 1980, has limited ECAP payment to these households to the amount that will bring their SEAP payment up to the ECAP maximum grant of $300. In order to provide the SSI and PA household with an additional $50 to $175 payment, approximately $7 million more would be needed.

Program Title	Program Description	Program Administration
Emergency Energy Assistance Credit—as established in 1979 under the New York State Tax Law—Section 606-A, as amended.	An income tax credit of $35 is provided to each person age 65 and over, who heads a household with income below $14,000 per year and who files with the Department of Taxation and Finance for the credit. The credit is rebateable for those who are not required to file tax returns and is in effect for the 1979 income year. In the case of a husband and wife filing separate New York income tax returns, the credit is given to only one spouse.	The New York State Department of Taxation and Finance is responsible for tax credits and rebates.
State Fuel Crisis Assistance Program—as established in 1979 under Social Services Law—Title 13, as amended.	State financial assistance given to households who are experiencing heating fuel related crisis and have not received benefits for any other energy assistance program. Households with incomes between 125 percent and 200 percent of the Office of Management and Budget poverty guidelines may receive from $100 to $200 in assistance. Assistance can be used for direct payment to suppliers of home heating fuel or for immediate assistance in the form of cash up to $50 for warm clothing, temporary shelter, repairs to heating equipment, food and other supportive services. Assistance may also be provided to households whose rent includes heat. Such assistance may be in the form of emergency fuel deliveries to provide heat if owner of rental dwelling has abandoned responsibility for paying heating costs.	New York State Department of Social Services administers the program statewide and county social services offices are given this responsibility locally. Twenty-two million ($22,500,000) has been appropriated for the program.

amended to improve the Department of Energy weatherization program by expanding the number of homes weatherized, increasing the types of items eligible for weatherization assistance, and expanding program spending limitations.

For any federal action, such as the federal energy assistance program, to be cost effective, the thermal integrity of New York homes must be improved. Continued financial aid to the low income population is a must, but without expanding such programs, the potential energy and financial savings to low income persons—and to the State and Federal governments—may never be fully realized.

As of February 19, 1980, DOE regulations stated that a maximum of $800 may be spent to weatherize each dwelling unit. Included in this $800 is a set maximum amount allowed to buy repair materials ($100), before weatherizing begins. Repair materials include, but are not limited to: lumber used to frame or repair windows and doors that could not otherwise be caulked or weatherstripped; roofing materials used to repair leaks that damage insulation installed under the program, replacing furnace parts; and protective materials, such as paint, to seal materials installed under the program. The $100 repair limit places possible activities such as fuel burner retrofit in direct competition with other necessary measures, such as roof repairs. Program spending constraints of this kind greatly limit the number of energy conserving structural improvements that could be made to a low income home.

The primary aim of the weatherization program should be to lower the fuel bills of low income people. This goal will not be met if the program continue at its present funding level and holds to its present limits.

- Congress should amend the National Energy Act of 1978 to expand the National Weatherization Program for federally assisted public housing.

The National Energy Act of 1978 authorizes the Department of Housing and Urban Development (HUD) to make grants to finance energy conservation improvements to multi-family projects. Priority is given to projects in financial difficulty because of high energy costs. The Act requires HUD to establish minimum standards for energy conservation in multi-family dwellings and authorizes $25 million for the program this year.

There are an estimated 160,000 federally subsidized apartments in New York City and 30,000 others located throughout the State. Many are in a deteriorating condition. To improve such situations and help these low income dwellings conserve energy, a weatherization program is necessary.

An expanded federally backed public housing weatherization program would address the energy conservation needs of more tenant-occupied public housing projects. It would also reduce the amount of fuel cost pass-along that is likely when the rent is raised to cover rising heating and utility costs.

- Department of Energy should revise its weatherization program regulations to allow funds to be utilized for labor.

The unavailability of an adequate number of laborers under the CETA program to carry out the weatherization activities limits the program's effectiveness. Moreover, CETA provides little training for the majority of workers, who are often unskilled, and too little pay for those workers who are skilled.

The Department of Labor's budget for FY 1980 proposes over a 50 percent cut in the number of CETA workers. Long-term prospects for adequate weatherization in New York and the U.S. as a whole are insecure at best.

Out of the local Community Action Agency budget, DOE regulations allow 30 percent of the grant funds to be used to pay for on-site supervisory personnel and foremen as well as for other program support and administrative costs. DOE should revise its weatherization program regulations to allow local grant funds to be used to pay for weatherization labor. This action would improve the weatherization program by allowing local agencies to fund labor.

SECTION VI

Long-Range Electric and Gas Report

1. INTRODUCTION

Section 5-112 of the Energy Law requires the Energy Office to prepare a draft report making specific findings with respect to projected electric and natural gas demands and supply requirements, together with estimates of the cost of electricity and natural gas to consumers, over a fifteen-year forecast period. The Energy Law also requires the Energy Planning Board to approve or modify such findings such that a final Report can be adopted by December 1 of each odd-numbered year.

The draft Report was prepared in compliance with Section 5-112 of the Energy Law and the regulations adopted by the Energy Office thereunder. It was prepared as an integral part of the State Energy Master Plan in recognition of the substantial relationships among demands and supplies of all fuel forms. The demand, supply and price of electricity and natural gas are inextricably related to the demand, supply, and price of petroleum, coal and other energy resources.

Specific findings with regard to one or more fuel forms can only be made as an outcome of a comprehensive planning process which addresses all energy supply and demand options. The State Energy Master Plan represents the State's first attempt at comprehensive energy planning. Projections of electricity and natural gas demand, supply, and price in New York over the next fifteen years are presented as integral steps in forecasting total State energy needs, assessing the impacts of conservation and new energy technologies, and developing supply plans for all fuel forms.

The specific findings recommended by the Energy Office in the draft Report have been modified by the Energy Planning Board, as detailed in its Opinion and Order (Appendix A). The major substantive modifications relate to the forecast of electricity peak demand and the electricity supply plan. While the Energy Office recommended an electricity peak demand growth rate of 2.1 percent per year, the Board approved a rate of 1.8-1.9 percent per year. With regard to the electricity supply plan the Board made several modifications:

- Two additional 600-850 MW coal-fired power plants were added for the purpose of further reducing oil consumption; and
- The supply plan was made less specific with regard to locations, projected completion dates and sizes of new generating units.

Not all aspects of electricity and natural gas planning are discussed in this section. However, the specific findings required by Section 5-112 of the Energy Law, as approved by the Board, are presented. Discussion and substantiation of these findings may be found in the appropriate sections of the Plan and the Board's Opinion and Order.

2. ELECTRICITY

A. Electricity Demand

Statewide electricity consumption (KWH) is likely to increase at an average rate of 2.1 percent per year over the next fifteen years. Total statewide electricity peak demand is likely to increase at an average rate of 1.8-1.9 percent per year over the next fifteen years. This forecast is detailed in Figures VI-1 through VI-5, which present electric energy requirements by utility, by sector, and by end-use, as well as peak demand statewide and by utility. Further discussion of the forecast and the conversion from energy use to peak demand is contained in Section IV of the plan.

B. Electricity Supply

Supplies of electricity in New York are projected to remain adequate, reliable, and economic upon implementation of the electric generation and transmission plan in the State Energy Master Plan.

Construction of the new electric generating capacity set forth in Figures VI-6 and VI-7 will assure that adequate reserve margins are met and will allow existing oil-fired facilities to be operated less frequently. Conversion to coal of the existing oil-fired electric generating facilities set forth in Figure VI-6 will substantially reduce oil consumption in the electric utility sector, may well result in substantial savings to ratepayers, and, in many cases, appears to be achievable with capital investments substantially less than such investments for new generating capacity.

Figure VI-8 shows how the use of primary energy sources to generate electricity will change over the next 15 years upon plan implementation.

Implementation of the electric generation plan and maintenance of a reliable electric system will require upgrading of the State's electric transmission system. In addition to the generator leads required to connect new plants to the grid, upgrading of the transmission system will be required between Hydro Quebec and the New York interconnected system, between the Utica area and the Albany area, and in the Hudson Valley corridor between Albany and New York City.

C. Electricity Price

Real prices for electricity are likely to increase at an average rate of 1.8 percent per year, on a statewide basis, over the next 15 years. Projected energy prices and growth rates are shown in Figure VI-9 for all major fuel forms and consuming sectors. The projected growth of electricity price compares favorably with all other major energy forms.

3. NATURAL GAS

A. Natural Gas Demand

Statewide demand for natural gas is likely to increase at an average rate of 1.4 percent per year over the next 15 years. Figures VI-10 and VI-11 show the projected increase in demand by sector and the projected rates of growth.

The demand forecast shown in Figure VI-10 considers sectoral demands only, that is, it is a projection of gas consumption within each sector. In addition to meeting such demands, gas purchase requirements (supply) must include an additional volume of gas to meet total system requirements including lost-and-unaccounted-for[1] gas. Shown below is the total gas system requirements forecast based on lost-and-unaccounted-for gas estimates as reported by NYGAS.

[1]Line losses, measurement differences, stolen gas and other unaccounted for gas resulting in a difference between sales and purchases.

NEW YORK STATE GAS REQUIREMENTS (TBTU)

1980	1984	1989	1994
627,1	662.8	695.7	738.7

B. Natural Gas Supply

Natural gas supplied from the lower 48 states is expected to decrease over the forecast period. However, supplemental supplies are expected to become available to cover the deficiency and allow for growth in consumption. Estimated contributions to U.S. gas supply from all sources are shown in Figure VI-12. Supplies available to New York from these sources are shown in Figure VI-13. The forecasted demand of 738.7 BCF by 1994 can be met with a combination of supplements as indicated in the sensitivity analysis.

FIGURE VI-1
ELECTRICITY REQUIREMENTS (SALES)
NEW YORK STATE, 1960-1994

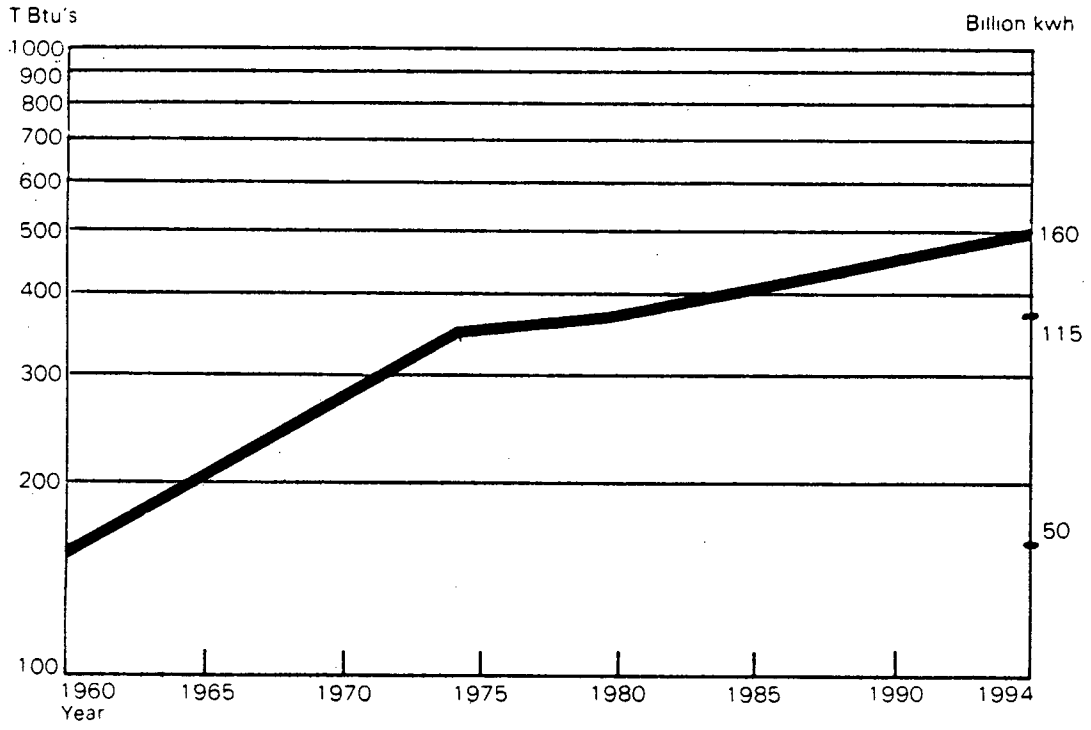


FIGURE VI-2
FORECAST OF NEW YORK STATE ELECTRICITY REQUIREMENTS (SALES) BY SECTOR, 1978-1994

Sector	Trillion BTU 1978	Trillion BTU 1994	Average Annual Percent Change 1978-1994
Residential	111.1	142.9	+1.59
Commercial	145.0	201.4	+2.07
Industrial	95.9	143.4	+2.55
Transportation	7.8	13.0	+3.24
Total Electricity Requirements	359.8	500.7	+2.09

FIGURE VI-3

ELECTRIC ENERGY FORECAST
BY SECTOR AND END-USE
1978-1994
(TRILLION BTU)

	1978	1980	1984	1989	1994	1978-1994 Growth Rate (%)
Residential	111.1	113.3	119.9	130.0	142.9	1.6
Space heating	6.9	8.1	10.5	13.7	17.2	5.8
Water heating	8.6	9.0	9.8	10.8	11.8	2.0
Cooking	4.8	4.9	5.2	5.7	6.1	1.5
Clothes drying	6.9	7.0	7.6	8.6	10.1	2.4
Central A/C	1.4	1.5	1.7	1.9	2.2	2.9
Room A/C	6.1	6.2	6.5	6.9	7.4	1.2
Appliances	76.4	76.6	78.6	82.4	88.1	0.9
Commercial	145.0	153.2	162.8	175.2	201.4	2.1
Space heating	15.4	15.6	17.3	19.7	23.5	2.7
Cooling A/C	33.2	36.5	40.1	45.3	55.9	3.3
Water heating	2.5	2.6	2.7	2.8	3.2	1.6
Lighting	70.3	72.4	74.9	78.8	87.7	1.4
Other	23.6	26.1	27.8	28.6	31.1	1.7
Industrial	95.9	101.6	113.2	124.5	143.4	2.5
Energy Intensive Manufacturing	65.8	70.7	77.5	84.8	94.1	2.3
Other Mfg.	28.2	28.9	33.5	37.3	46.5	3.2
Other Industrial	1.9	2.0	2.2	2.4	2.8	2.5
Transportation	7.8	8.7	10.4	12.2	13.0	3.2
TOTAL	359.8	376.8	406.3	441.9	500.7	2.1

FIGURE VI-4

ELECTRICITY SALES, PEAK DEMANDS AND GROWTH RATES
BY UTILITY, 1978 and 1994

	Sales (Billion KWH)*			Summer Peak (MW)			Winter Peak (NW)		
	1978	1994	Growth Rate (%)	1978	1994	Growth Rate (%)** (79-94)	1978	1994	Growth Rate (%)** (79-94)
CHE&G	3.3	4.8	2.36	614	964	2.47	623	964	2.61
CE	26.6	31.2	1.00	6714	7710	0.54	4862	5313	0.40
LILCO	12.4	17.5	2.14	2997	4206	1.83	2456	3749	2.39
NYSEG	10.5	16.8	3.00	1729	2742	2.78	2138	3413	2.69
NMPC	29.3	39.6	1.90	5002	6890	2.11	5500	7558	2.05
O&R	2.9	4.6	3.00	662	1088	2.80	515	839	2.88
RGE	5.1	7.8	2.69	983	1531	2.71	941	1514	2.87
PASNY	15.4	24.4	2.94	2348	3854	3.35	2500	4180	3.17
Total	105.5	146.7	2.09	21049	28982		19535	27530	
Coincident Peak				20418	28414	1.88	18939	27257	2.10

*Does not include losses, company use or sales for resale.
**These growth rates are based upon weather normalized 1979-1994 peak demand projections.

FIGURE VI-5
INTERCONNECTED SYSTEMS ELECTRIC DEMAND FORECAST
NEW YORK STATE (1979-1994)

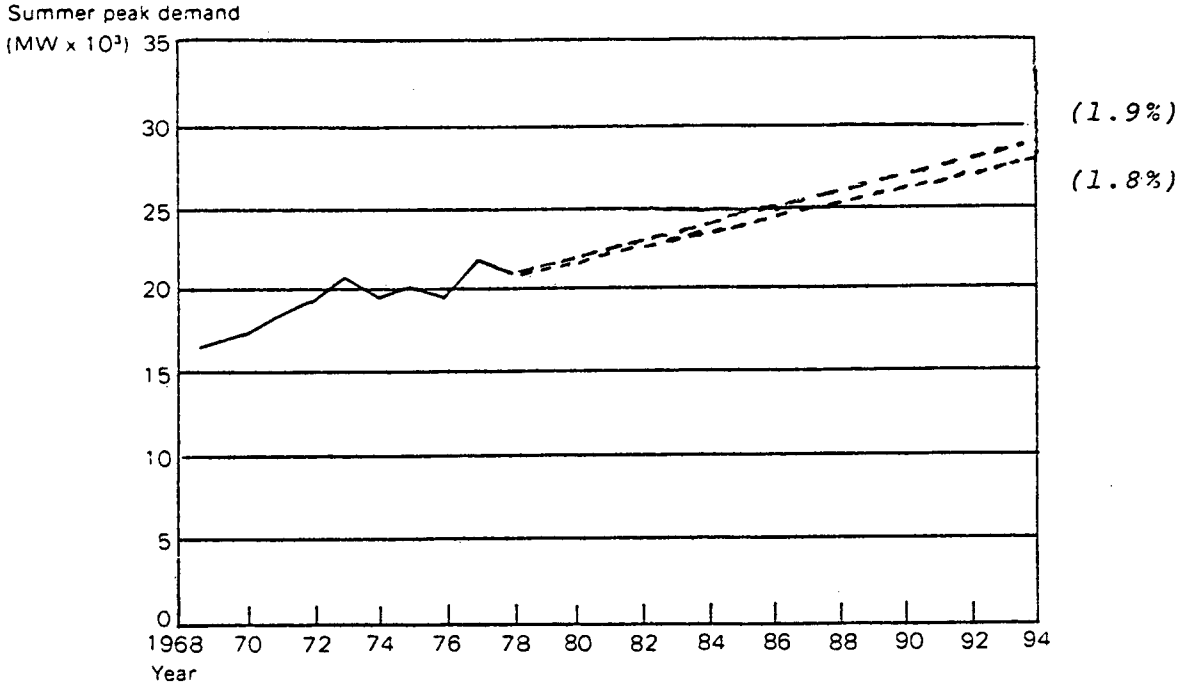


FIGURE VI-6
ELECTRICITY GENERATION PLAN
(1979-1994)

New Facilities	Capacity (MW)	Fuel	Date
Under Construction			
Oswego	850	Oil	1980
Shoreham	820	Nuclear	1980
Nine Mile Pt. 2	1080	Nuclear	1984
Somerset	850	Coal	1984
Planned			
Pumped Storage Hydro	1000	PS Hydro	1987
Coal and/or Coal-RDF (5 units)	3100-3600MW*	Coal/RDF	1986-1992
TOTAL	7700-8200		
Conversions			
Danskammer 3	122	oil to coal	1982
Danskammer 4	220	oil to coal	1982
Albany 1-4	400	oil to coal	1984
Ravenswood 3	928	oil to coal	1984
Arthur Kill 2	350	oil to coal	1984
Arthur Kill 3	501	oil to coal	1984
Fort Jefferson 3&4	380	oil to coal	1984
Lovett 4&5	399	oil to coal	1986
Ravenswood 1&2	770	oil to coal	1987
E.F. Barrett 1&2	380	oil to coal	1988
Northport 1-4	1532	oil to coal	1989
	5982		

Other (cumulative additions)	1984	1989	1994
Small Hydro Total (MW)	282	402	725
Solid Waste Total (MW)	208	298	298
Cogeneration Total (MW)	42	132	222
Canadian Import	1979-83	1984-87	1988-94
Capacity (MW)	800	800	800
Energy (Billions of KHW per year)	8.0	12.3	6.0

*600-800 per unit.

FIGURE VI-7
ELECTRIC DEMAND AND CAPACITY
1979-1994

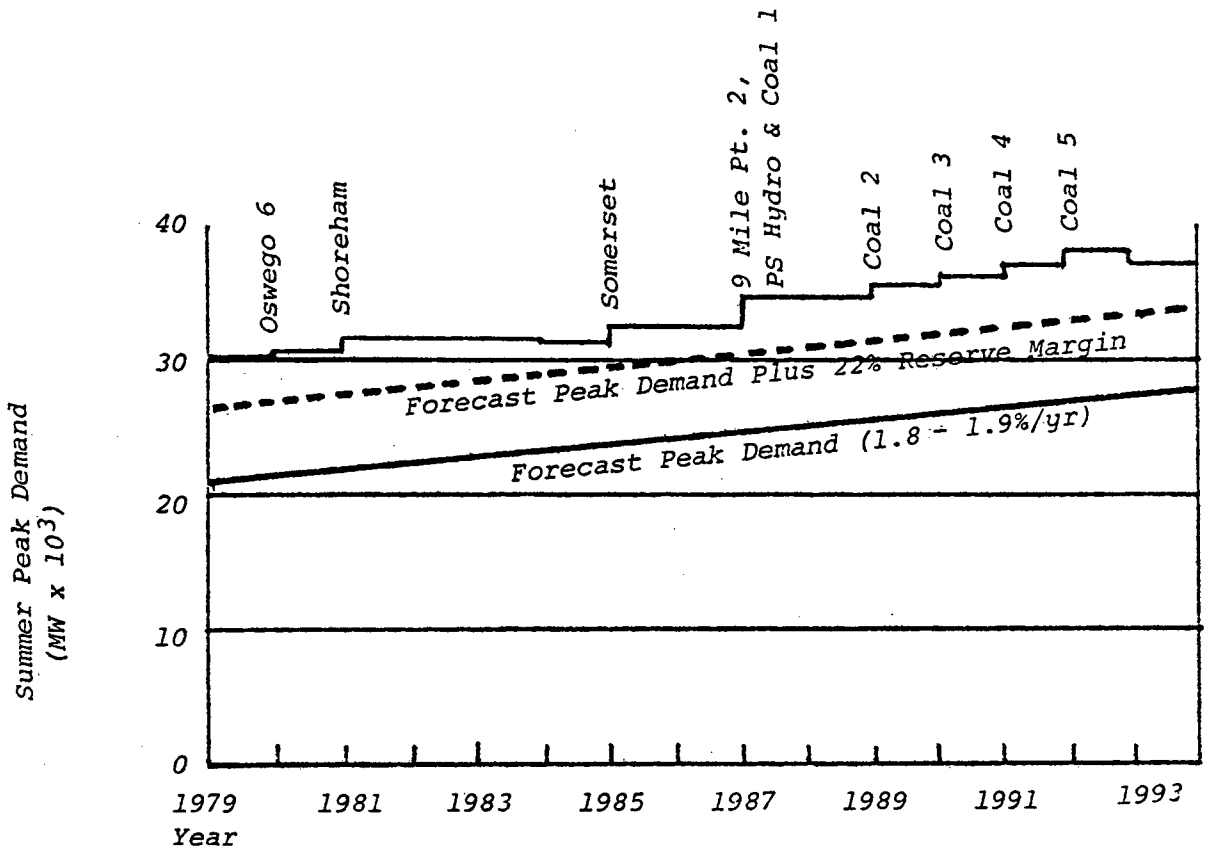


FIGURE VI-8
ELECTRICITY GENERATED BY PRIMARY ENERGY SOURCE
NEW YORK STATE (1979-1994)

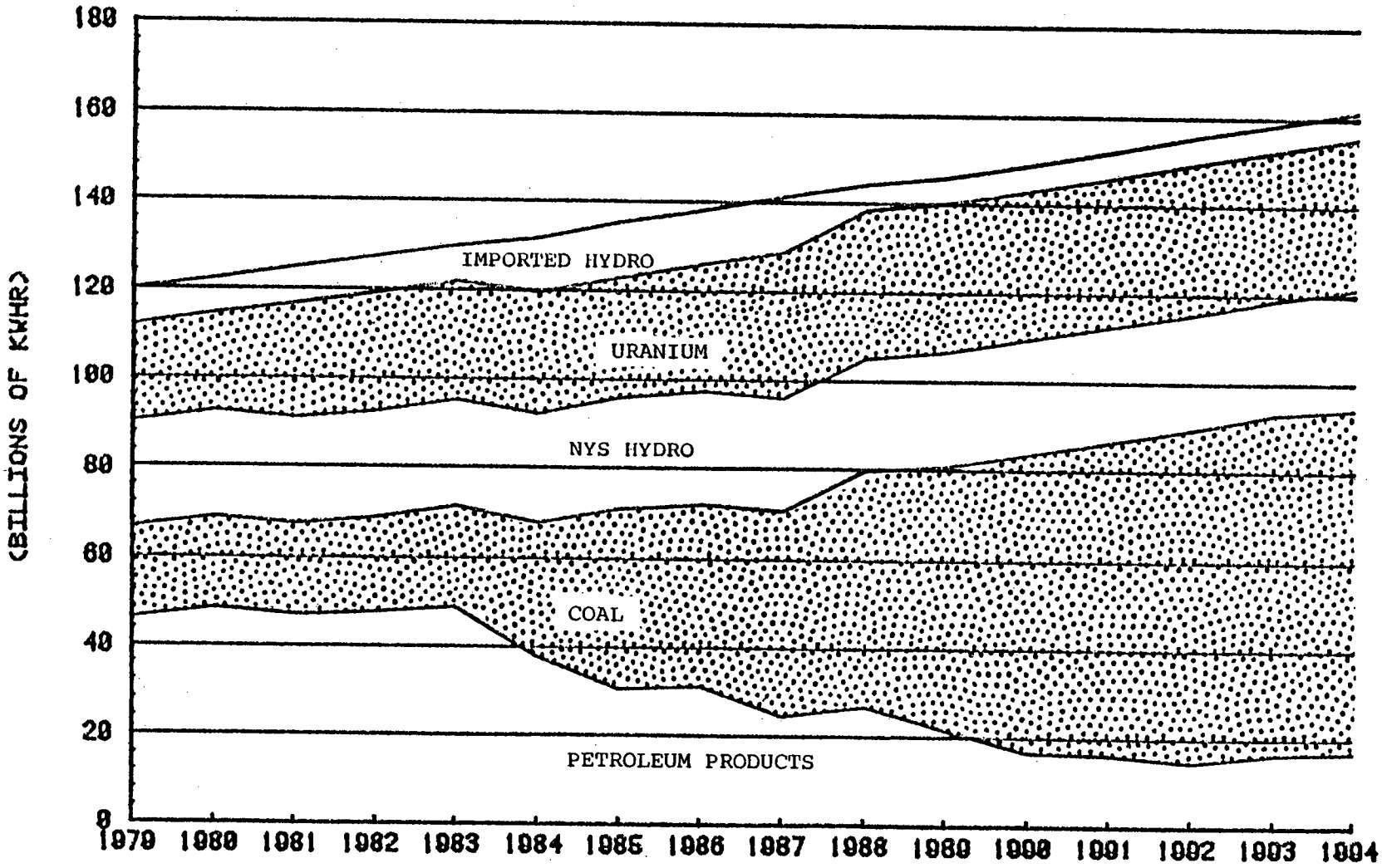


FIGURE VI-9

NEW YORK STATE ENERGY PRICE ASSUMPTIONS BY SECTOR AND FUEL TYPE, 1978-1994

	1978 Constant Dollars										Average Annual Percent Change			
	1978		1980		1984		1989		1994		1978-1980	1980-1984	1984-1989	1989-1994
	$/ UNIT	$/ MMBTU	$/ UNIT	$/ MMBTU	$/ UNIT	$/ MMBTU	$/ UNIT	$/ MMBTU	$/ UNIT	$/ MMBTU				
Crude Oil														
Foreign Acquisition Cost	14.47/bbl	2.57	20.26/bbl	3.60	21.93/bbl	3.90	25.18/bbl	4.48	29.18/bbl	5.19	18.3	2.0	3.0	3.0
Domestic Acquisition	10.62/bbl	1.89	14.42/bbl	2.56	21.93/bbl	3.90	25.18/bbl	4.48	29.18/bbl	5.19	16.5	11.0	3.0	3.0
Composite	12.46/bbl	2.22	16.99/bbl	3.02	21.93/bbl	3.90	25.18/bbl	4.48	29.18/bbl	5.19	16.8	6.6	3.0	3.0
Residential														
Natural Gas	3.37/mcf	3.24	3.64/mcf	3.50	4.26/mcf	4.10	5.08/mcf	4.89	5.92/mcf	5.70	4.0	4.0	3.6	3.0
Distillate	.51/gal	3.68	.72/gal	5.19	.82/gal	5.91	.92/gal	6.63	1.02/gal	7.35	18.8	3.3	2.3	2.1
Kerosene	.52/gal	3.82	.73/gal	5.41	.83/gal	6.15	.93/gal	6.89	1.03/gal	7.63	18.5	3.3	2.3	2.1
Electricity	.064/kwh	18.76	.068/kwh	19.90	.074/kwh	21.69	.080/kwh	23.33	.084/kwh	24.65	3.0	2.1	1.5	1.0
Commercial														
Natural Gas	2.53/mcf	2.44	2.79/mcf	2.69	3.46/mcf	3.33	4.52/mcf	4.35	5.80/mcf	5.58	5.0	5.5	5,5	5.0
Distillate	.49/gal	3.53	.70/gal	5.05	.80/gal	5.77	.90/gal	6.49	1.00/gal	7.21	19.5	3.4	2.4	2.1
Residual	.42/gal	2.81	.60/gal	4.01	.69/gal	4.61	.78/gal	5.21	.87/gal	5.81	19.5	3.6	2.5	2.2
Kerosene	.50/gal	3.70	.71/gal	5.26	.81/gal	6.00	.91/gal	6.74	1.01/gal	7.48	19.2	3.3	2.4	2.1
Electricity	.053/kwh	15.53	.056/kwh	16.48	.062/kwh	18.71	.061/kwh	19.60	.071/kwh	20.72	3.0	2.5	1.5	1.0
Industrial														
Natural Gas	2.36/mcf	2.27	2.65/mcf	2.55	3.41/mcf	3.28	4.50/mcf	4.33	5.87/mcf	5.65	6.0	6.5	5.5	5.5
Distillate	.49/gal	3.53	.70/gal	5.05	.80/gal	5.77	.90/gal	6.49	1.00/gal	7.21	19.5	3.4	2.4	2.1
Residual	.42/gal	2.81	.60/gal	4.01	.69/gal	4.61	.78/gal	5.21	.87/gal	5.81	19.5	3.6	2.5	2.2
Kerosene	.50/gal	3.70	.71/gal	5.26	.81/gal	6.00	.91/gal	6.74	1.01/gal	7.48	19.2	3.3	2.4	2.1
Coal	50.00/ton	2.08	53.05/ton	2.21	59.71/ton	2.51	66.57/ton	2.80	73.50/ton	3.09	3.0	3.0	2.0	2.0
Electricity	.053/kwh	15.53	.056/kwh	16.48	.062/kwh	18.71	.067/kwh	19.60	.071/kwh	20.72	3.0	2.5	1.5	1.0
Transportation														
Gasoline	6.92/gal	5.34	.918/gal	7.35	1.053/gal	8.43	1.182/gal	9.46	1.297/gal	10.38	15.2	3.5	2.3	1.9
Jet Fuel	.35/gal	2.59	.56/gal	4.15	.66/gal	4.89	.76/gal	5.63	.86/gal	6.37	26.4	4.2	2.9	2.5
Electric Utility														
Residual	.30/gal	2.00	.43/gal	2.87	.52/gal	3.47	.61/gal	4.08	.70/gal	4.68	19.5	4.9	3.2	2.8
Coal	33.51/ton	1.41	35.55/ton	1.50	40.01/ton	1.68	44.61/ton	1.88	49.25/ton	2.07	3.0	3.0	2.0	2.0
Distillate	.383/gal	2.76	.55/gal	3.97	.67/gal	4.83	.78/gal	5.62	.89/gal	6.42	19.5	5.1	3.0	2.7

FIGURE VI-10
NEW YORK STATE END USE ENERGY REQUIREMENTS
BY SECTOR AND FUEL TYPE, 1978-1994
TRILLION BTU

End Use Requirements	1978*	1980	1984	1989	1994
By Sector					
Residential	966.9	978.8	995.6	1011.1	1019.9
Electricity	111.1	113.3	119.9	130.0	142.9
Natural Gas	334.2	348.6	378.2	417.5	455.2
Petroleum Products	498.4	489.1	461.1	424.6	380.2
Wood and Other	23.2	27.8	36.4	39.0	41.6
Commercial	673.1	680.4	693.8	716.9	784.8
Electricity	145.0	153.2	162.8	175.2	201.4
Natural Gas	131.7	138.7	141.6	143.8	151.1
Petroleum Products	395.2	387.5	388.7	397.6	432.3
Other	1.2	1.0	0.7	0.3	—0—
Industrial	380.2	378.2	391.1	395.9	430.0
Electricity	95.9	101.6	113.2	124.5	143.4
Natural Gas	105.0	117.0	119.5	110.2	107.4
Petroleum Products	120.1	102.6	97.4	97.2	113.2
Coal (excluding coking) & Others	59.2	57.0	61.0	64.0	66.0
Transportation	1105.8	1081.8	1047.3	1054.9	1172.8
Electricity	7.8	8.7	10.4	12.2	13.0
Petroleum Products	1098.0	1073.1	1036.9	1042.7	1159.8
Gasoline	776.8	743.6	681.2	643.8	694.0
Total End Use Requirements	3126.0	3119.2	3127.8	3178.8	3407.5
Electricity End Use Requirements	359.8	376.8	406.3	441.9	500.7
Electric Utilities**	906.0	948.7	1022.9	1112.3	1260.3
Total Primary Energy Requirements	4032.0	4067.9	4150.7	4291.1	4667.8
End Use Requirements					
By Fuel Type					
Electricity	359.8	376.8	406.3	441.9	500.7
Natural Gas	570.9	604.3	639.3	671.5	713.7
Petroleum	2111.7	2052.3	1984.1	1962.1	2085.5
Other	83.6	85.8	98.1	103.3	107.6
Total End Use Requirements	3126.0	3119.2	3127.8	3178.8	3407.5

*Preliminary SEO estimates
**End use consumption is the energy consumed directly by the sector and differs from primary energy consumption by excluding electricity generation and transmission losses.

FIGURE VI-11

NEW YORK STATE END USE ENERGY REQUIREMENTS BY SECTOR AND FUEL TYPE, 1978-1994: AVERAGE ANNUAL PERCENT CHANGE FOR SELECTED PERIODS

End Use Requirements By Sector	1978-1980	1980-1984	1984-1989	1989-1994	1978-1994
Residential	+0.6	+0.4	+0.3	+0.2	+0.3
Electricity	+1.0	+1.4	+1.6	+1.9	+1.6
Natural Gas	+2.1	+2.1	+2.0	+1.7	+2.0
Petroleum Products	−0.9	−1.5	−1.6	−2.2	−1.7
Wood and Other	+9.5	+7.0	+1.4	+1.3	+3.7
Commercial	+0.5	+0.5	+0.7	+1.8	+1.0
Electricity	+2.8	+1.5	+1.5	+2.8	+2.1
Natural Gas	+2.6	+0.5	+0.3	+1.0	+0.9
Petroleum Products	−1.0	+0.1	+0.5	+1.7	+0.6
Industrial	−0.3	+0.8	+0.2	+1.7	+0.8
Electricity	+2.9	+2.7	+1.9	+2.9	+2.6
Natural Gas	+5.6	+0.5	−1.6	−0.5	+0.1
Petroleum Products	−7.6	−1.3	−0.0	+3.1	−0.4
Coal (excluding coking) & Others	−1.9	+1.7	+1.0	+0.6	+0.7
Transportation	−1.1	−0.8	+0.2	+2.1	+0.4
Electricity	+5.6	+4.6	+3.2	+1.3	+3.2
Petroleum Products	−1.1	−0.9	+0.1	+2.2	+0.3
Gasoline	−2.2	−2.2	−1.1	+1.5	−0.7
Total End Use Requirements	−0.1	+0.1	+0.3	+1.4	+0.5
Electricity End Use Requirements	+2.3	+1.9	+1.7	+2.5	+2.1
Electric Utilities*	+2.3	+1.9	+1.7	+2.5	+2.1
Total Primary Energy Requirements	+0.4	+0.5	+0.7	+1.7	+0.9
End Use Requirements By Fuel Type					
Electricity	+2.3	+1.9	+1.7	+2.5	+2.1
Natural Gas	+2.9	+1.4	+1.0	+1.2	+1.4
Petroleum	−1.4	−0.8	−0.2	+1.2	−0.1
Other	+1.3	+3.4	+1.0	+0.8	+0.8
Total End Use Requirements	−0.1	+0.1	+0.3	+1.4	+0.5

*End use consumption is the energy consumed directly by the sector and differs from primary energy consumption by excluding electricity generation and transmission losses.

FIGURE VI-12

ESTIMATED CONTRIBUTION TO U.S.GAS SUPPLY FROM ALL SOURCES (TCF/yr)

Source	1980 Low	1980 Expected	1980 High	1984 Low	1984 Expected	1984 High
Lower 48 Production	17.3	18.2	18.4	16.5	17.4	18.6
Alaska	—	—	—	—	—	—
Canada	1.1	1.3	1.4	1.1	1.3	1.4
Mexico	.2	.25	.3	.5	.62	.75
LNG Imports	.4	.57	.57	.9	1.3	1.7
SNG						
From Light Distillates	.25	.30	.30	.20	.25	.30
High Btu Gas From Coal	—	—	—	.05	.075	.10
New Technologies	—	—	—	.45	.67	.90
TOTALS	19.25	20.6	20.97	19.7	21.6	23.75

Source	1989 Low	1989 Expected	1989 High	1994 Low	1994 Expected	1994 High
Lower 48 Production	15.6	16.5	19.4	14.7	15.5	19.5
Alaska	.5	.87	1.2	1.4	1.6	2.5
Canada	1.0	1.5	2.0	1.0	1.5	2.0
Mexico	1.0	1.25	1.5	1.0	1.25	1.5
LNG Imports	1.0	1.50	2.0	1.25	1.87	2.5
SNG						
From Light Distillates	.15	.20	.25	.05	.10	.20
High Btu Gas From Coal	.30	.45	.60	.9	1.35	1.8
New Technologies	.90	1.35	1.80	1.6	2.4	3.2
TOTALS	20.45	23.6	28.75	21.9	25.57	33.2

FIGURE VI-13

NYS SUPPLY FORECAST
(ALL SUPPLEMENTALS INCLUDED)

	Low	Expected	High
1980	641	686	698
1984	653	719	791
1989	681	786	957
1994	729	851	1105

SENSITIVITY TO LOSS OF SUPPLEMENTALS
NYS SUPPLY
(BCF/yr)
(EXPECTED CASE ONLY)

	No Mexican	No Increased Canadian	No Mexican & Inc. Canadian	No Alaskan
1980	678	679	671	686
1984	699	708	687	719
1989	744	755	713	757
1994	810	802	760	798

	No Add'l LNG	No New Technologies	No High BTU Coal Gas	No Supplementals*
1980	686	686	686	671
1984	695	697	717	638
1989	755	741	771	593
1994	808	772	807	539

*Mexican, Increased Canadian, Alaskan, Additional LNG, New Technologies, and High BTU Coal Gas.

While New York State forecasted gas supplies (Figure VI-13) exceed forecasted demand, there is no assurance that all supplemental supply projects will be successfully developed. Excess supplies that may result from successful completion of these projects would, in general, further reduce oil consumption. Another option would be to improve individual pipeline reserve to production ratios by not producing domestic reserves in proportion to the estimated excess. Also, expansion of weather sensitive loads will require the addition of underground storage or other peaking capability. This will increase supply requirements above the forecasted sectoral demands. Finally, the strategic gas reserve proposed in the supply plan would also serve as a bank for excess gas supply. Considering all of the variables that may be encountered during this transition from reliance on domestic gas from conventional areas to diversified supplies, all of economic supplemental gas supply projects identified in the plan should be pursued.

New York State's contribution to this supply from its indigenous resources is expected to consist of continued onshore production and development of offshore Lake Erie resources. The estimated contribution from these sources to U.S. supplies is shown in Figure VI-14.

C. Natural Gas Prices

Real prices for natural gas are likely to increase at an average rate of 4.4 percent per year, on a statewide basis, over the next 15 years.

Implementation of the Natural Gas Policy Act of 1978 will heavily influence natural gas prices through 1985. Thereafter, the price of new conventional gas supplies is expected to track the world oil price. However, by 1989, end-use natural gas prices will still be significantly lower than petroleum prices. Figure VI-9 shows projected gas prices over the forecast period.

FIGURE VI-14

CONTRIBUTION TO U.S. GAS SUPPLY
FROM N.Y.S. INDIGENOUS RESOURCES
(BCF/yr)

Year	Onshore Production	Offshore Production	Total
1980	16.2	.3	16.5
1984	21.0	2.3	23.3
1989	22.9	4.9	27.8
1994	23.5	7.5	31.0