# ECONOMIC ASPECTS OF THE NEW JERSEY ENERGY SITUATION

GOVERNOR'S OFFICE OF POLICY AND PLANNING

STATE OF NEW JERSEY

BRENDAN BYRNE
*Governor*

# ECONOMIC ASPECTS

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GOVERNOR'S OFFICE OF POLICY AND PLANNING

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## I. SUMMARY OF FINDINGS

1. The most urgent problem facing the U.S. economy is the continuing constraint on energy supplies and the impact of increasing energy and energy-related prices. New Jersey's most critical energy problem is its dependence on oil, a fuel whose price has increased and is projected to increase at a higher rate than alternative fuels. This situation is compounded by the fact that New Jersey does not have a domestic supply of oil and is dependent on out-of-state, (primarily foreign) sources.

2. Energy consumption in New Jersey is substantially lower than the U.S. per capita average. New Jersey historically has been an efficient user of energy and has further improved its performance since the oil embargo of 1973.

3. The structure of energy consumption in New Jersey differs from the nation as a whole. While nationally, oil supplies approximately half of the energy consumed, in New Jersey oil accounts for over two-thirds of consumption. Natural gas and coal provide slightly less than half of the energy consumed nationally, but only one-fifth in New Jersey.

4. The post-1973 era brought a change in the growth of oil consumption. In 1977, New Jersey consumed 12.7% less oil than in 1973. Nationally, oil usage increased by 6.9% during the same period.

5. New Jersey is less dependent on natural gas than is the nation. In 1977, natural gas provided 27.8% of the energy consumed in the United States; in New Jersey, the comparable figure was 15.3%.

6. Oil has been a significantly more important fuel in New Jersey than nationally, especially in the residential and commercial sectors.

7. The transportation sector accounts for 35% of the State's energy demand and petroleum is virtually its sole energy source.

8. Electric utilities: residual oil continues to account for more than half (57%) of total fuel usage by utilities in New Jersey. This figure has been reduced, however, from 72% in 1973--the year of the oil embargo. Nuclear energy dramatically increased during this period from 9% in 1973 to over 22% by 1977. Coal accounts for 20% of the State utilities fuel consumption, less than one-half of the comparable national figure.

9. Industrial sector: consumption of natural gas was dramatically curtailed after the shortages of 1975-76. Fuel oil consumption actually increased, however, as a proportion of total consumption in the post-embargo years. Coal was virtually eliminated as an industrial fuel source by the 1970s.

10. The major industrial energy users in New Jersey are Paper and Allied Products, Chemicals and Allied Products, Stone, Clay, and Glass Products, and Primary Metal Industries. All have per employee energy expenditures of over $2,500. (The industrial average in New Jersey is $1,330.)

11. Rising energy prices will have the effect of (1) generating a redistribtuion of income between New Jersey and energy producing regions both outside and within the United States, and (2) generating a redistribution of revenue within the State between energy consumers and the energy industry. A substantial rise in energy payments could significantly undermine the capability of the State's private and public sectors to obtain the capital funding necessary to replace a deteriorating capital stock.

12. Severance taxes, in addition to directly increasing energy-related income outflows from New Jersey, may also impose indirect costs by weakening the competitive position of New Jersey with respect to energy-producing states through the ability of these states to substitute the severance tax for other less desirable revenue sources.

13. The United States Department of Energy projects a major shift away from petroleum with increased consumption of coal, natural gas and elctricity. Utilities, according to the projections, will virtually phase out oil as a fuel, to be replaced by coal and nuclear energy. By 1995, coal is projected to supply more than one-half of utility fuel consumption.

14. The cost of electricity is projected to remain unchanged until 1985 and to decline thereafter. All other fuels are projected to increase in costs. Coal costs will increase least of all - only 25% by 1995 - but residual oil will more than triple in price during the same period.

15. If per capita energy consumption in New Jersey remains the same in 1985 as it was in 1977, the State's total consumption of energy is expected to be 1,913 quadrillion BTU's. A reduction of 30 to 40% of this figure would mean gross energy consumption for New Jersey in 1985 of between 1,150 and 1,340 quadrillion BTU's. This would be, in spite of forecasted population growth, an actual decline of between 24 and 35% over current (1977) consumption.

## II. SUMMARY OF RECOMMENDATIONS

The policy recommendations of this paper are confined to those that can be initiated and implemented at the State and local governmental levels. They include and support major recommendations of the comprehensive New Jersey State Energy Conservation Plan of the New Jersey Department of Energy and of the State Energy Conservation Regulations which are being implemented by that agency in cooperation with other agencies of New Jersey State government.

1. Policies which involve out-of-state governmental entitites

A. With other northeastern states, New Jersey should continue to seek a research and financing organization such as the proposed Energy Corporation of the Northeast (ENCONO).

B. The effects of severance taxes on energy-consuming states should be studied and quantified.

2. Policies concerning a more balanced energy usage to make the State less dependent on oil by encouraging use of other fuels should be continued.

3. Residential sector policies

A. The energy conservation information programs that have been undertaken by NJDOE and the State's public utilities should be continued and augmented.

B. Conservation standards should be required by all homes, regardless of age, at time of sale. Requirements would include adequate insulation, day/night thermostats, et cetera.

C. Mid-term policies supporting efficient energy usage in future housing should be introduced. Requirements would support options to include new energy technologies in future housing.

D. Long-term policies encouraging energy efficient future residential developments should be introduced; zoning ordinances, subdivision and transportation plans should be included.

4. Commercial sector policies

A. Short-term policies, supporting more efficient energy usage for existing structures such as decreased energy consumption of 10% in the first year, 20% in the second and 30% in the third target year, should be mandated.

B. Mid- and long-term policies supporting efficient energy usage for new buildings, such as ASHRAE 90-75 to improve thermal efficiency standards for new structures should be progressively tightened over time.

5. Industrial sector policies

A. The Board of Public Utilities should take the lead in producing a framework by which industrial process steam will be effectively utilized for the cogeneration of electricity.

B. Oil burning boilers should be retrofitted wherever feasible for the use of anthracite. The potential of this measure can be

seen by the fact that coal, which has been virtually eliminated as an industrial boiler fuel, accounted for over one-fifth of energy usage in this sector less than a decade ago.

C. As part of its commitment to more efficient solid waste management, the regulations and rate policies of the Board of Public Utilities should be designed to encourage resource recovery and the production of Refuse Derived Fuel (RDF) as an alternative to existing landfill operations.

6. Transportation sector policies

A. An advisory program by NJDOT should be introduced to augment the existing efforts in introducing alternate work hours for better utilization of public transportation and less congested highways.

B. Improving the quality of mass transit, not only by new investments but through better organization of existing resources, should be the short-term objective. Improvements may include special bus lanes, shelters, route maps and posted schedules. Additionally, a periodical review of each bus route within the system in which it operates to improve efficiency and introduction of a local bus service to the "park and ride" facilities should be a procedure for every mass transit system in the State.

7. Electric utility policies

A. The Board of Public Utilities should expedite its announced policies of energy efficient utility pricing policies such as peak load pricing, elimination of master metering of multi-unit buildings, and interruptible rates for large industrial customers.

B. The Board of Public Utilities should encourage utilities to institute non-price energy efficient policies, such as automatic cutoff of air conditioning equipment and other large appliances, during peak times.

Within the past months, agencies of State government have come forward with significant new proposals and actions designed to enhance the effectiveness of energy utilization in New Jersey. Both the Departments of Energy and Environmental Protection have developed proposals for a Statewide resource recovery program. This proposal was passed by the State Legislature and Governor Brendan Byrne signed a bill on July 14, 1980 authorizing the $145 million Natural Resource Bond Act on the November ballot, $50 million of that for grants or loans for the design, acquisition and construction of resource recovery facilities. In another energy development, the Governor signed on July 14, 1980, a bill authorizing the placement of the Energy Conservation Bond Act of 1980 on the November ballot which would provide $50 million to enhance the energy efficiency of State buildings. All these programs were approved by voters in the November 1980 election. In addition, the Department

of Energy has studied the potential in New Jersey for the industrial cogeneration of steam and electricity. On the basis of commissioned studies and public hearings, the Department has developed recommendations which will be included in the State Energy Master Plan.

# PART ONE

# ANALYSIS

## I. INTRODUCTION

The most urgent problem facing the United States economy is the continuing constraint on energy supplies and the impact of increasing energy and energy-related prices.

New Jersey, as well as many other northeastern states, is in the unenviable position in a period of rising energy costs of lacking domestic energy sources. The State is dependent on foreign and out-of-State sources for fuels it consumes.

New Jersey's most critical problem is a heavy reliance on oil by all economic sectors, the price of which has increased and is projected to continue to increase at a much faster rate than other fuels.

Furthermore, New Jersey refineries are presently dependent for over 90% of their crude oil supplies on foreign sources; dependence on foreign crude oil has steadily increased since 1956 when approximately 40% of crude oil supplies processed in the State's refineries were from production sources within the U.S.

The energy problem in New Jersey is one of cost and the subsequent effects on output, employment, and income, but there is a strong supply component to the problem. Over the long run, rising costs and energy shortages, especially if they are borne unequally by the states, will have serious economic effects. Firms making location decisions may give major

consideration to local costs and the dependability of energy supplies. States which are energy producers will, through state-owned oil or natural gas resources, severance taxes and other devices, collect significant revenues which will supplant the more traditional business taxes upon which non-energy producing states must rely, thus adding even lower taxes as a locational incentive to business.

The impact of increasing prices for energy supplies may create significant problems of adjustment for the economy of New Jersey as substantially greater amounts of disposable income and available capital income are committed to energy payments and these funds are diverted from potential investment in the State to energy-producing regions both outside and within the United States. New Jersey's economic problems related to energy may continue, however, even if the nation achieves energy self-dependence as New Jersey expenditures now committed for foreign crude oil purchases are shifted to domestic energy supplies and energy-producing regions.

The short-term (1981-1985) aspects of the energy problem can be translated into policies which deal with emergency situations such as inadequate supplies and high prices of gasoline and heating oil. Mid-term (1985-1995) policies should deal with significant adjustments in energy supplies and demand to balance and diversify the State's consumption and lessen the State's dependence on one type of fuel. Long-term (1995-2000) policies should deal with possible new energy sources partially replacing today's limited supplies.

## II. OVERALL ENERGY CONSUMPTION

Energy consumption in New Jersey is substantially lower than the U.S. per capita average. In 1960, New Jersey, with 3.39% of the nation's population, consumed 3.02% of the nation's gross energy,* an energy/ population ratio of .89. By 1977, this figure had been reduced to .68. Thus, long before the energy crisis, New Jersey was, relative to the U.S. as a whole, highly energy efficient. And in the post-embargo period, the State further improved its performance. Furthermore, all sectors of the economy have contributed to the State's increasing energy efficiency.

The remainder of this section will illustrate and expand on the above statements. The years 1960, 1973, and 1977 are used as bench mark years: 1960 as a year in the era of relatively cheap and abundant energy; 1973, the year of the oil embargo, to symbolize the end of this era; and 1977, the latest year for which data are available, to illustrate the extent of the State's adjustment to an energy-scarce economy.

Table II.1A shows the changes in New Jersey's share of the nation's energy consumption. Over the whole of the 17-year period, the State's proportion of energy consumption declined in all sectors while its population share in 1977 was exactly equal to that at the beginning of the period.

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* "Gross Energy" includes the energy used to produce electricity as opposed to "net energy", also called "end energy consumed", which includes only the BTU value of the electric energy consumed. It takes approximately 3 BTU's of fuel to produce one BTU of electricy.

However, as can be seen from the last line in Table II.1A, the major sector contributions have come from the industrial sector which may largely be attributed to the decline in manufacturing in the State, and in transportation, an area in which the State's high population density gives New Jersey an advantage in its ability to conserve.

TABLE II.1A

NEW JERSEY'S PROPORTION OF UNITED STATES ENERGY USAGE

1960, 1973, 1977

| Year | Total Energy | Res. | Comm. | Ind. | Transp. | N.J. Share of U.S. Population |
|---|---|---|---|---|---|---|
| 1960 | 3.07 | 3.59 | 4.43 | 2.28 | 3.35 | 3.39 |
| 1973 | 2.74 | 3.64 | 4.78 | 1.47 | 3.04 | 3.50 |
| 1977 | 2.60 | 3.42 | 4.39 | 1.44 | 2.81 | 3.39 |
| Percent Change 1960-77 | -15.30 | -4.70 | -0.90 | -36.80 | -16.10 | -- |

The residential and commercial sectors, on the other hand, began and ended the period with higher consumption than warranted by population share and contributed least to the decline in consumption. Residential consumption is undoubtedly higher than the population share for reasons of climate, but the relatively small decline over the full 17-year period, caused by the large increases during the pre-embargo period, indicates that increased conservation efforts in the residential sector are likely to have positive results. The commercial/services sector is likewise a strong candidate for conservation, but in this case, the growing importance of this sector rather than any lack of conservation efforts is the primary reason for its high energy usage.

By recomputing the data as a ratio between the State's share of energy consumption to its share of population, the performance of New Jersey relative to that of the nation may be illustrated. This measure (Table II.IB) shows current energy consumption in New Jersey's industrial sector to be extraordinarily low and the transportation sector to have a significant advantage over its national counterpart. With the residential sector now (1977) at the national level, only the commercial sector remains a high per capita consumer of energy.

TABLE II.1B

RATIO OF PROPORTION OF ENERGY USED TO POPULATION SHARE

BY MAJOR SECTORS IN NEW JERSEY

| Year | Res. | Comm. | Ind. | Transp. | Total |
|---|---|---|---|---|---|
| 1960 | 1.06 | 1.31 | .67 | .99 | .91 |
| 1973 | 1.04 | 1.37 | .42 | .87 | .78 |
| 1977 | 1.01 | 1.29 | .42 | .83 | .77 |

Table II.2 once again illustrates the large contribution to energy efficiency made by all sectors of the New Jersey economy in the post-embargo period. In every case, the average annual decrease in demand has been greater in New Jersey than for the U.S. by sectors and total.

TABLE II.2

AVERAGE ANNUAL GROWTH (+) OR DECLINE (-) IN ENERGY DEMAND:

NEW JERSEY AND UNITED STATES

| | Total | Res. | Comm. | Ind. | Trans. |
|---|---|---|---|---|---|
| New Jersey | | | | | |
| 1960-73 | 3.16 | 3.04 | 5.41 | 0.26 | 4.29 |
| 1973-77 | -1.42 | -1.54 | -2.29 | -1.92 | -0.40 |
| United States | | | | | |
| 1960-73 | 4.06 | 2.81 | 4.79 | 3.70 | 5.06 |
| 1973-77 | -0.15 | -0.05 | -0.32 | -1.44 | 1.61 |

Table II.3 compares the relative importance of each sector's energy demands for New Jersey and the U.S. The pattern in transportation is virtually the same in New Jersey as in the U.S.; the industrial and commercial sectors have moved in the same direction as their U.S. counterparts but by significantly greater amounts, and the residential sector has continued to command a greater share in New Jersey than in the United States.

TABLE II.3

SECTOR DISTRIBUTION OF ENERGY DEMAND AS PERCENT OF TOTAL

| | Res. | Comm. | Ind. | Trans. |
|---|---|---|---|---|
| New Jersey | | | | |
| 1960 | 22.6 | 17.3 | 31.3 | 28.7 |
| 1973 | 22.3 | 23.0 | 21.6 | 33.1 |
| 1977 | 22.2 | 22.1 | 21.2 | 34.6 |
| United States | | | | |
| 1960 | 19.6 | 12.0 | 42.0 | 26.3 |
| 1973 | 16.8 | 13.2 | 40.2 | 29.8 |
| 1977 | 16.9 | 13.1 | 38.1 | 32.0 |

## III. ENERGY CONSUMPTION BY FUEL

### 1. Total Consumption

The structure of energy consumption in New Jersey and other Northeastern states differs from the nation as a whole. The primary fuel used is oil, but while nationally oil supplies approximately half of the energy consumed, in New Jersey it accounts for over two-thirds. Natural gas and coal provide slightly less than half of the energy consumed nationally but only a fifth in New Jersey. The balance comes from nuclear and hydro sources (see Table III.1). Nationally, over the period of 17 years, between 1960 and 1977, the only significant change in the consumption pattern was a gradual shift from coal, approximately in proportion to the gain in the nuclear energy. In New Jersey, a similar trend is noticeably stronger; the use of coal diminished at a faster rate than the gain from the nuclear sources. The fuels which replaced coal to balance the State energy needs have been oil and natural gas.

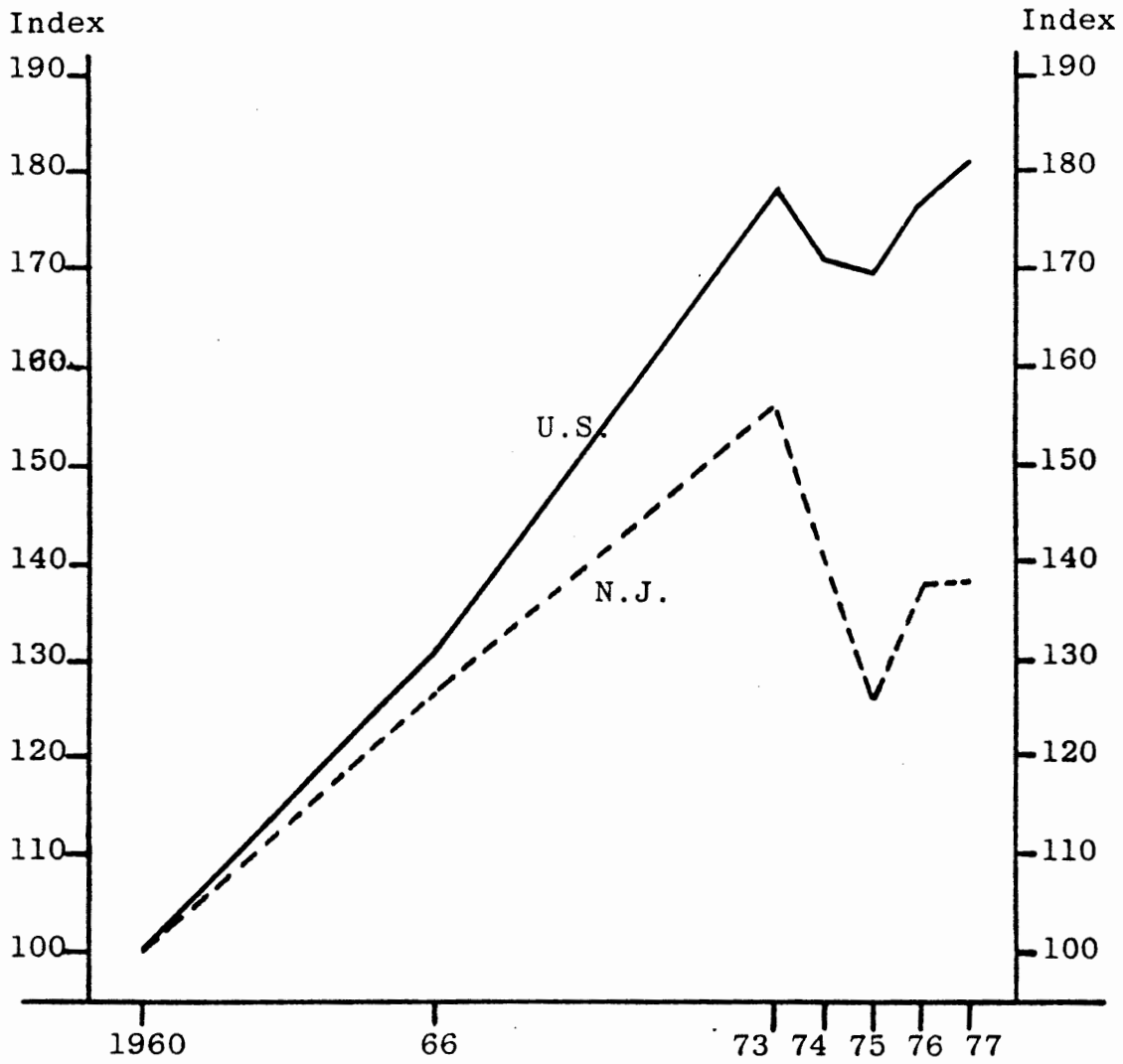
TABLE III.1

COMPARISON OF GROSS ENERGY CONSUMPTION BY SECTORS:
NEW JERSEY AND UNITED STATES PERCENT OF TOTAL

| Area | Oil | Nat. Gas | Coal | Nuclear | Hydro |
|---|---|---|---|---|---|
| New Jersey | | | | | |
| 1960 | 70.9 | 11.9 | 17.1 | -- | * |
| 1973 | 77.7 | 16.6 | 3.6 | 2.0 | * |
| 1977 | 76.2 | 15.3 | 4.1 | 4.4 | * |
| United States | | | | | |
| 1960 | 44.5 | 26.5 | 25.1 | -- | 3.8 |
| 1973 | 44.3 | 32.2 | 18.2 | 1.2 | 4.0 |
| 1977 | 45.8 | 27.8 | 19.6 | 3.6 | 3.2 |

Less than .05%

CHART III.1




Gross Energy Consumption; U.S. & N.J.

(1960 = 100)

OPEC's embargo had a strong impact on the U.S. energy consumption. There has been a noticeable decline of energy consumption nationally and even a stronger decline in New Jersey. (See Chart III.1 and Table III.2) The post-embargo (1973-1977) national average annual growth rate of energy

consumption was slightly more than a half percent annually, which is a considerable slowdown when compared to the average increases of over four percent in the pre-embargo period (1960-1973). New Jersey has done even better than the nation, consuming 10.9% less energy in 1977 when compared to 1973 which translates into a 2.6% average annual decline.

TABLE III.2

COMPARISON OF AVERAGE ANNUAL CHANGE IN ENERGY CONSUMPTION BY FUELS: NEW JERSEY AND THE UNITED STATES

PERCENT GROWTH/DECLINE

| Area | Total | Oil | Nat.Gas | Coal | Nuclear | Hydro |
|---|---|---|---|---|---|---|
| New Jersey | | | | | | |
| 1960-66 | 4.20 | 3.50 | 8.58 | 3.69 | -- | -- |
| 1966-73 | 2.90 | 4.85 | 4.12 | -8.22 | -- | -- |
| 1973-77 | -2.62 | -3.03 | -4.25 | .81 | 17.62 | -- |
| United States | | | | | | |
| 1960-66 | 4.66 | 3.55 | 7.14 | 3.61 | -- | 4.97 |
| 1966-73 | 4.46 | 5.35 | 5.24 | .62 | 47.9 | 4.85 |
| 1973-77 | .64 | 1.44 | -2.76 | 2.55 | 31.2 | -4.40 |

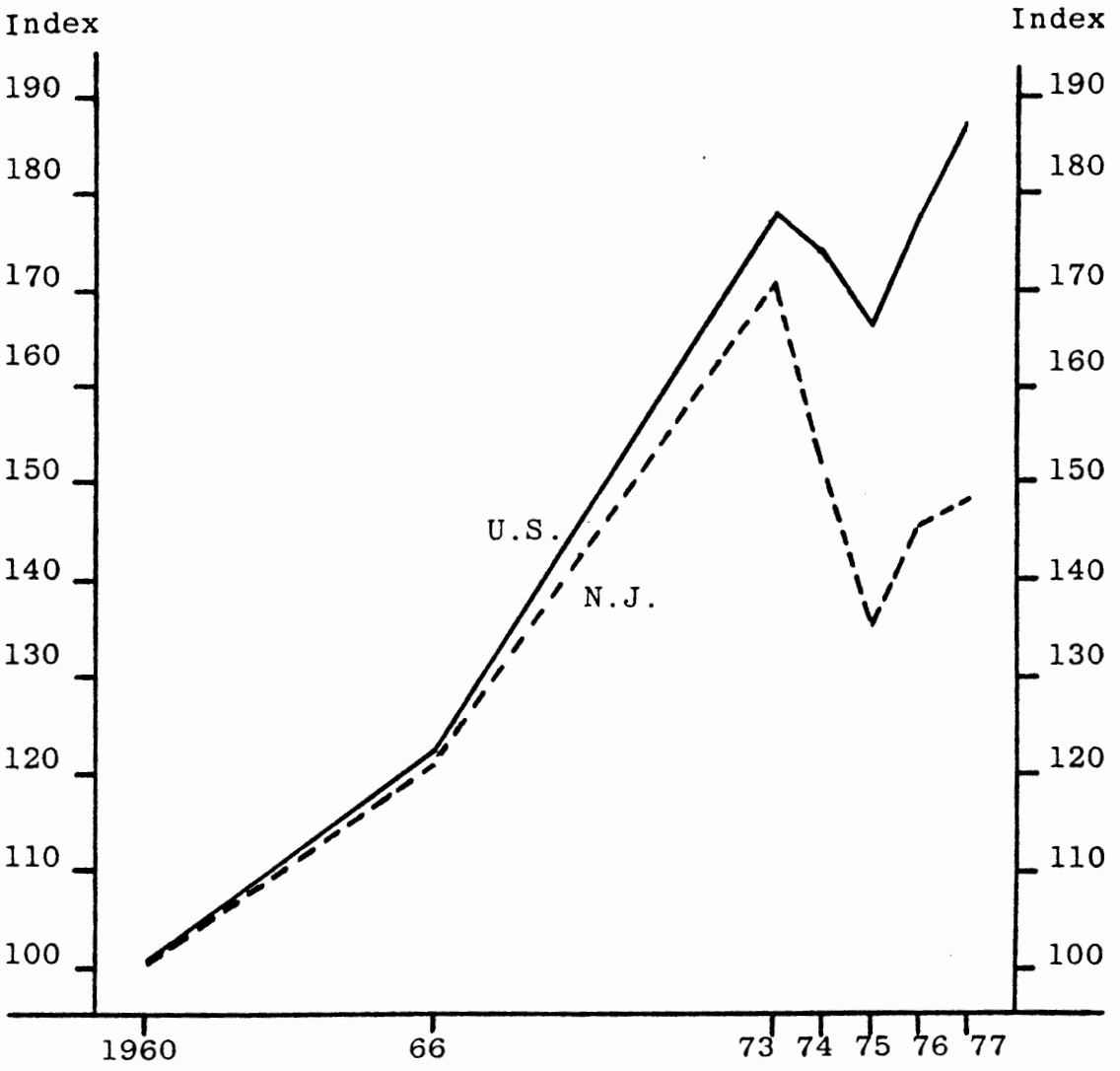
The only fuels with increased consumption in the post-embargo period in New Jersey are coal and nuclear. New Jersey, as a state, thus appears to have adjusted better than the rest of the U.S. to higher prices and shortages.

2. Oil

In analyzing oil consumption in New Jersey between 1960 and 1977, two specific periods could be separated: the pre-embargo era when the State's use of oil was parallel to that of the nation, and the post-embargo period,

characterized by a strong decline in which the peak 1973 level of consumption was never again reached, as opposed to the 1975 upturn that occurred for U.S. consumption (see Chart III.2).

CHART III.2




Oil Consumption; U.S. & N.J.

(1960 = 100)

The post-1973 era brought a change to the so far uninterrupted growth of oil consumption. While in the pre-embargo period, the consumption of oil has been increasing annually from 3 to 5% in the commercial and 1.5 to 2% in the residential sector and as much as 5 to 17% by utilities; there has been a

reversed trend in the post embargo period. An average annual decline of 3% in the commercial and residential sectors and 8.3% by utilities in the consumption of oil has occurred. In 1977, New Jersey consumed 12.7% less oil than in 1973, compared to an increase of 5.9% for the nation for the same period. Nationally, only two sectors, residential and commercial, noted a declined oil consumption, while in New Jersey, a decline has occurred in every sector (see Table III.3).

TABLE III.3

COMPARISON OF AVERAGE ANNUAL CHANGE IN OIL CONSUMPTION

BY SECTORS: NEW JERSEY AND THE UNITED STATES

PERCENT GROWTH/DECLINE

| Area | Total | Util. | Res. | Comm. | Ind. | Trans. |
|---|---|---|---|---|---|---|
| New Jersey | | | | | | |
| 1960-66 | 3.50 | 5.21 | 2.16 | 5.62 | .25 | 4.05 |
| 1966-73 | 4.85 | 17.20 | 1.58 | 3.23 | -1.47 | 4.49 |
| 1973-77 | -3.03 | -8.29 | -2.91 | -2.90 | - .69 | -.37 |
| United States | | | | | | |
| 1960-66 | 3.55 | 7.85 | 1.78 | 3.54 | 2.47 | 3.98 |
| 1966-73 | 5.35 | 22.40 | 1.22 | 2.82 | 2.45 | 5.37 |
| 1973-77 | 1.44 | 2.43 | -1.56 | -1.46 | 3.78 | 1.94 |

New Jersey's post-1973 decreased consumption of oil is an encouraging sign of reaction of the continuing problem of the State's still higher-than-average dependence on one fuel oil. For example, in 1977, New Jersey consumed 3.83% of the U.S. total consumption of oil while the State's share of the total energy consumption was 2.3%; the State accordingly used 66% proportionately more oil than the nation to satisfy its energy needs. A similar

comparison by sectors reveals 220.3%, 150.7%, 56.5% and 55.8% proportionately more oil consumed by utilities, and by the residential industrial and commercial sectors, respectively. These differences are reflected in the distribution of oil consumed by major sectors as seen in Table III.4.

TABLE III.4

COMPARISON OF OIL CONSUMPTION BY SECTORS: NEW JERSEY AND UNITED STATES

PERCENT OF TOTAL

| Area | Util. | Res. | Comm. | Ind. | Trans |
|---|---|---|---|---|---|
| New Jersey | | | | | |
| 1960 | 8.7 | 16.8 | 18.6 | 17.8 | 37.9 |
| 1973 | 21.0 | 12.5 | 18.9 | 9.4 | 38.2 |
| 1977 | 15.0 | 12.5 | 19.0 | 10.5 | 43.1 |
| United States | | | | | |
| 1960 | 3.2 | 14.9 | 14.1 | 13.1 | 54.6 |
| 1973 | 11.7 | 10.2 | 11.9 | 10.2 | 56.0 |
| 1977 | 12.1 | 9.0 | 10.6 | 11.1 | 57.1 |

While nationally the majority of oil is used by the transportation sector (there is no substitute fuel), in New Jersey more than half of the oil used is consumed by other sectors. In 1977, 31.5% of all oil in the State was consumed by two sectors: the residential and commercial; nationally, only 19.6% of all oil was consumed by these sectors. Therefore, a gradual decreased use of oil primarily by the commercial and residential sectors and by New Jersey's utilities in favor of other fuels appears to offer the most opportunity for further improvement of the State's overall energy situation. The analysis of energy use by major sectors is provided in Section IV of this report.

### 3. Natural Gas

New Jersey's present 15.3% usage of natural gas as a proportion of all energy consumed is relatively much lower than nationally where natural gas provided 27.8% of energy consumed in 1977 (see Table III.1, page 7). Between 1960 and 1973, natural gas usage in New Jersey had a faster growth rate when compared to the United States (see Chart III.3), and when compared to other fuels in New Jersey (see Table III.2, page 9). If not for the artificial shortage that occurred in the early 1970's and again in 1976, natural gas would have been used much more widely presently.

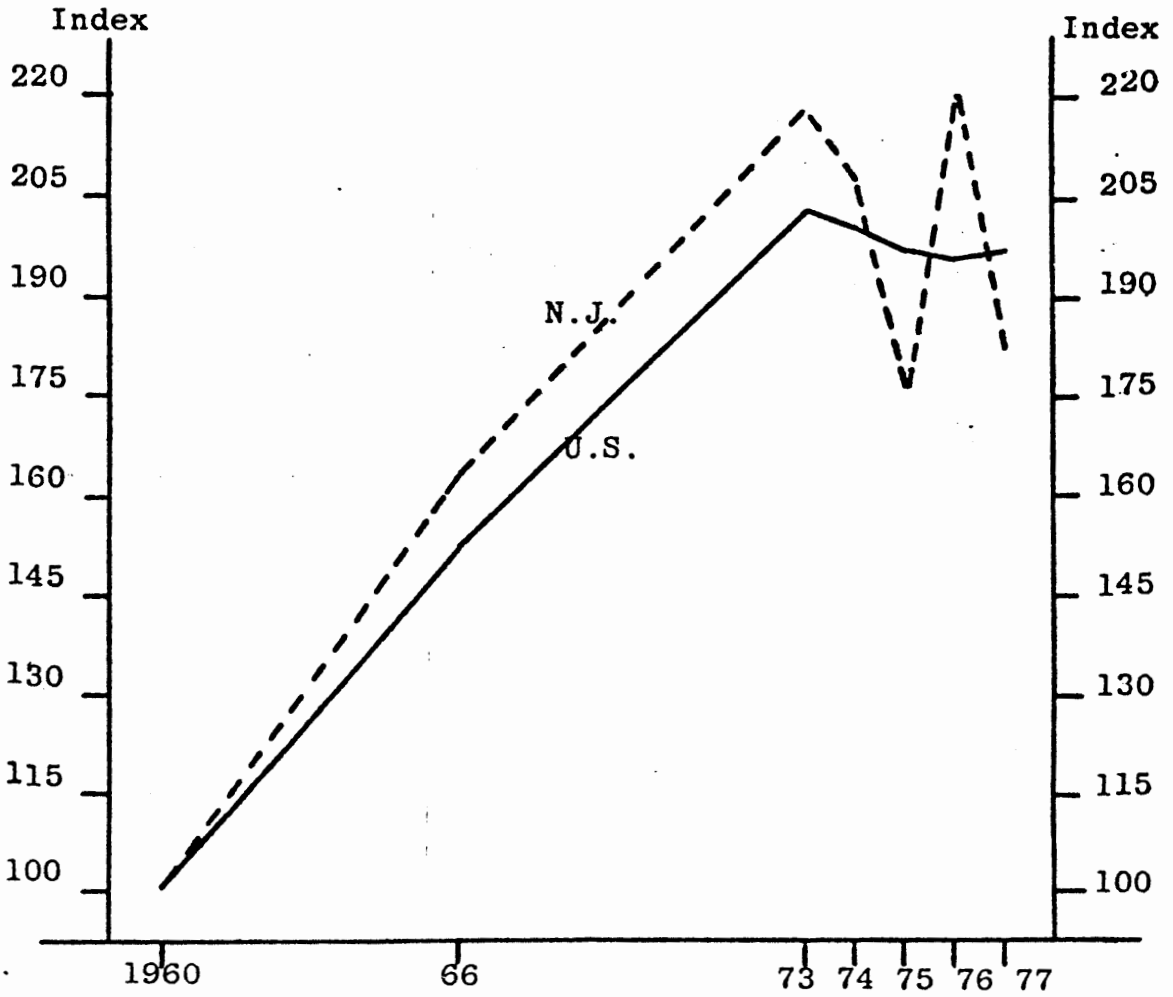
New Jersey's consumption of natural gas grew twice as fast as the State total energy consumption for this period, 117.5% to 56.1%. The fastest growth occurred in the commercial and industrial sectors (see Table III.5 below) which can be explained by a relatively low use of natural gas by these sectors in the early 1960s. But more than half the natural gas used in the State is consumed by the residential sector (see Table III.6, page 15).

TABLE III.5

COMPARISON OF AVERAGE ANNUAL CHANGE IN NATURAL GAS CONSUMPTION: NEW JERSEY AND UNITED STATE; PERCENT GROWTH/DECLINE

| Area | Total | Util. | Res. | Comm. | Ind. | Trans. |
|---|---|---|---|---|---|---|
| New Jersey | | | | | | |
| 1960-66 | 8.58 | -1.64 | 8.50 | 13.80 | 13.33 | -- |
| 1966-73 | 4.12 | .71 | 1.55 | 15.47 | 4.21 | 2.23 |
| 1973-77 | -4.22 | -14.20 | -.45 | -3.06 | -7.69 | -3.40 |
| United States | | | | | | |
| 1960-66 | 7.14 | 7.13 | 4.01 | 8.03 | 6.99 | -- |
| 1966-73 | 5.24 | 4.73 | 2.38 | 6.94 | 6.66 | 4.49 |
| 1973-77 | -2.76 | -2.76 | -.25 | -.94 | -4.07 | -6.11 |

CHART III.3




Natural Gas Consumption; U.S. & N.J.

(1960 = 100)

TABLE III.6

COMPARISON OF NATURAL GAS CONSUMPTION BY SECTORS:

NEW JERSEY AND UNITED STATES PERCENT OF TOTAL

| Area | Util. | Res. | Comm. | Ind. | Trans. |
|---|---|---|---|---|---|
| New Jersey | | | | | |
| 1960 | 18.4 | 54.2 | 7.5 | 20.0 | -- |
| 1973 | 8.0 | 45.3 | 20.5 | 26.0 | .2 |
| 1977 | 2.9 | 54.3 | 21.8 | 20.8 | .2 |
| United States | | | | | |
| 1960 | 16.9 | 30.4 | 10.8 | 42.6 | -- |
| 1973 | 16.3 | 22.1 | 11.8 | 46.4 | 3.3 |
| 1977 | 16.3 | 24.7 | 12.8 | 43.4 | 2.7 |

Northeastern states have experienced interruptions in supply of natural gas such as curtailment and new hook-up moratoriums. Traditionally, natural gas has been a low cost, plainful forum of energy. As a result there has been an increase in natural gas production from about 13 trillion cubic feet (Tcf) in 1962 to a peak of about 22 Tcf in 1973. During most of this period, drilling declined because low prices and other factors led producers to expect a relatively low rate of return on their investment. However, reserve additions continued to exceed production withdrawals until the early 1970s. This situation changed drastically during the early 1970s when annual reserve additions began falling below annual consumption, total gas production leveled off, and then fell to its present levels of about 19 Tcf per year. At this time, OPEC countries placed the embargo on the United States and sharply raised world oil price. As there is a direct relationship between world oil prices and domestic demand on natural gas (a high world oil price elicits

a high domestic gas price and its unregulated-intrastate price was increased to $2.00 per Mcf, while regulated interstate prices stayed at about $.55 per Mcf. That in effect caused shortages of gas in consuming states and a surplus in producing states.

In 1978, the National Gas Policy Act (NGPA) was passed. With the NGPA, gas may be priced at the new ceiling price, irrespective of when it is sold. Therefore, the 1976 shortage in some parts of the country and unlimited supplies in others should not occur in the future.

4. Coal

Air pollution restrictions, introduced with the Clean Air Act (PL88-206) of 1963 and tightened by subsequent amendments, forced a shift from low cost high sulfur content coal and coke to other fuels. Especially affected were major users such as utilities and the industrial sector in the Northeatern states. Chart III.4 reveals how dramatic the coal consumption decline was in New Jersey when compared to that of the nation. This has resulted in a shift to natural gas or low-sulfur fuel oil and the gradually increasing use of nuclear power by the State's utilities.

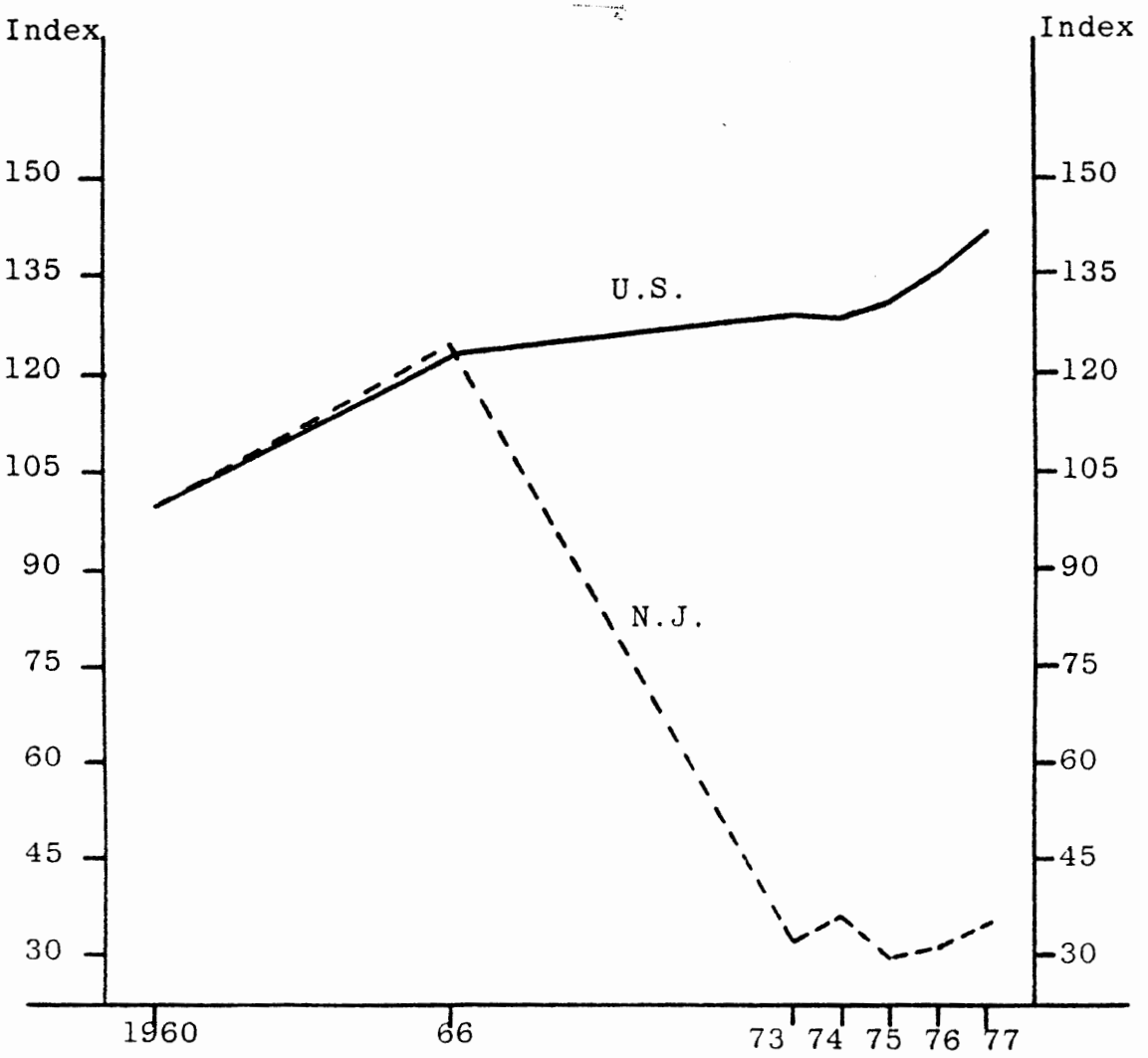
As Table III.7 shows, New Jersey's coal consumption by the residential, commercial and industrial sectors has declined substantially, while utilities became the dominant coal-using sector (93.3% of total use in 1977).

TABLE III-7

COMPARISON OF COAL CONSUMPTION BY SECTORS:

NEW JERSEY AND UNITED STATES, PERCENT DISTRIBUTION BY SECTORS

| Area | Util. | Res. | Comm. | Ind. |
|---|---|---|---|---|
| New Jersey | | | | |
| 1960 | 50.6 | 7.9 | 7.9 | 36.4 |
| 1973 | 90.9 | 2.4 | 2.4 | 5.1 |
| 1977 | 93.3 | 1.2 | .7 | 4.8 |
| United States | | | | |
| 1960 | 42.4 | 6.7 | 3.8 | 47.0 |
| 1973 | 64.6 | 1.4 | .8 | 33.2 |
| 1977 | 72.2 | .6 | .3 | 26.9 |




Coal Consumption; N.J. & U.S.

(1960 = 100)

The position of coal has changed recently, however, with the increase in world oil prices and decrease in planned nuclear capacity. The projections by the Federal Department of Energy indicate that there is renewed strength in industrial demand and that electric utilities consumption of coal continues to increase. In fact, New Jersey industrial use of coal in 1977, when compared to 1976, increased from 1.4 to 3.3 trillion BTUs after a long decline and the total coal consumption in the State increased at an annual average rate of .81% between 1973 and 1977 due to the increased use by New Jersey's utilities (see Table III.8).

TABLE III.8

COMPARISON OF AVERAGE ANNUAL CHANGE IN COAL CONSUMPTION:

NEW JERSEY AND UNITED STATES: PERCENT GROWTH/DECLINE

| Area | Total | Util. | Res. | Comm. | Ind. |
|---|---|---|---|---|---|
| New Jersey | | | | | |
| 1960-66 | 3.69 | 10.87 | -8.06 | -8.08 | -4.60 |
| 1966-73 | -8.22 | - 7.74 | -8.39 | -8.47 | -9.88 |
| 1973-77 | .81 | 1.49 | -10.67 | -10.67 | -.72 |
| United States | | | | | |
| 1960-66 | 3.61 | 7.09 | -5.50 | -5.56 | 2.07 |
| 1966-73 | .62 | 3.86 | -6.60 | -6.56 | -2.56 |
| 1973-77 | 2.55 | 5.42 | -11.32 | -11.07 | -2.53 |

Despite the projected increase in the use of coal, a number of recent developments have made these projections uncertain. They are as follows:

- the revision of the sulfur dioxide emission standards by the Environmental Protection Agency;

- the implementation of Section 125 ('local coal provision') of the 1977 Clear Air Act Amendments;

- the passage of the Powerplant and Industrial Fuel Use Act of 1978, and

- developments affecting coal transportation costs such as: the 1978 sizable increase in railroad rates, proposed deregulation of railroad rates, and increased water transportation costs when the new waterway-users fee becomes effective in 1980.

## IV. SECTORAL ANALYSIS

In the previous section, energy consumption usage by major fuel was examined. This section will complement that analysis by examining the fuel composition of each sector's energy demand.

Table IV.1 shows total demand by sector for energy in New Jersey in 1977. In addition to the sectoral demand, fuel is used as a raw material - less than 2% of the total - in the manufacturing process.

TABLE IV.1

TOTAL SECTORAL ENERGY DEMAND - NEW JERSEY - 1977

| | 1012 BTU | Percent |
|---|---|---|
| Residential | 351.5 | 22.2% |
| Commercial | 349.8 | 22.1 |

| | | |
|---|---|---|
| Industrial | 335.3 | 21.2 |
| Transportation | 548.4 | 34.6 |
| TOTAL | 1584.9 | 100.0% |

Electric energy is treated as a distinct "fuel" in the non-utility sectors because it, and not the coal or oil or uranium that is consumed in its production, is the alternative to conventional fuels in these sectors. The fuels utilized in the generation of electricity are discussed separately.

In this section the composition of fuel usage for each sector is examined in historical perspective in terms of the bench mark years 1960, 1973, and 1977. For the transportation sector, however, a breakdown of fuel usage over time is not meaningful because petroleum accounts for over 99% of fuels consumed. In addition, because of the importance of the economic role of the manufacturing sector, a detailed analysis of the current use of energy by specific energy intensive industries in this sector is presented.

1. Residential

The pattern of fuel usage in New Jersey's residential sector mirrors that of the nation, both in the distribution of fuel usage and overtime. Two items, however, are of special interest. First, the natural gas shortage of the mid-seventies had no effect at all on residential usage in New Jersey. Second, oil is a significantly more important residential fuel in New Jersey than in the nation and it has continued to remain so in the same proportions over the study period. Thus, a significant oil savings can be achieved if New Jersey moves in the direction of the consumption pattern of other states.

TABLE IV.2

RESIDENTIAL SECTOR COMPARATIVE FUEL USAGE

AS PERCENT OF TOTAL

| | Fuel Oil | Natural Gas | Coal | Electric Energy |
|---|---|---|---|---|
| New Jersey | | | | |
| 1960 | 56.3 | 30.5 | 6.4 | 6.8 |
| 1973 | 48.4 | 37.6 | 0.4 | 13.5 |
| 1977 | 45.3 | 39.4 | 0.2 | 15.0 |
| United States | | | | |
| 1960 | 36.7 | 44.6 | 9.4 | 9.3 |
| 1973 | 31.0 | 48.9 | 1.7 | 18.4 |
| 1977 | 29.1 | 48.5 | 0.8 | 21.6 |

2. Commercial

The Commercial sector in New Jersey was heavily dependent upon oil in 1960 and remains so in 1977. The extent of its dependence did decline over this period but at a rate that was even less than its national counterpart. The distribution of the commercial sector usage of other fuels, and the change in that distribution since 1960, mirrors that of the nation. Of particular interest is the virtual extinction of coal as a fuel and the concomitant increases in importance of both natural gas and electric energy.

TABLE IV.3

COMMERICAL SECTOR COMPARATIVE FUEL USAGE

AS PERCENT OF TOTAL

| Area | Fuel Oil | Natural Gas | Coal | Electric Energy |
|---|---|---|---|---|
| New Jersey | | | | |
| 1960 | 81.5 | 5.5 | 5.4 | 7.6 |
| 1973 | 71.1 | 16.5 | 0.3 | 12.1 |
| 1977 | 69.1 | 15.9 | 0.1 | 14.9 |
| United States | | | | |
| 1960 | 56.8 | 23.9 | 8.6 | 10.6 |
| 1973 | 46.3 | 33.2 | 1.3 | 19.3 |
| 1977 | 44.1 | 32.3 | 0.6 | 23.0 |

3. Transportation

Petroleum is the sole energy source for this sector. Electricity accounts for less then one per cent of transportation demand; neither coal nor natural gas are utilized by New Jersey transportation.

Considering the dominance of petroleum in this sector and that transportation accounts for almost 35% of the energy demand in the State, it is apparent that in spite of the low per capita consumption in this sector in New Jersey, it is here that the major effort must be made if the goal of significantly reduced reliance on imported oil is to be met.

4. Utilities

New Jersey's position as a coastal state and the relatively low price of imported oil resulted in large scale conversions of coal-burning plants. The

poor state of rail facilities, the pollution associated with burning bituminous coal, and the competition from the new nuclear technology, are additional factors indicating little future for coal in New Jersey. The rising cost of imported oil with the coming of OPEC had its major effect in further stimulating the nuclear portion of the industry. Nuclear energy is now facing a moratorium on new construction and the price of oil, both imported and domestic, is rising at record rates. Thus, in spite of transportation and environmental obstacles to its use, coal seems to be the feasible alternative for base load generation. Solar must be included with wind power and other more exotic concepts only as possible long-run solutions.

TABLE IV.4

ELECTRIC UTILITIES COMPARATIVE FUEL USAGE

AS PERCENT OF TOTAL

| Area | Residual Oil | Natural Gas | Coal | Nuclear | Hydro |
|---|---|---|---|---|---|
| New Jersey | | | | | |
| 1960 | 36.3 | 12.9 | 50.7 | -- | 0.2 |
| 1973 | 71.7 | 5.8 | 14.3 | 9.0 | (0.8) |
| 1977 | 57.1 | 2.2 | 19.3 | 21.9 | (0.5) |
| United States | | | | | |
| 1960 | 7.4 | 22.0 | 52.3 | -- | 18.7 |
| 1973 | 18.8 | 19.2 | 42.8 | 4.6 | 14.5 |
| 1977 | 17.9 | 14.6 | 45.6 | 11.7 | 10.2 |

## 5. Industrial

Even more so than the nation as a whole, New Jersey industry reacted to the national gas shortage of the mid-1970s. Natural gas usage, which accounted for 22.7% of the total in 1973, declined to 15.8% by 1977. As a result, fuel oil actually increased as percent of total fuel usage from 1973 to 1977. The changing use of electric energy mirrors the nation's but has remained proportionately higher. Coal, however, which was a respectable 21.2% of total usage in 1960, was almost eliminated as an industrial fuel in New Jersey by the 1970s.

TABLE IV.5

INDUSTRIAL SECTOR COMPARATIVE FUEL USAGE

AS PERCENT OF TOTAL

| Area | Fuel Oil | Natural Gas | Coal | Electric Energy | Other |
|---|---|---|---|---|---|
| New Jersey | | | | | |
| 1960 | 43.1 | 8.1 | 21.2 | 8.0 | 19.5 |
| 1973 | 37.7 | 22.7 | 0.9 | 14.7 | 23.2 |
| 1977 | 39.8 | 15.8 | 1.0 | 17.3 | 27.5 |
| United States | | | | | |
| 1960 | 15.1 | 29.1 | 30.5 | 7.6 | 17.7 |
| 1973 | 12.9 | 42.8 | 17.3 | 9.5 | 17.5 |
| 1977 | 15.9 | 37.6 | 16.5 | 11.1 | 18.8 |

Manufacturing can be considered the most important economic sector in New Jersey because it is the base upon which almost all other economic activity is built. The service sector - from management consultant to shopping malls to local government - largely exists because the manufacturing sector created the income upon which service industries are based.

New Jersey manufacturing industries in 1976, the most recent year for which detailed data is available, paid an average of $1,330 per employee for fuel and electric energy. The comparable U.S. figure of $1,471 per employee was 10.4% above this amount. The BTUs per employee consumed by U.S. manufacturing was higher than that of the New Jersey average by an even larger 57.2% while at the same time, New Jersey paid 42.2% more per BTU it purchased than the U.S. average. New Jersey thus has a highly energy-efficient manufacturing sector, but one with a cost disadvantage to its more energy-intensive competition. Unless the State becomes more energy-efficient and/or changes to a more economic combination of fuels, energy costs will continue to be a contributor to the State's loss of manufacturing industry to other regions of the country.

The Census Bureau divides manufacturing into 20 industry groups, given Standard Industrial Code (SIC) numbers from 20 to 39 and thus known as two-digit industries. Of these, all but SIC 21, Tobacco Products, are represented in New Jersey. The 20 are then subdivided in approximately 200 three-digit industries, slightly less than half of which are large enough in New Jersey to warrant inclusion in the Census Bureau's Annual Survey of Manufactures.

As was noted previously, the per employee 1976 energy expenditure in New Jersey was $1,330. Four two-digit industries, which in total account for 24.3% of manufacturing employment, are, in effect, responsible for this figure being as high as it is by having significantly higher than average energy costs per employee. (Petroleum refining, which is an important New Jersey

industry, is not included in this analysis because its primary consumption of crude oil is as a feedstock rather than as an energy source.) These industries are: SIC 26, Paper and Allied Products, $2,910/employee; SIC 28, Chemicals and Allied Products, $2,990/employee; SIC 32, Stone, Clay, and Glass Products, $3,730/ employee; and SIC 33, Primary Metal Industry, $2,890/ employee.

By further disaggregation, the particular three-digit industries that are energy intensive can be found. (Unfortunately, because of rules against disclosure of the identity of individual firms, the greater the level of disaggregation the more often the Census Bureau will not supply information. In particular, industries SIC 262 and 263 did not have employment figures, but are characterized as energy intensive on the basis of our knowledge of the other three-digit industries in the SIC 26 industry group.) Table IV.6, page 27 lists the three-digit industries which are responsible for the high energy cost per employee of SIC 26, 28, 32 and 33. Column 1 gives the total energy expenditure of each of these ten industries and Columns 2 through 5 show the percentage distribution of this cost among fuel oil, coal, natural gas and electricity. (Census data were not available to enable a complete breakdown to be made among all energy sources for SIC 262, 263, 327 and 333. In these cases, the two-digit industry relationships were substituted and the estimated percentage indicated by an asterisk.)

Examination of the calculations of Table IV.6 points out the major dependence of New Jersey industry on petroleum products. In nearly every case, fuel oil is the major energy source, but electric energy, which in turn

is dependent upon petroleum is, in all cases, either the primary or secondary (second to fuel oil) source of energy for New Jersey manufacturing. (Although New Jersey utilities have been successful in reducing their dependence on petroleum, they have done so through increased use of nuclear energy, a fuel source whose future expansion has been questioned by growing public concern and opposition.) Only in the Stone, Clay and Glass Products industry group where natural gas accounts for almost one-quarter of energy expenditures, does another fuel play a major role. Coal usage was reported as zero in six of the energy-intensive three-digit industries, but disclosure rules did not even allow for an estimate in the remaining three. (For the State as a whole, coal accounts for less than .2 of 1% of total manufacturing energy costs.) Thus, New Jersey manufacturing is most dependent on that fuel whose price is forecasted to rise at the greatest rate and whose supply is subject to the uncertainties of international political relationships.

TABLE IV.6

ENERGY COSTS AND THEIR DISTRIBUTION AMONG FUELS IN

ENERGY INTENSIVE NEW JERSEY INDUSTRIES

| SIC Number | Name of Industry | (1) Total Cost 106$ | (2) % Fuel Oil | (3) % Coal | (4) % Natural Gas | (5) % Elec. Energy |
|---|---|---|---|---|---|---|
| 262 | Paper Mills | 27.7 | 61.1* | - | 4.1% | 30.3 |
| 263 | Paperboard Mills | 21.9 | 64.8* | - | 4.4* | 26.5 |
| 281 | Industrial Inorganic Chemicals | 33.5 | 47.5 | - | 6.3 | 43.9 |
| 282 | Plastic Materials, Synthetics | 30.6 | 45.1 | - | 4.9 | 45.8 |
| 286 | Industrial Organic Chemicals | 106.9 | 33.0 | - | 7.1 | 21.1 |
| 322 | Glass | 62.9 | 43.2 | | 24.6 | 29.7 |
| 327 | Concrete, Gypsum, Plaster Products | 10.2 | 24.6* | - | - | 32.1 |
| 329 | Miscellaneous Non-Metallic Mineral Products | 32.7 | 29.6 | - | 23.2 | 37.9 |
| 333** | Primary Nonferrous Metals | 15.6 | 21.4* | - | 3.8 | 37.8 |

Notes: * Estimates on basis of 2-digit Industry usage.
** Coke accounts for an estimated 13.0% of energy cost in SIC 333.

## V. EFFECTS OF INCREASED ENERGY COSTS ON NEW JERSEY

Rising energy prices will adversely affect the State's economy by:

1) reducing the amount of disposable income of individuals and businesses available for non-energy investment and consumption
2) generating a redistribution of income within the State between energy consumers and the energy industry; and
3) generating a redistribution of income between New Jersey and energy-producing regions both outside and within the United States.

### 1. Estimates of Current and Future Energy Payments

The level of income transfers between New Jersey and energy-producing regions both outside and within the United States is already significant as a result of the State's high dependence on outside regions for energy supplies. These transfers are likely to increase substantially as international and national energy policies result in higher prices for both conventional fossil fuel and potential synthetic fuel supplies.

In 1978, New Jersey consumers paid in excess of $3.6 billion for petroleum products. This amount could increase to an estimated $7.5 billion in 1985 on the assumption of continued federal policies to deregulate domestic crude oil prices to comparable world market levels.* If world prices continued to increase at the extraordinary rates of the past year, this estimate would be substantially under the actual level of New Jersey's expenditure for petroleum in 1985.

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*Based on New Jersey Department of Energy estimates. 1985 projections include inflation estimates.

Although the price of foreign oil has more than quadrupled since the 1973 oil embargo, the full economic impact on New Jersey has been mitigated by a federal program (designated "entitlements") which equalizes the costs of oil between refiners who use higher-priced foreign oil and those who use lower-priced domestic oil. This situation has ended with the removal in 1981 of domestic crude oil price control and New Jersey consumers will then bear the full impact of world market prices as domestic and imported crude oil prices reach equivalent price levels.

While natural gas payments by New Jersey consumers are not at the level of those for crude oil supplies, these payments will also increase substantially with phased price deregulation under the Natural Gas Policy Act of 1978 leading to full deregulation of newly discovered gas in 1985. New Jersey consumers will pay an estimated $500 million to Gulf Coast natural gas producers in 1985 and an estimated total of $2.3 billion over the 1979-85 period.

These natural gas payments, along with payments for Gulf Coast petroleum products, include severance taxes, which are energy production taxes imposed by energy-producing states. Severance taxes accounted for approximately 19% of total tax revenues in the Gulf Coast region in 1978. These taxes, in addition to directly increasing energy-related income outflows from New Jersey, may have also imposed indirect costs by weakening the competitive position of New Jersey with respect to energy-producing states through the ability of these states to substitute the severance tax for other, less desirable revenue sources, which are more likely to have an adverse impact upon their business climate.

## 2. Impact on the State's Economy

This energy-induced redistribution will reduce the capital available for needed public and private investment in the State. This means that:

a. industries other than the energy industry will have less capital available for needed investment in both energy-related and general plant and equipment improvements;

b. consumers will have less capital for traditional consumer purchases, and

c. less capital will be available for necessary investment in the redevelopment of the State's public infrastructure systems.

These costs will be disproportionately borne by those industries unable to pass the costs along through increased prices, and will also be particularly burdensome for low-income consumers. Rising energy prices will also lead, at least in the short run, to an overall increase in the rate of inflation throughout the economy.

Economic growth may thus be reduced by the energy-induced redistribution of funds because of the potential decrease in overall investment. While specific data is unavailable, it seems likely that currently relatively small amounts of this capital are returning to the State through investment by energy-producing or energy-related companies.

The demands on capital posed by the energy situation are particularly serious in view of substantial existing captial needs of New Jersey and the region. The substantial rise in energy payments could significantly undermine the capability of the State's private and public sectors to obtain the capital funding necessary to replace a deteriorating capital structure. The State's public infrastructure systems - roads, bridges, sewers, water systems, and public transit facilities - and aging private capital stock must be replaced in order to enhance the State's competitiveness with other regions.

Increased capital is also needed in order to counteract the decline in the capital stock resulting from the net disinvestment (investment below actual replacement needs) by small business during the early and mid-1970s.

Over the 1972-75 period, according to a recent report by the Regional Plan Association, total private investment in the 31-county region examined fell from $15.3 billion to $9.8 billion. In 1976, the rate of investment in new plants and equipment was $1,570 per employee in the 17-county Port region, which was significantly lower than the U.S. rate of $2,260 per employee.

Energy-related payments must thus be curtailed to increase the capability of private industry to invest in general plant and equipment improvements. This would contribute to an increase in productivity and economic growth in the State, and would reduce inflation.

Although the State will incur significant economic costs from rising energy prices, the costs would be greater if not for the following factors:

1. New Jersey has significantly lower per capita use of energy than most other regions. This should tend to ease the relative impact of higher energy prices on residents of the State.

2. Communications, business services, and other low energy-using industries which tend to be concentrated in New Jersey, as in the Northeast generally, may prove to be among the fastest growing industries in an era of rising energy costs.

3. Rising energy prices may increase the economic incentive for business to locate in the energy-efficient urban areas of New Jersey.

4. The economic incentive to add to existing plan capacity rather than to build new plants in a period of rising inflation will favor the older industrial economies of the nation, such as New Jersey.

## VI. PROGNOSIS: PROJECTIONS TO 1985, 1990 and 1995

Of the seven scenarios provided to Congress by the Department of Energy, scenario C-High was selected as the superior scenario for the development of New Jersey State policy. In light of recent events, domestically and abroad, it is also the most realistic. It is a conservatively optimistic scenario -full employment is approached in the early 1980s and the economy grows steadily thereafter, minor reductions in inflation through the mid-1980s are followed by more significant declines, and there is an absence of exogenous shocks to the economy - but does include an assumption of relatively high world oil prices. The assumed 1985 price, in 1978 dollars, is $21.50. Assumed prices for 1990 and 1995, likewise in 1978 dollars, are $23.50 and $31.50, respectively. Unfortunately, the assumptions of the high oil price scenario have become conservative in light of recent events. Under new price schedules announced on December 12, 1979, the price of Saudi crude rose by 33% to $24 a barrel. Even after adjusting for the inflation of the past year, this is higher than the assumed 1985 price of the high imported oil price scenario.

### 1. Demand by Sectors

After an initial decline from present levels of consumption, the DOE scenario projects a level of coal consumption that increases at a rate slightly more than one-half of 1% per year between 1985 and 1995.* Both the

*The DOE disaggregates their national projections into ten regions - one of which was New Jersey plus New York state. The authors felt that any further attempt at disaggregation would only exacerbate the error inherent in any forcast and, therefore, the analysis of the remainder of this section is in terms of the New York/New Jersey region.

commercial and transportation sectors are projected to experience a decline in consumption over the 18-year period - 1977, the latest for which data is available, to 1995. Increased demand by the industrial sector is projected to essentially maintain its current level of consumption. The yearly projections for each of the four sectors is presented in Table VI.1.

TABLE VI.1

PROJECTED DEMAND BY SECTOR - NEW YORK/NEW JERSEY REGION

10 BTU/YR

| | 1977 (actual) | 1985 | 1992 | 1995 |
|---|---|---|---|---|
| Residential | 1300.3 | 1298.1 | 1356.9 | 1354.9 |
| Commercial | 1101.9 | 920.0 | 907.1 | 919.0 |
| Industrial | 608.2 | 798.9 | 893.9 | 1009.0 |
| Transportation | 1640.3 | 1496.3 | 1473.5 | 1466.6 |
| TOTAL | 4713.0 | 4604.8 | 4744.6 | 4887.3 |

*Does not include refineries.

NOTE: Totals are greater than the sume of sector demands because they include fuels used as raw materials in the production process.

2. Consumption by Fuels

When the sectoral projections are disaggregated by fuel (Table VI.2), there is a major shift away from petroleum consumption. Exclusive of that, used in the generation of electricity, petroleum now accounts for 60.5% of total energy demand (1977 data). The DOE projection reduces this figure to 44.5% by 1995. The difference, to allow for the 3.7% increase in total energy demand from 1977 to 1995, is taken up by increased use of coal, natural gas, and, to the largest extent, in terms of absolute amounts of BTUs, electricity.

Which fuels will be burned to produce that electricity thus becomes a critical question.

TABLE VI.2

PROJECTED CONSUMPTION BY FUELS - NEW YORK/NEW JERSEY REGION

10 12 BTU/YR

| | 1977* | 1985 | 1990 | 1995 |
|---|---|---|---|---|
| Coal | 95.3 | 140.7 | 184.6 | 224.0 |
| Gasoline | 1175.0 | 965.4 | 919.9 | 936.5 |
| Distillate | 1020.5 | 852.5 | 881.3 | 829.2 |
| Residual | 653.7 | 497.7 | 450.0 | 409.3 |
| Natural Gas | 732.9 | 868.5 | 878.7 | 905.2 |
| Electricity | 504.8 | 686.9 | 808.1 | 939.0 |
| TOTAL | 4713.0 | 4604.8 | 4744.6 | 4887.3 |

*Computed from DOE data.

3. Utility Consumption by Fuels

The DOE projects a radical change in the way in which electricity is generated in New Jersey (Table VI. 3). Oil, which now accounts for the majority of the BTUs consumed by the State's electric utility industry, will be virtually phased-out as a fuel by 1995. It will be replaced by coal which, according to the DOE projection, will provide 55.6% of utility consumption, and by nuclear. The latter will, according to the projection, approximately double its present levels of output and therefore a moratorium or even a substantial slowing down of the growth rate of nuclear will have dire effects in New Jersey. Given the environmental and transportation difficulties that will no doubt arise even in meeting the DOE coal projections, any cutback in nuclear capability is likely to cause a continued reliance on imported oil in contrast to the national energy policy.

TABLE VI.3

PROJECTED UTILITY CONSUMPTION PATTERNS - NEW YORK/NEW JERSEY REGION

10 12 BTU/YR

| | 1985 | 1990 | 1995 |
|---|---|---|---|
| Coal | 501.0 | 1412.2 | 1608.3 |
| Oil | 1017.2 | 86.7 | 0.8 |
| Natural Gas | -- | 20.2 | 20.3 |
| Uranium | 577.5 | 931.8 | 1263.5 |
| TOTAL | 2095.6 | 2450.8 | 2892.8 |
| PERCENT DISTRIBUTION | | | |
| Coal | 23.9 | 57.6 | 55.6 |
| Oil | 48.5 | 3.5 | -- |
| Natural Gas | -- | 0.8 | 0.7 |
| Uranium | 27.6 | 38.0 | 43.7 |
| TOTAL | 100.0 | 100.0 | 100.0 |

4. Cost by Fuels

The reason for the increase in the role to be played by electric energy, and the concomitant importance of the growth of nuclear capabilities, can be seen in Table VI.4. All fuels, with the exception of electricity, are projected to have significant increases in cost. Electricity costs, on the other hand, are actually projected to decline by 8.5% over the 18-year period from 1977 to 1995. When it is noted that the cost of residual oil, currently the major fuel for electric utilities, is projected to increase 125% over this same period, with the cost of coal increasing by a relatively minor 25.4%, the dependence of these projections on the availability of the nuclear option is apparent.

TABLE VI.4

PROJECTED COST OF ENERGY BY SELECTED FUELS -

NEW YORK/NEW JERSEY REGION

1978 Dollars Per Unit

| | 1977* | 1985 | 1990 | 1995 |
|---|---|---|---|---|
| Coal | $39.98 | $43.69 | $47.37 | $50.14 |
| Gasoline | 27.81 | 31.42 | 33.59 | 41.84 |
| Distillate | 19.57 | 23.79 | 26.35 | 34.89 |
| Residual | 14.46 | 22.81 | 24.62 | 32.57 |
| Naturual Gas | 2.83 | 3.70 | 3.75 | 4.37 |
| Electricity | 52.58 | 53.14 | 49.50 | 48.11 |

Price Units are: Coal: $/Ton; Petroleum Products: $/Bbl;
Natural Gas: $/MCf; Electricity: $1/MKWH

*Computed from actual data

To facilitate comparisons among fuels in any given year, the values of Table IV.4 were recomputed for Table VI.5 on a common BTU basis.

TABLE VI.5

PROJECTED COSTS - NEW YORK/NEW JERSEY REGION; 1978, $/$10^6$ BTU

| | 1977 | 1985 | 1990 | 1995 |
|---|---|---|---|---|
| Goal | 1.68 | 1.84 | 1.99 | 2.11 |
| Gasoline | 5.30 | 5.99 | 6.40 | 7.97 |
| Distillate | 3.36 | 4.08 | 4.52 | 5.99 |
| Residual | 2.30 | 3.63 | 3.92 | 5.18 |
| Natural Gas | 2.74 | 3.59 | 3.63 | 4.23 |
| Electricity | 15.41 | 15.57 | 14.51 | 14.10 |

Conversion: Coal $23.8 \times 10^6$ BTU/Ton

Gasoline $5.248 \times 10^6$ BTU/bbl

Distillate $5.825 \times 810^6$ BTU/bbl

Residual $6.287 \times 10^6$ BTU/bbl

Natural Gas $1.032 \times 10^6$ BTU/bbl

Electricity 3412 BTU/KWH

Coal, as expected, is projected to remain the least expensive energy source with natural gas becoming less costly by far than any petroleum alternative. Electricity, although remaining high priced on a BTU basis, falls in price both absolutely and even more so relative to other fuels.

5. Cost by Sectors

To complete the analysis, Table VI.6 presents projected costs by sector. Obviously, the more petroleum dependent a sector is, the greater will be the cost increases it experiences. The ability to replace oil by coal or by natural gas (its projected increase in cost from 1977 to 1995 is a relatively low 54.4% -- low relative to distillate, for which it is most likely to be substituted and which has a projected cost increase of 78.3% for the same period) is the key to whether a sector will experience moderate or excessive cost increases in the future.

TABLE VI.6

PROJECTED COST OF ENERGY BY SECTOR - NEW YORK/NEW JERSEY REGION

1978 $10$^{6}$ BTU

| | 1977* | 1985 | 1990 | 1995 |
|---|---|---|---|---|
| Residential | 6.26 | 6.33 | 6.71 | 7.65 |
| Commercial | 5.66 | 8.30 | 9.08 | 10.24 |
| Industrial** | 5.04 | 5.38 | 5.38 | 5.96 |
| Transportation | 4.78 | 7.50 | 7.83 | 9.39 |
| Average | -- | 6.89 | 7.21 | 8.26 |

*Actual in 1978 dollars (computed)

**Does not include refineries.

# PART TWO

# POLICIES

## I. INTRODUCTION

The State of New Jersey responded to the energy crisis almost from the moment of the oil embargo of 1973. Governor Byrne convened a Task Force on energy which reported to him in May of 1974. Among its many recommendations was the creation of a Cabinet level Department of Energy. A major action of the new department was the promulgation in 1977 of the New Jersey State Energy Conservation Plan. This plan contained 22 specific conservation measures which became the basis of the Department's activities in this area and was subject to subsequent revisions (the latest dated February 1980) In addition, the Department has published State Energy Conservation Regulations (August and September 1978) and, in cooperation with the NJDOT, New Jersey's Implementation Plan to Eliminate Dependence on Foreign Oil. Thus the State of New Jersey has been deeply involved in both the formulation and implementation of policy in response to the national energy crisis. The recommendations of this paper are made in the context of the work of the NJDOE and associated State agencies with the objective of strengthening those policies currently being implemented and suggesting additional directions to better conserve and more efficiently utilize limited and expensive energy resources.

A Harvard Business School study has stated that the U.S. can reduce its total energy consumption by 30 to 40% and continue to have "the same or an even higher standard of living." It may be more difficult to achieve this saving in New Jersey which is among the relatively energy-efficient states, but in terms of current (i.e., 1977) consumption, a 30 to 40% reduction in consumption would mean the BTU equivalent of between 90 and 120 million

barrels of oil yearly. Assuming that in the absence of conservation, per capita consumption remained the same, then such a saving would mean in 1985 (using a Bureau of the Census projection) the equivalent of 100 to 130 million barrels of oil. This figure would be even more significant if in addition to the overall reduction in demand through conservation, the State had an effective program which resulted in the substitution of more abundant and less expensive fuels in situations in which oil is now consumed.

In line with the Harvard Business School's statement that a major change in energy consumption can take place without a radical change in life-style, the assumption of a long-term supply side solution implies that we should not make highly capital intensive commitments based upon what may well be a temporary situation. This is an additional reason why almost all of the (demand side) policy recommendations of this paper are recommendations for the short term.

Goals and objectives should be explicitly stated with a time frame for achieving desired results. A simple measurable goal might be to maintain the current level of total energy expenditures in the face of per unit cost increases. Furthermore, emphasis should be placed on the utilization of market forces wherever possible, government serving as a facilitator and only taking a more direct role when the working out of market forces will cause unacceptable high costs in employment or welfare.

This part of the report is divided as follows: the section on Balanced Energy Usage contains analyses of the possibilities of natural gas, electricity, and coal as substitutes for oil; the following sections contain

recommendations for each of the five sectors of the New Jersey economy - and after an introductory statement make a series of policy recommendations applicable to that sector. In cases where such statements are feasible, a dollar estimate of the value of energy savings is included.

## II. BALANCED ENERGY USAGE

In addition to a major goal of the State's energy program, which is a reduction of energy usage, the State identified the more specific goal of reduced dependence on oil. In addition to conservation, the means of attaining this goal is a policy of favoring conversion of oil burning facilities to alternative fuels.

The composition of energy usage in the commercial and residential sectors of the State is a prime reason why New Jersey is so intensively an oil consumer. In 1977, 31% of total oil used in the State was consumed by these two sectors; nationally, this figure was 19.6%. These percentages indicate that there is ample room for oil savings in the commercial and residential sectors. However, the industrial sector in New Jersey, in spite of its high degree of energy efficiency, also presents opportunities for conversion from oil to a more abundant fuel source. New Jersey's electric utilities, as are all electric utilities on the East Coast, are heavily dependent on imported oil.

Excluding significant growth in nuclear capability as being politically unacceptable, and solar energy, synthetic natural gas, hydrogen, oil shale and

biomass as fuels whose potential lie in the very long run, the viable alternatives to oil are natural gas, electricity and coal.

1. Conversion from oil to natural gas

New Jersey's usage of natural gas as an energy source is relatively much lower (15.3%) than the nation's usage (27.8%); therefore, an increased use of natural gas is a logical energy policy for the State to follow under the condition of adequate supplies. The Natural Gas Policy Act (NGPA), passed in 1978, assures that the short supply that occurred only in the Northeast region of the country in the 1970s, will not be limited to a specific area again.

An average New Jersey all-year housing unit consumes about 1,193 gallons of oil annually. Conversion of 1% of houses would, in a month's time, mean about 200 conversions per day Statewide; this would release about 5 million gallons of oil annually for other uses.

Most of the older urban and suburban areas, typical in New Jersey, are hooked in to the existing network of natural gas, but nevertheless use oil rather than gas for heating purposes. This provides an option of converting from oil to gas, which is the least expensive conversion. With the September 1980 prices, to heat a home with oil costs 26.9% more than with gas.[1]

[1]Calculated from NJDOE retail price survey published in "NJ Monthly Energy Profile - September, 1980", table pp. 6 and 15, 1 THERM Natural Gas = $.558; 1 THERM Oil = $ .708; (1 THERM = 100,000 BTU's).

Many homeowners have already decided to convert from oil to gas. The number of residential heating customers that use natural gas has increased by 68,000 in September 1980 when compared to September 1979.

In addition, the N.J. utilities have drastically increased the natural gas usage from 2.2% of the total fuel unit in 1977 to 11.1% in September 1978 and to 18.7% in September 1980, thus reducing the usage of oil to generate electricity by 8.6% in 1979.

2. Conversion from oil to electricity

Increased installation of heat pumps is particularly noteworthy. It is a device that became commercially available in 1950s, but is still far from widely used. A heat pump can deliver up to three times as much output in thermal energy as it receives in electrical energy input, which means a 50 to 70% efficiency improvement relative to electric resistance heating in the New Jersey climate. This amounts to an annual energy savings of 15 to 25 million Btu's per household. The recently technologically improved heat pumps can heat air or water, which means that conversion from oil furnaces to heat pumps are technically possible. Such conversion would be eligible for federal tax credits on grounds of greater efficiency; therefore, it may be a feasible alternative for many homes, especially the older ones equipped with an old type, not very efficient, furnace.

The following policy should be introduced to induce the option of conversion to heat pumps:

- The New Jersey Board of Public Utilities should require that utilities prepare an evaluation of old type furnaces that are being used in the State in order to identify brand names and models of those that are least feasible when compared to a heat pump thermal efficiency. This information should be publicized in the State. Homeowners whose houses are equipped with these furnaces should be eligible for a free on-site inspection and a benefit/cost estimate. Many will probably decide for conversion, thus resulting in lower oil consumption for the State and more efficient energy usage.

3. Conversion from oil to coal

A decade ago, when the price of a barrel of crude oil was less than $2.00, 7.2% of the energy consumed in New Jersey was through the burning of coal. Today when the price of oil has risen to over $30 a barrel, coal accounts for only 3.9% of our energy consumption. The larger amount of coal consumed in 1970 is an indication of the degree to which we can change the composition of fuel usage in New Jersey toward coal and away from oil; the 1980 price of oil indicates the necessity of such a change.

Unfortunately, the coal we used to burn has numerous disadvantages in today's world. First, it has a high sulfur content which is unacceptable by current clean air standards. The technology that can eliminate this sulfur from stack smoke scrubbers - is a significant cost factor and may be prohibitive to some industrial users. Furthermore, there are problems, environmental and economic, associated with the sludge that accumulates as a result of the scrubbing process. Additional drawbacks of conversion to coal

are the costs of conversion itself - a significantly larger boiler is required for the same heat output, the current state of the rail system makes it especially difficult to physically, not to mention economically, transport coal from the mine to the sites in New Jersey, and the land use and environmental problems caused by the need to store large amounts of coal close by the boiler. Of course the argument in favor of coal is its very low BTU cost, especially when compared with oil.

It is possible, however, that the anthracite reserves of northeastern Pennsylvania may give us the best of both worlds. Although it is more expensive than bituminous, both at the mine mouth and in operating costs, that difference becomes insignificant when compared to the price of oil. Furthermore, anthracite has significant environmental advantages when compared with bituminous. Most importantly, its sulfur content is sufficiently low that it could be burned without scrubbers and have no more of an adverse effect than much of the oil that is currently being burned in the United States.

Among the other environmental advantages of anthracite to potential New Jersey users is its location. Anthracite coal fields are located in northeastern Pennsylvania, a location which entails a shorter trip to New Jersey sites than would the bituminous of western Pennsylvania or of West Virginia. This minimizes the adverse environmental effects during shipment and also minimizes the capital costs associated with rail facility upgrading that would be necessary if large scale movements of coal are to take place -an electric generation station with 1,000 mega watt capacity, the size of a typical nuclear facility, would require approximately three million tons of coal yearly.

## III. RESIDENTIAL SECTOR

The residential sector consists of single-family, multi-family, and mobile homes. Major uses of energy in this sector include: space heating - 53%, water heating - 19%, cooling - 5%, air conditioning - 7%, and cooking, refrigeration, freezing, small appliances and lighting - 21%. Space heating and water heating are major users of energy consumed by this sector, therefore, an effort to cut the energy use should concentrate on these two uses. Unlike the auto stock, the residential buildings stock turns over slowly. An average year adds 1.5% of new houses in New Jersey; that means that the existing buildings should be the primary target of an energy-saving action to achieve a significant result. New buildings can have a substantial impact only in the long term.

The following examples, cited in the study conducted by the Harvard Business School,* will show how significant energy savings can be accomplished through simple programs performed on existing houses.

The Washington Natural Gas Company, serving the Puget Sound area, went into the energy conservation business after the embargo, selling a "conservation kit" for attic insulation. Purchasing a "kit" meant that the company provided and installed insulation, guaranteed it, and financed it. The cost

*Robert Stobaugh and Daniel Yergin, eds., Energy Future, Report of the Energy Project at the Harvard Business School, New York 1979.

was about $200. The reduction in energy savings was 22%. By November 1977, the company had sold 14,000 such kits, and it is estimated that its advertising and promotion created a demand that led to an additional 42,000 jobs for other contractors. The utility is now selling a more elaborate kit which includes attic insulation, pilotless natural gas furnace, and automatic day/night thermostat. This, the company estimates, has reduced energy use for heating by an average of 36%, and has freed gas for 16,500 new homes without requiring any new supply. As this example shows, there is a very important aspect of retrofitting the existing buildings-creation of jobs in local markets. The National Association of Home Builders Research Foundation has projected that the retrofitting of 40 million single-family homes might require the establishment of 6,000 businesses, each generating at least $400,000 of business a year (500 hours at an average $800 per house), and many thousands of jobs.

As another example, Twin Rivers, New Jersey, a community of 3,000 well-constructed residences, has been studied for energy use by the Center for Environmental Studies at Princeton University over a period of five years. The researchers found that a 67% reduction in annual energy consumption for space heating was possible with a relatively simple package - interior window insulators, basement and attic insulation, and plugging of air leaks. The study also found that some residents use twice as much energy to heat and cool their houses as do other residents in identical structures. This means that changing attitudes and behavior may play an important part in the reduction of energy consumed.

New techniques such as passive solar energy systems should be introduced where possible. A passive solar system is one that uses the structure of the house to collect, store, and distribute the sun's heat. The system relies on little, if any, mechanical help. Recently, the Senate approved a proposal to provide builders and developers with a credit of as much as $2,000 if they include passive solar energy systems in the design of the house. Less ambitious designs of passive solar techniques can decrease fuel consumption by 40 to 50%; proper insulation and other steps to retain heat can slash an additional 30 to 50%. A cost of improved efficiency and passive solar construction adds no more than 10% to the cost of a new home.

In California, both San Diego and Santa Barbara counties now require solar water heaters on all new electrically-heated houses. In two years since San Diego County adopted the actions first law requiring more use of solar energy, it has become a national leader in its use and development. More than 3,000 new residental units have been equipped with sun-activated heating devices and about 8,000 more are scheduled to have them installed in 1981. In addition, under a State Public Utility Commission rebate program for existing homes, 29,000 city utility customers are to replace electric or gas water heaters with solar devices over a three year period. These units are economic outside the Sunbelt as well; savings are a function not only of the amount of sunshine but also of the cost of electricity.

In New Jersey, utilizing funds from a September 1979 Home Improvement Loan bond issue, the New Jersey Mortgage Finance Agency has initiated a two million dollar demonstration program to finance solar residential hot water

systems. The interest rate will be 8 3/4%, considerably below current market rates.

Governor Byrne, in announcing the program, stated that it "...will highlight the importance of providing low interest funds as one of a variety of incentives needed to encourage home owners to develop and use alternate sources of energy."

A homeowner will be able to obtain a loan of as much as $3,000 for a solar hot water system plus $1,500 for additional energy saving improvements. The homeowner making these expenditures will also be able to take advantage of federal income tax credits -- 40% for solar system expenditures and 15% for other energy improvements. To be eligible for a loan under this program, a home must be located in New Jersey, owner-occupied, and contain not more than four residential units. The loans are limited to a maximum term of 15 years and, of course, the homeowner must meet standard credit criteria. Individual loans would be obtained from private lenders -- there are currently 75 participating institutions in the State -- which, in turn, will sell them to the Mortgage Finance Agency.

1. Short-term policies supporting effective use of energy

A. The following are a few of the many conservation efforts and activities that have been or will be promoted in New Jersey: The Home Energy Savings Program (HESP) was initiated November 1, 1979, by the Department of Energy in a cooperative effort by all

electic and gas utilities. This program replaced the Company's Home Insulation and Energy Conservation Program which had operated since September, 1977.

The HESP program was based on recognition of the fact that attitudes and behavior play an important role in the reduction of energy usage. Services offered under this program included a $15 in-home energy survey performed by State-certified company representatives who had been trained to perform audits. Additional literature offered included a Guide to Residential insulation and a booklet on Financing Home Energy Conservation Improvements. Customers were informed of the program through newpaper advertisements and by an insert included with bills received during November and December 1979 and January 1980.

Results of the HESP in the PSE&G service area, as of August 1980, show that 11,900 inquires from customers have been received, including 2,700 requests for in-home surveys and an additional 8,400 requests for the Do-It-Yourself Workbook #1.

The HESP will be replaced by an expanded version in conformance with the Residential Conservation Service Program (RCSP) required under the National Energy Conservation Policy Act. Implementation of the new federally mandated program is expected to commence January 1981.

The purpose of the RCSP is to encourage the installation of energy conservation measures including renewable resource measures in existing one-to-four family houses. All eligible customers under the program are to be

notified of this program by electric utilities by means of bill inserts to be mailed during the first three months of 1981. The State plan will offer energy conservation audits of the home, an inspection of the heating system, and solar and wind energy audits. Recommendations for energy conservation improvements made as a result of the audits will be accompanied by a cost and savings calculation for each improvement. Utility respresentatives will assist homeowners in obtaining contractors and finding financial lending institutions, if so desired.

Additional research programs have been introduced in New Jersey in some areas on an experimental basis:

The House Doctor Program (HDP) is an experiment in the effectiveness of modular retrofitting of existing houses to limit heat loss by Princeton University in the "Twin Rivers" housing development in cooperation with the New Jersey gas utilities. The purpose of this study-program is to devise methods to detect and minimize air infiltration in existing residential structures and to evaluate the effectiveness of the various insulating techniques. This program was initiated in the 1979/80 heating season and will continue through the 1980/81 season.

The Residential Energy Efficiency Program (REEP) will be introduced to approximately 1,000 houses in the Lakewood, New Jersey area as a pilot experimental program. It is expected that the experiment will provide a basis for implementing REEP on a national scale. The concept of REEP is to provide owners or residents with a no-charge service for an audit and actual retro-

fiting of a house. The cost of this service will be covered by purchase of the saved energy from the utilities involved and resale of it to local utilities at a price sufficient to cover the cost of retrofitting homes.

B. In order to ensure a significant effect on energy usage in the existing housing stock, the State should mandate conservation measures on multi-family and single-family homes by a requirement that each swelling conform to certain conservation standards at the time a house is sold. (Over 10% of the State housing stock is put up for sale each year.) Such a program will allow the cost of retrofitting to be included in the price of the house and it would assure a buyer that the house he purchases meets a statutory standard.

Assuming that many homeowners, without anticipating the sale of their home, will complete a similar project voluntarily, influenced by the direct incentives of high energy prices and the federal residential tax credit for retrofitting (which is due to expire in 1985), and the federal authorization grant for low-income families, we can expect that by 1985 most of New Jersey's homes will be retrofitted. As a result, a 30% reduction of energy used by this sector can be expected.

2. Mid-term policies supporting efficient use of energy for new housing

The following policy should be introduced to reach future housing:

- thermal efficiency standards should be imposed on each newly built structure,

- passive solar systems should be advised whenever possible,

- a feasibility study for hot water supply from solar systems should be required on each new home,

- a feasibility study for heat pumps to be used on new electrically heated homes should be required,

- day/night thermostats, hot water heater timers, and meters with a timer should be standard equipment on each new and renovated house, and

- technical option for future installation of solar panels on the roof should be provided.

3. Long-term policies encouraging energy efficient future residential development

The New Jersey Municipal and Land Use Act has been amended in November 1980. The amendment directs developers to design streets and construct buildings in such a way as to maximize the use of solar energy. The "solar and energy conservation zoning" will affect the lay-out on new roads, residential developements and commercial and industrial buildings. Many energy-saving features are included in the law which makes this law the first

comprehensive energy conservation zoning law in the United States. The New Jersey municipalities are by this law ordered to draft municipal master plans to reflect new energy-conservation measures for the next version of plans that comes every six years. The new plans must be ready in 1982 and they must include the energy conservation strategy.

To make the new law effective, the State government should assist local planners in preparing plans. Local planners do not have the energy conservation expertise to prepare the energy impact assessment of master plans. Guidelines on how to prepare energy-conscious zoning and subdivision plans should be developed by urban planners and architects to help local planning offices to develop the local area plans.

4. . Estimate at Savings

In 1977, the State's residential sector spent an estimated $1.7 billion on energy; of that, $535.6 million on oil; $379.2 million on natural gas; $813.6 million on electricity; and $1.3 million on coal. Assuming a 30% final reduction of energy used by the residential sector by 1985, we can expect that the State's residents would save, between 1980 to 1985, an equivalent of a one year energy bill paid by that sector; that is approximately $1.8 billion* if the short- and mid-term policies will be successfully applied.

*Savings computed with the data from Table VI.5 - Projected Costs by Fuels -New York/New Jersey Region. Based on the assumption of 5% annual decrease of consumption.

## IV. COMMERCIAL SECTOR

The commercial sector consists of structures with a variety of functions such as retail stores and supermarkets, wholesalers, office buildings, auto repair shops, warehouses, educational services, health services, public buildings, religious services, and hotels. Most of the buildings that are presently used, and will be used for many years, have been constructed when energy supply was not a problem and energy costs were low. A typical older office building of the 1960s and 1970s uses annually between 150,000 to 250,000 Btu's per square foot and sometimes more. A new building, designed to save energy, can use as little as 40,000 to 50,000 Btu's per square foot annually. However, as the existing buildings will stay in service for many years, they should be the primary target of any energy-saving effort to be undertaken by the State.

An effective program based on a combination of price and regulation that may be called a semi-market approach, was introduced in 1973 in Los Angeles during the oil embargo. The Los Angeles example was found by the Harvard Business School's Energy Future Report to be one of the most effective energy conservation programs that has been introduced in the United States. The purpose of the Los Angeles project was to significantly cut the consumption of electricity by the residential, industrial and commercial sectors over an extended period of time.

The Los Angeles project was composed of two separate phases. Under Phase I, customers were to cut back on their energy use. There was a stiff penalty for noncompliance: a 50% surcharge on the total bill. The aim was to reduce electrcity consumption in the city by 12%. The response went far beyond the targets of Phase I.

| | Target | Achieved Reduction |
|---|---|---|
| Residential | 10% | 18% |
| Industrial | 10 | 11 |
| Commercial | 10 | 28 |
| Total | 12 | 18 |

There was no need to go into Phase II. The embargo had ended; penalties were never applied.

In New Jersey, oil is the major fuel used by the commercial sector (70% to the total energy consuption in 1977 came from oil). Therefore the Los Angeles experience, designed to decrease use of electricity only, cannot be simply transferred to New Jersey but will have to be adjusted for New Jersey's conditions.

The Harvard study concluded that the large amount of flexibility left to customers to figure out how and where to make their own cuts about "essential" and "non-essential" uses made for the program's success. A similar program can be designed to fit New Jersey's commercial sector. Such a program should be administered as any tax is; the citizen is obligated to comply, compliance is verified by a random audit.

1. Short-term policies supporting effective use of energy

- A program to mandate conservation measures of commercial, service, office and public properties, should be legislated. Landlords or users, depending on who is billed for energy used in a building, should be held responsible for compliance.

In this program, landlords or users should calculate their total energy consumption of the last year and be asked to cut consumption by 10% in the first year, 20% in the second, and 30%, in the third target year of the program. Flexibility should be left to each of them to decide how and where to make their own cuts. A random audit by local or State authorities to verify the compliance should be performed and penalties imposed for non-compliance. Those found not to comply in the first year may have their penalty payment returned if consumption of energy in the second and third year is found to have decreased by the required amount.

Such a program may prove to be very effective without requiring much additional government personnel. As in the Los Angeles example, customers would have the flexibility to decide how to cut energy use. Some would simply plug air leaks and conserve by cutting on non-essential uses. Others would shift to more efficient energy systems or fuel. Penalties collected for non-compliance can be used to finance other energy programs, i.e., weatherization financing for low-income families.

This program may be more complicated to enforce in New Jersey, where the majority of fuel used is oil, than it was in Los Angeles but these difficulties can be overcome with some careful planning. Information on consumption in physical units should become a part of all energy invoices as it is on utility bills. Compliance can then be verified simply by comparing energy consumption in successive periods.

Landlords or users who could prove that they have already improved the thermal efficiency of their properties by 30% in a recent period should not be excluded but may be given diminished targets such as 15% over the three-year period.

This program, as described above, may seem to be a strong imposition of the government on business. In fact, it is not. Firstly, it provides for flexibility to act and decide, which the private sector prefers to governmental imposition of fixed rules; and secondly, it addresses the very energy-inefficient situation that has developed in this sector as a result of the typical lease agreement presently in use. Landlords usually provide energy; tenants then do not directly pay energy bills overlook efficient energy consumption. Landlords, of course, pass along their growing energy costs through increased rent. Therefore, regulations for this program should be designed to correct the current energy inefficient relationship between landlords and users. Landlords should be given the opportunity of changing the contractural relations so that tenants would be responsible for energy bills. It can be expected that tenants, being directly responsible for energy bills, would simply comply by more efficient energy use.

## 2. Mid- and long-term policies supporting efficient use of energy for new buildings

A separate program for future buildings, to provide the energy conservation and efficiency should be developed.

New buildings thermal efficiency standards, such as ASHRE 90-75, should be augmented by annual tightening of standards (similar to miles per gallon for automobiles). For example, 100,000 Btu's per square foot in 1980; 90,000 in 1981; with a final target to be achieved in 1985. How many Btu's per square foot will be permitted should be decided by energy specialists and architects.

## 3. Estimate of savings

In 1977, the State's commercial sector spent an estimated $1.8 billion on energy; of that, $811.8 million for oil, $152.3 million on natural gas, $801.3 million on electricity, and $.8 million on coal. Assuming a 30% final reduction over the period of three years, we can expect that the State's commercial sector would save $1.1 billion in 1977 prices. As the cost of energy is steadily going up, the expected savings could be even more significant. The Federal Department of Energy estimates that the cost of energy for the New York/New Jersey commercial sectors will increase from $5.66/million Btu's in 1977 to $8.30/million Btu's in 1985; an increase of 46.6% (see Table VI.6). If we can achieve a 30% decrease of consumption in three years, and maybe even more by 1985, we would be able to substantially help the sector to cope with higher prices. Or, if the decreased consumption will equal the increase of

prices, we can eliminate the economic impact for the sector of higher energy prices. Many experts believe that 40 to 50% reduction of consumption by the commercial sector is possible as it is believed that this sector is presently the least efficient energy user.

4. Energy Efficiency in Public Buildings

In addition to the policy actions by the New Jersey DOE, State government is fulfilling its part in energy conservation by seeing that its own house is in order. The "Energy Conservation Bond Act of 1980" (S749) has been introduced in the Legislature by Senator Bernard J. Dwyer of Middlesex County. This legislation authorized the issuance of $50,000,000 in bonds for an energy audit and renovation of public buildings; the audit to cost not more than $3,000,000 and the remainder for energy efficient renovations. As required by law, the proposed bond issue has been submitted to and approved by the Commission on Capital Budgeting and Planning and subsequently signed by the Governor and approved by voters in the November 1980 election.

The Act recognizes the fact that State government is responsible for the maintenance of many buildings built in an era of cheap energy and which can be considered antiquated from an energy efficient point of view. This includes not only State offices but educational facilities and institutional buildings. The goal of the legislation is stated simply as "accomplishing a net reduction in energy consumption."

The proceeds of the bond issue will be placed in a dedicated fund to be designated the "Energy Conservation Fund." The immensity of the task is such that it could not possibly be accomplished in a timely fashion through yearly appropriations. The Act does, however, provide for appropriations from revenues derived from the State sales tax and from property taxes to meet principal and interest payments.

## V. INDUSTRIAL SECTOR

Although the industrial sector accounts for a substantial 21% of total energy usage in the State, it may also contain the widest range of energy usage among its component parts. Some industries are high intensity users of energy; for others, energy is a relatively minor item in their cost structure. One industry will find it necessary to have an assured supply of a particular energy source; another views energy sources as highly substitutable. Thus, the recommendation of this section, although relevant to the sector in the aggregate, will have various degrees of applicability for particular industries.

Nevertheless, there is little doubt that industry is more dependent on petroleum than it need be. Two decades ago, coal accounted for over one-fifth of industrial energy consumed; today it has virtually disappeared as an energy source. Before the natural gas crisis of the winter of 1975-76, this fuel accounted for 23% of energy consumed in the industrial sector; after the crisis, this fell to 16%. By simply returning to where we used to be in the use of coal and natural gas, a significant step will have been taken in reducing our oil dependence.

Furthermore, there are by-products of the industrial process which, although not considered an energy source in the past, nevertheless have this potential. Two significant items are process steam which can be used in the co-generation of electricity and solid wastes which can be incinerated to produce steam.

There is little romance in conservation, yet experience has already shown it to be one of the most profitable of potential industrial investment opportunities. Many examples can be given but one from New Jersey can suffice here. With an investment of $37,000, the American Can Company's New Jersey facility reduced its energy consumption by 55%. This translated into an annual savings of $700,000.

The specific recommendations that follow can all be started and show results immediately but if continued and expanded, will continue to have effects in the mid and long term. The pace at which they are implemented will of course depend on the economics of the individual plant. All would significantly reduce total usage of energy and, in particular, reduce their dependence on oil as a boiler fuel, without having a negative effect on either output or employment.

1. Cogeneration of electricity by process steam-producing facilities

Industries such as chemicals, paper, petroleum refining, and food processing, which use large amounts of steam in their manufacturing process, are among the most important in New Jersey. A Princeton University report estimates that if this steam were first used to generate elecricity, the lowering of temperature which this process would entail would still allow the

residual heat to adequately perform its industrial work and New Jersey's electrical supply could be increased between 10 and 90%. The practicality of cogeneration is attested to by the fact that as much as one-third of total power generated in some European countries is by cogeneration.

Obstacles to cogeneration include the resistance of both utilities and industry. A manufacturing firm understandably would be reluctant to become an independent producer of electricity and utilities likewise cannot be expected to want to give up part of their market, decrease their rate base or endanger their reliability standards. The BPU must adjust its regulations so that although cogeneration facilities are part of the plant of a private firm, management will be in the hands of the utility and the utility can either own the facility or be treated as such by the BPU.

2. The Department of Energy Cogeneration Study

In June of 1976, Princeton University's Center for Environmental Studies, in response to a request by Governor Byrne's Cabinet Energy Committee, prepared a report on "The Potential for Electricity Generation as a Byproduct of Industrial Steam Production in New Jersey." This study, prepared by Professor Robert H. Williams, made a strong argument for cogeneration stating that not only would costs be less than conventional modes of electric generation but that the utilization of industrial sites in New Jersey had the potential of increasing the State's supply of electricity between 10 to 90%.

More recently, the NJDOE, in conjunction with the Public Advocate, commissioned an "Analysis of Cogeneration Systems Applicable to the State of New Jersey" from a private consultant, Thomas Electric Corporation. This report was completed in December 1979. Lastly, as a first step toward implementing the written analysis, the Department held public hearings regarding cogneration.

The end result of this activity is the Department's conclusion that "cogeneration is an old idea whose time has come." This statement comes from a document prepared by the Department and submitted to the Legislature and the Board of Public Utilities. Its recommendations will become part of the State Energy Master Plan.

Cogeneration will improve the efficiency of electricity production for the following reasons:

- Greater flexibility. Lead times are several years less than for large central stations. The current uncertainty about future changes in demand coupled with difficult financial conditions makes flexibility a particularly desirable characteristic.

- Smaller resource requirements. The probability of a proportionately large outage is reduced when production takes place in many smaller plants than in a few large plants. Smaller reserves mean of course that less total capacity is needed to maintain a given level of reliable output.

- Independence from foreign sources. Newer fuels, such as refuse derived fuel (RDF) which cannot practically fuel large central stations, can be used in the smaller cogenerating plants.

- Different ownership options. A large central station is almost by definition owned by a utility or a group of utilities. Smaller cogeneration units on the other hand can be owned by an industrial firm, jointly owned by the firm and the utility, or owned by a third party, such as an industrial park or local governmental unit, in addition to the option of utility ownership. These alternatives provide a flexibility which may result in savings to the consumer.

Regardless of ownership, however, the facility must be linked to the utility grid to provide both reliability and a market for surplus production. Thus, the cooperation of the utility is crucial to the success of cogeneration. This, in turn, means that the policies of the State regulatory authorities are crucial to the success of cogeneration.

In arguing for marginal cost pricing, the DOE paper contends that the existing rate structure would discourage a manufacturer from producing more than he himself can consume, resulting in less than optimal production. Any additional profit that accrues to the manufacturer as a result of a higher (i.e., more economic) level of production would be split with the utility.

In summary, "developing an appropriate regulatory context" is the major action of a State cogeneration policy. This means having the cogenerator file as a utility with the Board of Public Utilities so that an effective rate

structure can be established. In addition, DOE should provide technical assistance to industry and disseminate information on the advantages of cogeneration to industry with cogeneration potential. And, of course, the study of the technical and economic aspects of cogeneration and development of new policies toward this technology should be an ongoing activity of State government.

### 3. Resource Recovery Proposals

An estimated 15 million tons of solid wastes are disposed of annually in New Jersey. Landfill sites are rapidly filling up and are, in the main, environmentally unsound. To exacerbate the situation, tipping fees are kept below market rates through regulation by the Board of Public Utilities so that it is uneconomic to bring landfills up to environmental standards. (As an indication of the rate structure in New Jersey relative to that of contiguous states, an estimated 2.3 million tons of the solid wastes disposed of in New Jersey are trucked in from out of State.)

The possibility of resource recovery from solid wastes and the associated possiblity of transforming the solid wastes into a RDF presents the opportunity of contributing solutions to both the energy and landfill problems.

With this in mind, the New Jersey Department of Energy convened a Resource Recovery Financing Policy Panel in March 1979. The membership of the Panel included New Jersey State agencies (including the Governor's Office of

Policy and Planning), local governments and bi-state agencies, trade associations, private firms, bankers, and public representatives. After numerous meetings and the review of a draft report, a final report was issued in December 1979.

The Panel concluded that between $1.3 and $1.6 billion may be needed for resource recovery in the decade of the 1980s. To finance this effort, the Panel recommended a combination of taxes, a bond issue, and earmarked payments by private operators.

The proposed tax would produce $18.6 million yearly, approximately 1/8 of the total resource recovery cost. It would be raised by a landfill tax of $.31/cubic yard, equal to $1.24/ton, and used in the following manner:

$4.2 million for an environmental cleanup fund.

$4.8 million for a rebate to municipalities with recycling facilities.

$4.2 million for recycling planning grants to local agencies. Funds will also be available to private groups as low interest loans.

$5.4 million for public sector energy resource recovery grants and a private sector loan fund.

The purpose of the bond issue is to establish a loan guarantee fund. Thus the proposed $40 million dollar issue can be expected to leverage private lending many times this amount. Furthermore, $10 million is to be placed in escrow accounts by private operators to bring their own facilities up to environmental standards.

State government, through the general fund, would indirectly make financial contributions by granting both investment tax credits and sales tax exemptions for resource recovery capital purchases. State government would further support these facilities by guaranteeing a minimum waste flow, by allowing a premium on State purchases of recycled products, and by exempting resource recovery services from competitive bidding provisions. A controversial recommendation, but one that may be critical to the success of the program, is that resource recovery expenditures be exempted from local government expenditures caps. As an aside, the Panel recommended the continuation of rate regulation "in order to protect the public interest."

At approximately the same time the Department of Energy's Resource Recovery Panel was issuing its final report, the Department of Environmental Protection came forward with an ambitious plan for a solution to the problems associated with solid waste disposal.

Although the two programs address the same issues, there are differences between them; the most significant being that the DEP proposal relies solely on the issuance of bonds for public sector financing, eschewing the use of additional taxation completely.

As an alternative to a tipping tax and relaxation of caps, the Department of Environmental Protection has proposed that the State finance up to a maximum of 50% of regional resource recovery facilities. Based on a planned expenditure of $1.2 billion, the Department requested a total of $600 million in general obligation bonds. The Commission has approved the program in

principle and as an initial step, has voted in favor of placing a $50 million issue on the November 1980 ballot. It was approved by the voters in the November 1980 election.

Grants would be made available to the 22 resource recovery districts in the State - the 21 counties plus the Meadowlands Development Commission. Initially the grants could be applied to all costs short of actual construction up to a maximum of 50% of the total. These include administrative costs associated with requests for proposals (RFP) and the developement of contracts, feasibility studies, and the actual design of the facility. Grants would be made to districts in stages as they progress toward the goal of construction of the facility. The Department will evaluate progress and has the option of discontinuing further grants should the project no longer seem feasible.

Over the long term, the Deparment hopes to get the full $600 million in bonding authority. On the basis of a 50% match, this would fully finance, including construction costs, their Statewide resource recovery proposal. As of June 1980, in addition to the Commission on Capital Budgeting and Planning, the Department of Energy and the Office of the Governor have agreed on this approach to the problem. The next step is approval by the Legislature.

4. Conversion to coal as a boiler fuel

Although this recommendation is of greater significance to utilities, it nevertheless can have a substantial effect in industries which now rely upon petroleum as a boiler fuel. In the short run, at least burning bituminous is

impractical on environmental grounds, but the use of low sulfur anthracite from nearby Pennsylvania fields is feasible both economically and environmentally. A successful State effort to improve rail facilities might make a significant contribution toward encouraging conversions.

5. Conservation

Although last on our list, and the least specific, conservation is probably quantitatively the most important item on the list. In the short run, it is easiest to implement; and in the long run, may have an effect greater than more sophisticated technological or admininstrative recommendations. The State should be enforcing energy efficient building codes and transportation standards and ensure an energy conscious use of lighting, heating, and air conditioning on the part of industrial users. By improved maintenance, industry could have substantial savings with little investment. Further improvements, involving retrofitting, may have payoffs significantly higher than even current interest rates. In the longer run, the combination of increased energy costs and State-imposed standards will encourage energy saving technological innovations.

The peak year for industrial energy consumption was 1966 when 785.2 trillion Btu's were consumed by New Jersey industry. By 1977, admittedly with a smaller industrial base, this figure was 583.93 trillion Btu's - a 2.1% annual rate of decreasing consumption. Simply maintaining that rate until 1985 will result in an industrial consumption figure of 478.5 trillion Btu's. This saving of 105.4 trillion Btu's is the equivalent of 18 million barrels of

oil. With the current price of imported oil at over $30 a barrel, this translates into $544 million worth of energy savings.

## VI. TRANSPORTATION SECTOR

New Jersey, as other states, will substantially reduce the amount of gasoline that is used by the transportation sector in the mid-term due to the fact that most of the private automobile stock will be replaced by the new, far more efficient car that was mandated by the federal government. Also, the possibility of significant financing from the windfall profits tax to the State's transportation system could help to lower consumption substantially as an improved public transportation system attracts more riders. But irrespective of how successful the federal programs will prove to be, there is much that the State can do in areas where federal policies cannot be applied to lower gasoline consumption in the short-, mid- and long-terms. Transportation consumed 43.1% of all oil used in the State in 1977 which is equal to 34.6% of all energy consumed. Any improvement accomplished in this sector translates directly and instantly into lower consumption of oil, directly diminishing the economic impact of rapidly growing prices.

New Jersey uses relatively much less energy for transportation than the rest of the nation. This is not due to a more energy-conscious population of the State, but to New Jersey's high density development resulting in less vechicle miles traveled and extensive public transport when compared to other areas. It is probably safe to assume that the State's population shares with other Americans, similar wasteful gasoline consumption habits acquired in the

past. Therefore, State policies should, among others, be designed to help its citizens to realize that by changing some energy-wasteful into energy-conscious habits, savings can be accomplished without much change in their life style.

The following measures to improve the transportation system should be supported by the State:

- Alternate work hours to decongest roads and public transportation in rush hours.

- Organizational improvements of the existing mass transit system to make it more effective and efficient for users.

Alternate work hours may serve two purposes; firstly, to extend a time of peak hour that would result in more comfortable and more attractive, therefore more frequently used public transportation, and secondly, would decongest highways allowing for more efficient use of automobiles.

Alternate work hours can be introduced in four different ways:

- flextime - employees select their own starting and leaving hours; this would help both the public transportation and congested highways;

- staggered hours - sub-groups of employees start and end work at variable times to be applied in places where the flextime system

cannot be applied, i.e., factories where most of the workers are needed at the same time to operate;

- staggered starting work hours for groups of employees of large employment facilities or for employees of various enterprises located in one area.

- compressed work weeks - that means fewer work days per week with longer hours. This policy should be examined to see if the increased leisure time would not result in more trips.

NJDOT has already encouraged an alternate hours programs but more desirable would be an active advisory role by NJDOT. For example, areas where congested traffic is an everyday occurrence can be pinpointed, destinations of commuters determined, and appropriate information provided to those employment centers whose staggered hours would decongest such areas. Many departments in Trenton and Newark have already instituted staggered hours for their employees. State government can thus be an example to others as to how to become more efficient in transportation energy use.

In many cases, little additional investment is needed to improve the quality of public transportation. For example, in Portland, Oregon, the reorganization of the city public transportation system increased ridership by 20%. A plan combining urban design and mass transit had been introduced. Under the plan, rerouting of lines, introducing bus lanes in some areas and bus shelters with route maps and schedules were provided. Additional small

improvements were made such as clear design of symbols for buses and lines, all maps color coded, et cetera. The results are paying off; 15 minutes were cut from the average bus ride through downtown; 40% of all trips to downtown are made now by public transit, and traffic volume entering downtown has declined to the 1971 level reducing carbon monoxide levels in the air. These and other similar improvements should be done by every mass transit system in the State. Well-organized public transportation will attract more riders, by decreasing the consumption of gasoline.

## VII. ELECTRIC UTILITIES

The State's electric utilities are, aside from the transportation sector, our largest consumer of petroleum. The first two recommendations that follow suggest means by which this petroleum dependence could be reduced and eventually diminished by means of substitute fuels. But for such an event to realistically occur, there must concomittantly be a reduction in the demand for electric energy itself. A variety of recommendations to this end are categorized as either price or non-price policies and discussed as items 3 and 4. These last items, because they deal with the relations of utilities with other sectors of the economy, could in fact have been listed as individual sector recommendations. They are listed here, however, because the initiative for implementation has to come from the utility, usually with a mandate or at least the acquiescence of the Board of Public Utilities, and because their effects cut across sectoral lines.

1. Continued expansion of nuclear capability

Although no one any longer views nuclear reactors as an energy panacea, it cannnot be denied that they must play an important role in our energy future. New Jersey has been a leader in the use of nuclear energy; however, all projections of future nuclear generation must be substantially modified in view of the recent events at Three Mile Island. Nevertheless, it is essential that we at least move toward increased nuclear capability if petroleum independence is to be a reality.

2. Conversion to coal as a boiler fuel

The loss of faith in nuclear energy has placed the burden of petroleum independence on coal. Unfortunately for New Jersey, the major sources of coal in the eastern United States, the fields of southern Pennsylvania, West Virginia and Kentucky, are, in the short run at least, inaccessible by rail. In addition, this coal is high sulfur bituminous and it is even questionable whether it would be environmentally acceptable in a state which already has such a high degree of industrial air pollution. And, furthermore, even if scrubbers were satisfactory, the sludge would itself cause a major disposal porblem. Thus, the prognosis for bituminous is dim indeed.

Fortunately, northeast Pennsylvania, which is close enough to make it relatively simple to solve transportation problems, has an ample share of low sulfur anthracite. This coal has certain economic disadvantages vis-a-vis bituminous which accounts for its almost total elimination as an industrial

fuel over the past decades. (It, of course, lost out to heating oil as a residential fuel because of the esthetic and convenience advantages to the home owner.) However, environmental considerations have changed the benefit/cost ratios and anthracite may well be the utility (and to a lesser extent, the industrial) fuel of the future.

However, for this to become a reality, the State of New Jersey will have to take an active position vis-a-vis an upgrading of railroad track and rolling stock and support action on the part of Pennsylvania to encourage the open pit mining that an economically efficient anthracite operation would require.

Many of the following policies, which involve measures to be taken by the State's public utilities, have either been instituted by electric utilities or are the announced policy of the NJDOE. To the extent, however, that they have not been fully implemented, for instance time of day pricing is not available to the residential sector, these policies have the potential for a significant contribution to the State's energy conservation effort.

3. Energy efficient pricing policies

A. Peak load pricing - the per Kwh cost of electricity should increase in periods of high demand on generating capacity. This would imply higher rates in summer than in winter; higher rates during the day than in the evening.

B. Master metering - the practice of using a single meter in multi-unit buildings should not be permitted in new structures and should be phased out in existing structures.

C. Interruptable rates - lower rates should be available to industrial and commercial customers for choosing service subject to interruption during periods of peak demand.

4. Non-price energy-efficient policies

A. Automatic cutoff - utilities should be able to selectively cut off services on air conditioning units during periods of peak demand. (The New Jersey peak, as well as almost all of the United States, is in mid-afternoon summer peak due to the ubiquitous air conditioner.)

B. Energy analysis - electric utilities should perform the service, for nothing or a nominal additional fee (the remainder to be financed from general revenues), of performing energy analysis of residential and smaller commercial and industrial structures. The analysis would include estimates of payback periods for specific conservation devices.

Ultimately, the total amount of energy that will be saved by electric utilities depends upon the ability of the consuming sectors to conserve. But a simple reduction in output is not a meaningful goal because efficient energy usage may well mean substituting electric energy for other fuels. The

meaningful goal for New Jersey utilities is to reduce its dependence on oil. In 1977, 57.1% of New Jersey's electric output was fueled by oil (the comparable U.S. figure was 17.9%). In order to produce power in that year, New Jersey's electric utilities used 85.85 million barrels of residual oil and 4.04 million barrels of distillate. If the U.S. Department of Energy projections are in fact attained, oil is reduced to 3.5% of total utility fuel by 1990 and a minute fraction of one percent by 1995, New Jersey will have taken a major step toward its goal of a substantial reduction in the use of petroleum in the State. New Jersey, since 1977, has achieved a significant reduction of oil usage in production at electricity. Oil is an longer the pricing fuel used. Only little over 20% of electricity produced was fueled by oil in 1980 while in 1977, this figure was 57.1%. Natural gas, coal and nuclear are the three primary fuels used.