....Energy Plan for Long Island, New York

March 1991

Wind Turbines

Weatherization

Generation

Natural Gas

Conservation

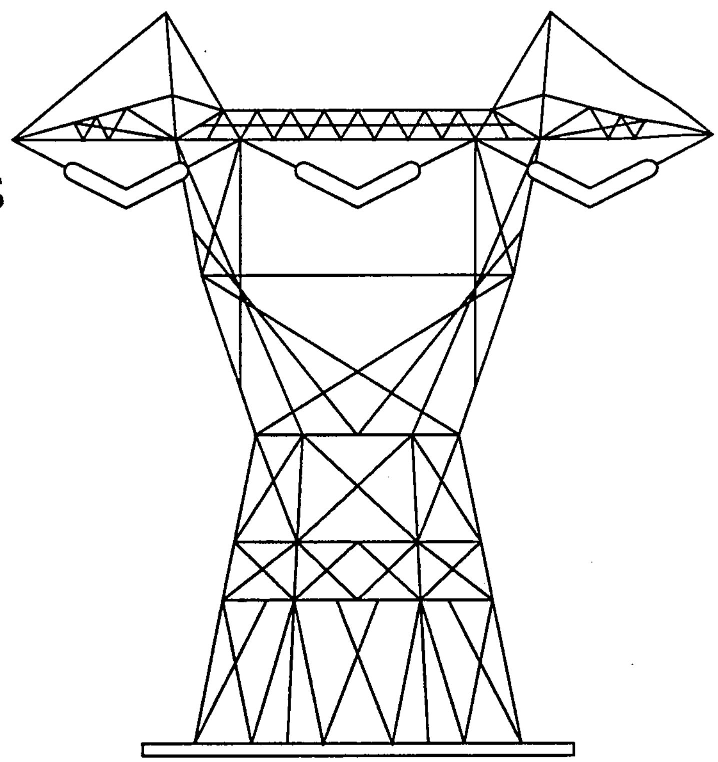
Hydropower

Photovoltaics

Ethanol

Methanol

Solar Thermal



Long Island Regional Planning Board

ACKNOWLEDGEMENTS

In the preparation of this report, the authors have enjoyed the generous cooperation of many people who are concerned with Long Island's energy future. We wish to express our appreciation in particular to the following:

In the New York State Energy Office: Charles R. Guinn, John E. Smith, Maynard Bowman, Sharon Costello, Elizabeth Donati, Brian Henderson, Dennis Hodges, Ruth Horton, James Parmalee, Burton J. Rounds, Michael J. Scott, Charles Searle, Jr., Harry A. Sheevers, and Peter R. Smith.

In the New York State Energy Research and Development Authority, David R. Wolcott.

In the New York State Public Service Commission, Sam M. Swanson and Richard C. King.

At the New York Department of State, Rick Gerardi, Patrick Sweeney, and Michael Malec.

At the New York Power Authority, Robert A. Hiney, Philip J. Pellegrino, Willam Palazzo, and Christopher O'Brien.

At the Long Island Lighting Company, John P. Buehler, Charles A. Daverio, and Paul Guleksen.

At Brookhaven National Laboratory, Gary A. Goldstein, Samuel C. Morris III, John W. Andrews, Roger J. McDonald, and Barbara L. Pierce.

For their helpful comments, we also wish to thank Harry Davitian of Entek Research, Inc., and Richard Loulou of Groupe d'études et de recherche en analyse des décisions, Quebec, Canada.

This final report benefits also from the comments and discussion at an earlier meeting of the the Long Island Regional Planning Board led its chairman, Morton Certilman.

Finally, we offer our special thanks for the assistance and guidance we have received from the staff of the Long Island Regional Planning Board, especially Pearl M. Kamer, Ken Babits, and the executive director, Lee A. Koppelman.

The views expressed in this report are our own, of course, and are not necessarily shared by any of the above.

Douglas Hill
Miriam Kroon

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES (continued)

LIST OF FIGURES

EXECUTIVE SUMMARY

With the Shoreham nuclear power plant closed, Long Island (defined here as Nassau and Suffolk Counties) faces the next two decades with serious energy handicaps. Overly dependent upon imported oil for electricity and home heating as well as gasoline, Long Island faces recurring price spikes and the danger of an acute shortage. Worse, the cost of Shoreham guarantees that the Long Island Lighting Company will have the highest electricity prices in the continental U.S. for at least a decade to come. Natural gas, the alternative to oil and electricity for many uses, is unavailable to a large part of Long Island's population. As natural gas becomes the fossil fuel of choice because of its environmental advantages, Long Island seems destined to remain at the tail end of the pipelines from the Southwestern U.S. and Western Canada.

Essentially, Long Island has three main energy problems:

- o The continuing problem of overdependence upon petroleum
- o The imminent problem of escalating electricity rates
- o The future problem of restricting greenhouse gas emissions.

To address these problems, Long Island needs to reduce its use of energy, replace petroleum, and find sources of power that release less greenhouse gas. Specifically, Long Island should:

- o Promote energy conservation of all fuels
- o Assure an increased supply of natural gas, and
- o Increase hydroelectricity imports from the North.

Energy conservation is basic to improving Long Island's energy future. However, energy conservation has lagged since the mid-1980s when oil prices were low and government supports ended. A modest energy conservation program run by New York State could be more fully exploited by Long Islanders. LILCO's demand-side management program, while slanted toward load shifting and peak shaving, is the principal impetus to saving energy on Long Island, and it is essentially limited to electricity. Unfortunately, the cost of LILCO's demand-side management program feeds back to its electricity rates, raising the cost of electricity even more. Those likely to be hardest hit by these price rises are low-income people who already pay a higher proportion of their income for energy. Worse, energy conservation programs for low-income people have faltered because they are not "cost-effective," and Long Island weatherization programs have been slighted in favor of those upstate where winters are colder and costs are lower.

With the greenhouse effect looming, Long Island finds itself poorly endowed with renewable resources. Photovoltaics could become important if prices continue to drop, wind turbines can probably contribute marginally, and rooftop solar water panels can help individual homeowners. Ethanol from Midwestern corn is beginning to supplement gasoline as motor fuel here. The most substantial source of renewable energy potentially available to Long Island, however, is hydroelectricity from Niagara Falls and Quebec.

Continuing a long political tradition, Niagara hydropower is delivered to industrial customers upstate at about two cents a kilowatt-hour while LILCO customers now pay, with fuel price adjustments, more than fourteen cents. Quebec has potential hydroelectric power equivalent to more than half the present generating capacity of New York State. LILCO seems dubious about the 5 percent of its power that it is now scheduled to receive from Canada, however, and shows no interest in getting any more. The New York Power Pool would rather see LILCO generate its own electricity.

Two major Long Island companies have already opted out of LILCO electricity for cheaper upstate power, and a New York State program makes it possible for others to do the same if they promise to create jobs or threaten to move out of the State. So far, the effect has been to raise the rest of Long Islanders' electricity costs about 1 to 2 percent.

Electricity is not Long Island's only energy problem, of course. To reduce oil consumption, measures to improve traffic flow can be taken in the short run, and land-use planning and building construction practices can be effective in the long run. Compressed natural gas as a vehicle fuel is a proven alternative for fleet vehicles, preferable to methanol as an alternative fuel on Long Island because it does not threaten the ground water.

But Long Island's unique problem is electricity. LILCO's problems become Long Island's problems.

What can be done?

The primary answer has to be more conservation. However, oil and natural gas also need to be conserved, and funding has to be decoupled from LILCO electricity rates to avoid a vicious circle. Ideally, the funding, and perhaps the responsibility for promoting energy conservation on Long Island, should be in the hands of an agency with public funding authority like the New York Power Authority and the Long Island Power Authority. The means of promoting conservation should not be allowed to increase the cost of energy to low-income people.

The Public Service Commission is taking positive steps in this direction by widening the New York State utilities' demand-side management program for low-income people to include gas conservation as well as electricity, and by raising the possibility of limiting rate increases to specific classes of customers. However, without having its authority broadened by State legislation, the Public Service Commission cannot materially influence conservation of oil.

Natural gas is the fossil fuel of the future, both to generate and replace electricity. It is likely that liquefied natural gas (LNG) importing terminal facilities in the Northeast will be expanded in the next two decades. Long Island now uses its coastal location to import oil. Long Island can choose to make itself a candidate for an LNG import terminal, or it can choose to remain at the wrong end of the pipeline.

The rest of the industrial world is committing itself to control greenhouse gas emissions. The United States, the world's biggest emitter of greenhouse gases, will not be able to avoid doing the same for the next two decades. Together with conservation and switching to natural gas, renewable energy will have to be expanded. Long Island should position itself for this likelihood by contracting for significantly more Quebec hydropower, if necessary through the New England Power Pool which is only 10 or 25 miles away from Long Island power lines.

Long Island's energy prospects could hardly be worse. The actions needed to improve them--publicly-funded energy conservation to save all fuels, aggressive pursuit of long-term natural gas supplies directly for Long Island, and greatly increased imports of Canadian hydropower--are on nobody's calendar today. The planning steps that are needed are those that will put them on the agenda.

ELECTRICITY

About one-third of Long Island's energy needs are provided by electricity. With the highest electric rates in the United States and a decade of guaranteed 5 percent rate increases in prospect, LILCO electricity presents Long Island with one of its major problems.

Overshadowing Long Island's future is the continuing burden of the cost of the Shoreham nuclear plant. Under the terms of the Shoreham Settlement, $4 billion amortized over the next 40 years will be charged to LILCO's electric ratepayers. The present value of the average householder's share of that bill -- the amount he would have to put in the bank now to make the additional future payments -- is about $2,800. For the first ten years of the agreement, the impact will be applied gradually through a "rate moderation component" by which, in effect, LILCO ratepayers borrow $570 million during the first five years and repay it during the second five years at 8 percent interest. The peak in future payments (which LILCO now proposes to turn into a three-year plateau) is reached in 1998. In that year, average electric rates will be about 14.5 percent higher than they would have been otherwise, which translates to an electric bill that is about $200 higher for the average residential customer and $1,875 higher for the average industrial/commercial customer.

In the absence of Shoreham's electricity, LILCO has been squeaking through its summer peak loads in the past few years. Partly depending upon purchased power, LILCO has been just able to meet the 18 percent reserve margin required by the New York Power Pool. The growing number of independent power producers operating cogeneration plants and incinerators on Long Island and the completion of a new New York Power Authority transmission link across Long Island Sound before the summer of 1991 will save LILCO from continuing to face the high risk of failing to meet peak summer loads.

In the near term, LILCO is planning a 150-megawatt addition to its generating capacity, probably to be provided by a natural-gas fueled combined cycle plant to be built by the New York Power Authority at Holtsville. In competition, the Long Island Power Authority is pushing plans to convert parts of the Shoreham plant to a gas-fired combined cycle plant as an alternative. LILCO is also under contract to buy Quebec hydropower from from the New York Power Authority beginning in 1995-96 to provide about 5 percent of its capacity.

Although LILCO has no announced plans to do so, several of LILCO's aging power plants will be due to be phased out during the 1990s, leaving a growing gap between its power requirements and its capacity. The gap can be filled by reducing the need through further energy conservation, by additional generating capacity on Long Island owned either by LILCO, the New York Power Authority, or independent power producers, or by additional electricity imports.

Energy conservation is the preferred solution, but there are questions as to how much energy can be saved at what cost and at what effect on electricity rates. Local cogeneration is the next best solution, but there are questions about the dependability of independent power producers. Any local electric generators are likely to be fueled by natural gas, and there is a question as to whether natural gas supplies will continue to be adequate. Quebec has huge potential for developing additional hydropower for export, but there is a question as to how it could reach Long Island.

Long Island's electric strategy should therefore be to develop all three options: more electric conservation, a more assured supply of natural gas, and more hydropower.

ENERGY CONSERVATION IN BUILDINGS

The principal impetus for conservation of electricity on Long Island is LILCO's demand-side management program. With an annual budget of about $30 million, LILCO has in the past few years developed programs both for shaving its peak loads and for saving energy. To be cost-effective, LILCO has concentrated on big commercial/industrial users and selective residential users. LILCO's costs and revenue losses from these programs are recovered as follows: approximately $35 million of direct program costs are built into base rates while another $7 million is recovered through the fuel adjustment clause. LILCO's 1991-92 programs will in effect cost its electric ratepayers another half-cent per kilowatt-hour, about $40 per year to the average residential customer who does not conserve.

Whether LILCO energy conservation program is sufficiently ambitious has been questioned. By the year 2000, LILCO's plan is expected to produce a 9 percent reduction in electric energy. The New York State Energy Office would like to see a 14 percent reduction which they estimate can be achieved at double the cost. The Long Island Power Authority contractor would add to that substantial gas savings at more than half again the State Energy Office cost. The Public Service Commission has ordered LILCO to sit down with its critics to see what it can do.

New York State also funds and manages a wide variety of energy conservation programs, paid for largely from the declining pool of petroleum overcharge restitutionary funds. In 1989, about $15.5 million was spent on Long Island. In proportion to its population, Long Island has received its bare share of State funding of these programs, principally by obtaining the lion's share of rebates for air conditioners, oil burners, and refrigerators. It has received a lesser share of some conservation programs such as those for agriculture, not-for-profit organizations, and institutions. The Long Island Power Authority has been urged by its contractor, Tellus Institute, to mount a demonstration program for institutional conservation on Long Island.

LOW-INCOME WEATHERIZATION

A casualty of energy conservation programs on Long Island has been the low-income population. Low-income families typically spend about a quarter of their income for energy, compared to about 7 percent for others. They cannot afford any contribution toward conservation measures. The low-income housing stock is often in dilapidated condition. Extensive home repairs may be necessary to protect the energy saving measures installed, and often new furnaces, boilers or roofs are needed. Moreover, the energy-using behavior of low-income people is typically very wasteful. Considering the cost, it is difficult to justify low-income conservation measures on the basis of cost-effectiveness.

A proposed low-income program in LILCO's 1990 demand-side management plan, together with similar programs throughout the State, was cancelled by the Public Service Commission pending a study of the problem. Under a recent Public Service Commission order, a three-year pilot program for low-income people will be instituted by the State's utilities under new guidelines. It will the first Public Service Commission program to deliver both gas and electric savings.

The program will be coordinated with the Weatherization Assistance Program administered by the New York State Department of State. This is a highly regarded program that has installed energy conservation measures in over 230,000 dwellings since its inception in 1977, by Federal law spending an average of $1,600 per house. At the rate of about 22,250 units weatherized in 1989, however, the Weatherization Assistance Program has more than a 60-year backlog.

Unfortunately, the Weatherization Assistance Program has been limited on Long Island. Nassau and Suffolk Counties are allocated about 7.2 percent of the State budget, about $2.37 million in 1990, but almost a third of that went unspent, apparently because of difficulties in keeping satisfactory local administrative organizations.

Weatherization Assistance Program funds are allocated to counties in part by the number of low-income residents there. This is measured by the eligibility standards of the Home Energy Assistance Program (HEAP) of the New York State Department of Social Services, which provides direct funding for home heating fuel to low-income families. Unfortunately, the HEAP standards do not take into account the difference in the local cost of living throughout the State. The Towns of Huntington and Islip have vainly proposed to the Weatherization Assistance Program that the eligibility standards of the U.S. Department of Housing and Urban Development (HUD) be substituted for the HEAP standards. The HUD standards do distinguish sections of the State by the local cost of living. The eligibility limits by the HUD standards are 70 percent higher than the HEAP standard for a single-person household on Long Island, and 28 percent higher for a family of three. The new Public Service Commission low-income program will unfortunately also use the HEAP standards.

Thus, there are three strikes on low-income families needing energy conservation on Long Island:

1. The county allocation formula does not take into account the higher cost of living on Long Island.

2. The money that is allocated is not being fully used.

3. The electric energy they are not saving is more expensive here than elsewhere.

At the same time, the electricity rates of low-income families include the cost of conservation measures paid for others by LILCO, that is, large companies and families with central air conditioning and swimming pools.

COGENERATION AND INDEPENDENT POWER PRODUCERS

Efficiency in electricity production is as important as its efficient use by customers. The fuel for generating electricity is most efficiently used when the heat produced also serves a useful purpose. The Public Utility Regulatory Policies Act of of 1978 encourages cogeneration of steam and electricity by industry by requiring utilities to buy the electricity at reasonable prices. The New York State Alternate Energy Act of 1980, the "six-cent law," guarantees a rate of six cents per kilowatt-hour of energy delivered to the utility.

This legislation is changing the face of the electric utility industry. Large companies like LILCO are depending increasingly on cogenerated electricity produced by independent power producers. As of May 1990, eleven cogeneration projects to generate a total of 695 megawatts of electricity were identified as under construction or in planning. Proposals for others continue to be announced.

However, LILCO considers only about 300 of this 695 megawatts potential as "secure." The public utility industry is clearly uncomfortable with depending upon small new companies with no track records. In the industry view, the growth in non-utility generation could quickly stall if there were significant changes in the cost of capital or the ability to obtain natural gas.

Independent power producers proposing to LILCO must make their own arrangements for fuel -- which in all of the eleven identified projects has been natural gas -- and then work a deal with LILCO to have it delivered. With the near-term supplies of gas to Long Island less than adequate for both increased electric generation and the customary retail use, LILCO is in effect in competition with its own electric suppliers for fuel.

From the standpoint of energy efficiency, cogeneration by independent power producers is to be encouraged. New York State independent power producers complain that the favored tax status of the New York Power Authority gives it unfair advantage in competitive bidding. New York State legislation that has been introduced to assure a more level playing field should be supported.

NATURAL GAS SUPPLY

Natural gas is not only the favored fuel for cogeneration on Long Island. Of the other 66 cogeneration plants planned for New York State, almost 90 percent will burn natural gas. Both the combined cycle plant proposed by the New York Power Authority for LILCO and the proposed Shoreham conversion would use natural gas. Nationwide, the utility industry is turning to natural gas.

Compressed natural gas (CNG) vehicles are being widely introduced, and they can help to reduce Long Island's dependence upon gasoline. Natural gas furnaces can replace those using oil. Natural gas appliances can replace those using electricity. Recently developed natural gas heat pumps for residences may reduce the need for electricity to meet summer peak cooling loads.

Whether natural gas supplies will continue to be adequate to meet this growing demand is a question. The Northeast is dependent primarily upon pipelines from the Gulf States and the Canadian West. The interstate natural gas pipeline infrastructure serving the New York State is inadequate. The expected expansion into new markets, such as cogeneration and primary fuel for power plants, cannot occur without significant capacity additions including new pipelines.

The Iroquois pipeline that will bring natural gas to Long Island across Long Island Sound will increase LILCO's supplies by about one-eighth, not enough for power plant fuel as well as expansion for retail users. The capacity of Iroquois can be doubled with additional pumping stations, and at least one other gas pipeline will probably reach Long Island's south shore within a decade. Nevertheless, Long Island will remain at the tail end of the pipelines.

An alternative to pipeline gas for Long Island is imported liquefied natural gas (LNG). It is likely that facilities for importing LNG to the Northeast from Europe or Africa will be expanded in the next two decades. Long Island could make use of its coastal location, as it now does to import oil, to establish an LNG import terminal. Considering Long Island's history of siting energy facilities, of course, it would take a courageous entrepreneur to make the endeavor. There is little risk in beginning to develop the option, however, and the New York State Energy Research and Development Authority should be asked to study the feasibility, economics, and safety of such an enterprise. The New York State Department of Environmental Conservation should be urged to publish its standards for siting new LNG facilities implementing legislation that was passed in 1976.

THE GREENHOUSE EFFECT

Although it is not yet acknowledged by the U.S. Federal government, there is a virtual consensus in the international community of climatologists that the earth's climate is changing as a result of the greenhouse effect. Except for the U.S., Russia, and China, most of the industrial nations of the world have committed themselves to a policy of stabilizing or reducing greenhouse gas emissions. These include Japan, Germany, Britain, Canada, France, Italy, Australia, the Netherlands, Belgium, Denmark, Finland, Sweden, Norway, Switzerland, Ireland, and New Zealand.

Without presuming to judge the scientific merits of the question, it would be imprudent under the circumstances for an energy plan for the next twenty years not to include measures for greenhouse gas emission restrictions.

The steps needed to reduce greenhouse gas emissions are, fortunately, much the same as otherwise recommended in this plan, beginning with promoting energy conservation and efficient energy use, and underscoring the need to substitute natural gas for other fossil fuels. The final major step is the substitution of renewable energy for fossil energy.

It is in the justification for renewable energy that most of the difference in energy prospects occurs. Energy conservation is largely worth doing anyway on economic or other environmental grounds. Additional energy conservation to reduce greenhouse emissions will become more and more expensive, however. On the other hand, most renewable energy is now too expensive, for example, for electric generation. With further development and wider use, however, it should become progressively less expensive.

Long Island is not richly endowed with renewable resources. The renewable energy technologies that have so far contributed most to providing energy are rooftop solar water heating panels and municipal waste incinerators. Ethanol mixed with gasoline is now being introduced to Long Island.

In the future, declining costs may make photovoltaic panels, wind turbines, and solar thermal electricity more competitive here. Other renewable technologies that may find applications elsewhere are not likely here: wet or dry geothermal energy, biomass for electricity or heat, wave or tidal power.

The major potential source of renewable energy for Long Island is hydroelectric power imported from upstate New York and Quebec.

Half of the renewable energy in the U.S. today comes from hydroelectric dams. Long Island receives some of this energy from the New York Power Authority plants at Niagara Falls. This is extraordinarily cheap energy, about two cents per kilowatt-hour. The hydroelectric power that LILCO will begin receiving from Quebec in 1995-96 at about 7 or 8 cents per kilowatt-hour is priced to be lower than the avoided costs of New York State utilities. Future prices of Quebec hydropower are negotiable. The cost of new construction is rising, but on the other hand Quebec's export price to the neighboring province of Ontario has been about one-third less than to New York. However, there is little enthusiasm among New York State utilities for purchasing additional Canadian hydropower, and there are technical problems. One problem is the capacity of transmission lines connecting Long Island to the mainland.

The New York Power Authority cable to be completed in early 1991 will make it possible to import Quebec hydropower later in the decade. According to modeling studies performed by the New York State Energy Office, however, the connection between Long Island through ConEd to the rest of the New York Power Pool will remain the most heavily loaded interconnection in the State. Long Island is in effect an appendage of the New York Power Pool. This isolation has led LILCO to argue in the past that it needs a 30 percent safety margin for its installed power rather than the 18 percent that is required by the New York Power Pool. An alternative to greater generating capacity on Long Island, however, would be better integration into the regional power pools. This would seem to be possible by making better connections with the New England Power Pool the 10 to 25 miles across Long Island Sound.

A connection now exists between Northport and Norwalk, Connecticut, with a capacity of up to 286 megawatts. However, Norwalk is not strongly connected with the rest of the New

England Power Pool. Within the New England Power Pool, there is a major transmission line to New Haven, which is about 20 to 25 miles from Port Jefferson and Shoreham. At Millstone there are four 345-kva transmission lines about 12 miles from Orient Point. To determine how well Long Island might link up with this system requires an analysis of the power flows that might result.

Studies in Quebec indicate that further exports of Quebec hydropower are more likely to be made to New England than to New York because of the comparative costs of making the connections. To position itself for greenhouse gas emission restrictions, Long Island should develop stronger transmission ties with the New England Power Pool.

SUMMARY OF RECOMMENDATIONS

ENERGY CONSERVATION

1. Policy: Promote energy conservation of all fuels.

Action:

Support Public Service Commission initiatives to conserve gas as well as electricity.

Support any legislation to broaden the authority of the Public Service Commission to include conservation of oil.

Appoint a Conservation Facilitator to promote conservation and assure that Long Island capitalizes on State and Federal funding for conservation.

Require an energy audit with prescription for corrective action before sale of any home can take place.

Effect conservation in county and town buildings as examples of energy-efficient construction and maintenance.

Cooperate in any effort to bring together Long Island resources for the development and manufacture of a new generation of energy-efficient housing.

2. Policy: Foster cogeneration projects by legislation favorable to independent power producers.

Action:

Support the continuation of the New York State Alternate Energy Act of 1980, the "six-cent" law.

Support legislation assuring a "level playing field" for independent power producers vis-a-vis the New York Power Authority.

3. Policy: Decouple energy conservation from electricity rates.

Action: Support the Public Service Commission initiative to allocate rate increase due to conservation to the customers or class of customers benefitting.

HYDROELECTRIC POWER

Policy: Bring more hydroelectric power to Long Island.

Action:

Propose to the New York State Public Service Commission that a minimum percentage of the generating capacity (installed or purchased) of New York State utilities be provided by renewable energy, beginning with 10 percent, to prepare for greenhouse gas emission restrictions.

Coalesce the political force needed to mount a major effort in the New York State legislature to secure more northern New York State hydropower for Long Island.

Request that New York State Energy Research and Development Authority sponsor a study of expanding imports of Quebec hydropower to Long Island, including the possibility of connections through the New England Power Pool.

CONSERVATION IN TRANSPORTATION

Policy: Reduce oil consumption on Long Island.

Action:

Assist employers in establishing company commuter programs that would help employees set up car and van pools, coordinate work hours among companies, and act as advocates for conservation.

Support the establishment of a fourth lane for Long Island Expressway as a high occupancy land for car and van pools and buses.

Encourage the enforcement of the 55 mph speed limit.

Encourage the use of telecommuting by requesting a New York State Energy Research and Development Authority study of telecommuting on Long Island.

Encourage the use of compressed natural gas as a motor fuel for fleet vehicles.

INTRODUCTION

In the aftermath of the controversy over the Shoreham nuclear power plant, Long Island faces serious energy problems. Electricity costs on Long Island are the highest in the country, and the Shoreham settlement guarantees that they will become disproportionately higher for at least the next decade. More than almost any other part of the country, Long Island depends upon imported oil for electricity generation and heating as well as transportation. Natural gas, which is moderately priced, is unavailable to large portions of Long Island because of inadequate local supply.

The Long Island Lighting Company's aging electric generating plants are supplemented by inadequate transmission connections to the New York Power Pool. A new cable across Long Island Sound to be completed in 1991 will relieve this constraint on the importation of electricity for summer peak loads and on possible future supply of less expensive upstate and Canadian hydropower, but, arguably, only temporarily.

Long Island lies at the end of the natural gas pipelines that originate in the Gulf States and western Canada. The amount of gas that reaches the Island, primarily through a single pipeline, is insufficient to serve most of Eastern Suffolk and many possible closer customers. A branch of the proposed Iroquois pipeline through Long Island would increase gas supply by only about one-eighth.

Except for incinerators, all of the new electric generators to be built on Long Island in the next decade are intended to be fueled with natural gas. Indeed, the utilities in the statewide New York Power Pool are planning on natural gas to fuel about 80 percent of new electricity generators. However, the interstate natural gas pipeline infrastructure serving New York State is inadequate; the expected expansion of natural gas into new markets, such as cogeneration and power plants, cannot occur without significant capacity additions including new pipelines.[1]

Finally, with virtually no local renewable energy sources planned other than municipal waste incinerators, Long Island is poorly prepared for possible greenhouse gas restrictions. Canadian hydropower is anticipated to provide no more than 5 percent of LILCO's capacity. Cheaper Niagara hydropower continues to be allocated by New York State primarily to upstate customers.

Long Island thus faces the next two decades with a choice of overpriced electricity, scarce natural gas, or continued dependence on imported oil. Or energy conservation.

Progress in energy conservation has largely stalled since the mid-1980s when government financial incentives ran out and oil prices were low. A modest conservation assistance program continues in New York State using up petroleum overcharge restitutionary funds. The major force driving future conservation efforts on Long Island is LILCO's demand-side management program which is concerned exclusively with electricity. LILCO's costs in promoting this program are paid by further raising the cost of its electricity, thus exacerbating for many the problem that conservation was meant to relieve. The most severely penalized ratepayers are Long Island's low-income people for whom energy conservation has been found to be not "cost-effective."

In trying to reduce its dependency upon imported oil and in seeking to assure itself a future share of natural gas, Long Island confronts a widely shared problem. In facing a decade or more of steeply rising electricity prices, Long Island is alone.

Present Energy Situation

To put Long Island's energy use into perspective, an estimate of the main energy flows in 1989 is shown in Figure 1. As indicated in the left side of the figure, about three-quarters of Long Island's energy arrives in the form of petroleum. By comparison, 42 percent of all energy consumed in the U.S. is petroleum. About 17 percent of Long Island's energy arrives as natural gas, less than the 24 percent national average.

About 7 percent of Long Island's energy imports is electricity, measured by the energy content of the fuel burned to generate it or its equivalent in hydroelectric or nuclear power. About 4 percent is nuclear power, compared to the national average of 7 percent, and 2.3 percent is hydroelectric, compared to 3.5 percent nationally.

Coal, which provides 23 percent of U.S. energy, is no longer used on Long Island in significant amounts. Other minor sources of energy, such as propane and wood, are not represented in the figure.

The center portion of Figure 1 shows the portion of petroleum and natural gas that are burned here to generate electricity. The end-uses served by petroleum, electricity, and natural gas are shown on the right.

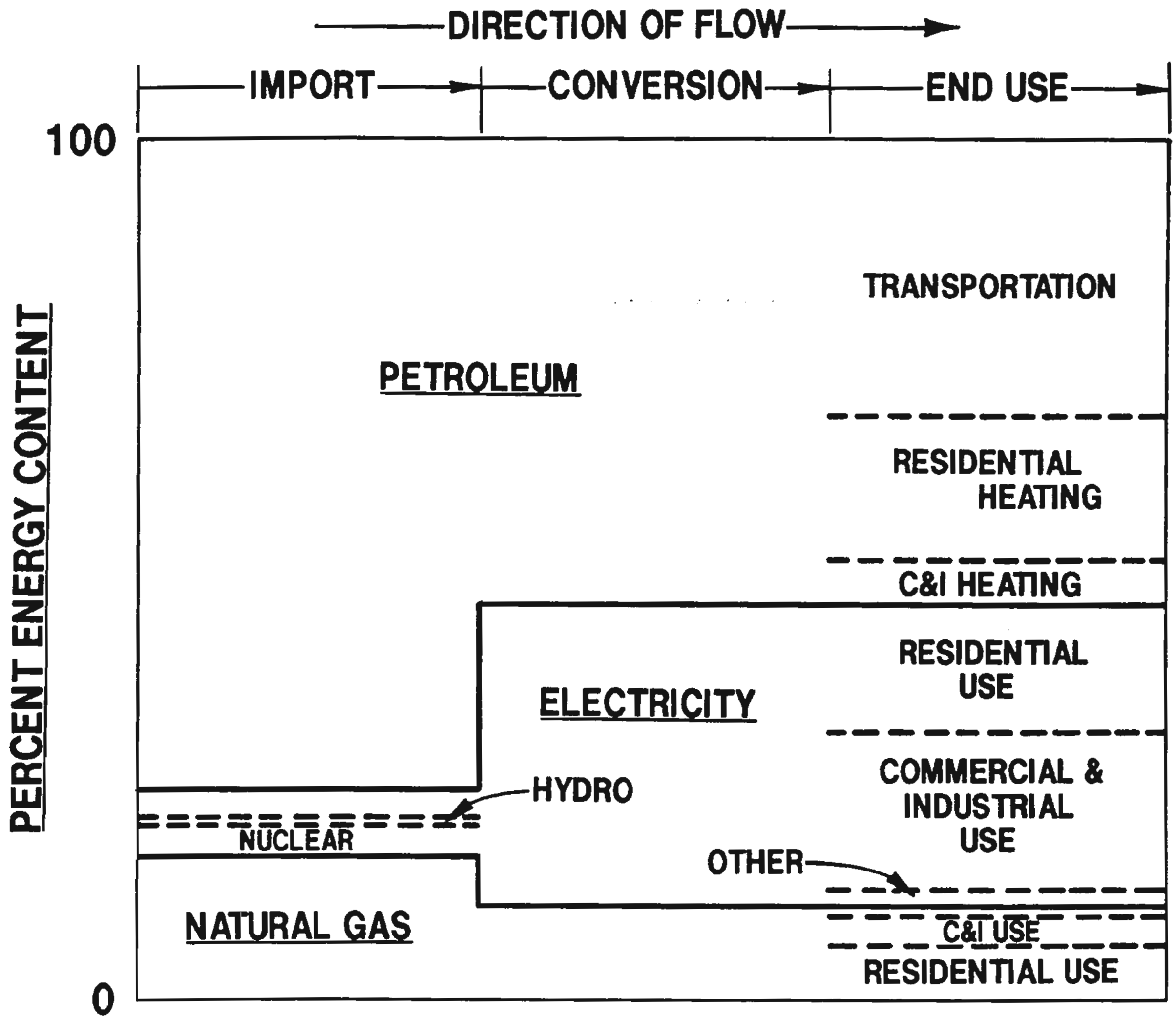


Figure 1. Main Energy Flows on Long Island

More than half the petroleum used on Long Island is used for transportation, with residential heating the next most important use, followed by heating of commercial and industrial establishments. Natural gas provides a relatively small amount of residential heating, in contrast with the national situation where gas is used more for home heating than oil.

Electricity, which is used a bit more for commercial and industrial purposes than to meet residential needs, meets about one-third of Long Island's end-use requirements. It is the cost of this electricity -- present and prospective -- that makes electricity a major problem for Long Island.

LILCO electricity prices are compared in Table 1 with those of the twenty-four other major electric utilities in the Northeast: New England, New York, New Jersey, and Pennsylvania. LILCO's price is highest for each category of customer: residential, commercial, and industrial.

How much higher is illustrated in Figure 2 which lists the utilities in order of their industrial energy price. LILCO's price of 14.61 cents per kilowatt-hour is followed by Con Ed at 12.77 and Commonwealth Electric (of Massachusetts) at 10.39 cents per kilowatt-hour. The price of all the remaining 22 utilities is less than 9 cents per kilowatt-hour, less than two-thirds of LILCO's price.

The variation in price among New York State utilities, labeled in Figure 2, is also worth noting. LILCO and Con Ed, almost two cents per kilowatt-hour lower in price, top the list. Rochester Gas and Electric is the median utility, thirteenth in order of the 25. All of the remaining New York State utilities are below the median in cost.

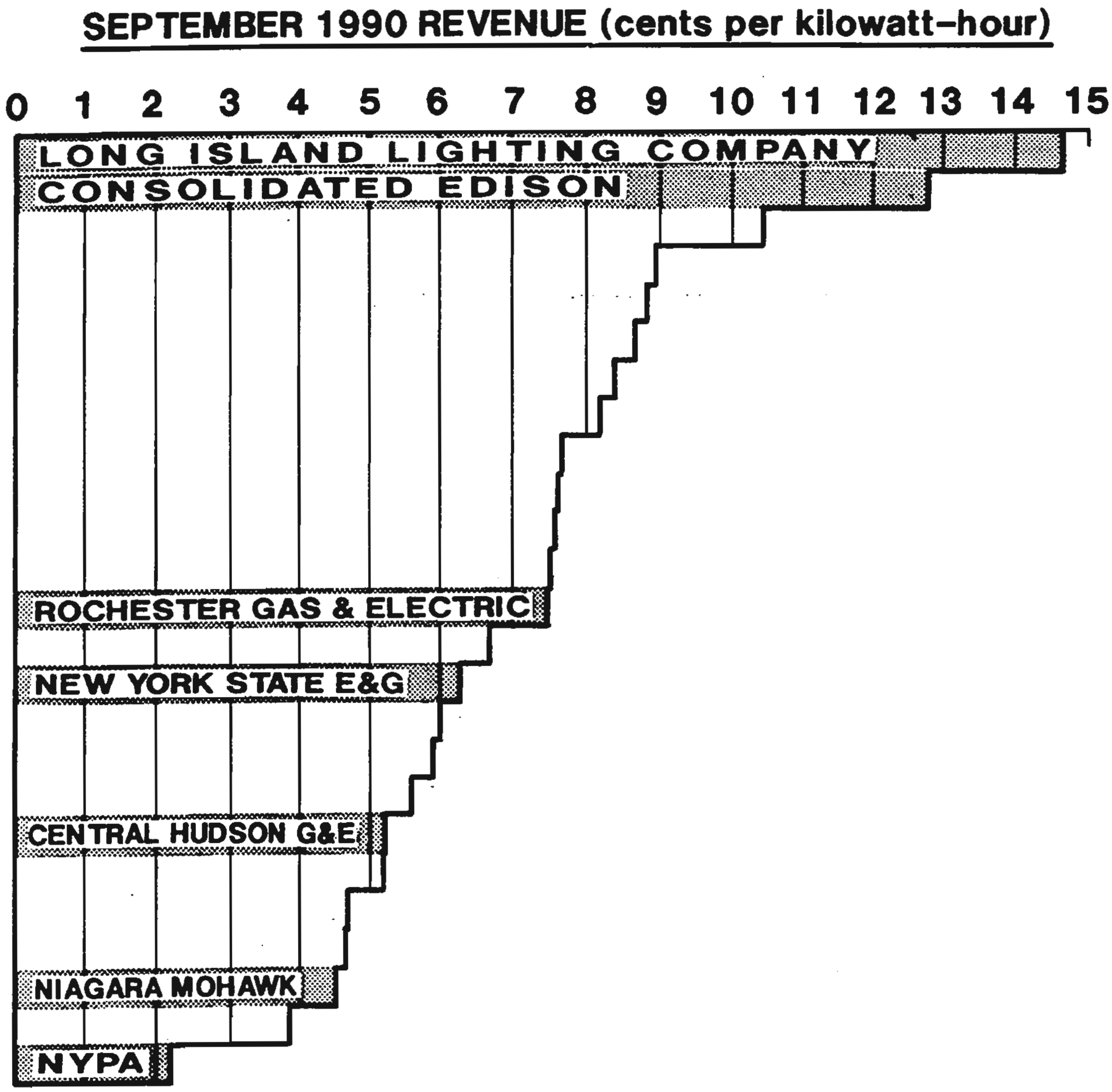
Most dramatic of all is the contrast between industrial electricity prices in the Northern and Southern ends of the State. LILCO's price is almost seven times that of the New York Power Authority's 2.14 cents per kilowatt-hour.

Table 1. Electricity Prices in the Northeast
(Ranked by Revenue per Kilowatt-Hour from Industrial Customers)

Utility	State	September 1990 Revenue Cents per kilowatt-hour Resid'l	Comm'l	Indust'l
Long Island Lighting	**NY**	**14.86**	**14.32**	**14.61**
Consolidated Edison	**NY**	**14.08**	**12.54**	**12.77**
Commonwealth Electric	MA	13.69	12.75	10.39
Narragansett Electric	RI	10.12	9.56	8.92
United Illuminating	CT	11.58	10.34	8.79
Western Mass. Electric	MA	11.47	9.59	8.62
P.S. New Hampshire	NH	10.40	9.16	8.36
Boston Edison	MA	10.40	9.57	8.18
Philadelphia Electric	PA	14.04	12.78	7.62
Jersey Central P&L	NJ	11.24	9.34	7.57
Public Service E&G	NJ	10.98	9.24	7.54
Connecticut L&P	CT	9.94	8.69	7.49
Rochester G&E	**NY**	**9.76**	**10.06**	**7.46**
Bangor Hydro-Electric	ME	9.64	8.93	6.64
New York State E&G	**NY**	**10.16**	**8.40**	**6.23**
Central Vermont Pub.Serv.	VT	10.77	8.90	5.97
Pennsylvania P&L	PA	8.21	7.60	5.86
Metropolitan Edison	PA	8.25	7.10	5.56
Central Hudson G&E	**NY**	**10.48**	**8.35**	**5.18**
Central Maine Power	ME	9.24	7.41	5.16
Green Mountain Power	VT	7.92	5.76	4.61
Pennsylvania Electric	PA	8.06	6.87	4.60
Niagara Mohawk Power	**NY**	**9.07**	**8.34**	**4.49**
West Pennsylvania Power	PA	5.46	4.81	3.79
New York Power Authority	**NY**	**NA**	**NA**	**2.14**

Source: U.S. Energy Information Administration (1990)

Figure 2. Comparison of Electricity Prices to Industry Among 25 Northeastern Utilities



Source: U.S. Energy Information Administration, Form EIA-826 (1990)

THE SHOREHAM SETTLEMENT

Overshadowing Long Island's energy future, the Shoreham settlement between New York State and the Long Island Lighting Company (LILCO) will tax LILCO's electricity customers $4 billion. For whatever reason, the cost of the Shoreham settlement has been allocated to LILCO electricity rates, and therefore to LILCO electricity ratepayers, as opposed, say, to all LILCO customers including gas ratepayers, LILCO stockholders, or all residents of Long Island or New York State. The $4 billion settlement will cost the average household about $2,800. This means that the average householder would have to deposit about $2,800 in the bank now if the account were used only to cover his additional payments over the next 40 years.[2]

The impact of this cost is postponed by a "rate moderation agreement" by which ratepayers in effect borrow now and repay later at interest. At the conclusion of this adjustment period in 1998, electricity rates will be about 15 percent higher than without the cost of Shoreham, as shown in Figure 3. For the average residential ratepayer, this means an increase in his annual bill of about $200. For the average commercial/industrial ratepayer, the increase is about $1,875 that year. (See Appendix H for details.)

Clearly, LILCO's problems become Long Island's problems.

The effect of this allocation of the Shoreham cost is to distort local energy decisions against the use of LILCO electricity. In part, this leads simply to cost evasion. By New York State law, companies using more than 400 kilowatts can switch to New York Power Authority electricity if they can demonstrate that it will create jobs or keep them in New York State.[3] Two of Long Island's largest electricity users, Brookhaven National Laboratory and Grumman, had already done so. Three Long Island communities that originally generated their own power are also served by the New York Power Authority;[4] conceivably, other communities could follow suit.[5] As a result of any such evasions, the cost of the Shoreham settlement will be allocated to the remaining LILCO electricity ratepayers.

While a case can apparently be made for aiding individual companies in the common interest, Long Island's energy future should not be based simply on ways to evade LILCO electricity. The cost of Shoreham presumably will not go away, it will simply be borne more inequitably.

Nevertheless, overpriced LILCO electricity should encourage energy conservation and switching to natural gas, and to that extent it may ironically serve Long Island's future energy interests.

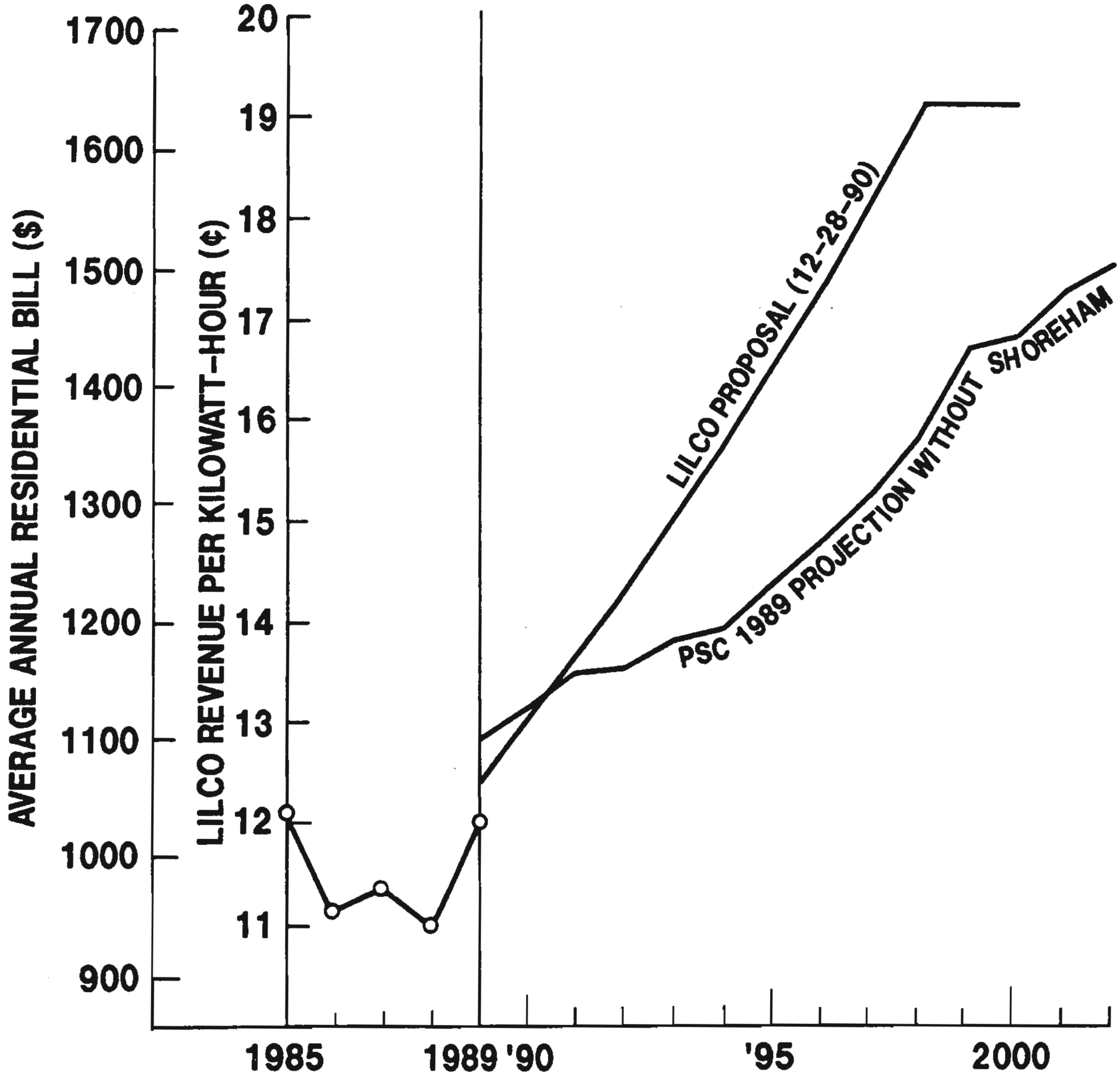


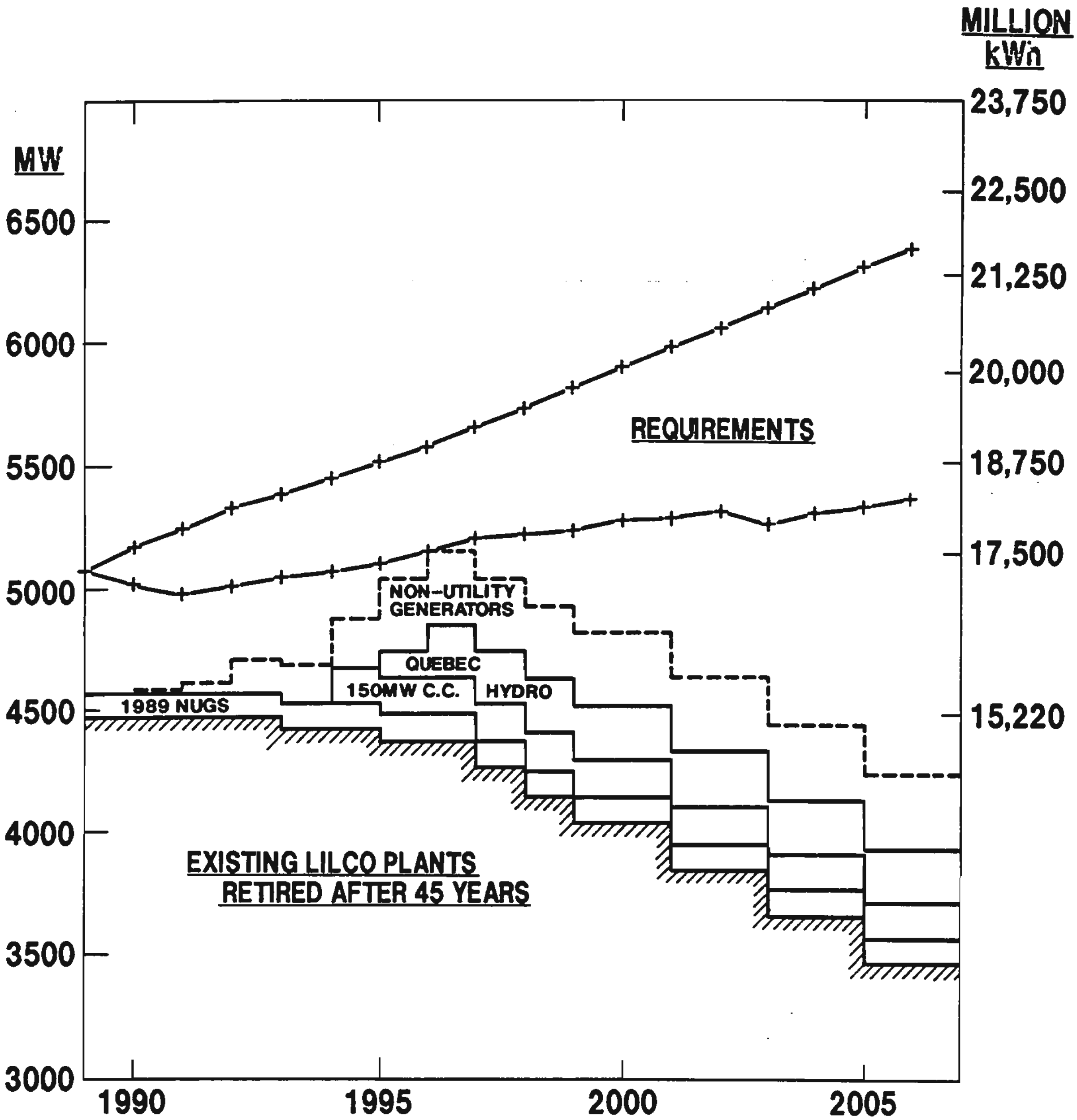
Figure 3. Projections of LILCO Electricity Rates

ELECTRICITY DEMAND PROJECTION

Long Island's need for additional electrical capacity is contingent upon a number of uncertainties: uncertainty in the impact of demand-side management, the extent of "natural" energy conservation that takes place without LILCO assistance, the number of cogeneration plants that are developed, and the extent of New York Power Authority sales in LILCO territory, as well as economic uncertainty. Based on a comparison of LILCO's projections with those of the New York State Energy Office and the U.S. Energy Information Administration, the most likely range of electricity requirements is shown in Figure 4. The range shown is LILCO's base projection, with and without estimated conservation including that resulting from their demand-side management program.

The rationale for this estimate and other energy demand projections is detailed in Appendix A.

Figure 4. Long Island Electrical Capacity vs. Requirements



ELECTRIC GENERATION AND TRANSMISSION

To meet its electricity needs, Long Island has some new technical options, new procedures, some -- but perhaps not enough -- new organizations, and mostly the same old powerplants.

Electric Generation

Most of LILCO's power comes from 13 steam-electric power plants, ranging in age from 23 to 42 years, a total of 2,718 megawatts of capacity that burns heavy oil (Table 2). For peaking power, there are 15 combustion turbines of 1,359 megawatts capacity that burn light distillate oil or natural gas. The fuel for these units, together with three diesel engine plants of 20 megawatts capacity, consisted in 1989 of 83 percent oil and 17 percent natural gas. LILCO owns 194 megawatts capacity of a nuclear power plant, Nine Mile 2, located upstate. Coal is no longer used.

Table 2. LILCO Generating Facilities in 1989

Source: New York Power Pool, Load and Capacity Data, 1990-2006, pp. 22, 23.

STATION	UNIT	LOCATION	SERVICE DATE MO/YR	TYPE	FUEL PRI	FUEL METHOD OF HANDLING	FUEL MAX STOR CAPACITY (X1000)	FUEL ALT	FUEL TIME LIMIT ON USE	FUEL METHOD OF HANDLING	FUEL MAX STOR CAPACITY (X1000)	CAPABILITY (MW) SUM	CAPABILITY (MW) WIN	COOL SYS	UNIT AVAIL HRS 1989	1989 AVERAGE HEAT RATE (BTU/KWH)	1989 AV PROD COST (MILLS/KWH)	1989 ENERGY NET (GWH)
NORTHPORT	1	NORTHPORT	07/67	ST	S	W	2009 BBLS	-	-	-	-	383	383	A	7311	10438	#3 32.00	2036.5
NORTHPORT	2		06/68	ST	S	W		-	-	-	-	384	383	A	5997	10041	32.00	1792.6
NORTHPORT	3		07/72	ST	S	W		-	-	-	-	370	370	A	6761	10536	32.00	1935.2
NORTHPORT	4		12/77	ST	S	W		-	-	-	-	379	379	A	8028	10024	32.00	2153.4
NORTHPORT	GT		03/67	CT	K	T	2.3 BBLS	-	-	-	-	15	19	C	5165	17444	#2	0.9
PORT JEFF	1	PORT JEFFERSON	12/48	ST	S	W	643 BBLS	-	-	-	-	48	47	A	8351	14355 #4	35.60	250.4
PORT JEFF	2		10/50	ST	S	W		-	-	-	-	46	46	A	8098	14355	35.60	#1
PORT JEFF	3		11/58	ST	S	W		-	-	-	-	194	192	A	8052	10214	35.60	1047.0
PORT JEFF	4		11/60	ST	S	W		-	-	-	-	194	194	A	7590	10176	35.60	983.5
PORT JEFF	GT		12/66	CT	K	T	2.3 BBLS	-	-	-	-	16	20	C	8583	16645	#2	2.9
GLENWOOD	4	GLENWOOD	12/52	ST	S	W	147 BBLS	G	NONE	F	-	110	110	A	8338	11387	35.50	558.8
GLENWOOD	5		11/54	ST	S	W		G	NONE	F	-	110	106	A	7866	11834	35.50	539.5
GLENWOOD	1		04/67	CT	K	T	45.2 BBLS	-	-	-	-	16	20	C	6822	13659 #4	79.00	59.8
GLENWOOD	2&3		06/72	CT	K	W		-	-	-	-	107	135	C	6005	13659	79.00	#1
BARRETT	1	ISLAND PARK	11/56	ST	S	W	480 BBLS	G	NONE	F	-	192	192	A	4076	10618	36.50	602.4
BARRETT	2		11/63	ST	S	W		G	NONE	F	-	193	193	A	6714	10432	36.50	1008.5
BARRETT	1-8		07/70	CT	K	T	23.8 BBLS	G	NONE	F	-	126	160	C	7793	15724 #4	30.10	243.4
BARRETT	9-12		08/70	CT	K	T		G	NONE	F	-	166	206	C	7915	15724	30.10	#1
F.ROCKAWAY	4	F.ROCKAWAY	12/53	ST	S	W	50.0 BBLS	G	NONE	F	-	115	115	A	7970	10691	37.80	556.9
SHOREHAM	1	SHOREHAM	07/71	CT	K	T	22.6 BBLS	-	-	-	-	47	62	C	7433	13139 #4	#2	32.6
SHOREHAM	2	SHOREHAM	04/66	CT	K	T		-	-	-	-	17	21	C	8475	13139		#1
SHOREHAM EMD	1-4		09/88	IC	K	T		-	-	-	-	8	8	C				#1
W.BABYLON	4	W.BABYLON	07/71	CT	K	T	11.6 BBLS	-	-	-	-	48	63	C	7009	13044	72.90	35.5
SOUTHOLD	1	SOUTHOLD	08/64	CT	K	T	2.9 BBLS	-	-	-	-	14	17	C	8278	19797	#2	1.4

TYPE OF UNIT

ST - Steam Turbine (Non Nuclear)
SB - Steam (BWR Nuclear)
SP - Steam (PWR Nuclear)
SH - Steam (HGTR Nuclear)
IC - Internal Combustion
CT - Combustion Turbine
HY - Conventional Hydro
PS - Pumped Storage

TYPE OF PRIMARY AND ALTERNATE FUEL

C - Coal
G - Natural Gas
E - Synthetic Gas
K - Middle Distillate Oil
(No. 1,2 Oil,Kerosene,Jet Fuel)
S - Heavy
(No. 4,5,6 Oil,Bunker & Crude)
N - Nuclear
Q - Median Hydro
L - Adverse Hydro

METHOD OF HANDLING

W - Water Transportation
T - Truck
R - Rail
F - Pipeline
B - Conveyer

TYPE OF COOLING SYSTEM

A - Once Through Cooling
B - Natural Draft Cooling Tower
C - Air

Table 2. LILCO Generating Facilities in 1989 (cont'd)

STATION	UNIT	LOCATION	SERVICE DATE MO/YR	TYPE	FUEL PRI	FUEL METHOD OF HANDLING	FUEL MAX STOR CAPACITY (X1000)	FUEL ALT	FUEL TIME LIMIT ON USE	FUEL METHOD OF HANDLING	FUEL MAX STOR CAPACITY (X1000)	CAPABILITY (MW) SUM	CAPABILITY (MW) WIN	COOL SYS	UNIT AVAIL HRS 1989	1989 AVERAGE HEAT RATE (BTU/KWH)	1989 AV PROD COST (MILLS/KWH)	1989 ENERGY NET (GWH)
S.HAMPTON	1	S.HAMPTON	03/63	CT	K	T	2.9 BBLS	-	-	-	-	11	14	C	8311	21321	#2	2.1
MONTAUK	2-4	MONTAUK	04/61	IC	K	T	.8 BBLS	-	-	-	-	6	6	C	8647	10095	86.50	2.3
E.HAMPTON	1	EAST	12/70	CT	K	T	3.1 BBLS	-	-	-	-	21	25	C	8743	13618 #4	70.00	.12.0
E.HAMPTON	2-4	HAMPTON	12/62	IC	K	T	1.3 BBLS	-	-	-	-	6	6	C	8529	13618	70.00	2.8
HOLTSVILLE	1-5	HOLTSVILLE	07/74	CT	K	W,F	-	-	-	-	-	243	322	C	7926	13320 #4	73.10	375.1
HOLTSVILLE	6-10		07/75	CT	K	W,F		-	-	-	-	253	336	C	8254	13320	73.10	#1
WADING RI	1-3	SHOREHAM	07/89	CT	K	T	42.9 BBLS	-	-	-	-	247	316	C	3610	12136	#2	214.4
NINEMILE	2	SCRIBA	04/88	SB	N	-	-	-	-	-	- #5	194	194	B	4826	11170	41.10	771.0

TOTAL LILCO	SUMMER	WINTER
ST - STEAM TURBINE (OIL)	2718	2710
SP - STEAM (BWR NUCLEAR)	194	194
IC - INTERNAL COMBUSTION	20	20
CT - COMBUSTION TURBINE	1347	1736
	4279	4660

NOTE #1 - NET ENERGIES PROVIDED IN COMBINED TOTALS.
NOTE #2 - ACTUAL GENERATION DOES NOT RESULT IN A TRULY REPRESENTATIVE PRODUCTION COST.
NOTE #3 - PRODUCTION COST PROVIDED BY TOTAL STATION RATHER THAN UNIT.
NOTE #4 - HEAT RATE PROVIDED BY TOTAL STATION.
NOTE #5 - LILCO'S SHARE (18 PERCENT OF JOINTLY OWNED UNIT).

TYPE OF UNIT

ST - Steam Turbine (Non Nuclear)
SB - Steam (BWR Nuclear)
SP - Steam (PWR Nuclear)
SH - Steam (HGTR Nuclear)
IC - Internal Combustion
CT - Combustion Turbine
HY - Conventional Hydro
PS - Pumped Storage

TYPE OF PRIMARY AND ALTERNATE FUEL

C - Coal
G - Natural Gas
E - Synthetic Gas
K - Middle Distillate Oil
(No. 1,2 Oil,Kerosene,Jet Fuel)
S - Heavy
(No. 4,5,6 Oil,Bunker & Crude)
N - Nuclear
Q - Median Hydro
L - Adverse Hydro

METHOD OF HANDLING

W - Water Transportation
T - Truck
R - Rail
F - Pipeline
B - Conveyer

TYPE OF COOLING SYSTEM

A - Once Through Cooling
B - Natural Draft Cooling Tower
C - Air

In addition, LILCO had in 1989 "firm purchase system capability" of 400 megawatts. This consists mainly of the following sources:[6]

Independent power producers	116 megawatts
New York State Electric & Gas	107
New York Power Authority	
Fitzpatrick	77
Blenheim-Gilboa	50
Municipal systems	
Freeport and Rockville Centre	34

The decisions as to how the life of LILCO's plants will be extended or how they will be replaced will be guided by the New York Power Pool Integrated Planning Strategy within the framework of New York Public Service Commission and local regulations. "Article VIII" of the New York State Public Service Law, which established the rules for power plant construction during the Shoreham era, has expired.

A goal of the NYPP Strategy is to defer the need for major new power plants owned by utilities. In the absence of the failure of a major plant, the Power Pool anticipates that it will be economical to keep "almost all" of the existing power capacity operating through 2005 (at which time LILCO's plants would be between 38 and 57 years old with an average age of 47 years).[7] This policy is questioned by the New York State Energy Office, whose calculations indicate that it would be cheaper if nine of LILCO's 13 steam-electric plants were replaced [8], and by the New York State Department of Environmental Conservation which favors retiring plants that do not meet newer air pollution standards at age 45.

The typical book life assumed in the electric utility industry is 40 years.[9] For the sake of comparing LILCO installed generating capacity with projected energy requirements in Figure 4, major steam-electric plants are assumed to be retired after 45 years.

The addition of new generating plants is taking place during a period of revolutionary change in the electric utility industry. By direction of the Public Service Commission, a system of competitive bidding conducted by the individual utilities is expected to provide a major portion of future resource capacity requirements.[10] Bidders may include independent power producers (IPP), purveyors of demand-side management (DSM) packages, and other utilities in or out of the State including the New York Power Authority. A utility can bid on its own requirements, but the procedures are onerous to avoid compromising the process.

Under the U.S. Public Utilities Regulatory Policies Act of 1978, utilities are required to purchase electricity from independent power producers that is produced by cogeneration. Independent power producers also benefit from the New York State Alternate Energy Act of 1980, the "six-cent law" which guarantees a rate of six cents per kilowatt-hour of energy

Independent power producers also benefit from the New York State Alternate Energy Act of 1980, the "six-cent law" which guarantees a rate of six cents per kilowatt-hour of energy delivered to the utility. On the other hand, independent power producers complain that the favored tax status of the New York Power Authority gives it an unfair advantage in competitive bidding, and New York State legislation has been introduced to provide a more "level playing field."

It should be noted that at six cents per kilowatt-hour, electricity generated by independent power producers is the cheapest power the utilies can buy. According to LILCO data, it is less expensive than the cost of generating energy using combustion turbines, although it is not, of course, similarly available on demand. It is not as cheap as electricity generated by LILCO's base load steam-electric plants, which costs about three-and-a-half cents per kilowatt-hour. However, it is more efficient in its use of fuel. Taking the useful heat generated into account, cogeneration plants may use up to 60 percent or more of the energy content of the fuel, compared to about 33 percent in the most efficient Northport plant. Cogeneration on Long Island is therefore to be encouraged.

As of May 1990, 19 small power projects under LILCO totaling 800 megawatts of electric power were identified as under construction or in planning, including 11 cogeneration projects (695 megawatts) and 4 incinerators (85 megawatts). LILCO considers that only 300 megawatts of this is "secure," however, including all the incinerators. Figure 4 accordingly shows only 300 megawatts of non-utility generators bounded by a broken line indicating some uncertainty. Proposals have also been made for a 300 megawatt cogeneration plant at Pilgrim State Hospital and a 5.4 megawatt cogeneration plant for Entenmann's Bakery.

Nationally, nonutility generation has grown rapidly and now provides approximately 28,000 megawatts in the United States, almost 5 percent of present electricity production capability. Financing and fuel supply are highly uncertain elements in the nonutility market, however. Significant changes in the cost of capital or the ability to obtain natural gas could quickly stall the growth in nonutility generation, according to the Electric Power Research Institute.[11]

In addition, in response to a LILCO request for proposals, a 150 megawatt combined cycle plant is a likely candidate to be on line by 1994, probably to be built for LILCO at Holtsville by the New York Power Authority.[12]

At the same time, the Long Island Power Authority has commissioned an evaluation of possible conversion of the Shoreham nuclear plant to a combined cycle plant burning natural gas.[13] Seven possible configurations have been evaluated , ranging in capacity from 384 to 1,369 megawatts, which make varying degrees of use of the existing Shoreham facilities. (By comparison, the capacity of the Shoreham nuclear plant was 849 megawatts.)

To find room for this capacity, according to this report,[14] LILCO has identified the following sources (as of 1997) as replaceable:

Hydro Quebec	218 megawatts
Bidding block	150
Niagara	81
Gilboa	50

In addition, the chairman of the Long Island Power Authority has asked for a moratorium on the proposed 150-megawatt New York Power Authority plant at Holtsville.[15]

Quebec Hydropower

Quebec hydropower will begin to supply LILCO with 218 megawatts of capacity in 1996, half of which starts in 1985. This power is part of an agreement reached in 1988 among Hydro-Quebec, the New York Power Authority, and all seven of the State's private utilities. The agreement was intended to provide "a truly balanced statewide program...that reflects the needs and special circumstances of the different parts of the state."[16]

Under this agreement, 1,000 mw of "firm power" is purchased from Hydro-Quebec by the New York Power Authority for distribution to downstate users, as follows:

Con Edison	483 megawatts
LILCO	218
Orange & Rockland	100
Retail government customers	200
	1,000 megawatts

("Firm power" means that this capacity is available at all times. Retail government customers include New York City subways and Westchester County commuter trains, public buildings, etc.)

This 217 megawatts of Quebec hydropower will amount to about 5 percent of LILCO's capacity in 1996. As part of this agreement, LILCO also receives power from two other New York Power Authority projects: the Niagara Expansion and the Blenheim-Gilboa pumped storage facility, as follows:

	Niagara Expansion	Blenheim-Gilboa
Con Edison	256 megawatts	179 megawatts
LILCO	115	81
Orange & Rockland	28	19
Central Hudson	0	18
	399 megawatts	297 megawatts

At the same time, upstate utilities continue to receive power from the Niagara Project as follows:

Niagara Mohawk	250 megawatts
New York State Electric & Gas	220
Rochester Gas & Electric	130
	600 megawatts

Quebec hydropower will be continue to be delivered to the New York Power Authority for further distribution in New York State under a 1988 diversity contract for 800 megawatts which is to be extended to 2008. (Under a "diversity contract," power is exchanged between Quebec and New York State as available with no firm capacity guaranteed.) By comparison to the total of 1,800 megawatts contracted with New York State, the New England Power Pool's use of Quebec hydropower will reach 2,000 megawatts by 1991; a post-2000 Hydro Quebec project of another 1,500 megawatts is in the planning stages with a decision due by January 1992.[17]

The price paid by New York Power Authority for Quebec hydropower is reached by negotiation. The cost of this electricity is much lower. Hydro-Quebec's average selling price for electricity to Ontario has been about two-thirds that to New York; to New England it has been about 7 percent higher.[18] The basis for an equitable price has been evaluated by a Quebec research group, GERAD (Groupe d'études et de recherche en analyse des décisions).[19], [20]

The price of the 1,000 megawatt firm power contract with New York Power Authority consists of two parts: $207.43 per kilowatt per year in 1985 dollars for the guaranteed capacity, and 1.776 cents per kilowatt-hour for the energy delivered. The capacity price will escalate to 1995-1996 dollars based on a construction price index, and thereafter go no higher. The energy price will continue to vary with inflation according to a formula tied to changes in the gross national product deflator. In addition, LILCO will pay for transmission charges within New York State.[21]

The cost of Quebec hydropower under the firm capacity contract is estimated to be between 85 and 90 percent of the long-run avoided costs calculated by the Public Service Commission. The long-run avoided costs are calculated on the assumption that future capacity will otherwise be met by a mixture of combustion turbines and base-load coal-fired plants, the latter to be added later in the 1990s. For LILCO, the estimate is 88.1 percent of avoided costs as calculated in the table reproduced in Table 3.[22]

Table 3.
Economics of Hydro–Quebec Firm Contract Vs. 1989 Long Run Avoided Costs

June 14, 1990

Purchaser: LILCO

Capacity	218	MW	Capacity Charge	$17.29	(1985 $/kw–mo)
Energy	1432	GWh/yr	Energy Charge	$17.76	(1985 $/MWh)
Inflation Rate		4.1%	Wheeling Charge	$3.34	(1990 $/kw–mo)
Discount Rate		10.0%	Loss Factor	0.94	

Hydro–Quebec Contract Costs
(Millions of Current Dollars)

Year	Capacity Block1	Capacity Block2	Energy	Transmission	Total	July 1989 LRAC Generation + Energy ($/MWH)	Delivered Energy (GWH)	Avoided Cost (Millions)	Savings (Millions)
1995	22.5	0.0	12.7	3.6	38.8	73.7	449	33.1	-5.7
1996	33.8	23.5	33.0	9.3	99.5	85.8	1122	96.3	-3.2
1997	33.8	35.2	41.2	11.6	121.7	89.3	1346	120.2	-1.5
1998	33.8	35.2	42.9	12.1	123.9	93.2	1346	125.5	1.6
1999	33.8	35.2	44.6	12.5	126.2	97.0	1346	130.6	4.4
2000	33.8	35.2	46.5	13.1	128.5	101.1	1346	136.1	7.6
2001	33.8	35.2	48.4	13.6	130.9	105.5	1346	142.0	11.1
2002	33.8	35.2	50.4	14.2	133.5	110.1	1346	148.2	14.7
2003	33.8	35.2	52.4	14.7	136.1	114.9	1346	154.7	18.6
2004	33.8	35.2	54.6	15.3	138.9	119.9	1346	161.4	22.5
2005	33.8	35.2	56.8	16.0	141.7	125.1	1346	168.4	26.7
2006	33.8	35.2	59.1	16.6	144.7	130.6	1346	175.8	31.1
2007	33.8	35.2	61.6	17.3	147.8	136.3	1346	183.5	35.7
2008	33.8	35.2	64.1	18.0	151.1	142.3	1346	191.6	40.5
2009	33.8	35.2	66.7	18.7	154.4	# 148.5	1346	199.9	45.5
2010	33.8	35.2	69.5	19.5	157.9	155.0	1346	208.7	50.8
2011	33.8	35.2	72.3	20.3	161.6	161.9	1346	217.9	56.3
2012	33.8	35.2	75.3	21.1	165.4	169.0	1346	227.5	62.1
2013	33.8	35.2	78.4	22.0	169.3	176.4	1346	237.5	68.2
2014	33.8	35.2	81.6	22.9	173.5	184.2	1346	248.0	74.5
2015	11.3	35.2	56.6	15.9	119.0	192.3	898	172.6	53.6
2016	0.0	11.7	14.7	4.1	30.6	200.7	224	45.0	14.4
Total	675.8	703.5	1183.3	332.5	2895.1			3524.6	629.5
1995 NPV	279.0	264.0	411.4	115.6	1069.9			1214.0	144.0

88.1 % of LRAC

Avoided costs extrapolated to 2016 at 4.4% per year.

The cost of Quebec hydropower in 1996, for example, is 8.58 cents per kilowatt-hour (shown in the table as $85.8/MWH). Of this, 1.776 cents per kilowatt-hour is the cost of energy at the Canadian border; the remainder is the capacity charge, the wheeling charge, and transmission losses.

Hydro-Quebec is capable of delivering much more hydropower to the United States. Quebec expects its own power requirements to increase over time, and by building capacity early it can supply the U.S. market with capacity it will eventually need itself. Judging by the series of studies done by the Quebec research organization, GERAD, the cost of future Quebec exports to the U.S. is negotiable. The question is how the cost will be shared of building the capacity to be sold first to the U.S. but eventually used by Quebec for its own purposes.

Only about 400 megawatts more can be exported to New York State without an upgrade of the border link, however, and to increase its exports further Hydro-Quebec must either upgrade its internal transmission system to meet the standards of the Northeast Power Coordinating Council or provide direct links from its generating plants to the U.S. system.

The New York Power Pool notes that increased Canadian imports may also require the construction of new transmission lines in New York State. Canadian studies suggest that future hydropower exports to the U.S. are more likely to be made to New England, however.[23] For Long Island to receive a larger proportion of Quebec hydropower, a link with the New England Power Pool may be necessary, as discussed in Appendix B.

The potential hydropower in Quebec that is considered to be likely to be developed, taking into account favorable economics and the absence of overriding environmental objections, is estimated by the Canadians to be 17,900 megawatts, which is more than half of the present capacity of all the electric power plants in New York State. Nevertheless, LILCO is sceptical of this potential:

> Firm energy resources from upstate New York and Canada, projected for transmission over the new interconnection, may not be available as now contemplated and, unless supplemented, will represent a declining resource over time as the demand for energy in the Northeast United States and Canada increases.[24]

It must be said that Quebec hydropower is not an infallible source of energy. Service was interrupted in March 1989 due to a solar magnetic disturbance. A drought in 1989 contributed to a reduction in hydropower exports to New England [25], and drought conditions were expected to continue into 1991.[26] Over the next few decades, the greenhouse effect may begin to alter regional rainfall patterns in unpredictable ways. Quebec's costs of producing hydroelectricity will be higher as less desirable locations are developed.[27]

Nevertheless, the possibility of importing additional Quebec hydropower to Long Island in the future deserves more consideration that it seems to be getting for three reasons:

- o With possible future restrictions on greenhouse gas emissions, it is the most promising source of significant amounts of renewable energy.
- o It can be priced lower than the cost of alternative forms of utility generation;
- o It contributes to a diversity of supply that reduces vulnerability.

The potential for Quebec hydropower is discussed further in Appendix B.

The allocation of New York Power Authority hydroelectricity from Quebec and Niagara to the seven New York State private utilities preceded the Shoreham settlement by about a year. In view of the additional burden that the cost of Shoreham places on Long Island ratepayers and considering the disparity in cost to New Yorkers of Niagara and Quebec hydropower, this allocation seems ripe for review.

Transmission Limits

What limits the purchase of additional Canadian hydropower by LILCO? One consideration would seem to be the capacity of transmission lines between the New York Power Pool through ConEd to LILCO.

Recent transmission line construction has increased the New York Power Pool's capacity to send cheap upstate and Canadian power to the metropolitan area, but LILCO will apparently continue to be marginally connected to the New York Power Pool grid.

In recent years, the New York Power Authority completed Marcy-South, a transmission line through central New York to the metropolitan area. This is intended to deliver Canadian and cheap upstate New York power, including an additional 297 megawatts of Niagara peaking power to be completed in 1997, to Southeastern New York.

However, the existing transmission connections to LILCO through ConEd are far more heavily loaded than any other links in the New York Power Pool system. The summer of 1988 severely tested LILCO's ability to meet peak load, a problem that can be attributed to this limited transmission connection because LILCO's summer peaks are not disproportionately high. To relieve this problem, a new 27 mile long 345 kV transmission line is being constructed under Long Island Sound by New York Power Authority which will provide an additional 150 megawatts of capacity (eastbound) or 600 megawatts (westbound) in early 1991.[28,29]

According to New York State Energy Office modeling studies, this new link will reduce the percent of time the ConEd/LILCO interface operates at maximum capacity from 95 percent in 1990 to 35 percent in 1991, thereafter returning to 45 percent or more in most scenarios. Elsewhere in the State, these percentages rarely exceed zero. By the standards of the study, maximum capacity operation 35 percent or more of the time constitutes "serious problems." Moreover, the model suggests that cheaper electricity generated upstate would sometimes be exported from the New York Power Pool grid rather than sent to LILCO because of the ConEd/LILCO constraint.[30]

Oddly, it would seem, the State Energy Office study concludes not that additional transmission capacity is needed, but that emphasis should continue to be placed on lowering electricity demand and siting new capacity on Long Island.[31]

Similarly, the New York Power Pool Integrated Planning Strategy notes that the transmission of additional Canadian power will increase the prevailing power flow from north to south. Rather than inferring that additional transmission capacity is therefore needed, the Strategy concludes that it would be desirable to install new electric generators in Southeastern New York "and especially on Long Island." This would "retain transmission capability to transmit economical energy from upstate and Canadian sources while providing greater transmission reserve and increased reliability."[32]

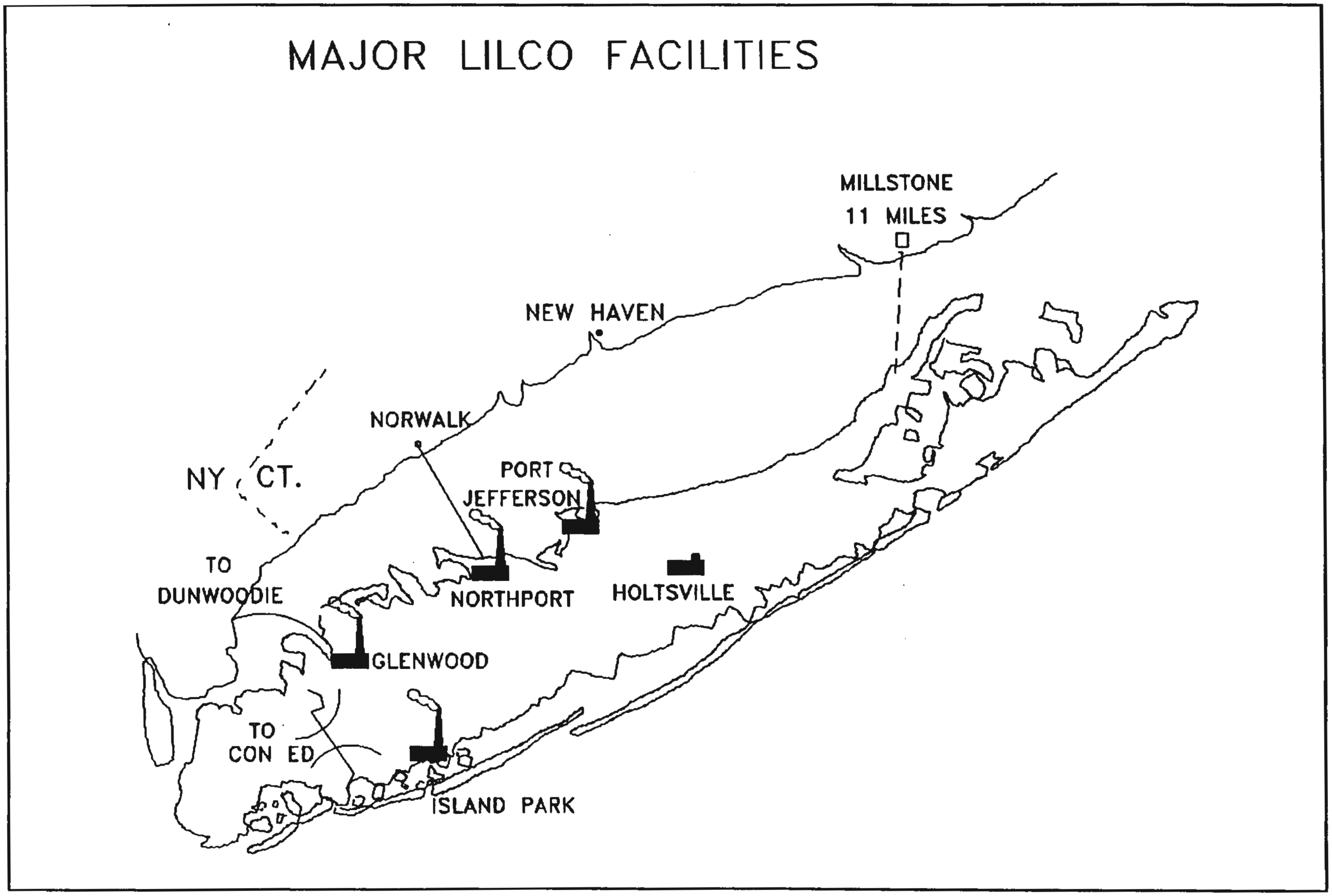
What this seems to mean is that the Power Pool favors transmission links that improve system reliability through the exchange of power among the utilities, but it will resist building more one-way transmission lines to Long Island.

Whether the constraints are physical or institutional, therefore, it appears that Long Island's access to cheap upstate and Canadian hydropower through the New York Power Pool will be limited.

An alternative for achieving better integration into regional electrical grids would seem to be a stronger connection between LILCO and the New England Power Pool (NEPOOL). A transmission line under Long Island Sound connects the Northport power station with Northeast Utilities in Norwalk, Connecticut. With all four Northport units in operation, the capacity of this line is about 100 megawatts. However, if one or more of the four Northport units is down, the full capacity of 286 megawatts can be used. Norwalk itself is only weakly connected to NEPOOL, however, so that a stronger link with LILCO, even if it were feasible institutionally, would require a major investment not only for a cable across the Sound but expansion inside Connecticut.

The physical proximity of Long Island to the New England Power Pool seems otherwise to be overlooked. As shown in Figure 5, Port Jefferson and Shoreham are only about 25 miles from a 345 kV power line in New Haven, Connecticut. Orient Point is only about 10 miles from Millstone from which four 345 kV lines emanate. The mental proximity is apparently not that close.

Figure 5. Power Lines on Both Sides of the Long Island Sound



The investment for another power line across Long Island Sound would require a long-term commitment to use it to buy, sell, or exchange power. Although New England Power Pool exports to New York State in 1989 exceeded Quebec exports to New England, nobody seems to be thinking about that.

LILCO itself has no plans for further transmission ties with other utilities. Discussions with ConEd on upgrading their interface have been dropped. LILCO disagrees with the New York State Energy Office model results, estimating that full capacity of the new cross-Sound link will not exceed 25 percent. Even at full capacity, such links fill their role in maintaining system reliability because they can temporarily carry 150 percent of maximum continuous load.[33]

As things stand, the prospects of achieving better access to regional electricity grids and Canadian hydropower through additional one-way transmission links are therefore unlikely. Better integration is only likely to be achieved through Long Island bearing its proportionate share of electricity production so that it can export as well as import power.

Electrical System Reliability

It has been suggested in the past that LILCO's electricity business be separated into two companies: one for generating electricity and the other for distributing it. The natural monopoly is the distribution system; supplies can come from anywhere.

While this recommendation was never implemented, the electric utility industry has since been moving in this direction. LILCO now obtains its new supply through bidding by independent power producers. In the future, the bidding may include "supply" through conservation measures in demand-side management packages, which could also be provided by vendors. The New York Power Pool notes that transmission service in the future will probably be required for a large number of non-utility generators, a pattern that suggests even more distance between electricity suppliers and distributors.

This new system introduces major uncertainties into delivering power. Independent power producers have little or no track records to verify their dependability, and, unlike utilities, they have no obligation to serve the public interest. As we have seen, LILCO is counting on less than half of the independently produced power that it has actually contracted for.

These disadvantages are offset by other considerations. Competition has been introduced into electrical supply leading to reductions in cost. Electrical generating units can be added to the system in smaller increments as the need becomes evident, rather than by making a multibillion dollar commitment to a large plant more than a decade before it is needed.

From a system reliability standpoint, a multiplicity of smaller units is more reliable than a few large units because individual failures are less significant. On strictly probabilistic grounds, the total installed capacity -- and therefore the total cost -- can therefore be less to assure the same level of system reliability.[34] This is often not apparent to the individual energy supplier who sees only the economies of scale possible in a single unit.

The argument for many small suppliers is diminished, however, if they all use the same source of fuel. A failure in the fuel supply would defeat the system regardless of the number and size of its individual units. With virtually all of LILCO's new electricity generation to use natural gas, the need for multiple sources of natural gas to Long Island becomes apparent.

Given the almost universal trend in New York State toward natural gas as a fuel (to be discussed below), it would seem to behoove LILCO to guarantee the supply of natural gas to its independent power producers. The eleven cogeneration plants now under contract to LILCO have made their own arrangements to obtain natural gas. The supply that they would need is the equivalent of four or five times the amount of natural gas that LILCO expects to begin receiving from the Iroquois pipeline in 1992.

Under present arrangements LILCO takes no responsiblity for their fuel supply. With natural gas likely to be in short supply on Long Island, in fact, LILCO will be in competition with its own suppliers for fuel.

ENERGY CONSERVATION

Energy conservation is the invisible source of energy. It does not pollute the atmosphere, it requires no fuel delivery infrastructure, it leaves no wastes, it does not adversely affect the balance of payments, and it now accounts for about one-quarter of the fuel we would have needed by 1973 standards. The prosaic means of energy conservation in buildings, such as storm windows and attic insulation, are being supplemented with high technology: low-emissivity windows and microprocessor-controlled "smart houses." Assistance in energy conservation is available from New York State, LILCO, the Suffolk County Energy Management Commission, and private energy service companies.

The Need for Energy Conservation

The need for energy conservation arises not only from the cost of Shoreham. A long-term trend toward higher oil prices as well as periodic price spikes will further increase the cost of electricity as well as gasoline and heating oil. And almost certainly, measures to reduce emissions of carbon dioxide and other greenhouse gases will be imposed during the next two decades. Under these circumstances, extraordinary measures for using energy more efficiently on Long Island are economically justified,

The major purpose of the Long Island's energy efforts in the next decade or more should therefore be to provide the information, services, and means of financing to make further improvements in energy efficiency and conservation.

Fortunately, some help is at hand.

Assistance for Energy Conservation

New York State agencies offer a wide variety of conservation assistance programs, most administered by the State Energy Office, partially funded with petroleum overcharge restitutionary funds that runs out in five or six years. The programs administered by the New York State Energy Office are as follows:

Energy Investment Load Program
Energy Advisory Service to Industry
Technical Feasibility Study Program
Small Business Energy Efficiency Program
Agricultural Energy Conservation Program
Institutional Energy Conservation Program
Supplemental Institutional Energy Conservation Program
Not-For-Profit Energy Conservation Program
Not-For-Profit Energy Conservation Grant Program
State Facilities Energy Conservation Program
Energy Conservation Bank
Appliance Rebate Program
Oil Heat Rebate Program
Residential Conservation Assistance
Codes and Standards Progams
Fleet Energy Efficient Transportation Program
Signal Timing Optimization Program
Transportation Systems Management Program

Long Island has been underrepresented in some of these programs in the past. This is due in part to government decisions that find conservation investments more cost-effective upstate where winters are colder and prices are lower. In part, however, Long Island has not taken full advantage of programs for institutional buildings, not-for-profit organizations, and agriculture. (See Appendix G.)

The New York Public Service Commission administers two conservation programs called SAVINGPOWER and ABCS. The New York Department of State Division of Economic Opportunity provides a weatherization program for low-income housing described further below. A particular problem on Long Island is the number of illegal apartments occupied by low-income people. If these are officially ignored, the State is unable to classify them as low-income housing.

In addition, by direction of the New York State Public Service Commission, LILCO and other New York State utilities have developed a series of "demand-side management" (DSM) programs. DSM programs consist of incentives to customers to change or reduce their use of electricity. These programs include peak clipping (for example, contracts with customers to cycle off their air conditioners on hot summer days), load shifting (for example, lower electricity rates at night to encourage electric use then), as well as genuine conservation measures (such as promoting the substitution of high-efficiency lighting).

The major impetus for energy conservation on Long Island is LILCO's demand-side management program, which is funded at a level of about $30 million a year. (See Appendix C.) LILCO's DSM programs have been criticized for insufficient attention to long-term conservation, as opposed to short-term peak load reduction measures. LILCO has also been urged to give greater emphasis to gas conservation and substituting gas for electricity, greater financial incentives to residential users, and more comprehensive programs for business and institutions. (See Appendix E.)

LILCO currently receives for its demand-side management program an amount that covers its direct costs, its lost revenues, and an incentive of 15 percent of "net resource savings." The latter includes an amount of $0.014 per kilowatt-hour for environmental benefits. Approximately $35 million is built into base rates, with an additional amount of about $7 million, principally related to revenue loss due to sales erosion and incentive revenues, is recovered through the fuel adjustment clause. The amounts recovered by the utility are reconciled annually, with underrecoveries flowed through the fuel adjustment clause.[35]

LILCO's 1991-92 demand-side management program will in effect raise its electric rates by 0.49 cents per kilowatt-hour.[36] Those customers who reduce their electricity use may then find their bills lower; those who don't will find their bills higher.

The LILCO energy conservation program is discussed in detail in Appendix C. A critique of the LILCO program is described in Appendix E. The potential for electric energy conservation on Long Island has also been estimated in a study for the New York State Energy Office, as described in Appendix D. Data from the New York State Energy Office Energy Advisory Service to Industry program is used in Appendix F to evaluate these several estimates of the potential savings from electric conservation measures.

The Suffolk County Energy Management Commission distributes a newsletter providing information on energy conservation, conducts seminars, provides a speakers bureau, and reviews building plans from the standpoint of energy conservation.

Finally, a new type of business has come into being to promote energy conservation. Energy service companies (ESCOs) conduct energy audits, install conservation measures, and arrange financing, often for municipal organizations like school districts, collecting their fee from the dollar savings that result. There are 56 ESCOs listed in a New York State Energy Research and Development Authority directory of North America, six in New York State, and one on Long Island.[37] Possible State arrangements to provide assistance in financing energy conservation have been also been explored by the New York State Energy Research and Development Authority.[38]

Unfortunately, these opportunities for assistance in energy conservation do not seem to be widely known. LILCO's DSM program has been criticized for having a piecemeal marketing approach. The State is apparently effective in marketing its conservation programs to the target groups. Surveys of the Energy Advisory Service to Industry (EASI) program, for example, indicate that half of the participating companies were contacted directly by the regional contractor, as opposed to newspaper or radio advertising. We were informed in a private communication, however, that Long Island has not been as responsive to New York State conservation opportunities as other parts of the State.[39]

Energy Conservation in Buildings

Over the past decade, the technology for energy conservation has been developing. Energy audits of homes have typically recommended attic insulation, storm windows and doors, caulking and weatherstripping, water heater and pipe insulation, clock thermostats, and replacing or tuning oil and gas burner heads. Other measures recommended for the homeowner are reducing hot water temperatures, and installing attic fans, ceiling fans, window fans, low-flow shower heads, low-flow faucet aerators, efficient fluorescent or sodium-vapor outdoor lights, and suitable landscaping: deciduous trees for shade on the south, evergreens for windbreaks on the north.

Weatherization programs in low-income housing may require some structural repairs such as caulking and sealing cracks in rooftops, walls, windows and basements, as well as boiler and burner overhauls. An average of $1,600 is spent on a low-income building in the New York State program, ranging up to $3,200 for a large house.

Continuing a ten-year-old program, the New York State Energy Advisory Service to Industry (EASI) has performed over 500 energy audits for companies in Nassau and Suffolk Counties in the past three years. The energy conservation measures recommended are improvements in lighting, replacement of electric motors, tuning burners, switching fuel, installing wind screens and air curtains, relocating air compressor intakes, installing insulation, installing destratification fans, and a variety of housekeeping measures. Major manufacturing process changes and cogeneration possibilities are not evaluated in these one-day surveys. Surprisingly, much the same set of measures are recommended for manufacturing and commercial establishments. Estimated energy savings range from 4 to 6 percent in electrical and electronic manufacturing to 8 to 12 percent in printing and publishing, wholesale and retail trade, and service industries.[40]

Major technological improvements now promise greater savings, however. An example is the improvements on the low-emissivity (low-E) windows that have now become standard. Older factory-made double-glazed windows with sealed interior air space were twice as resistant to heat loss as a single pane. Double-glazed windows have now been improved by applying low-E coatings to their interior surfaces. These coatings increase the resistance to heat loss in winter and heat intake in summer. Further improvements are possible. Evacuating the interior space or filling it with argon or transparent insulating material can produce a "superwindow" with from six to ten times the resistance to heat loss of a single pane of glass. Superwindows may give way to "smart windows" containing a solid-state electrochromic optically switching film that transmits heat into buildings in winter and shuts heat out in summer without affecting the window's transparency.[41]

A second example is lighting. In a typical commercial building, lighting uses about two-fifths of all electricity directly and more than half when their contribution to the heating load is considered. Using high-efficiency ballasts and fluorescent tubes with reflectors would reduce electric loads cost-effectively by 55 percent; using today's best hardware would give 80 to 90 percent reductions. Compact fluorescent lamps use 75 to 85 percent less electricity than the incandescent bulbs they replace and last nine to thirteen times longer.

Beyond light bulbs, new laser technology applied to holographic films for windows has shown that natural sunlight striking a window through many angles during the day can be programmed to diffract light up to thirty feet into building interiors, reducing the need for artificial light.

In industry, the next best opportunity to save energy is with improved electric motors. Motors consume 65 to 70 percent of industrial electricity and more than half the electricity generated in the U.S. New, high-efficiency electric motors equipped with electronic adjustable speed drives can reduce the electricity load from 31 to 72 percent.[42]

In homes, improved refrigerators and freezers can now consume 80 to 90 percent less electricity.

The future may hold "smart houses" with automated environmental control systems, and superinsulated "optimum homes" with controlled airflows using heat exchangers to maintain inside air temperatures, possibly heated entirely by their water heaters.

How Much Energy Can Be Saved in Buildings?

The New York State Energy Plan calls for electric utilities to implement DSM programs that will achieve 8 to 10 percent savings of electricity by the year 2000, and 15 percent if economically justified.[43] An example plan developed for LILCO -- not including the possibilities for fuel switching and cogeneration -- found the 8 to 10 percent target feasible, but that the measures needed for a 15 percent reduction were not cost-effective. (See Appendix D.) A second analysis indicated that a 12 percent reduction in electricity could be achieved with fuel switching, and gas conservation would provide additional energy savings. (See Appendix E.)

A 1990 report of the Electric Power Research Institute finds that it is technically feasible to save from 24 to 44 percent of U.S. electricity by 2000 in addition to the 8.5 percent already included in typical utility forecasts, albeit at high cost. Arguing that most of the best technologies are less than a year old, technological optimists estimate a long-term potential reduction in electricity needs of about 75 percent at an average cost of 0.6 cents per kilowatt-hour, a small fraction of present electricity costs.[44]

For Long Island in the next two decades, however, the evidence is that energy savings of 10 to 15 percent from conservation measures in buildings is achievable. Whether energy conservation will resume or remain on a plateau is another question.

What is Holding Back Conservation?

What prevents people from investing more in energy conservation? In large part, it is economic rationality based on current market conditions. This is evident by the leveling off in the rate of conservation in the mid-80s when the real price of fuel was at a low point.

However, economic rationality is defined differently for different parts of the population. This is evident from the different discount rates that are appropriate. From a utility perspective, a 10 percent real discount rate is established by its cost of money. From a consumer's point of view, a 6 percent real discount rate is established by the interest he can earn in a bank account. From a societal point of view, about a 3 percent real discount rate represents the traditional long-term cost of money to the government.[45]

These explicit discount rates are theoretically determined by external conditions. They must be contrasted with implicit discount rates that represent actual behavior in the marketplace, revealed, for example, by the payback period businessmen actually require to make conservation investments. Implicit discount rates are typically much higher than explicit discount rates, meaning that investments are unlikely to be made without more favorable conditions. For householders, conservation investments may not be made because of inadequate information (how do you get State weatherization assistance?), limited product choices (high-efficiency light bulbs are not in the local hardware store), third party purchases (the landlord pays for the heat), and other imperfections in the marketplace.

DSM programs required by the Public Service Commission can be seen as substituting low societal discount rates for high implicit consumer discount rates to make conservation investments through the monopoly power of the utility.[46]

Moreover, actual behavior in the marketplace varies among consumers. Wealthy consumers may ignore conservation measures because the potential dollar savings are worth less than the time spent to gain them. Poor consumers, who may spend a quarter of their income for gasoline and heating oil, may be too short of capital for bank account interest to be a relevant alternative. The purchase of automobiles, typically loaded with psychological accessories like self-esteem, the will to power, sex appeal, and conspicuous consumption, illustrates how far consumer behavior can deviate from economic rationality defined, for example, as cheap transportation.

What Can Be Done to Encourage More Energy Conservation?

Many of the changes required to foster greater energy conservation are beyond the powers of local government. Gasoline use is determined by the number of cars on the road and their efficiency. The principal alternatives for reducing gasoline consumption are therefore to reduce the number of cars on the road or to improve their efficiency. The current debate on a gasoline tax, which would reduce the number of cars on the road, versus higher gasoline mileage standards, which would improve the efficiency of new cars, represents choices on the national level.

However, there are local options. The number of cars on the road can be reduced by encouraging carpooling with the use of express lanes and car-sharing parking lots and by fostering company programs to establish vanpools. This could also improve the efficiency with which cars are used by reducing traffic slowdowns. The State is also acting to reduce traffic slowdowns through traffic information signs that notify drivers of tie-ups ahead and by improving traffic light timing. At the other extreme, speed limits could be more rigorously enforced. The difference between the 55 mph State speed limit and the prevailing 65 mph or higher typical Expressway speed represents a potential gasoline savings of 15 percent, according to some estimates.

Improving traffic flows, however, is a short-term fix. Long-term improvements in transportation efficiency will depend upon fundamental land-use planning. A check list for such sustainable development is shown in Table 4.

Table 4. Check List for Sustainable Developments

1. Resource Evaluation

Did the predesign study:

- Evaluate the terrain, flow of water, plants and wildlife?
- Analyze the climate?
- Research the history of the area?

2. Site Design

Does the development:

- Preserve fragile ecosystems?
- Use natural grades to contain new run-off?
- Leave distinctive natural features intact and accessible?
- Ensure that a minimum of earth and vegetation are disturbed during development and construction?

3. Circulation

Does the layout:

- Minimize distances between points of destination?
- Cluster medium and high-density areas while leaving other areas undisturbed?
- Include non-residential functions within residential areas?
- Provide safe paths for self-powered means of transportation?
- Include paths that are as direct as or more direct than routes provided for motor vehicles?
- Provide the self-powered paths on a separate grade where possible to enhance safety?
- Have paths (such as sidewalks) ramped to street level to allow easy access for wheel chair pedestrians and bicyclists?
- Separate walking and bicycling paths in high-traffic areas?
- Provide bicycle lockers at destinations?
- Use pervious materials instead of paved areas?
- Provide routes for connecting with the mass transit system and facilities for encouraging ridership?
- Provide a way to upgrade nearby road facilities to accommodate self-powered transportation?

4. Infrastructure

Is your development team:

- Designing roads and utilities to minimize energy costs?
- Using the most efficient types of outdoor lighting only where needed?
- Integrating infrastructure into natural habitat?

5. Power

Are you taking an approach that:

- Uses the most energy-efficient method of performing tasks?
- When possible, uses renewable energy directly instead of indirectly?
- When renewables are not available, uses fuel (e.g., natural gas) directly instead of through the production of electricity?
- Generates power within the development from cogeneration or renewable sources?
- Contracts for maintenance with a utility or renewable energy equipment specialist?
- Minimizes lengths of distribution lines?

6. Building

Is the development being designed to:

- Orient streets on an east-west axis so that the predominant sides of buildings' glass areas will face within 20 degrees of north and south?
- Incorporate natural ventilation, daylighting and passive solar heating into building designs?
- Situate buildings so that they do not block solar access to adjacent buildings?
- Situate buildings in such a way that they do not block natural ventilation of adjacent units?
- Use renewable energy sources for water heating and space heating?
- Use architectural guidelines to ensure quality designs instead of imposing minimum square footage requirements?
- Minimize the use of incandescent lighting?
- Promote wall and roof surfaces that either reflect (in hot climates) or absorb (in cold climates) the majority of the sun's heat?
- Promote the use of locally available non-toxic materials for building components?
- Provide a low-cost method for upgrading to renewables at a later date, where renewable systems are not presently cost-effective?

7. Landscape

Does the development design:

- Preserve natural landscape and habitats?
- Incorporate landscape design that provides shade from the summer sun?
- Employ landscape materials that will minimize long-term requirements for maintenance, irrigation, pesticides or herbicides?
- Use native vegetation?
- Use natural biological controls to reduce pests, avoiding toxic chemical use?

8. Water

Do the design and facilities:

- Use drought-tolerant plants?
- Mandate low-water-use toilets (1-1/2 gallons/flush or less)?
- Mandate low-flow showerheads (2 gallon/minute or less)?
- Reuse water (e.g. household grey water for watering landscaping)?
- Where needed, distill drinking water using solar energy?
- Use efficient hydraulic designs and pumps?
- Collect rainwater to serve as the water supply?
- Use groundwater only in quantities that can be replenished?
- Use natural means of water treatment and water disposal?

9. Food

Does the development:

- Include food-producing landscapes sufficient to meet the needs of residents?
- Integrate tracts of food-producing land throughout the development that can be gardened or farmed without excessive quantities of polluting machinery?
- Provide guidelines to grow crops organically?
- Offer methods to use solid and liquid wastes from the sustainable development as fertilizers?

10. Wastes

Do your subdivision regulations or guidelines:

- Include on-site recycling centers?
- Require separation of organic wastes from other garbage?
- Provide for a community tool and appliance sharing/renting center?
- Allow only non-toxic, biodegradable or recyclable items to be sold within the development?
- Provide for periodic collections of toxic materials?
- Ensure the use of natural biological systems to treat sewage?

11. Education

Does the development sales team:

- Offer literature on all aspects of sustainable developments?
- Offer "how-to" workshops on projects that enhance the sustainable community?

12. Miscellaneous

Do the regulations:

- Impose noise limits on regularly used equipment and ensure good sound insulation in closely-spaced units?
- Permit clotheslines, solar collectors and other items that reduce energy use?
- Permit only non-motorized boating on water sites and allow renting these boats as part of the recreation area?
- Encourage the use of natural ponds and lakes as "swimming holes" instead of an energy- and chemical-intensive swimming pool?
- Create a neighborhood association to help maintain the quality of the development?

Source: Solar Today, September/October 1990.

Conservation Facilitator

To promote energy conservation on Long Island, a Conservation Facilitator should be appointed. It would be the Facilitator's job:

- To search out opportunities for State assistance in conservation programs for residences, small business, and local government
- To provide information on State, LILCO, and New York Power Authority programs to potential recipients of conservation assistance
- To try to alter State decision rules for investments in energy conservation that discriminate against Long Island
- To provide product information to distributors of electric lights, lighting fixtures, and appliances
- To promote conservation in Long Island building practices, encourage towns to make building codes more stringent
- To publicize the need and opportunities for energy conservation
- To arrange for training, seminars, and public information programs in energy conservation
- To verify enforcement of the energy conservation aspects of building codes
- To promote a conservation ethic on Long Island.

Industrial organizations large enough to have their own energy staffs probably do not need this kind of help. Opportunities for cogeneration projects are probably well attended to by independent power producers searching for market opportunities. The Conservation Facilitator would direct his efforts at everyone else.

ENERGY CONSERVATION FOR LOW-INCOME FAMILIES

It is Long Island's low-income population that suffers most from its high energy costs. Low-income families typically pay a higher portion of their income for energy, and on Long Island they are less likely to benefit from public energy conservation programs. This is due in part to the application of the same standards Statewide to qualify for energy assistance, regardless of the local cost of living, and partly from administrative problems in the past few years. A declining budget for the New York State Weatherization Assistance Program, the principal source of low-income energy conservation on Long Island, will extend what has been estimated to be a 60-year backlog. An encouraging development is a proposed Public Service Commission policy that will enable LILCO and other New York State utilities to resume and widen their low-income programs.[47] Unless New York State standards for low-income energy assistance are changed to reflect the local cost of living, however, a large number of low-income Long Islanders will still receive no assistance.

Typically, low-income families spend about 25 percent of their income for energy compared to 7 percent for the non-poor. While low-income families consume 22 percent less energy and pay 25 percent less on utilities than the non-poor, they use 20 percent more energy per square foot of living space. [48]

Home Energy Assistance Program (HEAP)

Federal support for fuel assistance and energy conservation began in 1974. The fuel assistance program eventually became known as the Low-Income Home Energy Assistance Program (LIHEAP), administered by the U.S. Department of Health and Human Services.[49] In New York State, the program, called the Home Energy Assistance Program (HEAP), is administered through the Department of Social Services. Eligible families receive direct payments for fuel, the amount depending upon the type of fuel and which of four "heating degree regions" in the State the family lives in. The range of benefits on Long Island is from $100 to $275. In the coldest regions of the State, the range is from $120 to $325.

Eligibility for HEAP assistance is determined by family income according to the number of persons in the household, as shown in Figure 6; the income standard is the same throughout the State regardless of the local cost of living. Figure 6 shows Tier 1, the lower of two income eligibility standards, which is set at 130 percent of 1990 poverty guidelines of the the U.S. Office of Management and the

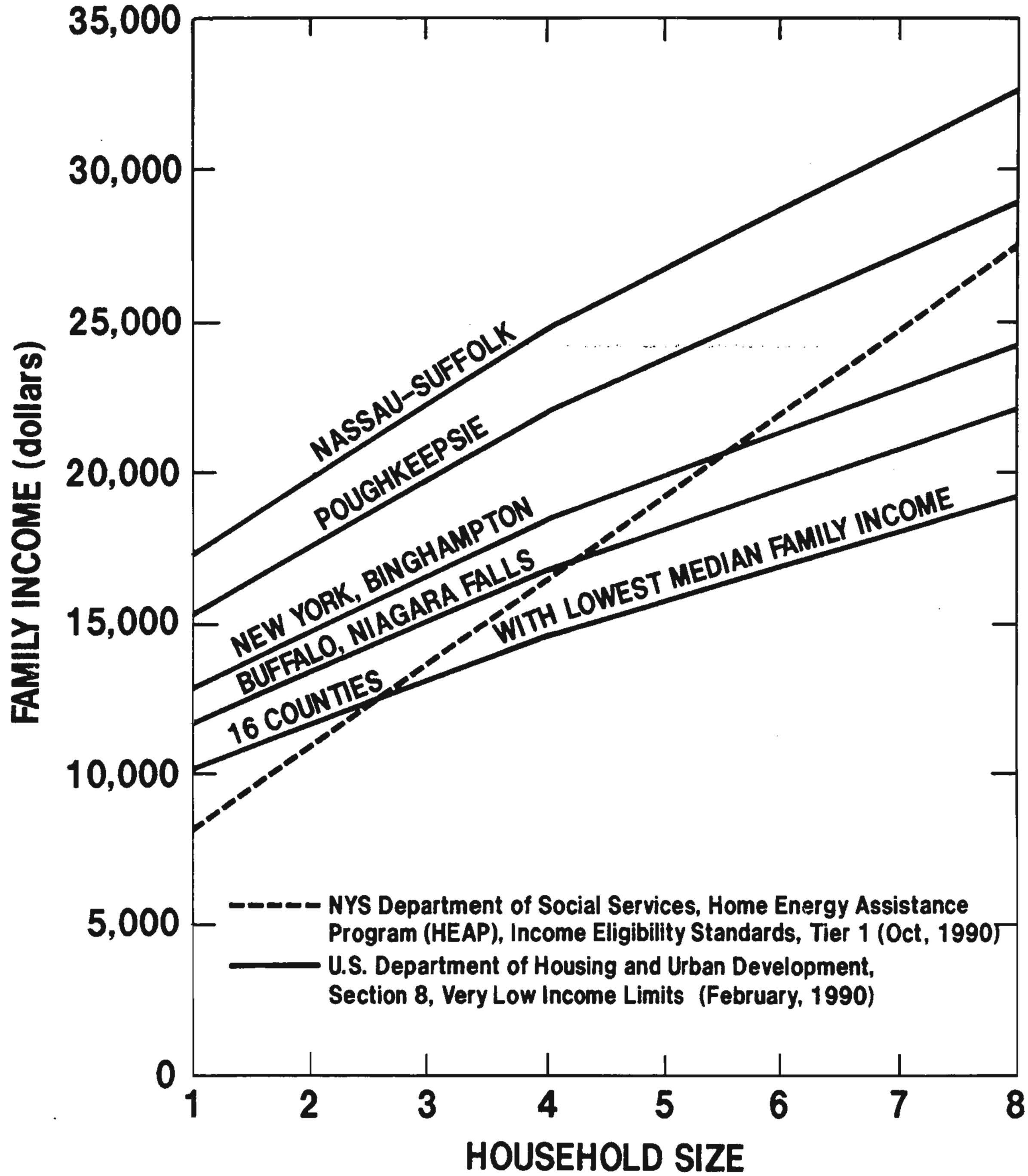


Figure 6. Comparison of HEAP and HUD Section 8 Low-Income Eligibility Standards

(Tier I)

Budget.[50] A very rough estimate of the number of qualified people who actually receive HEAP payments in one Long Island township is about half; people in illegal apartments steer clear.[51]

Weatherization Assistance Program (WAP)

The residential energy conservation program, the other type of Federal aid, became known as "weatherization."[52] The purpose of this program is to weatherize the homes of the low-income persons, especially the elderly and the handicapped. There are currently over 20 million households in the United States living within 150 percent of the poverty level and theoretically eligible for weatherization. Only 2 million households have been weatherized to date. At current U.S. Department of Energy weatherization production levels of 300,000 units per year, it will take 60 years to weatherize all eligible households.[53]

In New York State, the Weatherization Assistance Program is administered by the Department of State, Division of Economic Opportunity. Since its inception in 1977, over 230,000 dwelling units of the estimated 1,800,000 eligible households in New York State have been weatherized. About 22,250 units were weatherized during the 1989 program year.

From a level of about $49 million in the 1986-87 program year, funding for the Weatherization Assistance Program has declined as follows (in millions of dollars):[54]

	1989	1990 (11 months)
U.S. Department of Energy	$16.4	$15.8
Petroleum Violation Escrow Funds	18.6	11.9
N.Y.S. Department of Social Services (through HEAP)	5.25	5.2
	$40.25	$32.9

Note that these amounts for the entire State compare with LILCO's annual demand-side management budget of about $30 million. By Federal law, the average direct expenditure per house cannot exceed $1,600, although there is no limit on individual home expenditures.[55]

The program operates through 93 local subgrantees which include community action agencies, community-based organizations, local government agencies, and Native American Tribal Agencies.[56] Under contract to the Department of State, the subgrantees perform a number of services including identification of eligible clients, evaluation of dwelling units to be weatherized, and supervision of weatherization work performed by a staff or subcontractors.

The subgrantees make use of advanced weatherization technologies, such as blower doors (used to evacuate air through the building to identify air leaks), infrared thermography, and computer-based energy audit protocols. Energy audits are likely to be of high quality because they are followed up by the actual weatherization work.

There is every indication that the Weatherization Assistance Program is well managed. From the point of view of the Department of Public Service, for example:

> WAP offers years of experience and success in reaching and working with low income consumers, and in installing energy efficiency measures in their households. It has recently adopted a more sophisticated energy survey technique -- the Targeted Investment Protocol System (TIPS) -- which drives the investment in the dwelling based on its potential to save energy. WAP also has a large scale bidding and procurement protocol for the purchase of materials and services which is highly successful in getting the most value for each dollar invested. Finally, it has credibility and the trust of the low income community it serves.[57]

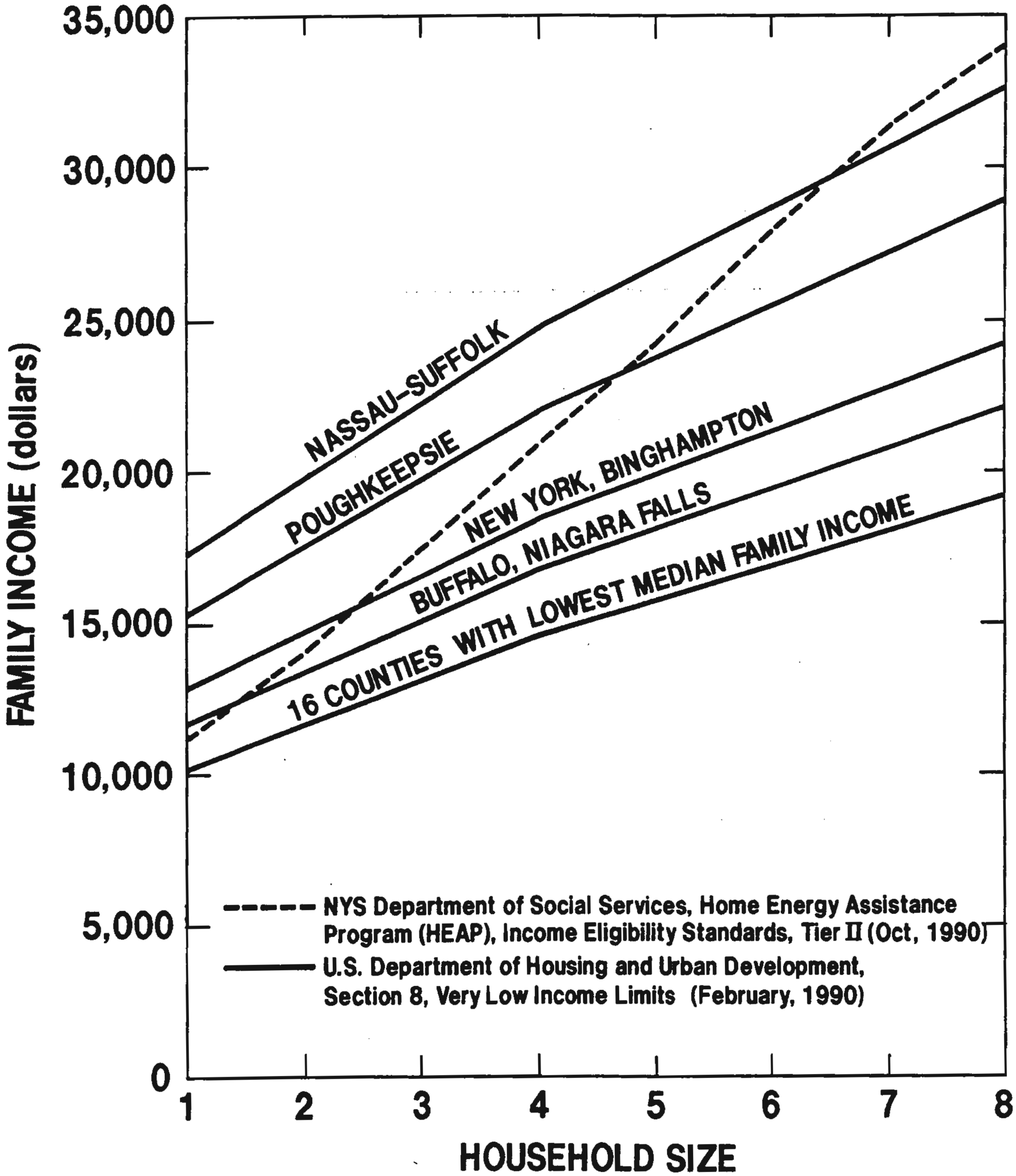
Unfortunately, the Weatherization Assistance Program has not penetrated very deeply into Long Island. Funds are allocated to counties using a formula that takes into account relative climate, expressed in heating degree-days, and the size of the low income population, according to the HEAP income eligibility standards. By this formula, Nassau County is allocated 3.0243 percent and Suffolk County 4.0896 percent of the Statewide pool, for a total of 7.2 percent, or $2.37 million in 1990. (The population of the two counties is about 14.7 percent of the State's population.)[58]

Although this 7.2 percent of Weatherization Assistance Program funds hase been available to Long Island, only about 5 percent has actually been spent here. We understand that this is because of difficulty in identifying local capacity for the required level and quality of service. Almost a third of the allocation to Long Island has therefore gone unspent.

An annual State Plan for the Weatherization Assistance Program is submitted to the U.S. Department of Energy after public hearings that are held in several parts of the State. In order to increase the funding for Long Island, the towns of Huntington and Islip have in the past proposed that the Section 8 Program Income Eligibility Limits of the U.S. Housing and Urban Development (HUD) be substituted for the HEAP guidelines.[59] The two sets of standards are compared in Figure 7.

Figure 7. Comparison of HEAP and HUD Section 8 Low-Income Eligibility Standards

(Tier II)



The family income limiting eligibility for public assistance is in both cases dependent upon the number of persons in the household. Unlike the HEAP standards, however, the HUD Section 8 eligibility limits vary throughout the State according to local family income levels. Family income eligibility limits for the Nassau-Suffolk Metropolitan Statistical Area are 70 percent higher than for the sixteen counties in New York State with the lowest median income.

For example, for a one-person household the eligibility limits are the same for HEAP (Tier II) and HUD Section 8 (Very Low Income), about $10,300 per year, in the sixteen New York State counties with the lowest median family income. In those counties the number of one-person households qualifying for energy aid would be the same by either standard.

In Nassau-Suffolk, however, the HUD Section 8 limits would make a one-person household eligible up to a family income of $17,350, an amount 70 percent higher than the HEAP standards. For a three-person household, the HUD Section 8 income limit for Nassau-Suffolk is $22,300, 28 percent higher than the HEAP standard of $17,424. Clearly, the HEAP eligibility standards, by not accounting for variations in the local cost of living, discriminate against many low-income families in high-cost areas like Long Island.

Despite the proposal by the town of Huntington and Islip, the eligibility guidelines for the Weatherization Assistance Program continue to be those of the New York State Department of Social Services Home Energy Assistance Program (HEAP).

The second part of the allocation formula compares counties by heating degree-days. Quite reasonably, this favors counties in colder climates. However, it fails to take into account the cost of energy which in the case of electricity in particular varies widely throughout the State.

Thus, there are three strikes on low-income families needing weatherization assistance on Long Island:

1. The county allocation formula does not take into account the higher cost of living on Long Island.

2. The money that is allocated is not being fully used.

3. The energy they are not saving is more expensive here than elsewhere.

At the same time, the electricity rates of low-income families include the cost of conservation measures paid for others by LILCO. Under LILCO's present demand-side management program, electric rates for all residential customers will increase by 0.49 cents per kilowatt-hour in the next two years while less than 5 percent of them will benefit from its rebate programs: essentially those with central air conditioning or swimming pools.[60], [61] LILCO Low-Income Program

The Home Insulation and Energy Conservation Act (HIECA) program, established by the New York State legislature, is administered by the State's nine major electric and gas companies and overseen by the Public Service Commission. Under the SAVINGPOWER component of this program, free on-site home energy surveys are offered, and subsidized financing through loans is provided to residential owner-occupied households and renter-occupied households. The survey consists of an inspection of and report on the efficiency of the furnace/boiler and the level and quality of the insulation, caulking, and weatherstripping in the dwelling. LILCO's 1990 budget for its SAVINGPOWER program was $2,273,390 to include 20,000 audits.[62]

However, a Statewide SAVINGPOWER market study conducted in 1986 concluded that this program primarily serves middle income consumers.[63] Under the SAVINGPOWER program, therefore, most utilities -- including LILCO -- initiated pilot projects aimed at low-income households. LILCO proposed a three-year program funded at about $400,000 per year aimed at providing grant funds to 425 or more low-income households per year. For qualifying households, a SAVINGPOWER audit and analysis would be performed to identify areas of high electrical usage and potential energy conservation for possible funding. During the audit, low-cost energy conservation measures would be installed. Grants of up to $1,000 per family for electrical energy conservation measures were to be made up to a total of $200,000.[64]

Unfortunately, like other similar programs proposed by New York State utilities, this program did not pass the standard utility cost-effectiveness tests. The Public Service Commission therefore suspended the utility low-income programs in 1989 pending the outcome of its own study of the problem.

Following this study in 1990, the recommendation of the Department of Public Service to the Commission is that the gas and electric utilities establish and implement a Low Income Energy Efficiency Program following certain guidelines. Phase I is a Statewide Cooperative Planning Process, to be completed by September 1991, in which the utilities cooperatively establish details of program delivery methodology, funding levels, and cost recovery proposals. Program implementation, Phase II, would then begin for a period of three years.[65]

The study concluded that the utilities are appropriate agents for low-income energy conservation because of their unique knowledge, expertise, and ability to marshall the needed resources. They have knowledge of energy consumption patterns and need for assistance in paying utility bills, and access to households for, among other things, timely energy education and budget counseling assistance. (Studies indicate that 4 to 8 percent additional energy savings can be achieved through this opportunity for consumer education.[66])

The proposed program would be linked with the New York State Weatherization Assistance Program, and it would coordinate the "patchwork quilt" of other Federal, State, and local low-income programs including the New York State Energy Office's Energy Conservation Bank Program (described below), the New York State Department of Social Services' Emergency Boiler Replacement Program, the U.S. Department of Agriculture's Farmers Home Administration Housing Loans and Grants Program, and the Town of Hempstead Department of Planning and Economic Development's Home Improvement Program.

The proposed Public Service Commission program would be the first to deliver both gas and electric savings. It is expected to produce more gas than electric savings.

Nevertheless, the Department of Public Service staff anticipates that the program will not produce benefits exceeding its costs unless data are searched out that are hard to quantify. These may include environmental externalities, savings in the carrying costs for arrears, future arrears, uncollectibles, collection costs, complaint handling costs, termination and reconnection costs, and such societal benefits as job creation and neighborhood stabilization.

As with other utility conservation programs, the primary funding source would be the ratepayers; "taxpayer funding would be welcome, but is unlikely." Other possible sources of funding include:

o Shareholder support, particularly through the fuel fund mechanism

o Interest earned on HEAP prepayments

o Assistance from the private sector, specifically suppliers of conservation devices

o Homeowner equity: the utility would become a lienholder on the home, to be recompensed at such time as the property is sold.

Eligibility for the proposed utility low-income programs, alas, would be set by the HEAP guidelines, "primarily because they are consistent with the standard used for eligibility for both the Weatherization Assistance Program and the Energy Conservation Bank."

<u>Energy Conservation Bank</u>

The New York State Energy Office Energy Conservation Bank provides financial assistance to improve energy efficiency in one- to four-family homes. There are two components: interest-free loans primarily for low and middle income households, and grants for low-income households eligible by the HEAP guidelines. Both components are operated in conjunction with the utility SAVINGPOWER programs. Grants of $2,500 to $4,500 (depending upon the number of dwelling units in the building) are made for installation of energy conservation measures, including heating system improvements and replacements.[67]

There are approximately 685,000 households in New York State eligible to receive benefits under this program.[68] In 1989, 5,626 grants were awarded at a cost of $11.2 million; 4,372 load subsidies were approved at a subsidy cost of $2.9 million. Long Island received 13 percent of the grants ($1,452,000) and 9 percent of the loan subsidies ($202,000). This is a larger share than the 5 percent Long Island receives of the Weatherization Assistance Program funds. It suggests that low-income funds can be channeled to Long Island more effectively through the local utility than through New York State mechanisms, with both using the same HEAP eligibility standards.

Conclusions and Recommendations

Although their funding is declining as petroleum overcharge money runs out, the two New York State programs -- the Weatherization Assistance Program and the Energy Conservation Bank -- will be the principal sources of assistance to low-income Long Island households in the next few years. The larger of these is the Weatherization Assistance Program, and steps should be taken to widen its scope on Long Island.

Recommendation: Contact the Weatherization Director, Division of Economic Opportunity, Department of State, to assist in overcoming whatever obstacles prevent the full use of weatherization funds allocated to Long Island.

The allocation of weatherization funds to Long Island is now limited by the HEAP income eligibility standards that disregard the local cost of living.

Recommendation: Cooperate with other Long Island agencies in the Weatherization Assistance Program annual review to recommend replacement of the HEAP eligibility standards with the HUD Section 8 eligility rules that do take into account the local cost of living.

It appears, however, that the dependence of the Weatherization Assistance Program partly on HEAP funding makes it captive to the HEAP elibility rules. Moreover, the HEAP eligibility standards also affect Long Island through the Home Energy Assistance Program low-income fuel payment program itself, through the Energy Conservation Bank, and, in the future apparently, through a revived and expanded LILCO low-income program. To get to the heart of the matter, therefore:

Recommendation: Act to have the New York State Department of Social Services alter its income eligibility standards to reflect the local cost of living in the manner of the HUD Section 8 guidelines.

The principal driver for energy conservation in New York State is the Public Service Commission. Not only does it seem dedicated to furthering energy conservation, but it has the power to do so by increasing and deflecting payments by ratepayers to the utilities. The proposed expansion of the low-income program to include natural gas as well as electricity is a big step forward, although not as big on Long Island as elsewhere. Long Island needs to conserve on oil, over which the Public Service Commission has no authority. However, it could be given the authority to concern itself also with conservation of oil by the New York State legislature.

Recommendation: Long Island should support any proposed legislation that would widen the authority of the Public Service Commission to promote conservation of oil as well as electricity and gas.

Whatever efforts are made to foster greater conservation will leave behind some "nonparticipants" who have not benefited from government or utility programs. A disproportionate number of these nonparticipants are likely to be low-income people because their needs are least cost-effective to satisfy, and because they are least able to provide for their own energy conservation. They should not be subject to the additional burden of helping to pay for energy conservation for others.

Recommendation: Steps should be taken through the Public Service Commission to prevent any increase in utility rates of low-income ratepayers due to energy conservation programs.

NATURAL GAS

Natural gas is the fossil fuel of the future. It is sometimes described as the "transition fuel" that bridges the period to the post-fossil fuel age. The transition will last for at least the next twenty years. Whether Long Island will secure an adequate supply of natural gas is the main question.

Natural gas is the most environmentally acceptable fossil fuel. It creates less air pollution than other fossil fuels, and it causes no oil spills. Because of its chemical composition, natural gas when burned releases less carbon dioxide, the principal greenhouse gas, than coal or oil. Almost without dissent, therefore, it is regarded as the preferred fossil fuel if greenhouse gas emissions are to be restricted. The qualification is that leakage in its extraction and transportation may release significant amounts of methane, the principal constituent of natural gas, which is itself a greenhouse gas.

Natural Gas for Electric Generation

The State Energy Plan recommends that New York act to increase the cost-effective and efficient use of natural gas for all sectors by at least 50 percent by 2008 [69], and the electric utilities seem prepared to do their part.

After many years of reducing its reliance on gas generation, the electric power industry in the United States is committing to substantial increases in gas-fired generation. This is due to the attractive characteristics of combustion turbine and combined-cycle gas turbine technology. If additional utility-owned electric generating capacity is required in New York State in the next ten years, the New York Power Pool recommends combined cycle plants [70]; if near-term power shortages are anticipated or peaking power must by enhanced, combustion turbines would be used. In both cases, the fuel could be petroleum distillate or natural gas.

All nine of the cogeneration plants now identified as planned or under construction on Long Island will use natural gas. Of the other 66 cogeneration plants for New York State, 58 (88 percent) plan to use natural gas.[71] If all of the new generating plants that are planned by the New England Power Pool to be fired by natural gas come into being, the additional gas required will equal nearly half of New England's total 1988 consumption of natural gas for all end uses.[72]

A conversion of the Shoreham facility to natural gas is being considered by the Long Island Power Authority.[73] A 300 megawatt cogeneration plant proposed for Pilgrim State Hospital would use natural gas. A 150 megawatt combined cycle power plant proposed to LILCO by the New York Power Pool to be built at Holtsville would burn natural gas.[74]

If fuel cells -- highly efficient, noncombustion, nonpolluting sources of electricity -- come into general use during the next decade as expected, the preferred fuel to power them will also be natural gas.[75]

CNG Vehicles

Natural gas can be compressed in tanks to be used as fuel for vehicles as an alternative to gasoline. The New York State Energy Plan concludes that New York should encourage the use of compressed natural gas (CNG) by encouraging Federal and State actions to insure the increased use of CNG vehicles within New York State and by investigating the economic, environmental and energy implications of implementing specific Federal legislative and regulatory incentives.[76]

Compressed natural gas would be preferable to methanol on Long Island because it presents no risk to the ground water. CNG would be most suitable for fleet use by buses and trucks that have adequate space for the storage cylinders and can be refueled at a central location. However, a test is being conducted in British Columbia with 54 service stations in the Vancouver area, and $2,000 units for home compressors are being offered.[77] Successful tests of CNG buses have been conducted in New York City [78] and of CNG school buses in upstate New York.[79] United Parcel Service plans to convert 2,700 delivery trucks to natural gas in Los Angeles.[80] General Motors is planning to sell at least 1,000 GMC Sierra pickup trucks in 1991 with engines modified to run on natural gas.[81] There are 700,000 natural gas vehicles in use worldwide, including 30,000 in the U.S. Legislation has been introduced in Suffolk County convert 3,000 the county's trucks, cars, and police cars to natural gas at an estimated cost of $1,500 per car.[82]

Natural Gas in Residences

To reduce summer electrical peaks, natural gas refrigerators and clothes dryers can replace electric appliances. For the same reason, an important potential application of natural gas on Long Island is its use for residential air cooling in natural gas heat pumps. Natural gas has long been used for large commercial chillers, but smaller units suitable for residences have been developed, tested, and demonstrated only recently. Although natural gas heat pumps have a lower coefficient of performance (a measure of efficiency) than electric heat pumps, the Gas Research Institute claims that they are competitive in cost where electricity prices are high.[83], [84] LILCO is beginning to evaluate natural gas heat pumps in its DSM program.[85]

Natural Gas Supply

This boom in natural gas raises the question of whether gas supplies will be adequate. An Electric Power Research Institute report identifies three major risks that threaten to disrupt the optimistic outlook for natural gas power generation:

- If gas supply fails to respond to the modest price increases, meeting growing utility gas demand without significantly higher short-term prices will prove difficult.

- If electric utilities underestimate future gas generation requirements and do not plan for gas needs, of if gas producers are slow in responding to this potential market, the effect on gas deliverability and price could be disruptive.

- If fuel switching capability is used up or eliminated because of constrained backup fuel oil supplies or impending environmental legislation, the reliability and cost-effectiveness of gas-fueled power generation could be seriously compromised.[86]

Supplies of natural gas require large, up-front, capital investments that exhibit significant economies of scale. Once in place, the supply network is long-lived. In order for the investment to be risked, a secure long-term market must exist at capacity levels that are economical for buyer and seller. Long-term contracts with large-scale users have been the most common market mechanism. The Federal Energy Regulatory Commission regulates contracting between the gas production and gas pipeline companies and between the interstate pipelines and distribution companies. The Federal Energy Regulatory Commission has also retained the right to determine how much pipeline capacity will be built, where, and the costs of carriage of interstate movement of natural gas.

Over the last five years, many of the rules governing these trades and prices have been changed.[87] The price of natural gas is almost completely deregulated on the wholesale level. The changes instituted have necessitated the development of new market mechanisms. Spot market trades of natural gas have increased rapidly, and pipelines are now free to compete in selling to large users that formerly bought from distributors. They are also under obligation to carry trades from other companies. The New York Mercantile Exchange has just started a natural gas futures market that will allow pipelines and producers to reduce their price risk.

Whether supplies of natural gas will continue to be adequate is a question.[88] United States gas production peaked in 1973. and now continues at an annual rate about 20% lower. Through the use of advanced recovery techniques justified by higher gas prices, gas production in the lower 48 States is expected by the Gas Research Institute to remain steady through 2010. In the near term, however, the Northeast is looking for additional natural gas primarily from the Canadian West. Because of their domestic needs, Canadian projections indicate that their exports to the U.S. will turn down just after the year 2000. Mexico suspended its exports of natural gas to the U.S. in 1984, but it remains a potential source of supply.

There is also a problem of delivering natural gas to the Northeast and particularly to Long Island. The major near term prospect, now approved by the Federal Energy Regulatory Commission, is the Iroquois Natural Gas Transmission System with Canadian gas that enters New York State through Quebec.[89] However, the Iroquois and all other presently proposed pipelines to New York State will satisify only about 80 percent of the expected demand, according to the New York State Energy Office. For New York State to receive the natural gas it will need, the State Energy Office recommends only "aggressive pursuit" of additional supplies.[90]

Long Island suffers an additional constraint on natural gas supply. The New York Facilities System, jointly owned by Consolidated Edison, Brooklyn Union Gas Company, and LILCO, is the pipeline system in metropolitan New York that transmits gas to local distribution systems. Gas consumption patterns make it difficult to serve the Eastern part of the system. Accordingly, the Iroquois system enters New York City from the East through Long Island.

On the way, LILCO will initially receive 35,000 million cubic feet per day, or about 19 percent of Iroquois gas entering Long Island, and about 8 per cent of the total delivered to the Northeast.[91] The Iroquois pipeline will be capable of delivering twice as much gas to Long Island if its pressure is raised and if gas supplies are adequate. LILCO has offered to purchase one percent of Iroquois to gain a voice in its further decisions.

For long-term storage and transport by ship, natural gas is liquefied by cooling it to a very low temperature. Given the expected shortage and the higher prices of natural gas in the Northeast, it is likely that port facilities for importing liquefied natural gas (LNG) to the Northeast will be expanded in the next two decades. An LNG terminal in Boston Harbor is again nearing its capacity. There is a growing international trade in LNG; some 65 LNG tankers are in service worldwide. About 15 percent of the fuel imports of another energy-dependent island, Japan, are LNG, mostly for generating electric power.

For the Atlantic Coast, the present source of LNG is Algeria. However, Norway and Nigeria are planning to build LNG liquefaction plants; Venezuela is another potential source. A proposal has been made to bring LNG from Norway to the Northeast through a manmade island port.[92]

With uncertainty as to future natural gas supply and price, the New York Power Pool has questioned the "sanctity" of long term gas supply contracts.[93] The tightest of contracts can be abrogated if suppliers must provide gas at a substantial loss. While U.S. gas suppliers are now avoiding long term contracts in order to capitalize on expected gas price increases, Canadian suppliers have been willing to accept long-term contracts in order to gain access to the U.S. market. Presumably, a potential foreign LNG supplier would have the same incentive.

A recently completed study by the Electric Power Research Institute cautiously concludes:

> Gas prices in the United States can not yet support the cost of developing a new, grass roots LNG project. However, some existing and potential LNG suppliers have the ability, through some unique features, to lower their project costs sufficiently to supply LNG at competitive prices in today's market. Import and delivery systems for

LNG are already available. The combined capacity of the four U.S. import terminals, two of which are now in service, is more than adequate to handle the volume of LNG likely to be imported in the 1990s. Although even an existing LNG chain requires a steady, year-round throughput to support its high capital cost, contractual arrangements can be made to accommodate the seasonal requirements of gas buyers. Depending upon location, imported LNG could represent a viable source of primary or supplemental or backup fuel for some electric utilities.[94]

Unfortunately, LNG frightens people even though there are scores of LNG storage facilities throughout the U.S., including Long Island, to prepare for winter peak loads. An accident during the maintenance of an LNG tank on Staten Island in 1973 led to New York City legislation that prohibits the use of two LNG storage tanks there and New York State legislation that restricts construction of new LNG storage tanks. Although the legislation was passed in 1976, no regulations to implement it have yet been published by the New York State Department of Environmental Conservation. In that accident, no one off site was injured.

The aggressive pursuit of new supplies of natural gas would be furthered if the Department of Environmental Conservation published its regulations, and if the New York State Energy Research and Development Authority sponsored a study of the feasibility, economics, and safety of an LNG terminal in New York waters.

For an assured supply of the fossil fuel of the future, Long Island could take advantage of its coastline, as it now does for importing oil, to site an LNG terminal. Given Long Island's recent history in siting energy facilities, needless to say, it would take a courageous entrepreneur to make such a proposal, however strong the technical and economic argument case for it. In the absence of an LNG terminal, however, Long Island will remain at the wrong end of the pipeline.

LILCO's Stewardship

With the franchise for distributing both electricity and natural gas, LILCO lies at the heart of Long Island's energy problems. With its attention and resources so long preoccupied with Shoreham, with its steps back from the brink of financial disaster so recent, the question must be raised as to whether a convalescent LILCO is able to lead Long Island through the energy problems of the next two decades.

LILCO can be credited with carefully husbanding its natural gas supply and protecting its residential customers. LILCO's gas prices are significantly lower than those of neighboring gas utilities, Brooklyn Union Gas Company and ConEd. In part, this is due to the geographical circumstances and the local government. LILCO digs in dirt rather than asphalt, and it is less obstructed by "third-party interactions;" encountering interference with city or county water or sewer pipes, the utility has to make the changes. LILCO has applied strict controls on additional hook-ups and seems to have risked few "venture mains" into new territory.

Moreover, as a combined gas and electric utility, LILCO is able to take steps to level its annual gas consumption by burning gas for electricity generation in summer and sending it out for home heating in winter. The Electric Power Research Institute sees a growing interdependence between the electric and gas industries resulting from the increased use of gas for electric generation.[95]

On the other hand, with gas service unavailable in large areas of Long Island, it must be presumed that there is some unsatisfied demand for gas. Figure 8 compares the use of gas and electricity in Nassau and Suffolk Counties with Kings County (Brooklyn), and New York County (Manhattan) where Brooklyn Union Gas and ConEd hold the gas franchises, respectively.[96] While these figures date from 1980, there is no indication that the situation has changed dramatically since.[97]

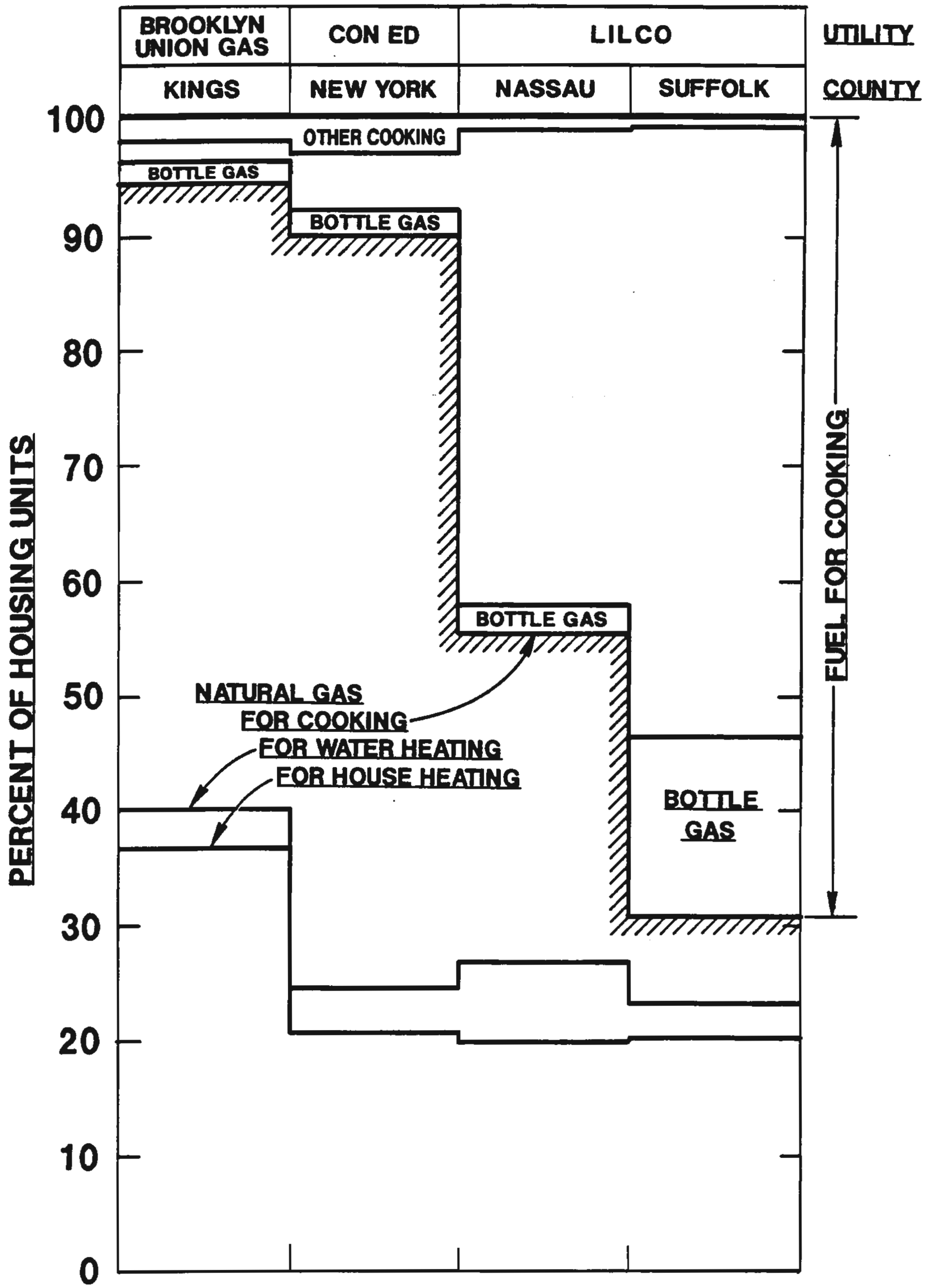


Figure 8. Comparative Use of Gas and Electricity in Long Island Vicinity (Source: 1980 Census of Housing)

From the hatched line down, the percentage of housing units using gas for cooking, water heating, and house heating is shown. For the two combined gas-and-electric utilities, ConEd and LILCO, about 20 percent of houses heat with gas. In Brooklyn Union Gas territory, over 35 percent of housing units are heated with gas. Similarly, the percentage burning gas for water heating is similar in ConEd and LILCO territory: about 25 percent. In Brooklyn it is 40 percent.

The greatest distinction among the counties is in the use of gas for cooking, ranging from 30 percent in Suffolk to 94 percent in Brooklyn. From the hatched line up, the figure shows the fuel used for cooking: natural gas, bottle gas, electricity, or other fuel. The use of bottle gas is about the same in Nassau, New York, and Kings counties; it is much greater, about 15 percent of housing units, in Suffolk.

The hatched line showing natural gas for cooking can be taken as an indication of the percentage of gas hook-ups in the four counties. (It is doubtful if many homes that use gas for house or water heating would not also use it for cooking.)

The primary determinant of this distribution in the use of gas and electricity is undoubtedly population density and distribution. The percentage of houses hooked up to gas could not be expected to be the same in rural Suffolk County and urban Kings County. Nevertheless, some comparisons are worth noting.

Virtually everyone in all four counties is served with electricity. Unless people are different, gas rather than electricity must be the fuel of choice for cooking since it is used so much more in the two New York City counties.

In the two city counties, the percentage of gas hook-ups is nearly the same, but the use of gas for home heating in the gas company's territory is double that in the territory of the combined gas-and-electric utility. This suggests that a combined utility is less successful in marketing the use of gas where there are hook-ups, the principal alternative for home heating being oil.

On the other hand, while the percentage of gas hook-ups in Suffolk County is the lowest of the four, the percentage of houses served with gas that use gas for house and water heating is highest there. This suggests successful marketing of the use of gas in houses that are hooked up by a combined utility: LILCO.

The high percentage of houses using bottle gas in Suffolk indicates a significant potential demand there for natural gas for cooking. Whether this would be an economical extension of LILCO's gas service in rural Suffolk County is, of course, another question.

LILCO's gas expansion plans are logically aimed at replacing oil heat; in most of the country gas heat is more common that oil heat. However, gas is clearly in competition with electricity as well, and LILCO can hardly be expected to promote its gas over its electricity.

With the narrow reserve margins on summer peak electricity loads of the past few years, LILCO's interests would have been served by substituting gas for electricity. This could have been accomplished through the use of commercial gas chillers and gas refrigerators. The DSM plans that LILCO has developed even under these circumstances, however, have been criticized for inadequately substituting gas for electricity. With the electricity peaking problem expected to be relieved in 1991, there will be even less incentive for LILCO to push gas at the expense of electricity.

Perhaps the broader question is LILCO's leadership in finding the natural gas needed for electricity generation in the next two decades. With Iroquois insufficient to fuel even those cogenerating plants already contracted for, where will the gas come from?

The Iroquois capacity can be doubled with future pumping stations and additional gas supplies at the other end. An additional pipeline is expected to reach Long Island within the decade, coming ashore near JFK airport. It seems clear, however, that the natural gas that Long Island will need in the next two decades is not now "in the pipeline." If its economic justification is primarily determined by the needs of LILCO's present residential gas customers, it seems unlikely to be.

We can hope that LILCO makes the most of its advantages as a combined utility to provide Long Island with the growing amount of natural gas it seems certain to need both for electric generation as well as direct retail use.

RENEWABLE ENERGY

Renewable energy may be on the verge of contributing noticeably to Long Island's energy supply. Photovoltaics, wind energy, ethanol fuel, and possibly solar thermal electric power are the main candidates to supplement rooftop solar water heaters and municipal waste as the principal local renewable energy sources. If national measures to reduce greenhouse gases are mandated, greater use of renewable energy sources will become essential.[98]

Renewable energy is due directly or derivatively from solar energy. Unlike fossil energy, using it does not deplete it. Long Island now benefits from renewable energy in the form of hydroelectricity imported from upstate and Quebec, the incineration of municipal waste most of which is "biomass," rooftop water heaters remaining from the period when they were encouraged by tax credits, and a handful of wind turbines, as well as "passive solar" incorporated in building design and siting.

In addition to the 72 megawatt incinerator operating in Hempstead, there are four others now under construction or in planning for Long Island with a total expected electricity output of 85 megawatts.[99] Except for these incinerators, there have been no independent power producers proposing to use renewable energy for LILCO. In part, this may be due to utility bidding procedures which give points for using demonstrated technology and thereby discourage innovation.[100]

A recent overview of the status of renewable energy technologies projects growth from their present 8 percent contribution to U.S. energy supply to 15 percent (with business as usual) or 35 percent (with Federal research and development funds doubled or tripled) over the next forty years.[101] For Long Island, the greatest potential for growth is the use of renewable energy in the next twenty years would appear to be hydroelectricity from Quebec, as argued elsewhere in this report.

Table 5 summarizes the status of individual types of renewable technology.

Table 5. Status of Renewable Energy

Proven Capability[a]	Transition Phase[b]	Future Supplies[c]
•Hydropower	•Wind	•Advanced Wind
•Geothermal - Hydrothermal (high-temp. electric) (low-temp. heat)	•Solar thermal/gas hybrid •Ethanol from corn	•Advanced Solar Thermal •Transportation fuel from energy crops
•Biomass - Direct combustion - Gasification	•Active solar in buildings	•Bio-derived methane •Ocean thermal
•Passive solar in buildings •Small, remote PV	•Geothermal - Hydrothermal (mod-temp. electric) •Remote PV	•Advanced geothermal - Hot dry rock - Geopressure - Magma •Grid-connected PV

[a]Mature technologies.
[b]Has or is entering market as technology develops, often with preferential tax or rate considerations.
[c]Advanced technologies that show potential.

Source: Interlaboratory White Paper, SERI/TP-260-3674 (March 1990)

Photovoltaics

Photovoltaic energy is produced by panels that convert sunlight directly into electricity. It has proven capability in small, remote applications and a future in utility applications, according to Table 5. There are reportedly up to 20,000 homes in the U.S. with photovoltaics.[102] A recent survey by the Electric Power Research Institute [103] identified 219 grid-connected photovoltaic systems with a total combined peak power rating of 11.6 megawatts, of which 9.4 megawatts were in three megawatt-scale plants. Perhaps another 20 megawatts of capacity exists in thousands of remote, stand-alone applications to power telecommunications, highway lighting and call boxes, navigation aids, security systems, water supply pumping systems, cathodic protection, vaccine refrigeration, remote monitoring, rural housing, and small villages.[104]

At present, the cost of photovoltaic electricity is about 25 to 35 cents per kilowatt-hour, as shown in Figure 9, but it is expected by some to decline to 12 cents in the early 1990s and to 6 cents by the year 2000. Photovoltaics are perhaps the most likely of the renewables to exhibit major market growth.

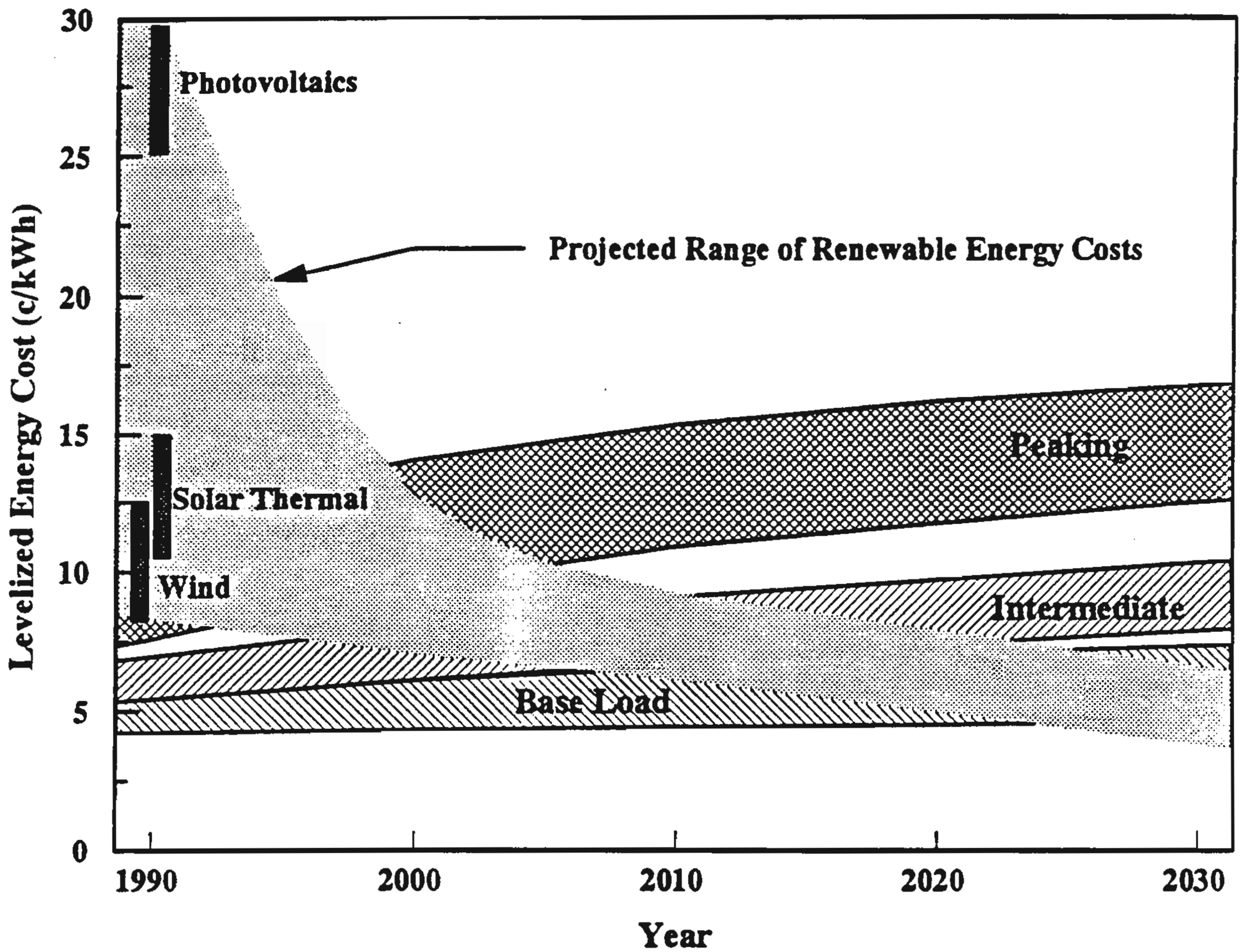


Figure 9. Projected Competitive Status for Selected Solar Renewables In The Electric Utility Sector.

Source: Hartley and Schuler (March 1990)

Photovoltaics have no significant local environmental impact, although hazardous materials are used in their manufacture.

Solar Thermal Energy

Solar thermal energy is produced by focusing sunlight on a pipe or container of fluid. The heated fluid produces steam which drives an electric generator. Solar thermal now provides the most efficient conversion of solar energy to electricity: 32 percent. There are 274 megawatts of grid-connected solar thermal generating capacity in California's Mojave Desert which is to be expanded by another 80 megawatts. An 80-megawatt plant requires about 400 acres. Supplemented by natural-gas-burning generators for up to 25 percent of delivered power, these plants deliver electricity for 8 to 12 cents per kilowatt-hour. Solar thermal energy price is expected by some to drop to about 5 cents per kilowatt-hour in the mid-1990s.([105], [106], [107])

Proponents of large-scale solar thermal energy propose a future installation in the deserts of the Southwest.[108] The solar-generated electricity would be used to produce hydrogen by electrolysis or splitting water molecules. Pipelines would carry energy in the form of hydrogen to the Northeast. Since hydrogen has only one-third the energy content of the same volume of natural gas, however, this would appear to be approximately three times as expensive as piping natural gas, despite the authors' contention that the transportation cost is about the same.

With 161,000 acres (28 percent) of the land in Suffolk County classified as "vacant," the possibility of local solar thermal power may bear investigation. The circulating fluid used in the California plant is a hazardous material with possible adverse environmental effects in case of accidental spills. The most significant environmental effect of the use of solar thermal power on Long Island would probably be the displacement of large areas of vegetation and animal habitat.

Wind Turbines

There are over 20,000 wind turbines in the U.S., with combined generating capacity of 1500 megawatts. There are 3,000 grid-connected houses with wind turbines that feed in about 20 megawatts of excess power.[109] Most U.S. wind turbines are located in California (1,200 megawatts) and Hawaii. The California wind turbines are mostly in wind farms located in three mountain passes that open on to hot, dry valleys or deserts, providing annual average wind speeds in excess of 14 miles per hour. The capacity factor indicating how much of the time electricity is generated is on the order of 17 to 21 percent, with one project consistently reaching 33 percent annually.[110]

The California wind farms were developed with the assistance of Federal and State subsidies. A decline in the number of operating wind turbines that began there in 1987 after the subsidies ended is attributed to the elimination of early unsatisfactory machines.

At present, wind energy is cheaper than solar, about 7 to 9 cents per kilowatt-hour, and some further decline in price is expected.

Wind turbines present some environmental problems. They are noisy, they may interfere with television reception, and there is some risk of damage or injury due to structural failures.[111] Large turbines are therefore best sited away from people.

The South shore of Long Island offers one of the better wind regimes in New York State. There are a few wind generators now connected to the LILCO grid. It appears likely that wind energy could make a contribution to Long Island's energy supply which would be particularly useful if it coincided with summer peak loads.

Energy Storage

The major problem with direct solar energy and wind turbines is that they generate power only when the sun shines or the wind blows, not necessarily when it is most needed. Unless they feed into a large electrical grid where their deficiencies are compensated by other sources, therefore, they must be coupled with a fuel-burning generator if dependable energy is required. Otherwise, some form of energy storage is needed.

Unfortunately, the choices for energy storage are limited. Pumped hydroelectric storage, the best choice, is not possible on Long Island. Batteries are very expensive. As mentioned above, hydrogen has been proposed as a transportation medium, and it could then serve also to store energy. The implication is that hydrogen itself would then serve as a fuel.

Long-term energy schemes have envisioned a future hydrogen-based energy system where hydrogen would replace natural gas in pipelines and be used for combustion in stationary power plants and vehicles. This does not seem likely to materialize on Long Island in the next twenty years, however.

However, Long Island's electricity loads peak on summer days when the sun is shining and there are dependable on-shore breezes coming off the Atlantic Ocean, and electric energy for air conditioning does not need to be stored.

Ethanol and Methanol

Ethanol is currently the largest form of renewable liquid fuel with an industry of about 25 Midwest plants capable of producing 1.1 billion gallons annually. Made mostly by fermenting corn, ethanol is used in gasoline blends around the country. Blends of 10 percent ethanol with gasoline now constitute about 8 percent of U.S. motor fuel, thus displacing 0.8 percent of U.S. gasoline consumption.

The U.S. cost of ethanol from corn is currently about $1.28 per gallon; however, the viability of corn-to-ethanol conversion is currently based on tax incentives and on present prices for corn in the food and feed markets. If all available corn cropland were used, the annual production of ethanol could exceed 10 billion gallons, or 10 percent of current gasoline usage in the U.S. The largest potential for ethanol from biomass exists in the use of abundant cellulosic (woody and herbaceous) biomass materials.[112]

Ethanol is a promising solution to ground-level air pollution because it produces lower levels of carbon monoxide and hydrocarbon emissions than does gasoline.[113], [114] Northville Industries Corporation recently announced that its gasoline on Long Island is being blended with ethanol.

Methanol, or wood alcohol, has characteristics similar to ethanol as a fuel and can also be produced from biomass, not yet commercially. Most methanol is presently manufactured from natural gas. However, it is poisonous and, unlike petroleum, it mixes with water. In large scale use on Long Island, it would present the hazard of ground water contamination.

Other Renewables

Other forms of renewable energy that may find applications elsewhere in the U.S. are not suitable for Long Island. There is no place for hydroelectric dams. Geothermal energy does not underlie our sand. The underground vertical temperature gradient is among the lowest in the country, making hot dry rock geothermal wells unpromising. Waves and tides are not extraordinary. Deep oceans with steep thermal gradients are not nearby.

A GREENHOUSE SCENARIO

There is widespread concern that the increase in the atmosphere of carbon dioxide and other "greenhouse gases" -- methane, nitrous oxide, and CFCs -- will cause global climate change with epic consequences. Carbon dioxide concentrations in the atmosphere are increasing primarily because of worldwide deforestation and combustion of fossil fuel to produce energy.

A great deal of uncertainty surrounds the likely extent of the consequences of the greenhouse effect. Nevertheless, there is a virtual consensus among the world's climatologists that if no action is taken to curb the emission of greenhouse gases the world will be warming at a rate faster than 0.1 degrees C per decade by the year 2000. By 2020, the rate will be twice as large. This has serious implications for shifting rainfall patterns and climate zones and rising sea level.[115]

Except for the United States, the USSR, and China, the major industrialized nations of the world have committed themselves to policies to curb greenhouse gas emissions, as shown in Table 6.[116]

Table 6. Carbon Dioxide Emission Control Policies of Major Nations (Source: New Scientist, 27 October 1990, p. 21)

Country	Contribution to World CO2 Emissions (%)	Policy Plans
USA	22.0	Not in favor of emission controls
USSR	18.4	Not in favor of emission controls at present
Japan	4.4	Stabilize at 1990 levels by 2000
Germany	3.2	30% reduction on 1987 levels by 2005
Britain	2.8	Stabilize at 1990 levels by 2005
Canada	2.0	Stabilize at 1990 levels by 2000 "as a first step"
France	1.9	Recommends 20% cuts by 2005, and up to 50% by 2030
Italy	1.8	Stabilize at 1990 levels by 2000. Parliamentary resolution for 20% cuts by 2005
Australia	1.6	20% reductions by 2005
Netherlands	0.65	Stabilize by 1995, and 3 to 5% reduction by 2000,followed by substantial cuts
Belgium	0.5	Stabilize at 1988 levels by 2000
Denmark	0.3	Calls for 20% reductions
Finland	0.26	Stabilize at 1990 levels by 2000, "at least"
Sweden	0.22	Stabilize on 1988 levels by 2000
Norway	0.22	Stabilize on 1990 levels by 2000
Switzerland	0.2	Supports stabilization at 1990 levels by 2000. 20% cuts proposed
Ireland	0.14	Supports stabilization at current levels by 2000
New Zealand	0.1	20% reduction by 2000

Without judging the merits of the scientific arguments on the possible severity of the greenhouse effect, it would be imprudent for an energy plan for the next twenty years not to take into consideration the possibility of restrictions on emissions of greenhouse gases. For the energy system, this means, in particular, limits on emissions of carbon dioxide which accounts for about half of greenhouse warming.

Carbon dioxide emissions can be reduced by: (i) energy conservation and more efficient use of energy, (ii) substitution of natural gas for oil and coal, and (iii) substitution of renewable energy for all fossil fuel. Thus, preparing for the greenhouse effect only strengthens the recommendations of this plan.

Greenhouse restrictions are likely to lead to more renewables rather than to more conservation. A study of the effectiveness of further electricity conservation measures suggests that we may be approaching a limit. The New York State Energy Plan recommends electricity conservation measures beyond the 8 to 10 percent targeted for the year 2000 only if they are cost-effective. Case studies of three New York utilities found that for only one could further reductions to 15 percent by 2008 be economically justified.[117]

While some analysts are more optimistic about the possibility for major energy savings, particularly in new buildings, it appears inevitable that conservation measures will reach the point of diminishing returns in the old buildings that constitute most of the stock. If this is the case, resources to reduce greenhouse emissions will be better spent elsewhere.

Unlike the price of more conservation, which may start going up, the price of more renewables is likely to be coming down with further development and large-scale manufacture. Moreover, the real price of competing fossil-generated energy will also be going up if there is a greenhouse problem.

Market prices of energy now partly reflect the cost of "externalities." An example of an externality is air pollution from a utility smokestack. The costs of air pollution are borne by those who suffer adverse health effects or property damage. When pollution control equipment is installed, the cost is transferred to the utility. The externality is thus internalized. The cost is then borne by those who receive electricity rather than those who receive emissions.

Greenhouse gas emissions may be seen as another externality. Their cost could be partially internalized by taxing fossil fuels; a "carbon tax" would tax them according to their greenhouse emissions, most for coal and least for natural gas. Competing renewable energy forms would then become more competitive in price.

The greatest change due to the greenhouse effect is thus likely to be seen in the expanded use of renewable energy. Photovoltaics in particular should benefit, because it is primarily price that is holding photovoltaics back.

There is great uncertainty as to the consequences of the greenhouse effect on specific regions of the world. However, climate changes would affect rainfall patterns. Plans to increase hydroelectricity imports to Long Island should be made with an awareness of this uncertainty.

AN ECONOMIC DEVELOPMENT SCENARIO

Long Island is probably facing a decade of sluggish economic activity. Further burdened with its escalating energy costs, Long Island needs to identify measures that can relieve them or otherwise encourage economic development.

Slow economic activity will reduce Long Island's energy needs but probably raise energy prices higher. The fewer the kilowatt-hours of electricity generated by LILCO, the higher the allocation of LILCO's fixed costs, including the Shoreham cost, to each kilowatt-hour. New York State's program for economic development, in which Long Island is apparently favored, is to give large corporations access to cheap New York Power Authority power. This exacerbates the problem of high LILCO electricity rates, in effect requiring the rest of the Long Island community to subsidize its large corporations.

If New York State wants to subsidize industry on Long Island, the way to do it is with really cheap Niagara hydropower generated by the New York Power Authority but distributed through LILCO. While the Western part of the State is now being subsidized with cheap Niagara hydroelectric power, Long Island is being punished for the Shoreham debacle. The remedy lies in the New York State legislature.

A second step is to assist independent power producers in their proposals. At least one enterprising independent power producer is proposing to attract a new industrial plant to Long Island specifically because of its requirement for heat. For such possibilities to continue, the national Public Utilities Regulatory Policies Act of 1978 and the New York State "six-cent law" need to remain in force.

Independent power producers have complained about the unfair tax advantage enjoyed by the New York Power Authority in competition for LILCO power generation work, and legislation has been introduced to equalize the situation. However, independent power producers themselves can qualify for special tax treatment by submitting their bids in conjunction with local governments that qualify.

Coping with adversity can lead to marketable skills; the Dutch experience with holding back the sea undoubtedly makes them the world's leading experts on dikes, a growth market if greenhouse predictions are right. Long Island with its overpriced energy has a strong incentive to provide more energy-efficient housing. In Brookhaven National Laboratory, Long Island has a pioneer in testing and promoting improved building practices.[118] The technology is being developed for a revolution in housing construction. Its application will be impeded by well-known problems of industry fragmentation, multitudinous building codes, etc. In Levittown after World War II, however, Long Island set the standard for the kind of housing that was needed then. The stage is set for setting the standard for the housing we will need in the next two decades.

ENDNOTES AND REFERENCES

1. Cotter, W. D., T. C. Jorling, and P. A. Bradford, New York State Energy Plan (September 1989), p. 33.

2. Long Island Lighting Company, Annual Report (1989), pp. 32, 33, 44, 45.

The Shoreham Settlement is implemented in a Public Service Commission rate order of 13 April 1989 which establishes a Rate Moderation Agreement. The Rate Moderation Agreement provides rate increases to LILCO of 5.4 percent on 18 February 1989, 5 percent on 1 December 1989, 5 percent on 1 December 1990, and "targeted " increases of 4.5 to 5 percent in each of the following eight years. The targeted increases will generally be subject to normal ratemaking procedures. The Rate Moderation Agreement provides for full capital recovery of a "regulatory asset" known as the Financial Resource Asset. The Financial Resource Asset has two components: the Base Financial Component and the Rate Moderation Component. The Base Financial Component represents the present value of the future net-after-tax cash flows promised to LILCO for its financial recovery. On 30 June 1989, the Base Financial Component was approximately $4 billion. This amount is to be fully recovered by LILCO through its rate base in amounts calculated by amortizing it over 40 years on a straight-line basis.

The first payment of this amortization would require a shocking immediate rate increase. Therefore, the pain is applied gradually by withholding part of the first payments to LILCO during a ten-year period and restoring them, with interest, during the latter part of the ten years. This is accomplished with the Rate Moderation Component.

The Rate Moderation Component reflects the difference between LILCO's revenues under the Rate Moderation Agreement and what they would otherwise be under conventional ratemaking. Its purpose is to prevent abrupt changes in rates, limiting them to the 4.5 to 5 percent range. Payments due to LILCO under the agreement are therefore initially deferred, collecting interest, but are expected to be fully recovered by 1999. The interest rates are based on common equity returns which range from 12.75 to 14.2 percent in 1989-91. The range of 4.5 to 5 percent increases is based on a number of assumptions which may not hold, as discussed elsewhere in this report.

Basically, however, the $4 billion is allocated to electric rates which are charged by kilowatt-hours. In 1989, LILCO sold 16,802 million kilowatt-hour of electricity. With this level of sales, the "present value" of the cost of the Shoreham settlement is $0.238 per kilowatt-hour. In 1989, the average LILCO residential customer consumed 7,932 kilowatt-hours. Therefore, the cost of the Shoreham settlement allocated to him is $1,888.

If LILCO sales remained level for the next 40 years and if the average residential customer could earn bank interest in the range of 12.75 to 14.2 percent, he could put $1,888 in the bank and draw it down to meet the additional electric charges due to Shoreham. His actual bank interest would be less than common equity returns; perhaps 8 percent bank interest compared to 12 percent LILCO equity returns. In this case, he would have to deposit about 50 percent more than $1,888 in the bank, or about $2,800. Rising LILCO sales in the future would increas the number of kilowatt-hour over which the Shoreham settlement amount would be allocated, and therefore reduce the required payment by the average residential customer.

3. Personal communication from Christopher O'Brien, New York Power Authority, 26 September 1990. The Economic Development Power Allocation Board of the New York Power Authority was established in 1987 by New York State to allocate lower-cost electric power to New York business that would contribute to the State's economy by increasing employment and maintaining the State's economic base. The New York Power Authority uses a portion of its nuclear power for this purpose. A total of 126.7 megawatts of power is available to the entire State of which 17.85 megawatts have been allocated to the LILCO service area.

4. Freeport, Greenport, and Rockville Centre. New York Power Authority delivered 700 million kilowatt-hours of electricity to Long Island in 1989 to these three communities, Brookhaven National Laboratory, Grumman, Nassau County Public Utility Agency, and Suffolk County Electrical Agency. This amounts to 4.2 percent of the electricity delivered by LILCO, meaning that LILCO rates are one or two percent higher than they would be if LILCO also served these customers. New York Power Authority, Annual Report (1989) pp. 44, 47.

5. The City of Watertown, for example, has begun active consideration of a municipal takeover of the electric distribution system of Niagara Mohawk Power Corporation.

6. Parmalee, J., New York State Energy Office, personal communication, 5 December 1990.

7. New York Power Pool, Integrated Planning Strategy of the New York Power Pool (1989), p. 37.

8. New York State Energy Office, Department of Public Service, Department of Environmental Conservation, Draft New York State Energy Plan, Vol. IV, Electricity Supply Assessment (September 1989), p. 43.

9. Electric Power Research Institute, TAG Technical Assistance Guide, Vol. 1: Electricity Supply--1986, EPRI P-4463-SR (December 1986), pp. B-31ff.

10. New York Power Pool, Integrated Planning Strategy of the New York Power Pool (1989), p. 18.

11. Electric Power Research Institute, Cogeneration and Independent Power Production: Market Insight and Outlook, EPRI CU-6964 (August 1990).

12. New York Power Authority, press release, December 13, 1990.

13. Resource Management International, Inc., CMS Enterprises Company, Long Lake Energy Corporation, and Sargent & Lundy, Evaluation of the Shoreham Conversion, Vol. I, Executive Summary (draft report), Long Island Power Authority (September 1990).

14. Resource Management International, Inc. et al, ibid., p. I-13.

15. Wilson, K., N.Y. Official Urges Halt on Power-Plant Plan, Newsday, December 20, 1990.

16. New York Power Authority, press release, January 6, 1988.

17. New England Power Planning, Assessing NEPOOL's Resource Adequacy and Potential sources (1991-2005), Technical Supplement (June 1990), p. 44.

18. Filion, P., M. Gosselin, P. Prevost and G. Savard, Energy in Quebec, 1987 Edition, Direction des communications de le ministere de l'Energie et des Ressources, Government of Quebec (1988), p. 91.

19. Berger, C., R. Dubois, E. Lessar, A. Haurie, and R. Loulou, "Assessing the Dividends of Power Exchange between Quebec and New York State: a Systems Analysis Approach," Int. J. of Energy Research, Vol. 14, 253-273 (1990).

20. Berger, C., R. Dubois, A. Haurie, and R. Loulou, Modelling Electricity Trading in the Northeast, proceedings of the 12th Annual North American Conference of the International Association of Energy Economists, Ottawa, October 1-3, 1990 (in press).

21. Consolidated Edison Company of New York, Inc., Joint petition by Con Edison, Long Island Lighting Company, and Orange and Rockland Utilities to the New York State Public Service Commission Requesting Approval for Rate Recovery of the Costs to be Incurred under a Long-Term Purchase of 800 megawatts of Power and Energy from Hydro-Quebec through the New York Power Authority (September 6, 1990), p. 6.

22. ConEd et al., ibid., Exhibit 5B.

23. Ibid.

24. Long Island Lighting Company, Annual Report to the Securities and Exchange Commission for 1989, Form 10-K, p. 23.

25. New England Power Pool, 1989 Annual Report (1990), pp. 11, 17.

26. Parmalee, J., New York State Energy Office, personal communication, 5 December 1990.

27. Drouin, R., Notre Propre Énergie: l'Hydroélectricité, speech to the Electricity Club of Quebec (13 November 1990), p. 16.

28. New York Power Pool, Load and Capacity Data, 1990-2006 (April 1990), p. 83.

29. New York State Energy Office, Department of Public Service, Department of Environmental Conservation, Draft New York State Energy Plan, Vol. IV, Electricity Supply Assessment (September 1989), p. 24.

30. New York State Energy Office, Department of Public Service, Department of Environmental Conservation, Draft New York State Energy Plan, Vol. IV, Electricity Supply Assessment (September 1989), pp. 84-86, 108.

31. New York State Energy Office, Department of Public Service, Department of Environmental Conservation, Draft New York State Energy Plan, Vol. IV, Electricity Supply Assessment (September 1989), p. 89.

32. New York Power Pool, Integrated Planning Strategy of the New York Power Pool (1989), p. 57, 58.

33. John P. Buechler, LILCO, personal communication, 21 September 1990.

34. Hill, D., and V. Mubayi, Trade-Offs in Size, Quantity, and Reliability of Generalized Nuclear Power Plants, in Energy Solutions for the Nineties, Proceedings of Energy '87, a Specialty Conference Sponsored by the Energy Division of the American Society of Civil Engineers, April 27-29, 1987.

35. Richard C. King, Assistant Counsel, New York State Public Service Commission, personal communication (January 16, 1991).

36. New York State Public Service Commission, Order Concerning 1991 and 1992 Demand Side Management Plans, Case 28223 (November 27, 1990), Department of Public Service Recommendation.

37. Technical Development Corporation, Cohen & Dax, and Bingham Dana & Gould, A Detailed Guide to Energy Performance Contracting in New York Municipal and County Governments, New York State Energy Research and Development Authority (undated).

38. Lane and Edson, P.C., Investigation into the Establishment of a Corporation for Energy Financing, Report 87-15, New York State Energy Research and Development Authority (August 1987).

39. Costello, S., New York State Energy Office, personal communication, 19 July 1990.

40. Hill, D., Preliminary Analysis of EASI Data: Nassau and Suffolk, unpublished briefing notes (24 May 1990).

41. Bevington, R., and A. H. Rosenfeld, Energy for Buildings and Homes, Scientific American (September 1990) pp.77ff.

42. Fickett, A.P., C.W. Gellings, and A.B. Lovins, Efficient Use of Electricity, Scientific American (September 1990) p 65ff.

43. Cotter, W.D., T.C. Jorling, and P.A. Bradford, New York State Energy Plan, Overview (September 1989), p. 2.

44. Lovins, A.B., Energy, People, and Industrialization, in Energy Technologies for Reducing Emissions of Greenhouse Gases, proceedings of an Experts' Seminar, Paris, 12-14 April 1989, Organisation for Economic Co-Operation and Development, International Energy Agency (1989), Vol. 2, p. 301ff.

45. Miller, P.M, J.H. Eto, and H.S. Geller, The Potential for Electricity Conservation in New York State, Report 89-12, New York State Energy Research and Development Authority (September 1989).

46. Ruff, L.E., Environmental Protection Through Energy Conservation: A "Free Lunch" At Last? conference on Energy and the Environment in the 21st Century, March 26-28, 1990, Preprint Volume II (1990), p. DIV-1ff.

47. State of New York, Department of Public Service, Recommendation, Case 89-M-124, tober 18, 1990.

48. Vine, E. L., and I. Reyes. Residential Energy Consumption and Expenditure Patterns of Low-Income Households in the United States, Lawrence Berkeley Laboratory, Berkeley, California (1987).

49. Low-Income Home Energy Authorization Act of 1981, PL 97-35, Title 26; Human Services Reauthorization Act of 1984, PL 98-558, Title 6; Human Services Reauthorization Act of 1986, PL 99-425, Title 5.

50. Home Energy Assistance Program, New York State Department of Social Services, Desk Guide, DSS-3862 (Revised October 1990).

51. Personal communication, Bruce Grant, Community Development Agency, Town of Huntington (31 December 1990).

52. Energy Conservation and Production Act, PL 94-385, Title 4; State Energy Efficiency Program Improvement Act of 1990.

53. Schlegel, J., J. McBride, S. Thomas, and P. Berkowitz, The State-of-the-Art of Low-Income Weatherization: Past Present, and Future, Proceedings of the ACEEE 1990 Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, Washington (1990), p. 7.208.

54. N.Y.S. Department of State, Division of Economic Opportunity, Weatherization Assistance Program, State Plan, 1990 Program Year, July 1, 1990 - March 31, 1991.

55. Schlegel, J., J. McBride, S. Thomas, and P. Berkowitz, ibid., p. 7.

56. New York Department of State, Weatherization Assistance Program Briefing Undated).

57. An Evaluation of the New York State Weatherization Assistance Program, Final Project Report, prepared for the New York State Energy Office by the Synertech System Corporation, SYN TR 90-513, June 1990, Section 6, quoted in State of New York, Department of Public Service, Recommendation, Case 89-M-124, October 18, 1990.

58. Girardi, R., Weatherization Director, Division of Economic Opportunity, Department of State, State of New York, letter to D. Hill (5 November 1990).

59. U.S. Department of Housing and Urban Development, Section 8 Program Income Eligibility Limits (February 16, 1990).

60. New York State Public Service Commission, Order Concerning 1991 and 1992 Demand Side Management Plans, Case 28223 (November 27, 1990), Department of Public Service Recommendation, pp. 6, A-39.

61. Long Island Lighting Company, 1991-92 Electric Conservation and Load Management Biennial Plan, pp. 41ff, 59ff.

62. Long Island Lighting Company, 1990 Electric Conservation and Load Management Plan, Table 1.

63. Urban Systems Research and Engineering, Inc., SAVINGPOWER Market Survey for New York State (October 22, 1986).

64. Long Island Lighting Company, 1990 Electric Conservation and Load Management Plan, pp. III-85 to -90.

65.. New York State Public Service Commission, Notice of Proposed Rulemaking, Case -M-124, Proceeding on Motion of the Commission to Determine Whether the Major Gas and Combined Gas and Electric Utilities Subject to the Commission's Jurisdiction Should Establish and Implement a Low Income Energy Efficiency Program (November 12, 1990).

66.. Quaid, M., Low-Income Energy Education Programs: A Review of Evaluation Results and Methods, in Proceedings of the ACEEE 1990 Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, Washington (1990), p. 7.157.

67. New York State Energy Office, 1989 Report on Use of Petroleum Overcharge Restitutionary Funds, p. 44ff.

68. New York State Public Service Commission, Order Instituting Proceeding and Requesting Comments, Case 89-M-124 (June 21, 1989), Appendix A, p. 3.

69. Cotter, W.D., T.C. Jorling, and P.A. Bradford, New York State Energy Plan (September 1989), p. 10.

70. New York Power Pool, Integrated Planning Strategy of the New York Power Pool 1989), p. 19.

71. New York State Energy Office, Small Power Data Base (May 1990), Table 3.

72. New England Power Planning, Assessing NEPOOL's Resource Adequacy and Potential Resources (1991-2005), Executive Report (June 1990), p. 13.

73. Resource Management International, Inc., CMS Enterprises Company, Long Lake Energy Corporation, and Sargent & Lundy, Evaluation of the Shoreham Conversion, Vol. I, Executive Summary (draft report) (September 1990).

74. New York Power Authority, press release, December 13, 1990.

75. New York Power Pool. Integrated Planning Strategy (1989), p. 52.

76. Cotter, W.D., T.C. Jorling, and P.A. Bradford, ibid., p. 10.

77. Holusha, J., Taking Natural Gas for Test Drive, The New York Times, May 31, 1989.

78. Brooklyn Union Gas Annual Report 1989, p. 3.

79. Mueller Associates, Inc., Dual-Fuel School Bus Demonstration, Report 87-17, New York State Energy Research and Development Authority (October 1986).

80. Stevenson, R. W., United Parcel to Alter Its Trucks in Los Angeles to Create Less Smog, The New York Times, July 11, 1990.

81. Hayes, T.C., G.M. to Sell Trucks Fueld by Natural Gas, The New York Times (July 25, 1990).

82. Woolley, M., Legislator Eyes Plan to Run County Fleet on Natural Gas, Suffolk Life (July 18, 1990).

83. Gas Research Institute, Residential Gas Heat Pumps: a Developing Technology (March 1987).

84. Gas Research Institute, Technology Profile: Residential Gas-Engine-Driven Heat Pump (January 1988)

85. LILCO 1991-92 Electric Conservation and Load Management Biennial Plan, p. 155.

86. Electric Power Research Institute, Natural Gas for Electric Power Generation: Strategic Issues, Risks, and Opportunities, EPRI P-6820 (September 1990).

87. Lyon, T.P., Natural Gas Policy: The Unresolved Issues, The Energy Journal, Vol. 11, No. 2 (April 1990) pp. 23-50.

88. Huntington, H.G., and G.E. Schuler, Jr., North American Natural Gas Markets: Summary of an Energy Modeling Forum Study, The Energy Journal, Vol. 11, No. 2 (April 1990) pp. 1-22.

89. Federal Energy Regulatory Commission, Opinion No. 357 (November 14, 1990).

90. New York State Energy Plan, Overview (September 1989), p. 14.

91. Federal Energy Regulatory Commission, Opinion No. 357 (November 14, 1990), Appendix C.

92. Hydro-Icona, Inc., The ICONA Project: a Business Project to Bring Norwegian Gas to the Northeast via a Manmade Island Port (undated).

93. New York Power Pool. Integrated Planning Strategy (1989), p. 21.

94. Electric Power Research Institute, Imported LNG as an Alternative Fuel, EPRI OCSP-6871 (November 1990).

95. Electric Power Research Institute, Natural Gas Requirements for Electricity Generation Through 2000: Can the Natural Gas Industry Meet Them? EPRI P-6821 (May 1990).

96. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Housing, Vol. Chapter B, pp. 34-357, 34-359.

97. Long Island Lighting Company, Appliance Saturation Survey, 1987 (February 1988) p. 37.

98. Morris, S.C., B.D. Solomon, D. Hill, J. Lee, and G. Goldstein, A Least Cost Energy alysis of U.S. CO2 Reduction Options, Proceedings of the Conference on Perspectives on Solar Energy and the Environment, Energy and the Environment in the 21st Century, Massachusetts Institute of Technology, March 26-28, 1990 (in press) Figures 4 and 10.

99. New York State Energy Office, Small Power Data Base (May 1990), Table 5.

100. For example: Long Island Lighting Company, Request for Proposals for Purchase of Electric Capacity and Energy, RFP #1 (November 8, 1989), Appendix A. Evaluation Sheet 7.

101. Idaho National Engineering Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratories, and Solar Research Institute, The Potential of Renewable Energy: An Interlaboratory White Paper, SERI/TP-260-3674, DE90000322 (March 1990), p. viii.

102. Solar Technical Information Program, Energy for Today: Renewable Energy, SERI/SP-220-3554, Solar Energy Research Institute (March 1990), p. 21.

103. Electric Power Research Institute, Survey of U.S. Line-Connected Photovoltaic Systems, GS-6306 (March 1989).

104. Interlaboratory White Paper, ibid., p. 9.

105. Solar Technical Information Program, ibid., p. 18.

106. California Energy Commission, Presiding Member's Report, Application for rtification for Luz Engineering Corporation, Luz SEGS IX and X Projects (Harper Lake), Docket No. 89-AFC-1 (December 1989), p. PROJ DES-1.

107. Interlaboratory White Paper, ibid., p. 8.

108. Ogden, J. M., and R. H. Williams, Solar Hydrogen: Moving Beyond Fossil Fuels, World Resources Institute (October 1989).

109. Solar Technical Information Program, ibid., p. 7, 13.

110. California Energy Commission, 1988 Annual Report, Results from the Wind Project Performance Reporting System (August 1989), pp. 7, 8, 12.

111. California Energy Commission, Avian Mortality at Larg Wind Energy Facilities in California: Identification of a Problem (August 1989).

112. Interlaboratory White Paper, ibid., p. 10.

113. Solar Technical Information Program, ibid., p.9, 10.

114. Hartley, D.L., and D.G. Schuler, Perspectives on Solar Energy and the Environment, Energy and the Environment in the 21st Century, Massachusetts Institute of Technology (March 26-28, 1990), p. F-82.

115. Gribbin, J., An Assault on the Climate Consensus, New Scientist, 15 December 1990, 26ff.

116. Bowler, C., D. MacKenzie, M. Cross, T. Thwaites, C. Joyce, R. Milne, and J. Gribbin, The Politics of Climate: A Long Haul Ahead, New Scientist (27 October 1990), p. 21.

117. Guinn, C. R., letter to Laurence DeWitt, August 10, 1990, with enclosure, Meeting the State Energy Plan DSM Goals: An Analysis of Prototypical DSM Programs for Niagara Mohawk Corporation, Consolidated Edison Company of New York, Inc., and Long Island Lighting Company, New York State Energy Office (August 1990).

118. For example: Loss, W., R. Jones, and P. Cerniglia, The Danish House at the Brookhaven International Housing Village: Preliminary Results, BNL 38790, Brookhaven National Laboratory (August 1986).

APPENDIX A

ENERGY DEMAND

ENERGY DEMAND

SUMMARY

The following section discusses the major elements influencing demand for various forms of energy used on Long Island. Several scenarios are developed to permit forecasting feasible ranges of these determinants into the next century. Major factors are the level of economic activity, employment, and population growth. A Long Island Gross Regional Product (GRP) range of .4% to 2.4% and population and employment growth rates of 0-1.1% were used to define the range of future paths of the economy.

Other factors discussed are expected price levels, commercial activity levels, transportation and home heating trends. The current Persian Gulf crisis was assumed to have no long lasting affects on prices or demand for petroleum products.

Prices of crude oil are expected to increase between 2.4% and 5.3% annually, adjusted for inflation. The natural gas price is expected to incrase annually between 0% and 5%, adjusted for inflation and electricity prices are projected to increase between 1% and 4% on an anualized basis, adjusted for inflation.

Projections of the determinants of demand are used to adjust and validate energy forecasts prepared by national, state, and regional agencies and by LILCO. The range of increase in electricity demand in the forecast is from about 7% to 83% by 2006. But adjusting for regional differences and rising electric rates due to the Shoreham agreement, a more feasible range is estimated at between 12-42% by 2006. This is equivalent to annual growth rates between 0.7% and 2.3%.

Natural gas demand is predicted to increase between 20-50% by 2007, while heating oil demand is expected to increase less rapidly, in a range of 8-10% above current levels. Motor gasoline demand is predicted to rise by 0.6-1.2% per year.

DETERMINANTS OF ENERGY DEMAND

The demand for energy is more difficult to determine than some other products because people do not make direct choices about purchasing it but choose instead levels of lighting, thermostat settings, or to drive to work rather than take the bus. Since the earlier oil supply shocks in 1972 and 1978, the factors that are crucial in predicting the amount of energy needed in an economy have been identified. The following paragraphs describe briefly what forces will play a part in the evolution of energy demand on Long Island over the next twenty years. Tables 1A-4A provide a summary of known determinants of demand for electricity, natural gas and oil.[1] For estimating future demand for Long Island's major energy sources, only those determinants that had available, local, historical data were used.

The demand for all types of energy is influenced by its own price, the price and availability of alternative fuels, the availability and relative cost of the technologies using the fuels, the number of people and businesses in the geographic area, and their economic well-being. Energy demand also varies by sector of the economy. Parts of the energy market are regulated by various government agencies.

The capacity to store electricity economically is limited, so production has to be able to expand and contract with demand which varies with time of day and weather. On Long Island, generating capacity is old and dependent on oil. The cost of electricity is going to increase to cover the costs of the Shoreham nuclear power plant.

Natural gas demand depends on the availability of a costly supply network. Introduction of natural gas into new markets has usually required steep discounts in its price compared to competing fuels to overcome the high connection costs associated with natural gas. On Long Island, many areas have not had access to natural gas. LILCO is planning to extend its distribution lines so that more people and businesses will have natural gas available. Key factors in the success of the program will be the relative price of natural gas compared to home heating oil and electricity, connection charges, and the costs, energy efficiency, and availability of gas appliances.

There are many different products derived from crude oil. Local consumption is difficult to determine because the markets for petroleum products are not regulated in the same way as natural gas and electricity. Major demand determinants for petroleum products are availability of alternative technologies and fuels and the price of the products. Some products compete with other oil products, like diesel and gasoline; others compete with electricity and natural gas.

Other energy sources such as coal, wood, or solar radiation do not contribute significantly to Long Island's energy needs and will probably not do so in the near future. The price of solar panels has been reduced and advances are being made on the costs and reliability of wind turbines. This may make these technologies competitive in the future, particularly if emission limits are placed on carbon dioxide.

TABLE 1A

DETERMINANTS OF DEMAND FOR ELECTRICITY

Residential Sector

Number and age composition of households
Household income
Price of electricity
Prevalence of electricity-using appliances
Costs and availability of alternative energy sources and appliances (natural gas, for instance)

Commercial Sector

Volume of sales
Price of electricity
Cost of electrical heat pumps vs those using alternative fuels for space heating
Reliability of service
Hours of business

Industrial Sector

Price of electricity
Intensity of electricity use of industry
Reliability of service
Relative price of alternative fuels
Relative cost of producing own electricity

Public Sector

Price of electricity
Number and size of schools
Size of budget
Expenditure for police
Types of public water supply (e.g. pumping needs)
Plant utilization level

TABLE 2A

DETERMINANTS OF DEMAND FOR NATURAL GAS

Residential and Commercial Sectors

Connection charges
Price of delivered gas
Price of alternative fuels
Availability of natural gas
Number and age composition of households
Household income
Heating degree days
Cooling degree days
Relative cost of natural gas appliances vs alternative fuel appliances

Industrial and Utility Sectors

Price of delivered gas
Price of alternative fuels
Availability
Long-term supply reliability
Long-term price stability
Regulation on use
Demand for industrial or utility outputs
Relative costs of competing products
Cost of industrial conversion

TABLE 3A

DETERMINANTS OF DEMAND FOR GASOLINE AND DIESEL*

PASSENGER VEHICLES

Determinants

Number of vehicles in circulation
New car cost
Price of gasoline
Relative size of age cohorts in population
Average annual mileage per vehicle
Road conditions and congestion
Characteristics of current car stock, gas mileage
Number of taxis and their gas mileage
Government ownership of vehicles and their fleet characteristics
Size and location of the labor force vs work place

Substitutes

Cost and convenience of public transport
Cost of taxi fares
Cost of diesel-fueled vehicles and diesel fuel
Cost of LNG conversion and cost and availability of LNG

BUSES

Determinants

Number of gasoline-driven buses in circulation
Gasoline mileage and age of bus fleet
Average annual mileage per bus
Public subsidies
Cost and availability of new buses and spare parts
Fares per passenger mile
Cost of gasoline
Traffic congestion
Population growth
Per capita income
Number of school buses, privately owned buses, etc.

---

* Diesel fuel is so similar to gasoline that no table is presented. For diesel, this table can be read substituting diesel for gasoline and gasoline for diesel.

Substitutes

Diesel buses
Number and costs of alternatives--cars, taxis, motorcycles
Availability of alternative public transport--railroad, boats.

GASOLINE TRUCKS

Determinants

Number of trucks in circulation
Gasoline mileage and age of current fleet
Average carrying capacity
Costs and availability of new trucks
License fees and vehicle taxes
Economic activity level, GDP by sector

Substitutes

Availability and costs of diesel-operated trucks
Availability and costs of LNG-operated trucks
Availability and costs of rail or ship transport

OTHER EQUIPMENT USING GASOLINE

Determinants

Construction activity level
Number of pumps, processing equipment, generators, agricultur al equipment, etc
Number of boats
Economic activity level by equipment level

Substitutes

Cost and availability of electricity and electricity-driven equipment
Cost of alternative diesel or LNG operated equipment

TABLE 4A

DETERMINANTS OF DEMAND FOR LIQUEFIED PETROLEUM GAS (LPG) AND FUEL OIL

LPG IN ALL SECTORS

Price and availability of LPG
Cost of supply bottles
Cost of LPG-using equipment vs alternatives
Household income, commercial and industrial activity levels
Population growth and economic expansion
Price and availability of natural gas

FUEL OIL IN ALL SECTORS

Electrical Utilities

Price of fuel oil and alternatives such as coal, natural gas, hydro and their availability
Demand for electricity
Expansion planned using fuel oil

Industrial Uses

Price of fuel oil and alternatives such as natural gas and electricity, when available.
Energy input requirements by industry or process
Potential conservation and its cost
Output levels by industry
Relative costs of self-owned generation plants and reliability of electrical service
Heating degree days

RANGE OF FUTURE DETERMINANTS OF LONG ISLAND ENERGY DEMAND

Estimating future demands for various forms of energy requires estimating values for the determinants of the energy demands described in the previous section. Forecasting single values for the array of data that would be necessary, given the preceding tables, is precarious and could be misleading. Three different scenarios are presented to demonstrate a range of moderate, feasible, future paths of the economy and interactions with energy demand. The scenarios are not designed to be extreme or low probability limits on possible demands. The three scenarios are based on different assumptions about economic growth on Long Island, smoothed over time.

The healthy growth scenario represents growth of 2.4% per year in gross regional product (GRP) and employment. The availability of jobs would increase population by 1.1% per year and encourage household formation growth at a rate of 1.7% per year. This scenario approximates the Center for Regional Studies employment estimates[2] and the Long Island Master Plan Housing Component[3] population and household figures.

The recent growth in the Long Island economy, approximately 1% per year growth in economic activity and employment, was extended to 2010 to form the mid-range scenario. The employment growth figure is taken from the New York State Department of Labor study of Long Island employment, Labor Market Assessment: Occupational Supply and Demand, Nassau-Suffolk, 1990.[4]

The slow growth scenario describes an economy with very slow growth in output and employment, .4% for 20 years. This scenario is unlikely to prevail for twenty years, but may be applicable for the next 1-5 years if there is a serious recession during the period.

The Energy Plan for Long Island should deal with the range of energy demands that these diverse scenarios represent. Long term policies should be applicable over a range of feasible developments or flexible enough to adapt to changing circumstances. The three scenarios used here are to demonstrate the uncertainty about future events and the appropriateness of alternative policies over a broad spectrum of conditions. No scenario includes a Middle East or any other war.

In order to put the Long Island scenarios in context, Table 5A shows assumptions about the national and state economies used by the Energy Information Administration in producing the U.S. Annual Energy Outlook, 1990[5], by the State Energy Office in producing the New York State Energy Plan[6], and assumptions used in this report about Long Island's economy. The national energy forecast was published in January 1990; the New York State plan was prepared in 1988.

TABLE 5A

GROWTH RATE ASSUMPTIONS FOR ECONOMIC INDICATORS

ECONOMIC INDICATOR	LONG ISLAND DATA	N.Y.STATE DATA	NATIONAL DATA
GROSS PRODUCT (GRP,GSP,GNP)	0.4 - 2.4%/year	2.5%/year	2.1 - 2.8%/year
DISPOSABLE INCOME		2.4%/year	1.8 - 2.3%/year
MANUFACTURING OUTPUT		2.7%/year	2.2 - 3.3%/year
POPULATION	0.0 - 1.1%/year	.3%/year	NA
EMPLOYMENT	0.4 - 2.4%/year	1%/year	1.4% to 2000, 0.7% 2000-10
NUMBER OF HOUSEHOLDS	0 .2 - 1.7%/year	.5%/year	NA

Estimates of population, economic activity level, and household income for the scenarios will be presented first, followed by price projections and quantities of energy demanded.

POPULATION

Population figures for Long Island for the last ten years are taken from the 1989 Long Island Population Survey, published by the Long Island Lighting Company.[7] Figure 1A shows the historical data and a feasible range of population growth for the next twenty years. The high estimate shows 1.1% growth per year, from the healthy growth scenario. The middle path represents the modest growth scenario and was based on population estimates using the labor market constraints from a study for the Long Island Regional Economic Development Council by the Long Island Regional Planning Board[8] and the low estimate represents an economic stagnation scenario that reflects a modest exodus of jobs and people from the area. The range in estimates is from 2.7 million to 3.4 million people by the year 2010, or 0% to 26% higher than 1989.

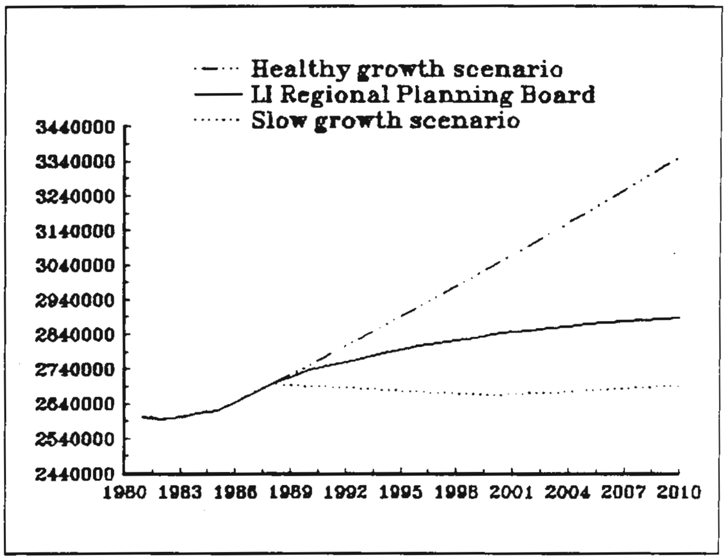


Figure 1A PROJECTED POPULATION OF LONG ISLAND

The number of people in a household has been declining on Long Island and nationally. Figure 2A shows two projections of household size. The faster decline is the trend from 1980 to 1988; an alternative decline projects the slower rate experienced in 1988-89. The national average household size in 1989 is lower than household size on Long Island and is shown as a constant. Estimates from the Housing Component of the Long Island Plan range from 2.65 to 3.1, for 2010, slightly higher than the range shown in Figure 2A which is 2.45 to 2.85 members.

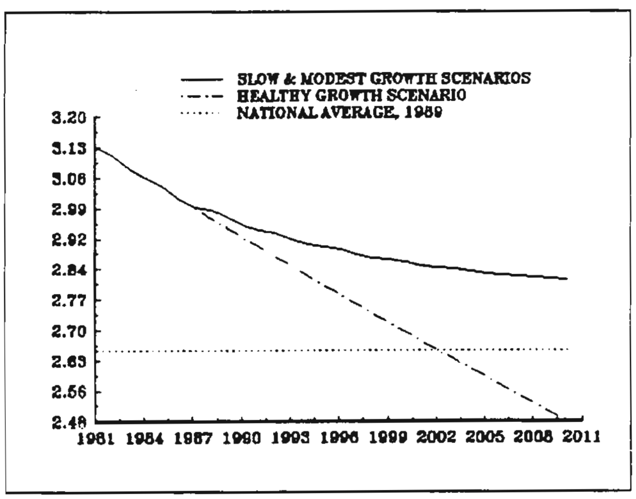


Figure 2A HOUSEHOLD SIZE

Figure 3A shows the population projections from Figure 1A translated into households. Even the slightly declining population of the economic stagnation scenario can produce an increase in the number of households on Long Island in the future. The State Energy Office projection of the number of households on Long Island is also shown. It falls in the middle of the range. There is a significant range in the estimated number of households between the high and low cases, 400,000, or a difference in growth between 5% and 62%.

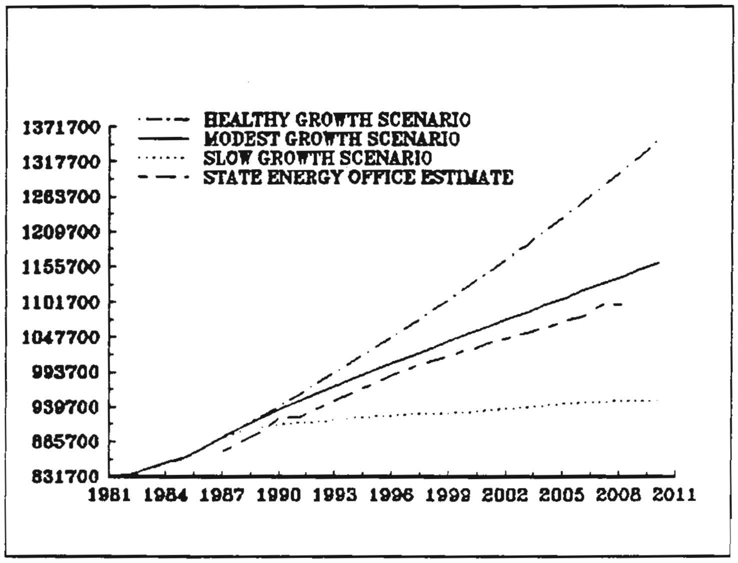


Figure 3A NUMBER OF HOUSEHOLDS

If nothing but population and household formations were changed, the amount of electricity, natural gas, and petroleum products consumed would increase. For example, average household consumption of electricity was about 5400 kilowatt hours (KWH) last year.[9] An increase in the number of households from approximately 900 thousand currently to 1.35 million in 2010, would increase residential electricity demand 2220 million KWH, if the average customer consumed as much electricity then as they do now. (See the section on Commercial Sector Activity below for an estimate of the effect on commercial electricity demand.)

The size and composition of households also influence energy use. Four people in two housing units will use more energy for heat, lighting, etc. than four people in one unit and six people in a housing unit consume more energy than two people do, in general. Patterns of energy use vary with the age and make-up of the household units, depending in large part on whether people are home or at work during the day.

Studies show that households use energy with different intensity through life-cycle changes. Older people use more space heat and electricity, but less gasoline. Growth in the 18-24 age cohort increases the number of cars and gasoline consumption. The Long Island Regional Planning Board estimates by age cohort show the size of the prime driving age cohort will remain about the same by 2000, the over 55 group will grow about 1%. A rapid change in average vehicle-miles traveled seems unlikely.

Population and the number of households are expected to grow on Long Island, creating additional demand for energy. The number of households is expected to be between 900,000 and 1.35 million by 2010. Population is expected to be between 2.7 and 3.4 million people, both depending on growth in the economy and availability of jobs.

ECONOMIC ACTIVITY AND EMPLOYMENT

There are few measures of economic activity, like gross regional product (GRP), available at the county level on a timely basis. Disposable personal income is only available with long time lags. Annual employment is used here to represent both economic activity levels and household income. The figures are available, they reflect the influence of economic activity and employment helps determine personal income.

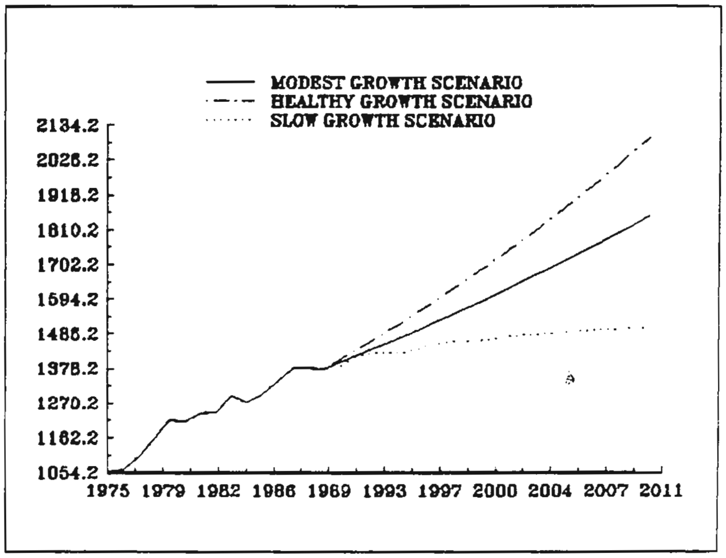


Figure 4A EMPLOYMENT ON LONG ISLAND

In a recent study, the State Labor Department[10] predicts annual employment in Nassau and Suffolk counties for all occupations will rise at 1.425% per year from 1988 to 1992. An earlier study by the Long Island Regional Planning Board[11] estimated an annual growth rate between 2.21%-2.63%, to 2000. Figure 4A shows the growth in employment extending these rates to 2010. A slow growth scenario lasting for the entire twenty years is also presented. Future employment is likely to fall within these boundaries. An economic downturn has begun at the present time, but it is not predicted to be as severe as the recession in the early eighties. However, it is expected to vary in intensity among regions.

The range in estimated employment by 2010 is from 1.5 million to 2.2 million people, a 7% to 57% increase over the present level of 1.4 million.

A continuation of the shift in employment from the manufacturing sector to the service sector would tend to reduce earnings, but at the same time there is expected to be a shift towards occupations that require more education and skills. This and the expected shortage of qualified people to fill these jobs will probably increase earnings enough to offset sectorial shifts.[12] Income is thus expected to keep pace with inflation, but not to push demand up significantly.

FUEL PRICES

The relative prices of competing fuels are important determinants of any specific fuel use. The prices of various sources of energy tend to move in the same direction since there can be substitution of one fuel for another if price differentials are maintained for a sufficient period of time. The price of crude oil has fluctuated sharply since the supply disruptions of 1972 and 1979, and taken the prices of natural gas and electricity with it. Since disruption and sharp changes are unpredictable, the current price of crude oil reflects the uncertainty about supplies we face at the present time. Shortly before the Iraqi invasion of Kuwait, the price of crude oil was falling as world-wide stocks of crude and product were rising. If the situation in the Middle East is settled in the near future, the current stocks and production will combine with the output from Iraq and Kuwait to cause a drop in oil prices. Because of the long term nature of this study, such temporary fluctutions are ignored. This amounts to an implicit assumption that there is not a significant supply disruption or lengthy war. However, the current situation should underline the importance of having alternative sources of energy avialable when disruptions in supply occur. That would minimize the cost in dollars and inconvenience of supply disturbances.

Prices paid for energy on Long Island are determined in a variety of markets. The price of crude oil is determined in a world market. Its price influences other energy prices by shifting demand for those other energy sources such as coal, natural gas and electricity, when oil prices change. Natural gas prices are established and regulated on a national and state level; electricity price is regulated at the state level, but determined in a local market.

Figure 5A shows the range of prices forecast for imported crude oil, in 1989 dollars. The estimates are from the Department of Energy, Energy Information Administration's Annual Energy Outlook, 1990. As the graph shows, historically the price of oil has varied over a wide range. Supply shocks are likely to cause wide swings in crude oil prices in the future as well. Long-term, the price will probably fall within the range represented here.

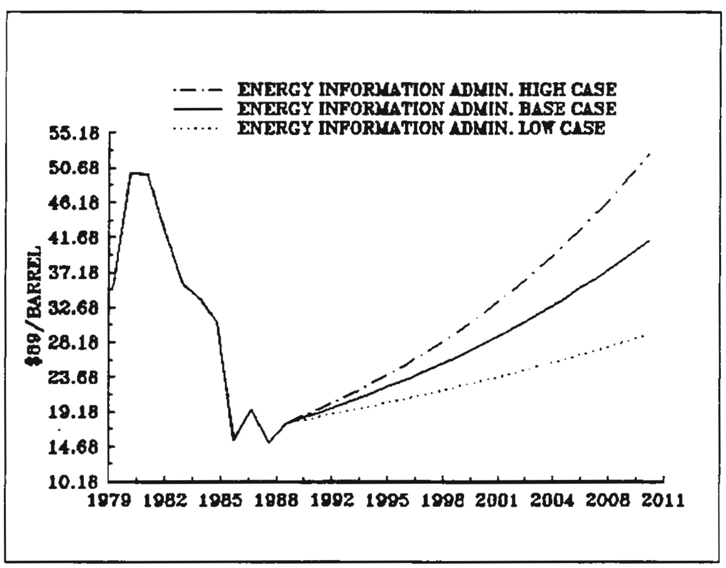


Figure 5A WORLD OIL PRICES IN 1989 DOLLARS

The price of oil products closely follows the price of crude oil and so are expected to rise in about the same proportion. Table 6A shows a variety of oil products and the range of prices expected nationally in 2010, by the Energy Information Administration. Prices are shown in 1989 dollars per million British Thermal Unit (MMBTU) and in the more familiar 1989 dollars per gallon (gal.).

TABLE 6A

OIL PRODUCT PRICES IN 1989 DOLLARS

ENERGY DEPARTMENT ESTIMATES

PRODUCT	$/MMBTU HIGH	$/MMBTU LOW	$/GAL HIGH	$/GAL LOW
Distillate	11.77	9.22	1.63	1.28
Jet Fuel	9.97	6.71	1.35	0.91
Motor Gasoline	13.83	9.95	1.73	1.24
Residual Fuel	7.60	4.23	1.14	0.63

Figure 6A shows the average yearly prices that residents of New York State and Long Island paid for regular, unleaded gasoline. On average, Long Island paid 1 cent less. Long Island made out less well when compared to the Western part of the state where gasoline was about 2 cents per gallon cheaper. According to the state surveys, Long Island pays more for self-service, premium, unleaded gasoline than any other part of the state.

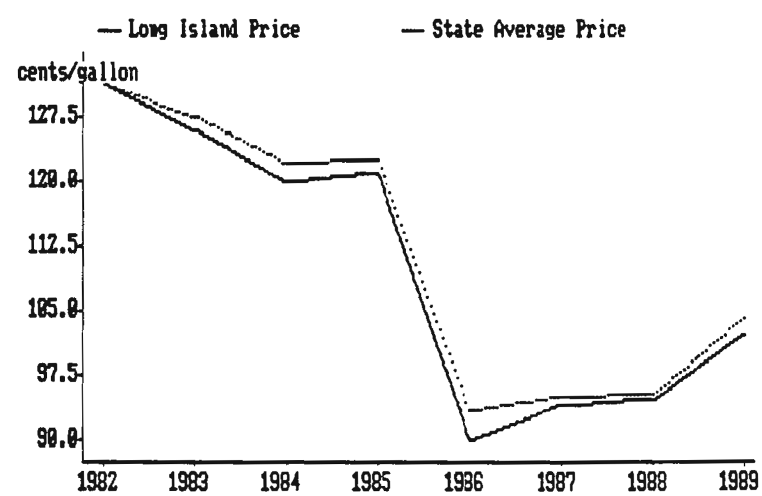


Figure 6A COMPARISON OF GASOLINE PRICES, LONG ISLAND VS N.Y. STATE

Three price paths for residential natural gas are shown in Figure 7A. The middle path is the price forecast by the New York State Energy Office.[13] The high path uses the percent increases forecast by the Gas Research Institute[14],[15] for the residential sector, and the low path is a continuation of the trend for the past 4 years at about a third of a percent less than the inflation rate. The recent uncertainty in the markets for crude oil and its products has caused natural gas prices to rise slightly compared to last year. If there is a war in the Middle East and supplies of crude oil are disrupted, the price of natural gas may rise, as it can be substituted for several petroleum products. However, the ability to switch to natural gas can not be achieved quickly by those who do not already have the capacity. This would be primarily a short-term affect.

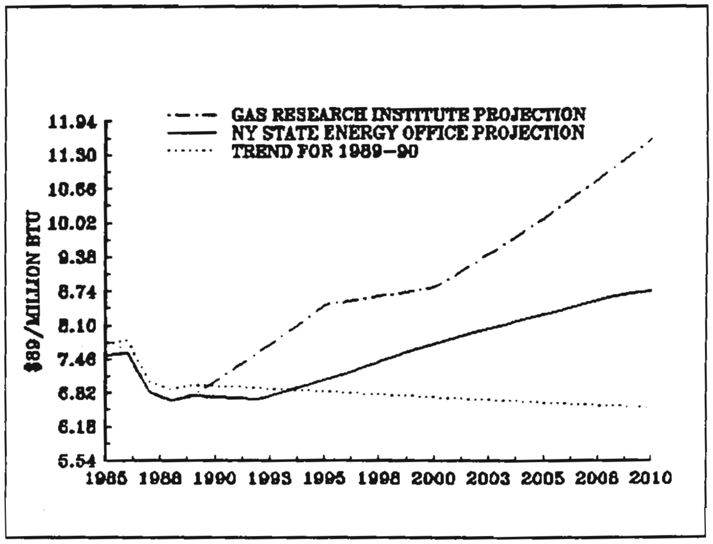


Figure 7A PRICE RANGE FOR RESIDENTIAL NATURAL GAS

The price paid for electricity is made up of rates which cover the costs of capital investments (fixed costs) and fuel charges which reflect changes in variable costs. On Long Island, the Shoreham settlement will affect electrical rates.[16] The Rate Moderation Agreement portion of the Shoreham Settlement anticipates an increase of about 5% per year in both components of the rates. Savings in fuel costs over the period of the Settlement, if they occur, will be used to reduce the deferred payment amount that made it possible to keep initial year rate increases at only 5%. Rates for electricity on Long Island will go up a minimum of 5% per year for the next ten years and probably longer. The Shoreham Settlement does not limit the rate increases to 5% after the first three years, but rather suggests 5% as a guideline, given a number of assumptions. Recently those assumptions have proven to underestimate recoverable costs, the interest rate, and inflation and to overestimate the kilowatts of electricity over which to spread the costs. Table 7A shows some of the factors used in estimating the needed revenue that forms the basis of the Rate Agreement and the current trends in those factors.

Table 7A RATE MODERATION AGREEMENT*

Component	Assumptions	Current Estimate	Direction of Effect on Rates
Inflation	4%/year	5.5%/year	Increase
Fuel Costs	5%/year increase	20%/short-term	Increase
Sales of Electricity	1.8% annualized	0.4% annualized	Increase
Capacity Requirements	900 Megawatts Combined cycle	300 Megawatts	Decrease

*Source: Draft Report Rate Moderation Agreement, (Exh. 610, New York State Public Service Commission, undated), 1990 Forecast of Electricity Sales, Requirements and Peak Loads: 1990 to 2006, (Long Island Lighting Company, Hicksville, NY, Spring 1990).

Figure 8A shows a range of feasible rates for electricity to residential customers over the next twenty years, in 1989 dollars. The slow growth projection shows a 1%, inflation adjusted, yearly increase in electrical rates throughout the forecast period. This is based on an assumption that there are small additional generating capacity costs and/or demand side management program costs placed in the rate base in the years 2001-2010, but unrecovered costs during the early years of the settlement will be added to the amortization amount, extending its recovery well into the next century. This is the most likely price path. Since the forecasts were first prepared, LILCO has requested approval by the Public Service Commission of 5 percent (1% inflation adjusted, at an inannual inflation rate of 4%) rate increases for the next five years, but extending the recovery period of the Rate Moderation Agreement another two years. Rates would be frozen for the last two years under the proposal, **but** if sales projections are too

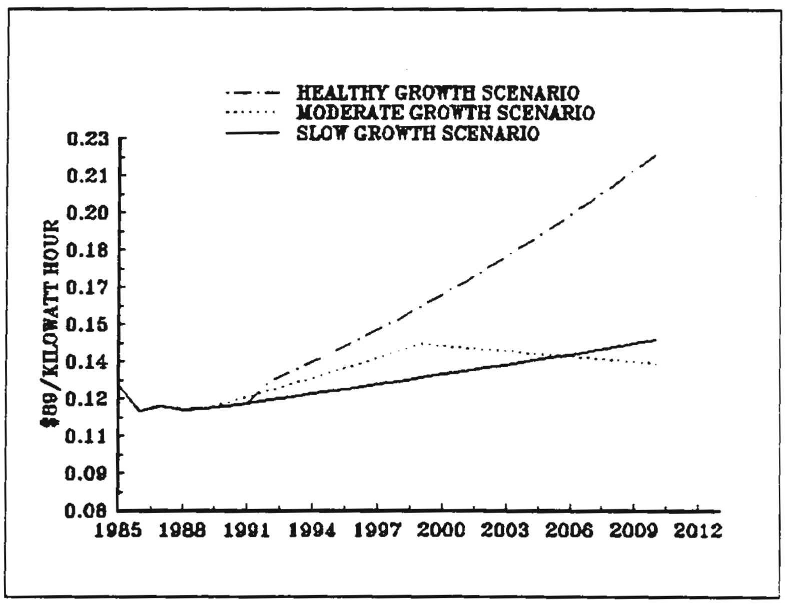


Figure 8A FUTURE PRICES OF ELECTRICITY ON LONG ISLAND, 1989 DOLLARS, 4% INFLATION low it would be made up from an addition assessed in the fuel adjustment amount, effectively raising rates.[17]

In the high rate scenario, the rate increases at an inflation adjusted 1% per year for three years as specified by the Rate Agreement and 4% inflation adjusted per year thereafter. This estimate assumes that additional generating capacity is needed to replace some of the aging plants now in service and to meet the growth in demand in the healthy economy scenario.

The third price path is based on increases of 3% per year, inflation adjusted, for the first ten years and a 3.5% per year decrease in the last ten years. This last projection is an attempt to estimate what might happen if rate increases in the early years were allowed to cover all costs in the Rate Moderation Agreement and for additions to capacity to meet moderate growth in electricity, instead of putting the unrecovered costs into an interest earning account.

By 2010, possible residential rates range from 13 cents to 22 cents per kilowatt hour, in 1989 dollars, as compared to about 13 cents currently. Because the Rate Agreement is in nominal dollars, an annual inflation rate of 4% was used to make the estimates and keep them consistent with other information about the agreement.

The price for industrial and commercial customers is expected to follow the same pattern, beginning at a lower base price. The expected price increases will create incentives for users to opt out of the system by becoming a co-producer, organizing a town to qualify for New York Power Authority less expensive, up-state power, or utilizing the Economic Development provision that allows large users to obtain power less expensively than their neighbors. If large electricity consumers are not available to share the costs, rates for residential and small business customers who do not have these options would increase more rapidly.

Higher electric rates will encourage conservation and substitution of other energy sources, reducing demand by individual consumers compared to current levels or to areas where rates are lower.

<u>Relative Prices</u>

Prices for electricity on Long Island are already high. Figure 9A shows a comparison of LILCO, the New York state average, and the national average for residential customers. Elsewhere in the U.S., electricity costs are expected to increase at less than the rate of inflation and electrical consumption is expected to rise.[18]

Figure 10A shows the price per BTU for residential electricity, natural gas, and distillate fuel oil in New York State. A comparison of prices is easier by heat content than by trying to compare cubic feet of natural gas to barrels of oil. However, it should be noted that the comparison is incomplete without the efficiencies of the energy-using appliances. It is the combination of fuel and technology that determines the total cost and least-cost choice, as pointed out in the section on determinants of demand. The graph illustrates why there is little advantage to switching between fuel oil and natural gas for home heating, where the efficiencies are about equal. Switching from electricity to either of the other fuels would save money unless an efficient electric heat-pump is the technology compared.

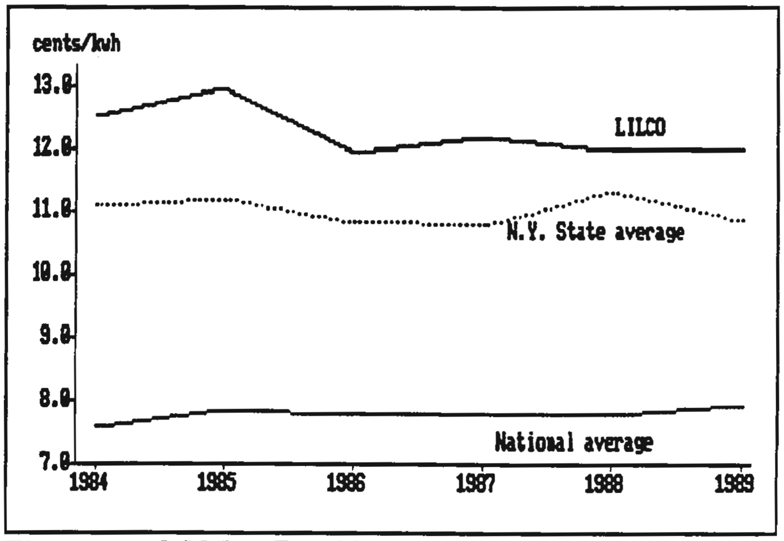


Figure 9A COMPARISON ELECTRICITY PRICES

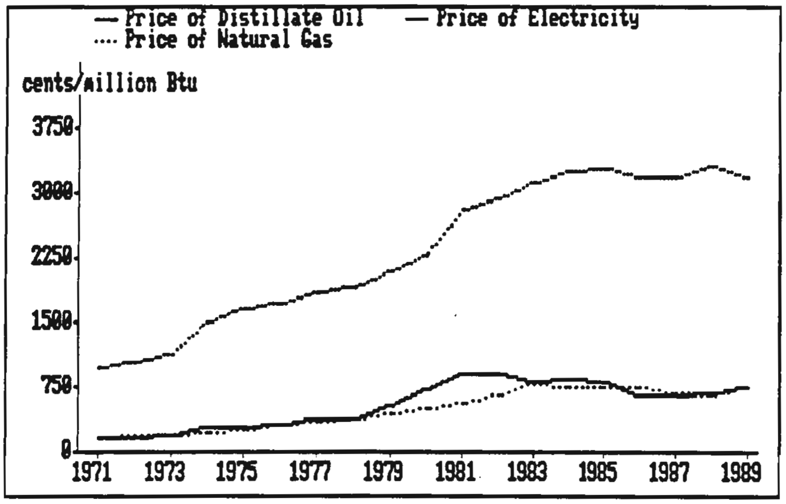


Figure 10A COMPARISON OF ENERGY PRICES

COMMERCIAL SECTOR ACTIVITY

An increase in population and/or households expands the amount of building space devoted to commercial enterprise as well as affecting residential consumption of energy. This secondary affect of population growth will boost energy consumption over and above those effects mentioned earlier. Nationally, when sales of electricity to residential customers rose 1%, commercial electricity sales rose about .75%. In the healthy growth case, this would increase demand for electricity by an additional 1823 million KWH, if the demand relationships remained unchanged.

TRANSPORTATION

Use of petroleum products for transportation purposes dominates U.S. demand for oil, comprising more than 62% of oil consumption in 1989.[19] Personal travel by automobile is the major determinant of gasoline demand. Because the number of cars per capita is close to saturation (1.2 cars for every licensed driver),[20] the amount of motor gasoline consumed will be determined primarily by the use and efficiency of the stock of cars. Car use, usually measured in vehicle-miles traveled, is highly correlated with disposable personal income. There are few reports of vehicle miles traveled being affected by the availability of public transportation. Of greater influence is distance to work and age. People over 65 drive far fewer miles than other age groups in the population.

Personal income is expected to increase at about the rate of inflation so there is no additional income effect or gasoline consumption projected from this source.

The number of cars on Long Island is expected to grow as the population expands but the number of cars per capita is expected to remain about the same. The replacement of older cars with newer ones will improve the average fuel efficiency from about 18 miles per gallon (mpg) to about 28 mpg by 2010.[21] Sustained high prices for motor gasoline would improve average fuel efficiency at a faster rate.

It has been reported that a recent gasoline price increase of 25% since Iraq invaded Kuwait, lowered demand almost 8%.[22,23] Continued high prices would probably have an even greater impact as people change their habits, buy more efficient cars, live closer to work, and make other long-term adjustments. The small increase in the federal gasoline tax recently passed by Congress will have little impact on gasoline and diesel sales or future efficiency choices.

HOME HEATING

In 1988, according to the latest completed LILCO Survey of Appliances, 66% of the households on Long Island used oil for space heating, 6% used electricity, 27% natural gas from LILCO, and 2% used other means. According to the Fuel Oil Association about 900 million gallons of fuel oil were used on Long Island last year--home heating used 650 million gallons, 20 million were consumed by LILCO, and 230 million was consumed by the commercial and industrial sectors.

The Fuel Oil Dealers Association provided the following information on average Long Island household use of fuel oil. In the early 1970's the average consumption was 1200 gallons of fuel oil. By the early 80's, consumption had declined 23% to 920 gallons, but in the last five years average consumption has risen to 980 gallons. The Dealers' Association felt it probable that the 23% decrease reflected a move to more fuel efficient equipment and insulation and that the recent 6% increase in consumption is a price induced increase in thermostat settings. The Association expects efficiency improvements this winter and reduced thermostat settings as a result of the price increases due to the Middle East embargo.

QUANTITIES OF ENERGY DEMANDED

ELECTRICITY DEMAND ESTIMATES

Long Island Lighting Company (LILCO)

LILCO prepares a forecast of electricity sales each year as part of their planning process. The most recent forecast, 1990 Preliminary Forecast of Electricity Sales, Requirements and Peak Loads: 1990-2006,[24] prepared by the Economic and Management Planning Department in the spring of 1990, details only one forecast, but provides separate estimates of the negative impact on sales of conservation, demand-side management programs (DSM), cogeneration, and New York Power Authority (NYPA) sales in LILCO territory. The forecast which LILCO used as a base for their adjustments, projects electricity sales to grow at the same rate as prior to 1988. The actual LILCO forecast coincides with the growth rate in 89-90. Figure 11A reproduces the LILCO forecast in gigawatt hours (1 billion watthours or 1 million kilowatt hours), on the right scale and the estimated megawatt capacity needed at the peaks, on the left. (Capacity planners at most utilities convert estimated demand in watthours to peak requirements in megawatts and, if there is insufficient capacity, estimate load curves which show demand by time period (season or day) to determine what type of capacity is most suitable to fill the need.)

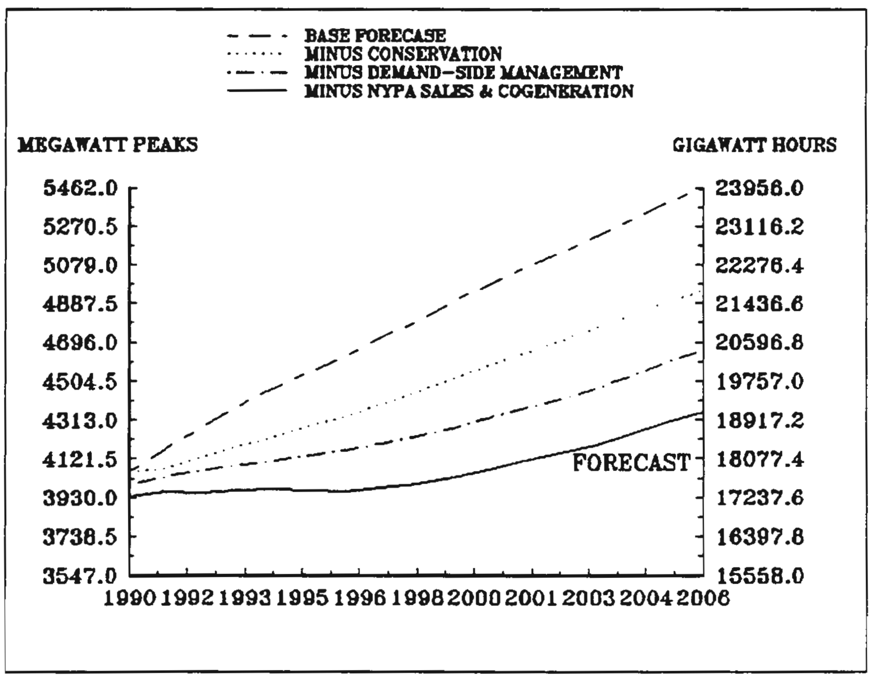


Figure 11A LILCO ESTIMATES OF ELECTRICAL REQUIREMENTS

New York State Energy Office

The New York State Energy Office also prepares estimates of demand for electricity on Long Island as part of their planning process, but not on a yearly basis. The Division of Policy and Planning reported estimates for four scenarios in Energy Demand Forecasts, 1988-2008, Technical Appendices.[25] These estimates are shown in Figure 12A and represent the largest spread by 2006 of any forecast.

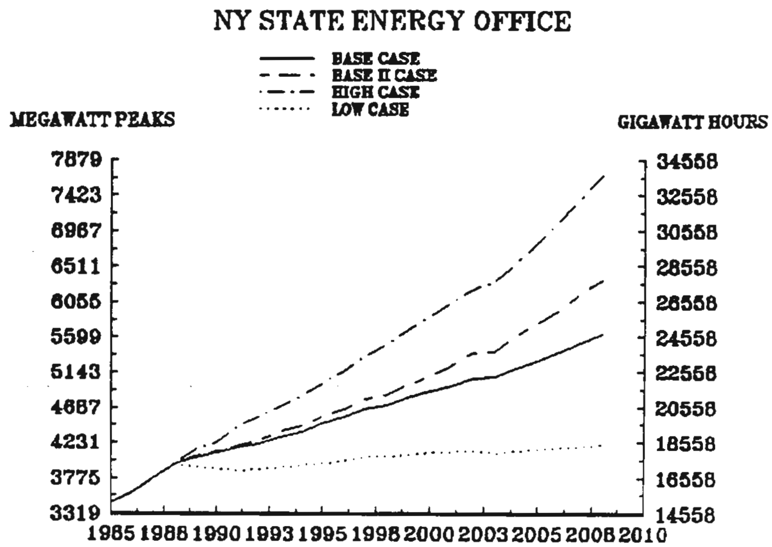


Figure 12A State Energy Office Estimates of Electrical Requirements

Next to the LILCO forecast, this is the forecast most specific to Long Island available. There is a year difference in the dates of preparation between the two forecasts.

Department of Energy, Energy Information Administration

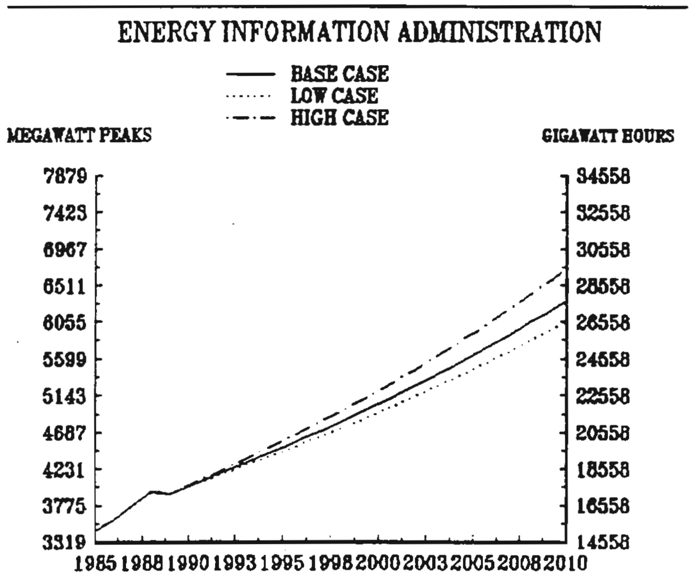


Figure 13A EIA Percent Increases Applied to LILCO 1989 Generation

The Annual Energy Outlook 1990 with Projections to 2010[26] presents five scenarios which result in different electricity demand growth rates. The growth rates range from a low of 2.1% to a high of 2.6% for electrical generation with 2.3% as the base assumption. These growth rates were applied to LILCO's 1989 generation to give the estimates in Figure 13A.

Range and Feasibility of Estimates for Electricity

By the year 2006, the estimates range from a high of 31,154 GWH to a low of 18,266 GWH, with the LILCO forecast at 19,081 within 5% of the low case.

Some of the variation in the estimates may be explained by the differences in prices used for the forecasts. The State Energy Office estimates show two price effects as Base 1 and Base 2. The prices are about the same for either case until 2000 but from 2000-2008 the average price is an inflation adjusted increase of 1.3% for Base 1, (Note the similarity to the price forecast above.) compared to an inflation adjusted decrease of 1% for Base 2. Economic activity level accounts for the additional changes in estimates to the high and low cases. It is unlikely that electrical rates on Long Island will decrease on an inflation adjusted basis, as in the Base 2 case.

As noted earlier, the Energy Information Administration estimates of prices show the real costs of electricity falling throughout the forecast period, but on Long Island, the price of electricity will rise. The forecast from the Energy Information Administration associated with the price decline is growth in electricity demand of 2.3% per year. One would expect Long Island growth to be less than that figure, other things being the same. The Energy Information Administration low growth rate is about the same as LILCO's high growth rate.

LILCO's estimates fall within the estimate ranges of the energy agencies, but the actual forecast is at the low end of the spectrum. LILCO can demonstrate its ability to meet these future demands with no additional generating or transmission capacity except those already under construction. The forecast is what is used in the New York Power Pool review to assure the reliability of the Power Pool. It is not clear what contingent plans exist to meet demand requirements if they exceed the LILCO forecast.

Because reliable service depends on adequately sized facilities, an additional test of the feasibility of the estimates was made. Aggregate demands, both historical and estimated, were divided by the number households on Long Island estimated earlier in the determinants section. The results are pictured in Figure 14A. The range calculated this way shows quite dramatically the behavioral differences implied in the range of estimates. Per household consumption ranges from a high of 25,310 KWH per year per household to a low of 15,180 in 2006. This latter figure is lower than at any time since 1980. It should be kept in mind that this is a gross comparison since it attributes industrial and commercial sales to households as well as residential consumption, but the historical data is treated in the same way as the projections.

The Energy Information Administration provides an estimate of the impact on electricity demand of Demand-Side Management (DSM) programs adopted by various utilities. Demand-side management programs are expected to lower demand about 3% by 2010. In contrast, LILCO is forecasting demand-side management impacts of between 5-

10% by 2006. Again, the differences may be due to differences in electrical prices. Falling real prices offer little incentive for demand-side management programs. Unfortunately, Energy Information Administration does not report the demand-side management impact when prices decline at slower rates. Other agencies have estimated that demand-side management programs can achieve savings in excess of 10% of electricity consumption by 2010.[27]

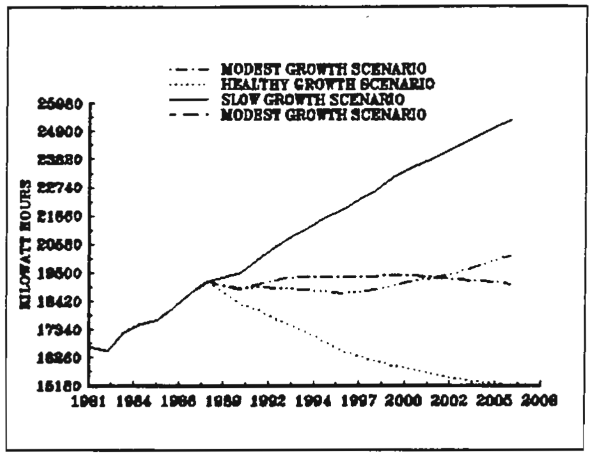


Figure 14A ELECTRICAL DEMAND DIVIDED BY THE NUMBER OF HOUSEHOLDS

Using LILCO's base for the high estimate and LILCO's forecast as the low estimate seems to represent a feasible range for electricity demand. There is a large difference in the implications for electricity prices and reliability between the high and low estimates. Narrowing the range based on historical data is difficult because the low estimate assumes a significant change in the demand pattern of households and businesses. If conservation measures are successful and economic growth follows the slow growth scenario, then the low projection of electricity demand is most likely. Under the healthy growth scenario, even with conservation, the higher end of the range is more likely.

QUANTITIES OF NATURAL GAS DEMANDED

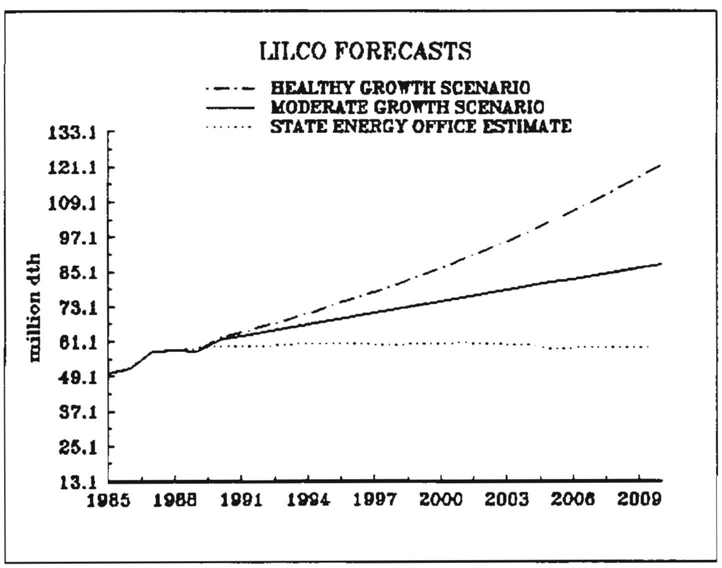


Figure 15A DEMAND FOR NATURAL GAS

LILCO also supplies Long Island with natural gas. Figure 15A shows natural gas sales from 1980-89 and three projections to 2010 in millions of dth, a thermal measure equal to a million BTU. The lowest projection is the State Energy Office estimate of natural gas on Long Island which is essentially flat over the period. LILCO's low projection is based on a modest expansion program and the high projection is based on expanding natural gas supply and sales. The State energy Office estimate was prepared before the Iroquois Pipeline was approved by the Federal

Energy Regulatory Commission.

The eastern end of Long Island has little natural gas available and hence no demand. The current pressure in the system will not support distribution at that distance. The proposed Iroquois Pipeline would increase much needed supplies of natural gas to Long Island although far east-end service would still be unlikely within the forecast period.

If the price for residential natural gas follows the high path and fuel oil does not, then conversions from fuel oil to natural gas would be discouraged. If the low price path is more correct, LILCO's demand forecasts appear more reasonable.

QUANTITIES DEMANDED OF PETROLEUM PRODUCTS

Heating Oil

The State Energy Office Energy Plan estimated petroleum demand for the residential sector as shown in Figure 16A. There are no official figures for any of the petroleum products on a county basis either from the state or federal energy agencies. The figures did not agree with those obtained from the Fuel Oil Dealers Association so two other estimates were made. These are also shown in Figure 16A, and are based on the reported 650 million gallons of heating oil for 1989. Both cases assume an improvement of 1% per year in household burner efficiency; the high case is based on households growth from the healthy growth scenario, the low case uses the low estimate of the number of households from the slow growth scenario.

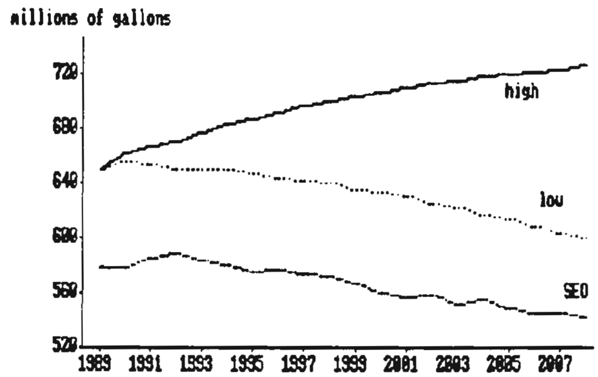


Figure 16A RESIDENTIAL DEMAND FOR FUEL OIL, Assuming 1%/year efficiency improvements

Motor Gasoline

The use of private automobiles to get to work dominates the transportation sector on Long Island and elsewhere. Several factors have been identified with the growth of the automobile for getting to work. One is the change in job location from central city to suburban locations where public transportation does not exist and where the scattered locations make it uneconomical to provide.

Along with the move to the suburbs, more jobs have been created and increasing numbers of women have entered the work force. The two processes complement each other. Suburban locations make it easier for women to work and still attend to family duties, and firms seeking workers locate near this new labor source. These trends are expected to continue and intensify. This suggests that under the healthy economic growth scenario, motor gasoline use would increase significantly, even with mileage improvements in new cars.

At the suggestion of the State Energy Office, an estimate of the sale of motor gasoline on Long Island was made using twenty percent of the state gasoline consumption. Long Island has about 15% of the state population, but a higher percent drive cars.

Figure 17A shows estimated gasoline consumption from 1971 to 1988 and two forecasts for growth. The high forecast uses the State Energy Office 1.2% increase, based on an increase of 2.6% in vehicle miles traveled and a 1.5% increase in fleet miles-per-gallon. The low estimate is based on the Energy Information Administration figures.

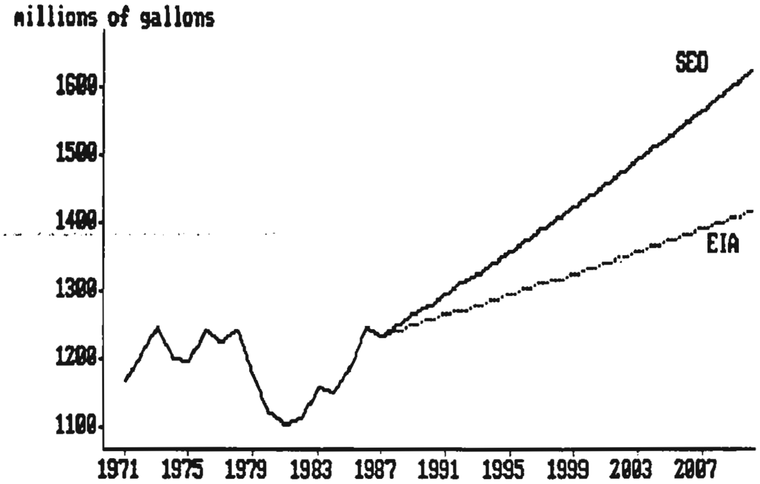


Figure 17A Estimated Gasoline Demand in Millions of Gallons

The Energy Information Administration predicts that vehicle miles traveled will increase 1.8% per year, with gasoline demand increasing between .3% and 1%, using .6% as the base case. The range in demand is primarily due to gasoline price effects on fleet efficiency, since vehicle miles traveled varies only .1% in the Energy Information Administration's estimates.

Growth in petroleum product consumption is expected to continue with growth in gasoline consumption rising the most. Fuel oil consumption will depend on the number of households and the expansion of natural gas in the home heating market. Annualized growth between .6% and 1.2% for motor gasoline is expected.

ENDNOTES AND REFERENCES

1. The tables used here owe much to the recent survey of analytic methods for energy problems by Mohan Munasinghe, Energy Analysis and Policy, (Butterworths, London,1990).

2. Center for Regional Studies, State University of New York at Stony Brook, Long Island Strategic Economic Plan, Interim Report No. 1, (Center for Regional Studies, SUNY, undated).

3. Long Island Regional Planning Board, Long Island Master Plan to the Year 2010: The Housing Component (Long Island Regional Planning Board, Hauppauge, N.Y., December 1989).

4. New York Department of Labor, Division of Research and Statistics, Labor Market Assessment: Occupational Supply and Demand, Nassau-Suffolk, 1990 (New York State Labor Department, May 1990).

5. Energy Information Administration, Department of Energy,Annual Energy Outlook, Long-Term projections, 1990 (DOE/EIA-0383(90), January 12, 1990).

6. New York State Energy Office, Department of Public Service, and Department of Environmental Conservation, New York State Energy Plan, Vol.I-IV (September 1989).

7. Long Island Lighting Company, Population Survey 1989: Current Population Estimates for Nassau and Suffolk Counties, (Hicksville, NY, June 1989).

8. Long Island Regional Board, Draft Report Labor Force, Employment and Occupational Projections: Their Implications for Higher Education on Long Island. (A Study for the Long Island Regional Economic Development Council, Hauppauge, NY, May 1990).

9. Long Island Lighting Company average residential quarterly estimate from the electric bills, 1990.

10. New York State Department of Labor, Division of Research and Statistics.

11. Long Island Regional Planning Board.

12. New York State Department of Labor, Division of Research and Statistics and Center for Regional Studies.

13. Ibid.

14. Gas Research Institute, GRI Baseline Projection of U.S. Energy Supply and Demand, 1991 Edition (Strategic Planning and Analysis, Gas Research Institute, August, 1990).

15. The Gas Research Institute and Energy Information Administration estimates are very similar, so only the Gas Research Institute estimates are used here. The Energy Information Administration estimate had a smoothed increase over time, but began and ended with the same price as the Gas Research Institute.

16. See Appendix H for a discussion of the effect on rates from the New York State Public Service Commission's point of view. An alternative estimate of the effect on rates can be found in The Economics of the Shoreham Nuclear Plant, prepared for the Committee on Energy and Natural Resources, United States Senate, July, 1989.

17. Wilson, K., "LILCO Seeks 3 5% Rate Increases," NEWSDAY (December 29, 1990).

18. U.S. Department of Energy, 1990.

19. Oak Ridge National Laboratory, Transportation Energy Data Book: Edition 10 (Oak Ridge National Laboratory, September, 1989).

20. Pisarski, Alan E., Commuting in America, A National Report on Commuting Patterns and Trends (Eno Foundation for Transportation, Inc., 1987).

21. Department of Energy, Energy Information Administration.

22. "Prices Throttle Gas Consumption," Newsday, (September 21, 1990, Business Section, p. 45-46).

23. A more recent announcement from the Department of Energy has indicated that oil consumption in 1990 fell 4% in the U.S. as compared to 1989.

24. Long Island Lighting Company, 1990 Preliminary Forecast of Electricity Sales, Requirements and Peak Loads: 1990 to 2006 (LILCO, Economic and Management Planning Department, Spring 1990).

25. State Energy Office.

26. Department of Energy.

27. Long Island Power Authority Comments on the "LILCO 1991-92 Electric Conservation and Load Management Plan", (New York Public Service Commission Case No 28223, Tellus Institute, September 17, 1990).

APPENDIX B

HYDROELECTRICITY FROM QUEBEC

HYDROELECTRICITY FROM QUEBEC

The hydroelectric potential of Quebec is enormous. About 28,800 megawatts of hydroelectric capacity is in operation or under construction there, about one-half that in all of Canada. The remaining potential has been estimated in three categories. The "gross remaining potential," some 70,500 megawatts of 179,000 in all of Canada, is the estimated resource that remains undeveloped. The "identified potential" of 39,300 megawatts consists of sites for which future development has been identified as technically feasible. The "planning potential" of 17,900 megawatts comprises sites that are considered to be likely candidates for future development, taking into account favorable economics and the absence of overriding environmental considerations.[1]

(What constitutes "overriding environmental considerations" may be in dispute. Aided by environmentalists, the Cree Indians of Quebec are fighting Hydro-Quebec's expansion plans in Federal and provincial courts. Hydro-Quebec also faces governmental environmental reviews that could delay construction for several years.)[2]

By comparison, the hydroelectric Niagara Power Project of the New York Power Authority is capable of 2,400 megawatts, little more than one-eighth of Quebec's planning potential.[3] The capacity of the New York Power Pool--the total maximum output that all the generators in the State would produce if operated simultaneously--is 33,285 megawatts.[4] Thus, likely future Quebec hydroelectricity could provide more than half of New York State's power if it were not used elsewhere.

Quebec hydropower is distributed in New York State through the New York Power Authority. In 1989, the New York Power Authority signed three new contracts with Hydro-Quebec. The first purchases two 500 megawatt blocks of power for a twenty-year period beginning in 1985 and 1986, respectively. The second is an extension for an additional 20 years, until 2018, of 800 megawatts of "diversity" power to be made available for seven months of each contract year. The third provides for the sale by the New York Power Authority to Hydro-Quebec of 400 megawatts of capacity during the November--March winter months.

LILCO is under contract to obtain 109 megawatts of Hydro-Quebec power through the New York Power Authority beginning in April 1995, increasing to 218 megawatts in April 1996 through April 2015 to provide about 5 percent of LILCO's system capacity. The contract is contingent on LILCO negotiating a firm transmission service contract with ConEd.[5]

Hydro-Quebec, the utility owned by the Province of Quebec, began exporting electricity to the U.S. in 1974 when an interconnection agreement was signed with the New York Power Authority. Two other agreements were signed with the New York Power Authority in 1978 and 1982, the latter ensuring electricity deliveries as of 1984. Similar agreements have since been signed with the New England Power Pool, the Vermont Department of Public Service, and Central Maine Power.[6]

The timing of electric power requirements of Quebec and New York State enables them to complement each other. Electricity demand peaks in the winter in Quebec when about 41 percent of its annual use is required. On the other hand, the New York system as a whole peaks in summer, although some upstate utilities have winter peaks, and summer and winter electricity usage is about the same (34 percent of annual demand). This load diversity has been exploited in the past through diversity, or economy, transactions in which electricity is exchanged as needed (and available) to meet peaks.[7]

Electricity contracts with Hydro-Quebec may take either of three forms:[8]

Economy, or diversity, contracts in which the sale of surplus energy with no capacity commitment on a short-term interruptible basis. These are an alternative, for the purchasing utility, to producing electricity at a higher cost.

o Firm-energy contracts in which Hydro-Quebec delivers an agreed amount of energy in weekly, monthly, or yearly units. The timing of delivery is not necessarily specified, but the amount is bounded by an upper limit of capacity and a total amount of energy per year.

o Firm-capacity contracts in which a portion of Hydro-Quebec's capacity is dedicated for the purchaser's use throughout the contract duration. The New York utility purchasing firm-capacity may use it to satisfy the minimum installed reserve, presently 18 percent, in excess of its annual peak demand required by the the New York Power Pool Agreement.

Power exchanged between Hydro-Quebec and New York State is constrained by the capacity of the interconnection link of 1,850 megawatts. This is established by a 765 kV transmission line between Chateauguay, Quebec, and Massena, New York, and two smaller 200 kV lines connecting Cedar Rapids, Quebec, and Massena.

To increase power exchanges between the two regions, new transmission systems would have to be installed. At present there is an upper bound set by the Northeast Power Coordinating Council (which consists of the utilities of the New England States, New York State, and the Canadian provinces of Ontario, Quebec and New Brunswick) at 2200 megawatts on the maximum interconnection capacity between Hydro-Quebec and its neighboring networks. This is to protect the reliability and stability on the Northeast power grid which could be jeopardized unless major changes in the reliability design of the Hydro-Quebec network are undertaken.

The stability limitation comes, basically, from the impossibility, due to the remoteness of its generating capacity, of operating the Quebec power system synchronously with its neighboring systems. In consequence, in the past, Hydro-Quebec has had to disconnect specific generators form its network and dedicate them to exports to New York utilities.

An alternative is to use asynchronous dirct current (DC) lines with convertors. There is also a reliability limitation to the increase in link capacity. The Quebec power system being mainly hydro can be put back into operation within a few hours after a major shutdown. This is not the case in New York State where utilities use mainly thermal plants that usually require two or three days to be started again. The Hydro-Quebec power system thus tolerates a lower reliability level than its U.S. partners. U.S. utilities, concerned with how this might lower their reliability level, want to limit the potential impact on their system of a possible blackout of the Quebec system. In the medium term, an increase in the link capacity between Quebec and New York State would require either a major change in the reliability design of the Quebec system or the dedication of specific generating units with DC lines.[9]

A Quebec research group, GERAD (Groupe d'études et de recherche en analyse des décisions).[10],[11] has taken the first step in modeling the future of long-term power transactions between eastern Canada and the Northeastern U.S.A. The MARKAL model is used to represent the least-cost evolution of the Quebec and New York State energy systems over 45 years, assuming that the only constraint on exchanging electricity is the physical linkage between the two systems. Increases in the link capacity is assumed to be achieved with dedicated units having DC line connections to New York to allow increases in line capacity beyond the 220 megawatt bound set by the Northeast Power Coordinating Council.

Three scenarios were compared: the status quo with no expansion of transmission line capacities, a moderate scenario that allows a 2000 megawatt expansion in transmission line capacities, and a high scenario in which a further expansion to 5000 megawatts is permitted beginning in the year 2000.

With the assumptions of the model, the total cost of electricity to the two systems would decrease as increasing interconnections allow greater exchanges. The total interconnection capacity would increase to a total of 3,850 megawatts in 1995 (using the full 2000 megawatt addition) and 6,050 megawatts (requiring less than the allowable additional 5000 megawatts) from 2000 on to allow these exchanges.

The power exchanges would modify the total energy produced and the generating capacities in both regions. In the high scenario, the installed capacity and the amount of electricity generated in Quebec would increase from 1995 through 2015, while installed capacity and average utilization factor in New York State would decrease substantially through the year 2000 before starting to grow.

Differences in the type of electric generating plants would also occur in both regions as a result of the power exchanges. In Quebec, hydro gradually becomes the sole source of electricity generation. In New York, firm capacity contracts reduce the need for base load capacity. Nuclear plants are not renewed after 2000, and coal-fired plants decrease until 2000 when new "clean-coal" technology--atmospheric fluidized bed plants--begins to replace conventional plants using scrubbers. Installed capacity of oil and gas-fired plants declines in these scenarios, which do not include further environmental restrictions. Peaking technologies--in particular, combustion turbines--are essentially unaffected in numbers, and thus become a larger proportion of the installed capacity of New York utilities through the year 2000.

A second study by GERAD broadens the view of electricity exchanges to include the Province of Ontario and New England.[12] The present transmission capacities between each pair of the four regions is listed in Table B.1.

Table B.1. Present (1990) capacity of transmission links among Northeastern regions (megawatts)

Quebec - New York	2,175 megawatts
Quebec - New England	2,200*
Quebec - Ontario	1,650
New York - New England	1,475
Ontario - New York	2,150

* This capacity will be reached in 1992 only.

Source: Berger, Dubois, Haurie, and Loulou (1990)

Taking into account the cost of additional transmission linkages, the cost of generating electricity needed in the Northeast would be minimized if connections among all four regions were increased. If one of the four were to be omitted, however, the least penalty is incurred if it is New York: about a 5 percent reduction in savings. The most important single link is between Quebec and New England which in itself provides about 80 percent of the total savings. This is due to the fact that the cost of new links between Quebec and New England is fairly low, and the cost of new lines between Quebec and New York is sufficiently high to prevent massive capacity increases between them.

In this study, additional transmission capacity between New York and New England was not allowed because of typical low usage of these links and because preliminary results did not project a large potential. In 1989, however, exports from the New England Power Pool to the New York Power Pool (633,485 megawatt-hours) were about 60 percent greater than from Hydro-Quebec to the New England Power Pool (392,952 megawatt-hours). The low level of exports from Hydro-Quebec in 1989 was apparently an anomaly due to the effects of a long-term drought, equipment outages, and transmission problems including an outage due to solar magnetic disturbances in March 1989. The total exchange of power between the the New England Power Pool and the New York Power Pool continued a decade-long decline in 1989, but for the first time in many years the New England Power Pool was a net seller.[13] It is not clear whether this signals a reversal in their continued power exchanges.

Hydro-Quebec Phase II to the New England Power Pool, with power flow to be initiated in late 1990, is scheduled to reach its full 2000 megawatt transfer capability by the summer of 1991, at which time the Phase I high-voltage direct-current terminal will be put on standby. This large "contingency" may have far-reaching impacts on managing the operation of the remainder of the eastern interconnected bulk power system of the New England Power Pool. It is expected that the New England Power Pool will become a summer peaking system early in its next 15-year forecast period.[14] A decision on a possible additional 1500 megawatts for after the year 2000 is to be made by 1992.[15]

If it is correct that future Hydro-Quebec exports are likely to favor New England over New York, the question arises as to whether a stronger link between Long Island and the New England Power Pool would not be advantageous. Long Island might want to import more Quebec hydropower either because of its price or because future greenhouse restrictions make the use of more renewable energy mandatory. Only the width of Long Island Sound separates LILCO transmission lines from the New England Power Pool.

An existing 138 kv transmission tie connecting Northport to Norwalk, Connecticut, about 10 miles long and used for normal firm capacity imports, is limited to 100 to 286 megawatts capacity.[16]. This interconnection is reported as fully utilized at present.[17] Norwalk is connected to the rest of the New England Power Pool only with 138 kv transmission lines.

However, to the east of Norwalk on the Connecticut shore, New Haven is served by a 345 kv line, and four 345 kv lines emanate from Millstone. New Haven is about 25 miles across Long Island Sound from Port Jefferson and Shoreham, both of which are connected to 138 kv lines on Long Island. Millstone is less than 10 miles from Orient Point.

The investment in such an intertie is unlikely without the prospect of its substantial use. This will depend upon future electricity production and consumption levels on both sides of the Sound.

To suggest that LILCO should seek a stronger connection to the New England Power Pool is like suggesting that the Mets also play in the American League. In both cases, the constraints are institutional. The game is the same.

REFERENCES

1. Energy, Mines and Resources Canada, Electrical Energy Branch, Electric Power in Canada 1987, Minister of Supply and Services Canada (1988), pp. 83, 109.

2. Gold, A. R., "Quebec Indians Ponder True Cost of Electricity," The New York Times (12 October 1990), p. A10.

3. New York Power Authority, Annual Report for 1989 (1990), p, 25.

4. New York Power Pool, Historical Data 1969-1990 (1990).

5. Long Island Lighting Company, Form 10-K to Securities and Exchange Commission for the Fiscal Year ended December 31, 1989, p. 22.

6. Government of Quebec, Energy in Quebec (1987), p. 89.

7. Berger, C., R. Dubois, E. Lessar, A. Haurie, and R. Loulou, "Assessing the Dividends of Power Exchange between Quebec and New York State: a Systems Analysis Approach," Int. J. of Energy Research, Vol. 14, 253-273 (1990), p. 258.

8. Berger et al. ibid., p. 259.

9. Berger et al. ibid., p. 260.

10. Berger et al. ibid.

11. Berger, C., R. Dubois, A. Haurie, and R. Loulou, Modelling Electricity Trading in the Northeast, proceedings of the 12th Annual North American Conference of the International Association of Energy Economists, Ottawa, October 1-3, 1990 (in press).

12. Berger et al. ibid.,

13. New England Power Pool, 1989 Annual Report (1990), pp. 11, 17.

14. New England Power Pool, ibid., p. 18

15. New England Power Pool, Assessing NEPOOL's Resource Adequacy and Potential Resources (1991-2005), Technical Supplement (June 1990), pp. 35, 44.

16. New York Power Pool, Load and Capacity Data, 1990-2006 (April 1990), p.53.

17. Long Island Lighting Company, Form 10-K to Securities and Exchange Commission for the Fiscal Year ended December 31, 1989, p. 18.

APPENDIX C

LILCO ENERGY CONSERVATION

LILCO ENERGY CONSERVATION

LILCO has conducted a full-scale demand-side managemen (DSM) program since 1986. Demand-side management consists of a diverse set of programs for both residential and commercial/industrial markets with a double purpose: to reduce peak loads and to reduce energy consumption through conservation.

The impetus for demand-side management comes from the Public Service Commission of New York State which, like many other states, has pressed for more electricity savings as an alternative to more electricity generation. The current slate of LILCO programs is meant to respond to criticism from the Public Service Commission that insufficient emphasis was being given to the goal of conservation. As a result of a later 1990 Public Service Commission review of the demand-side management plans of all the State utilities, some changes will be made in LILCO's proposed 1991-1992 plans, as indicated at the end of this appendix.[1]

In its May 23, 1989, "Opinion and Order Concerning Conclusions on Long Range Demand Side Management Plans (PSC Case 28223, Opinion 89-15), the Public Service Commission ordered New York electric utilities to file demand-side management planning impact scenario analyses as well as integrated long-range and annual program plans. Two scenarios were defined as shown in Table C.1.

Table C.1. PSC Demand-side Management Scenario Targets

	Scenario A	Scenario B
1993		
Summer and winter peak reductions	5%	5%
Annual energy reduction	2	5
2000		
Summer and winter peak reductions	10	10
Annual energy reduction	4	10
2008		
Summer and winter peak reductions	10	15
Annual energy reduction	4	15

As shown in Figure C.1, LILCO's base case long-range plan exceeds the Scenario A targets for annual energy impacts, but falls short of the Scenario B targets. The base case also meets the peak demand reduction goals except for Scenario B in 2008. The LILCO base case demand-side management plan is described briefly below in so far as it affects energy conservation.

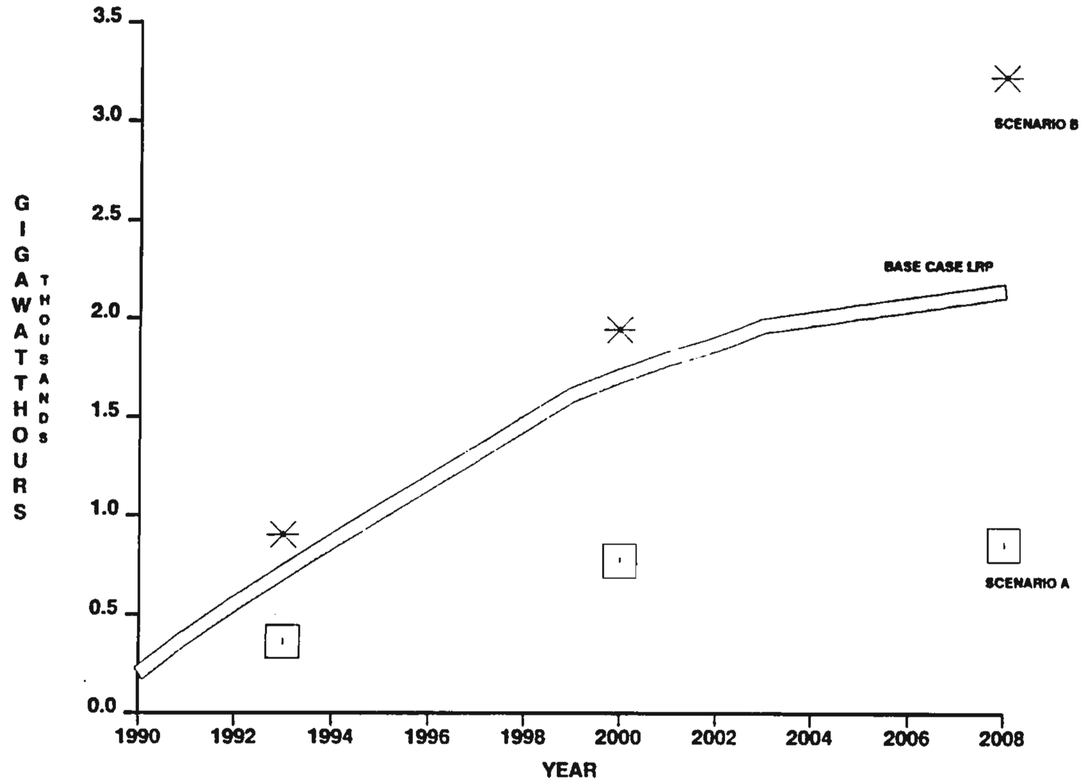


Figure C.1. LILCO long-range plan exceeds PSC Scenario A goals for annual energy impacts but not Scenario B.

Source: LILCO 1990 Long Range Energy Conservation and Long Range Management Plan, Figure K)

LILCO Conservation Programs

LILCO has emphasized industrial and commercial conservation programs over residential programs, and large customers over small. LILCO'S demand-side management budget for 1991 and 1992 favors commercial/industrial over residential by more than 2 to 1 (Table C.2). Less than 5 percent of LILCO's residential customers will have participated in its non-informational programs by the end of the 1992 Plan year.[2] The largest 2 percent of LILCO's commercial/industrial customers accounts for 55 percent of commercial/industrial electricity use; a total of about 17 percent of such customers accounts for 89 percent of such electricity use (Table C.3).

Table C.2. LILCO Demand-side Management Budgets, 1991-92

Program	1991	1992
Residential programs	$ 7,350,226	$ 7,478,229
Commercial/industrial programs	18,879,175	16,277,156
Gas substitution	1,161,462	1,241,167
Administration, evaluation and development	8,288,758	8,742,366
Total	$35,679,621	$33,738,918

Source: LILCO 1991-92 Electric Conservation and Load Management Biennial Plan, Tables A and B.

Table C.3. Distribution of Commercial/Industrial Electricity Use

No. of Customers	Non-coincident Maximum Demand	Percent of Customers	Percent of kWh Sales
125	Over 500 kW	2%	55%
790	From 50 to 500 kW	15	34
4,228	Less than 50 kW	82	11
5,143		100%	100%

Source: LILCO, 1990 Long Range Electric Conservation and Load Management Plan, pp. 139, 142, 144.

LILCO's present demand-side management effort consists of eight individually identified residential programs and nine commercial/industrial programs. These are listed in Table C.4 ranked by the amount of energy savings. (Four residential programs--Energy Hotline, Local Energy Shows, Mobile Energy Works Center, and Housewarmer--are grouped as Residential Energy Programs.)

Table C.4. LILCO Demand-side Management Programs through 1992, Ranked by Annual Electric Energy Savings

Sector	Program	Annual Elect. Energy Savings	Cumulative Savings	Cum.% (rounded)
Comm.	Dollars and Sense	181,190 MWh	181,190 MWh	33%
Comm.	Energy Analysis	151,007	332,197	60
R&C	Gas Substitution	91,140	423,337	76
Comm.	DSM Bidding	61,535	484,872	87
Comm.	Smart Start	25,186	510,058	92
Res'l	Information Programs	18,072	528,130	95
Comm.	Not-for-Profit	14,610	542,740	97
Res'l	Central A/C Rebate	7,200	549,940	99
Comm.	Energy Cooperative	2,632	552,572	99
Res'l	Energy Sense Profile	2,561	555,133	100
Res'l	Room A/C Rebate	889	556,022	100
Comm.	Power Alert	644	556,666	100
Res'l	Energy Cooperative	333	556,999	100
Comm.	Cooling Discount	65	557,064	100
Total		557,064 MWh		

Source: LILCO 1991-92 Electric Conservation and Load Management Biennial Plan, Table B.

Three programs--Dollars and Sense, Commercial Energy Analysis, and Gas Substitution---account for three-quarters of the expected energy savings. The top seven--adding DSM Bidding, Smart Start, Residential Information, and Not-for-Profit Programs--account for 97 percent of expected energy savings. A brief description of these seven LILCO demand-side management programs follows.

Dollars and Sense

The Dollars and Sense Rebate Program promotes the use of energy efficient technologies for various end uses by offering financial incentives to all commercial/industrial customers. A tabulation of the incentives offered in given in Table C.5.

Table C.5. LILCO Rebates in its Dollars and Sense Program

TECHNOLOGY[1]			INCENTIVE[2]
Customer Incentives:			
Lighting			
34 Watt Fluorescent Lamps			$.35/lamp
60 Watt Fluorescent Lamps			$.80/lamp
Screw-in Fluorescent Lamps			$5.00/lamp
Fluorescent Fixtures			$20.00/fixture
HID Fixtures (≤ 200 W)			$50.00/fixture
HID Fixtures (> 200 W)			$75.00/fixture
Energy Saving Ballasts			$9.00/ballast
Solid-state Dimmers			$16.00/dimmer
Optical Reflectors			$1.50/sq. ft.
Occupancy Sensors			$18.00/sensor
Fluorescent Current Limiters			$10.00/limiter
*HVAC			
Unitary A/C			
(three phase)	(8.4-8.99 EER)		$50/ton
	(≥ 9.0 EER)		$75/ton
(single phase)	(10.0-10.49 SEER)		$30/ton
	(≥ 10.5 SEER)		$50/ton
Room A/C	(9.0-9.49 EER)		$36/ton
	(≥9.5 EER)		$60/ton
Central Water Chillers			
Centrifugal	Air Cooled		
	(9.2-10.19 EER)		$40/ton
	(≥ 10.2 EER)		$60/ton
	Water Cooled		
	(17.1-19.39 EER)		$40/ton
	(≥ 19.4 EER)		$60/ton
Reciprocating	Air Cooled		
	(9.2-10.19 EER)		$40/ton
	(≥ 10.2 EER)		$60/ton
	Water Cooled		
	(13.0-13.99 EER)		$40/ton
	(≥ 14.0 EER)		$60/ton

*These levels are tentative. Final numbers to be determined based on revisions to the New York State Energy Code that are scheduled for late 1990.

Table C.5. LILCO Rebates in its Dollars and Sense Program (cont'd)

<u>Solar Window Film</u>	
Applied to Clear Glass (.40 Shading Coef.)	$1.00/sq. ft.
Applied to Tinted Glass (.40 Shading Coef.)	$.75/sq. ft.
<u>Thermal Energy Storage</u>	
1-100 KW	$500/KW
Over 100 KW	$50,000 + $300/KW (over 100 KW)
<u>Non-Electric Cooling</u>	
1-100 KW	$500/KW
Over 100 KW	$50,000 + $300/KW (over 100 KW)
<u>Refrigeration</u>	$200/KW
Glass Doors	
Heat Recovery Systems	
Evaporate Pre-coolers	
Floating Head Pressure Controls	
Parallel Unequal Compressors	
Liquid Pressure Amplifiers	
<u>High-Efficiency Motors</u>	
1-25 horsepower	$12/hp
26-200 horsepower	$300 + $5/hp (over 25 hp)
<u>Variable Speed Drive Motors</u>	$260/KW
<u>Energy Management Systems</u>	$235/KW
<u>Custom Rebates</u>	
Lighting	$100/KW
HVAC	$200/KW
<u>Dealer Incentives</u>	10% of Customer Incentive

[1] 1990 eligible technologies. These technologies will be re-evaluated and eligible items may be added or deleted, as appropriate following 1990 impact evaluations.

[2] 1990 incentive levels. These levels will be re-evaluated and may be adjusted following 1990 impact, process, and market research studies.

Source: LILCO 1991-92 Electric Conservation and Load Management Biennial Plan, pp. 79-81.

Meetings are held to educate customers, trade allies, architects and owners on the program, some to be co-sponsored with the New York State Energy Office. Additional technical assistance will be provided on such technologies as thermal energy storage and gas absorption cooling. The target participation for 1991 and 1992 is 1,444 customers in each year to provide an incremental annual energy savings of 27,709 megawatt-hours in each year.

The cost-effectiveness of the Dollars and Sense program is illustrated in Figure C.1 where it is compared with four other utility conservation programs and three typical electric generating plants. To be analogous to generating plant capacity factor, the conservation load factor (CLF) in the figure is defined as the quotient of the average annual load savings divided by peak load savings. The light lines starting from the origin represent the short-run marginal costs from existing generating plants which have zero capital costs.[3]

Commercial Energy Analysis

The Commercial Energy Analysis Program provides free energy management consultation services to commercial, industrial, not-for-profit customers, and government offices. The program provides an on-site energy audit by a contractor using XENCAP, an energy audit software package. The audit report summarizes energy saving strategies recommended for the specific facility, as well as costs and estimated savings associated with each recommended measure.

LILCO has selectively marketed the program to larger commercial and industrial customers, with the expectation that future participants will be smaller and therefore future impacts per participant will be smaller. For 1991 and 1992, the target number of audits is 1,800 in each year.

This program is also extremely cost-effective in comparison to six other commercial audit programs and the cost of alternative power generation, as shown in Figure C.2.

Gas Substitution

The Gas Substitution Program encourages the use of gas heat and gas alternatives to electric appliances, thereby reducing peak electric demand. It is available to all residential and commercial customers, estimated to be 600,000 in number, where gas is or will be available. (LILCO's gas customers numbered 426,000 at the end of 1989.) The priority in marketing is to those customers for whom gas substitution can be inititated in the most economic manner. The program is aimed first at customers who presently have gas service but not gas heating. The second priority is those customers who have gas mains available but do not use gas. Finally, the program is marketed in areas where gas mains will be installed.

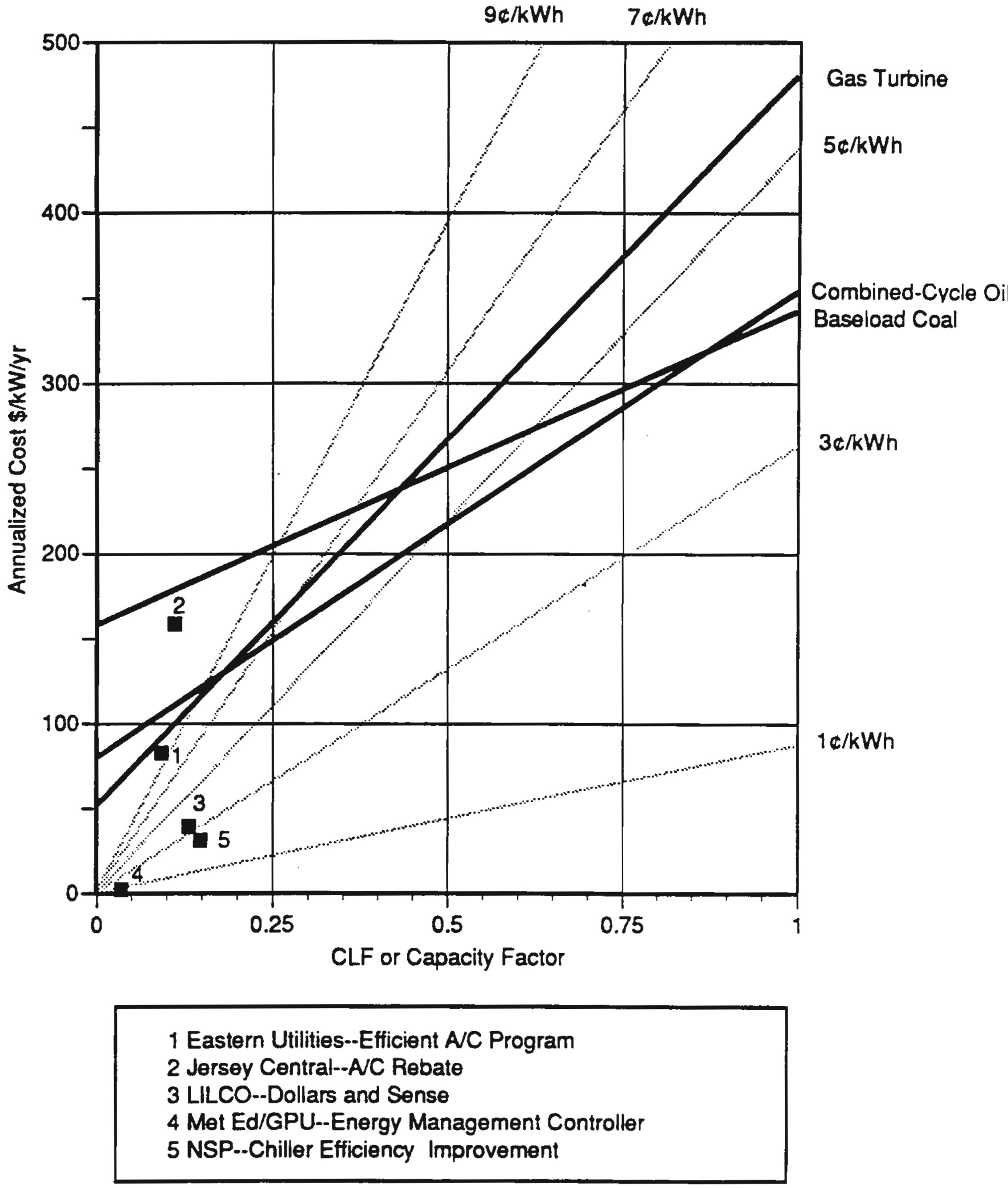
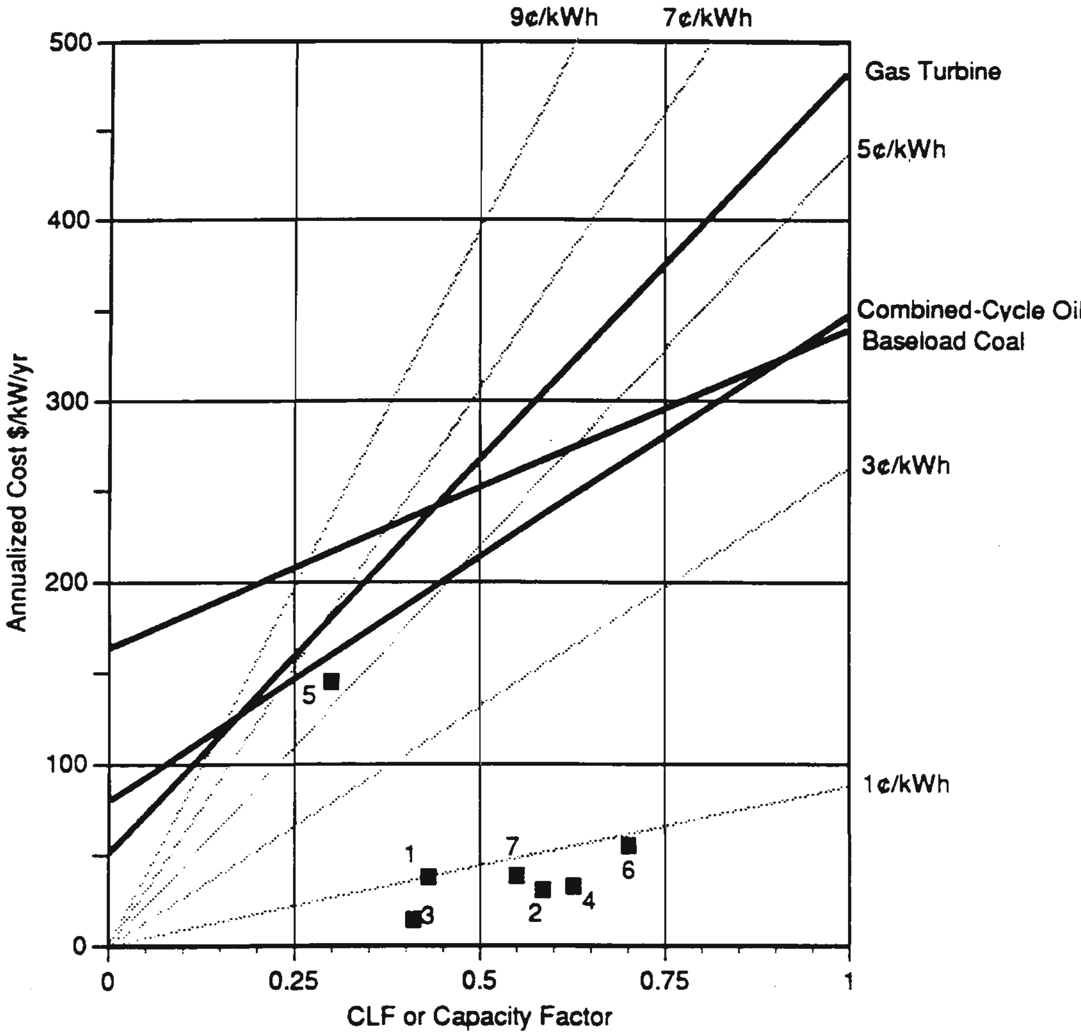


Figure C.2. LILCO's Dollars and Sense Program is Very Cost-Effective.

Source: Koomey et al. (1990), p. 5.120



1 BECO--Commercial Conservation Service
2 FP&L--Commercial and Industrial Energy Analysis
3 LILCO--Commercial Energy Audit
4 Northeast Utilities--Energy Check
5 SMUD--Small Commercial Audit
6 SMUD--Large Commercial Audit
7 SCE--Energy Management Surveys

Figure C.3. LILCO's Commercial Audit Program is Very Cost-Effective.

Source: Koomey et al. (1990), p. 5.117

It was expected that about 6,600 residential appliances and 5,375 commercial end uses would be affected in 1990. The targets for 1991 and 1992 are conversion of 12,800 and 13,652 end uses to gas for incremental annual energy savings of 30,472 and 32,082 megawatt-hours, respectively.[4,5]

The potential value of replacing electric with gas-fired cooling equipment has not been lost on LILCO:

> This area is particularly interesting to LILCO because as a combined gas and electric utility, the potential to replace electric load with gas load in the summer time would not only improve the reliability of the electric system but would also improve the utilization of the gas system...If...it is feasible to introduce gas absorption air conditioning in the service territory, large impacts on the electric peak could be made.[6]

Considering this potential, the initial steps of the Gas Substitution Program in this direction seem rather halting. First, the program includes the demonstration of one (1) gas absorption cooling unit installed at LILCO's Gas Customer Service Division Office in Island Park which will be monitored to collect operating data. Second, the program includes a "residential Gas Cooling Demonstration Program," the objective of which is to identify existing customers who now use residential sized gas cooling equipment and to gather data on operating costs, service experience, and overall customer satisfaction.[7]

<u>DSM Bidding Program</u>

The DSM Bidding Program achieves energy savings through a competitive process in which bid proposals are solicited from Energy Service Companies (ESCOs) and commercial/industrial customers installing demand-side management measures. The intent of this process is to determine and compare the costs of competitive bidding against similar utility-run programs. In this case, the similar utility program is the Dollars and Sense Rebate Program.

The DSM Bidding Program commenced in September 1989, and completion of all contracts and electric savings is targeted for June 1992. Approximately 40 ESCOs were offered the opportunity to submit proposals together with LILCO's top 500 commercial/industrial customers. Bids were received from six ESCOs and one customer in February 1990.

Under the program, qualified DSM measures include those in the Dollars and Sense Rebate Program. Ceiling prices were set on these measures equal to the incentives listed in Table C.5 plus an allowance for administrative costs avoided by LILCO plus a 30 percent allowance consistent with a Public Service Commission order.

It is expected that annual incremental energy savings from the DSM Bidding Program will be 18,607 and 4,652 megawatt-hours in 1991 and 1992, respectively.[8]

Smart Start Program

The Smart Start Program promotes the design and use of energy efficient technologies for various end uses in the construction market by offering financial incentives for both technical studies and the installation of qualifying equipment. The program applies to new construction and major renovations. Dealer incentives are used to encourage dealers to promote the program and increase their stock of energy-efficient equipment. Joint funding with the New York State Energy Office is being considered for technical training seminars for the design community on energy-saving technologies and on updates of New York State Energy Codes and Standards.

The DSM end-use technologies included in the Smart Start program are lighting, air conditioning, non-electric cooling, motors, thermal energy storage, energy management systems, and commercial refrigeration equipment. Alternatively, incentives are provided on a building-wide basis for buildings that exceed standard building practice in reducing electrical use, for example, by building envelope improvements and nonconventional lighting systems.

There are three categories of expenses included in the program:

o Analysis incentives to offset the cost of additional engineering, building design time and costs necessary to incorporate higher efficiency systems.

o Efficient equipment incentives to offset the higher initial equipment and installation costs.

o Building efficiency incentives to developers who wish to install efficient systems but do not find their choice of equipment on the list of qualifying items.

The participation target is 284 customers in both 1991 and 1992 to provide incremental annual energy savings of 5,489 megawatt-hours each year.[9]

Residential Information Programs

Residential information programs consist of Energy Hotline, Local Energy Shows, Mobile Energy Works Center, and Housewarmer.

The Energy Hotline is a customer outreach program that allows customers to obtain information on energy conservation and LILCO's conservation programs from trained energy specialists using a toll-free telephone number. As part of this program, a Senior Info-Line offers information on LILCO's senior programs such as the Golden Link Service. Also under this program, LILCO is working with the New York State Energy Office to develop appliance directories listing energy-efficient appliances in the marketplace. LILCO expects 31,000 Hotline contacts in both 1991 and 1992.

Local Energy Shows provide information in local shows such as home improvement shows, energy expositions, and civic forums. LILCO's target is 50,000 contacts in both 1991 and 1992.

The Mobile Energy Works Center visits sites to provide information on energy conservation. School districts will now be included in these visits. Teacher's aids will be provided beforehand, and children will receive literature, giveaways, and a conservation package to take home. The target for both 1991 and 1992 is 30,000 participants.

Under the Housewarmer Program, new homeowners are offered a visit by an energy specialist with an information packet. Purchasers of homes built before the State Home Improvement and Energy Conservation Act (HIECA) standards went into effect in 1980 are given a free SAVINGPOWER energy analysis. This is a computer-prepared report that provides conservation suggestions specific to the building type and equipment installed in the home. The number of new homeowners to be visited is targeted at 24,000 in both 1991 and 1992.

For the information programs collectively, the targeted number of participants is 135,000 in both 1991 and 1992. Somehow, LILCO is able to estimate from this that an incremental annual energy savings of 2,708 megawatt-hours will result in each year.[10]

LILCO has concluded that information programs are the most cost-effective for residential customers. LILCO proposed several residential programs in 1990 that the Public Service Commission ordered removed due to poor cost-effectiveness or for other reasons. These programs included a residential new construction rebate program, a low-income program, and multi-rate-period tariff projects. LILCO also discontinued its room air conditioning program due to poor cost-effectiveness.

In the past, LILCO has analyzed numerous programs for the residential sector and found it difficult to develop programs that pass the Total Resource Cost test for cost-effectiveness (see Cost-Effectiveness Tests below). In addition, their experience with technologies for the residential sector shows that decisions made by retailers cannot be linked to the availability of rebates for high-efficiency equipment. Rather, the seasonal nature, model year, availability, and features of the appliances drive the inventory decisions of local appliance dealers. In the absence of new technologies that may enter the marketplace, LILCO finds it unclear that a plethora of new residential programs can be offered that are cost-effective.[11]

Not-for-Profit Program

The Not-for-Profit Program offers technical and financial services for not-for-profit customers by coordinating and facilitating the energy management information of the Commercial Energy Analysis Program and the financial incentives of the Dollars and Sense Program. However, the Dollars and Sense incentives will be increased to meet the needs of the not-for-profit community which normally does not have the "up-front" capital to purchase and install energy-efficient items. In addition, agreements will be solicited from contractors and suppliers to accept rebates paid by LILCO as a portion of the payment for the project.

Not-for-profit customers include religious establishments, veterans organizations, and charitable organizations. 1990 was the initial year of operation of this program. The participation target for 1991 and 1992 is 165 customers in each year which is expected to produce incremental annual energy savings of 3,186 megawatt-hours for each year.

Scenario B Blitz Conservation Measures

The LILCO demand-side management base case falls short of the Public Service Commission targets for Scenario B for annual energy impacts as shown in Figure C.1, particularly for 2008 where the savings are only about 65 percent of those required. To meet the Scenario B goals, LILCO concludes that "blitzes" are necessary to achieve the maximum technical potential still available in some end-uses.

A blitz program consists of LILCO-sponsored direct installation of energy-efficient measures at full cost. In the residential sector, blitz programs would consist of neighborhood sweeps to replace lights, refrigerators, freezers, water heaters, electric ranges and ovens. All replacement appliances are assumed to exceed the 1990 Federal appliance standards. Commercial blitz programs would include refrigeration tune-up, lighting (delamping, reflectors, and electronic ballas replacement), and advanced lighting technologies. Customized industrial services and process optimization would also be required.

Problems inherent in large scale replacement of appliances are possible charges of unfair competition in essentially entering in the the appliance marketing business, and mass disposal of used appliances so that they are not retained and used elsewhere in LILCO's service area. A blitz to obtain participation from most of the eligible population is obviously a very expensive option, and its cost-effectiveness is questionable, as shown in Table C.6.[12]

Cost-Effectiveness Tests for Conservation Measures

Demand-side management measures by electric utilities in New York State are screened by a set of cost-effectiveness measures originally developed in California.[13] As applied by LILCO, these tests include:

o Total Resource Cost (TRC): Costs are defined as total outlay by the utility (program expenses only, exclusive of incentive payments or revenue losses) and the participating customer (incremental capital and operating expenditures). According to this approach, if the demand-side management alternative's costs are less than or equal to the avoided costs, then the proposed DSM alternative is considered "cost-effective."

o Rate Impact Measure (RIM): Measures the benefits of DSM in avoided costs against the expenses borne by all ratepayers. The expenses include direct program costs, incentive payments, and lost revenue as incurred by the utility. Lost revenues measure the changes in customer' bills resulting from changes in energy sales or demand valued at retail rates. The RIM test indicates whether average rates will go up or down as a result of any DSM program.

o Utility Cost (UC): Benefits of utility avoided costs are measured against total program administration costs, including incentives. The conceptual approach is to deem a DSM program "cost effective" if it lowers revenue requirements.

o Societal: For LILCO's demand-side management analysis, the Societal perspective mirrors the TRC, with the inclusion of the environmental benefit of $0.014 per kilowatt-hour established by the Public Service Commission for demand-side management savings.[14]

Table C.6. Benefit-to-Cost Ratios of LILCO Demand-side Management Programs by Societal Test

All Programs	LRACs w/o Support B/C	Scenario A Programs Only	LRACs w/ Support B/C
S/c Efficient Lighting	9.81	S/c Efficient Lighting	7.89
DSM Bid Efficient Lighting	8.92	DSM Bid Efficient Lighting	7.27
Comm. Refrig. Blitz Tune Up	8.00	S/c Efficient Refrigeration	6.20
P/A LILCO Plant	7.74	P/A LILCO Plant	5.96
P/A Vol. Load Curtailment	7.73	P/A Vol. Load Curtailment	5.95
P/A Residential Appeals	7.72	P/A Residential Appeals	5.95
P/A Small Commercial Appeals	7.71	P/A Small Commercial Appeals	5.94
S/c Efficient Refrigeration	7.66	Commercial Energy Audits	5.53
LILCO Energy Co-op	7.30	Comm. Not-for-Profit	4.27
Commercial Energy Audits	5.83	ESP/RECAP	4.09
Comm. Not-for-Profit	5.49	Comm. New Construction	3.85
Energy Sense Profile (ESP)/RECAP	5.09	LILCO Energy Co-op	2.60
Res. Water Heater Incentive	4.98	Res. Central A/C Rebate	1.88
Comm. New Construction	4.77	Res Info	1.57
Res. Servicing Elec. Equipment	4.77	S/c Efficient HVAC	1.07
Res. Freezer Replacement	3.41	S/c Thermal Storage	1.04
Industrial Energy Services	3.38	Comm. Cooling Discount	1.01
Res. Storage Water Heater	2.98	S/c Non-Electric Cooling	0.96
Gas Substitution	2.82	DLC 50% Air Cond. Cycling	0.86
Res. Blitz Water Heater	2.62	DSM Bid Efficient HVAC	0.77
Res. Central A/C Rebate	2.49	DLC 67% Air Cond. Cycling	0.74
Industrial Process Optimization	2.32	DLC Pool Pump	0.73
Comm. Cooling Discount	2.03	DLC 33% Air Cond. Cycling	0.54
Res. Info	1.90	DLC Water Heater	0.26
Comm. Blitz Lighting	1.87		
Res. Senior Lighting Coupon	1.62		
S/c Efficient HVAC	1.52		
Res. Refrigerator Replacement	1.50		
S/c Thermal Storage	1.44		
DLC 50% Air Cond. Cycling	1.42		
DLC 67% Air Cond. Cycling	1.37		
Customized Industrial	1.28		
DSM Bid Efficient HVAC	1.12		
Comm. Super Blitz Lighting	1.08		
DLC Pool Pump	1.07		
S/c Non-Electric Cooling	1.05		
Res. Blitz Lighting Giveaway	0.91		
Res. Blitz Freezers	0.90		
DLC 33% Air Cond. Cycling	0.81		
Res. Blitz Refrigerator	0.62		
DLC Water Heater	0.38		
Res. Blitz Elec. Range & Oven	0.16		

DSM = demand-side management
ESP = Energy Sense Profile
HVAC = heating, ventilating, and air-conditioning system
P/A = Power Alert

RECAP = Residential Energy Consumption Analysis Program
Source: 1990 LILCO Long Range Electric Conservation and Load Management Plan, p. 160.

Table C.6 shows the ranking of LILCO demand-side management programs by the Societal Test benefit-to-cost ratio. Additional demand and energy reductions are no longer cost effective when the benefit-to-cost ratio is less than one. The ranking of all Scenario A and Scenario B programs is shown in the left column. The ranking of only Scenario A programs is shown in the right column with the cost of administrative support allocated across all programs, a dubious procedure if the administrative cost is not proportionally reduced with the number of programs. Without this added administrative cost, all but the bottom two programs in the right column would show benefit-to-cost rations greater than one.

However, almost all of the programs fail the RIM test; this means that electric rates will rise if the current programs are continued or if new programs are implemented. This is an especially sensitive topic for LILCO due to the constraints of the Shoreham Agreement. The two-year rate impact calculation of programs selected for implementation in 1991-92 is an estimated $0.00485/kilowatt-hour ($0.00429/kilowatt-hour without support costs).

The Shoreham settlement established a Rate Moderation Agreement (RMA), the purpose of which is to prevent abrupt changes in rates. The Rate Moderation Agreement anticipates annual rate increases of about 4.5 to 5 percent during the rate moderation period of approximately ten years. Under these circumstances, reductions in sales growth forecasts are troublesome to LILCO because a very high proportion of incurred costs are fixed, and they are recovered through rates. Fixed costs include property taxation, interest charges, and the recovery of plant investments as well as the Shoreham write-off. Decrements in sales volume, regardless of the cause, require these fixed costs to be absorbed by a smaller sales base, which in turn causes rates to rise, all other things being equal. LILCO's sensitivity to this issue is compounded by the reality that its base rates are already among the highest in the nation.

Conservation programs, therefore, with their inherent impact on energy consumption and revenues, are of great concern to LILCO in striving to integrate demand-side management into a reliable, least-cost electricity supply mix. To place the magnitude of the issue in perspective, the LILCO 1990 Long Range Energy Conservation and Load Management Plan delineates programs that, by the year 2000, will result in annual sales reductions of 1,575,000 megawatt-hours which represents over $205 million (at $0.08 per kilowatt-hour inflated at 5 percent over a ten-year period) to be collected across the reduced sales base. This is much higher than the year 2000 estimates in the Shoreham Settlement Agreement where 405,000 megawatt-hours were estimated with a much smaller dollar impact of $32 million. While program costs for demand-side management are exempt from the Shoreham agreement rate increase cap of 5 percent, LILCO is striving to achieve the rate caps in toto.[15]

Utility Incentives for Conservation

LILCO's incentives for demand-side management are therefore necessarily mixed. In recent years when the LILCO system has been skirting the limits of its capacity during summer peak loads, LILCO has clearly had an incentive to shave peak loads. Energy conservation, however, not only reduces the kilowatt-hours of electric power for which LILCO is paid but raises its rates, as described above. The cost of the demand-side management program enters the rate base in the following manner.

The peak load reduction incentive is specified in the Shoreham Settlement Agreement as an additional 20 basis point (0.2%) on LILCO's allowed rate of return on common equity. LILCO receives the entire 20 basis points if it achieves at least 100 percent of its peak load reduction goals.

The conservation incentive is established by an estimate of the net savings to society. Net savings are differences between levelized resource benefits and costs over the life of those demand-side management programs with positive net benefits. In this computation, a standardized environmental benefit of $0.014/kilowatt-hour (escalated over time) is used. LILCO receives 20 percent of these net benefits. Unlike the peak load reduction incentive, the conservation incentive does not enhance shareholder's return on equity, but it improves the company's cash flow.

The recovery of all DSM costs, including the conservation incentive award, program costs, and lost revenues, is (presumably eventually) effected partially in base rates and partially in the "fuel adjustment clause." The recovery of the peak load reduction incentive award is effected as an adjustment to the deferred "rate moderation account" established by the Shoreham Agreement which is expected to be amortized over a ten-year period ending in 1999.

Under essentially this procedure, LILCO estimates a net revenue loss from its demand-side management activities of $11.7 million in 1989, offset by a $2.3 million incentive recovery. Revenue losses for the first seven months of 1990 were expected to be $12.6 million, of which $2.5 million was expected to be recovered.[16]

The traditional New York State ratemaking process provides disincentives to implement demand-side management and significant incentives to market electricity use as a means of enhancing profitability.[17] However, utility incentives in New York State are expected to be changed to a different ratemaking practice recently initiated for Orange and Rockland Utilities designed to contain a "revenue decoupling mechanism."[18] It is not clear, however, that even this new procedure removes the disincentives to energy conservation.[19]

November 1990 Public Service Commission Order

The proposed LILCO demand-side management plans described in this appendix are subject to change in response to an order of the Public Service Commission issued November 27, 1990, as follows:[20]

> Long Island Lighting Company:
>
> (a) shall meet with representatives from parties that provided comments on its DSM plan to develop additional programs in the residential sector to be incorporated into the 1991-1992 plan;
>
> (b) shall redesign the Gas Substitution Program so that it has a measurable impact on consumer behavior in switching from electric to gas;
>
> (c) shall phase out the Residential Load Control Program, direct the resources allocated to it to future residential energy efficiency programs, and submit a phase-out plan for staff by January 31, 1991; and
>
> (d) shall reconsider the level of resource allocations for all of its other load control programs, make changes in the interest of energy efficiency where practical and cost-effective, and report its plans in its March 1, 1991 report.

The Residential Load Programs are those that enable LILCO to reduce usage of central air conditioners, pool pumps, and for water heaters for those customers enrolled in previous years. Aside from the program of rebates on new central air conditioners, they are the only residential programs other than information programs.

Under the Public Service Commission order, all State utilities may exceed by up to 20 percent the previously approved budgets of resource savings programs only, "provided the programs experiencing cost increases remain cost-effective."[21]

This order is apparently motivated by concern for the equity of the proposed utility demand-side management programs:[22]

> To maximize program impacts and improve overall program equity it is important that the DSM program offerings provide energy savings opportunities to the broadest range of customers. Since the increasing scale of the utility DSM programs will provide upward pressure on rates, all customers must be given the opportunity to reduce their overall electric bill.

As implied by the reference to remaining cost-effective, the effect of this Public Service Commission order is likely to be greater equity -- more customers being offered conservation opportunities -- at the price of less overall program cost-effectiveness. Even with these good intentions, however, some residential customers will be left out. These will probably be those where energy conservation efforts are likely to be least cost-effective: low-income people, as discussed previously.

Apparently sensitive to this issue, the Public Service Commission also orders each utility to present by June 1, 1991, and analysis of the advantages and disadvantages of recovering individual DSM program costs from (i) only customer classes eligible to participate in each program, and (ii) only participants in each program.

And what will be the cost of LILCO's energy conservation? The overall projected rate impacts of LILCO's proposed demand-side management program is the highest in the State: 0.49 cents per kilowatt-hour, apparently considered to be merely "upward pressure," not a major rate increase.

What seems remarkable is that LILCO must by this order be responsive, not only to the Public Service Commission, but to the parties that provided comments on its demand-side management plan. One of those parties was the Tellus Institute under contract to the Long Island Power Authority. The Tellus comments, and comments on the comments, are summarized in Appendix E.

ENDNOTES AND REFERENCES

1. New York State Public Service Commission, Order Concerning 1991 and 1992 Demand Side Management Plans, Case 28223 (November 27, 1990), Department of Public Service Recommendation.

2. New York State Public Service Commission, ibid., p. A-39.

3. Koomey, J., A. H. Rosenfeld, and A. Gadgil, Conservation Screening Curves to Compare the Efficiency Investments to Power Plants: Applications to Commercial Sector Conservation Programs, proceedings of the ACEEE 1990 Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, Washington (1990), pp. 5.120.

4. Long Island Lighting Company, 1990 Electric Conservation and Load Management Plan, (1990), p. III-189.

5. Long Island Lighting Company, 1991-92 Electric Conservation and Load Management Biennial Plan (1990), p. 155.

6. Long Island Lighting Company, 1990 Plan, p. VI-123.

7. Long Island Lighting Company, Biennial Plan, p. 155.

8. Long Island Lighting Company, ibid., pp. 121-124.

9. Long Island Lighting Company, ibid., pp. 131-133.

10. Long Island Lighting Company, ibid., pp. 7, 15, 25, 51.

11. Long Island Lighting Company, 1990 Plan, pp. 205, 206.

12. Long Island Lighting Company, ibid., pp. 66, 118, 121, 122.

13.

14. Long Island Lighting Company, ibid., pp. 203, 204.

15. Long Island Lighting Company, ibid., pp. 24, 25, 35, 206.

16. Long Island Lighting Company, ibid., pp. 255, 256.

17., Cole, J. and M. Cummings, "Making Conservation Profitable: An Assessment of Alternative Demand Side Management Incentives, proceedings of the ACEEE 1990 Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, Washington (1990), p. 5.35ff.

18. New York State Public Service Commission, Agreement and Settlement Concerning Rate Plan, Performance Incentives and Revenue Decoupling Mechanism for Orange & Rockland Utilities, Inc., Cases 89-E-175 and 89-E-176 (June 8, 1990).

19. Marnay, C. and G. A. Comnes, Effect of the ERAM Mechanism on Utility Incentives, proceedings of the ACEEE 1990 Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, Washington (1990), p. 5.125ff.

20. New York State Public Service Commission, ibid., p. 11.

21. New York State Public Service Commission, ibid., p. 8.

22. New York State Public Service Commission, ibid., p. 6.

APPENDIX D

ESTIMATES OF LONG ISLAND ELECTRIC ENERGY CONSERVATION POTENTIAL

ESTIMATES OF LONG ISLAND ELECTRIC ENERGY CONSERVATION POTENTIAL SPONSORED BY NEW YORK STATE

Sponsored by the New York State Energy Research and Development Authority and in cooperation with the New York State Energy Office, the American Council for an Energy-Efficient Economy (ACEEE) has made its own estimates of the potential for electric energy savings on Long Island in a series of three studies. These assume prototypical energy conservation measures evaluated with a standardized computer model, making use of comparisons with other utility conservation programs elsewhere in the country.

The final estimate, described as an illustrative example rather than a blueprint for immediate application, concludes that LILCO electricity savings of 8 to 10 percent are achievable and cost-justified by the year 2000, but not savings of 15 percent by 2008 without additional measures such as load management programs, fuel switching, cogeneration, and newer technology. To achieve these targets, utility demand-side management budgets would be nearly tripled, and ratepayers who did not achieve sufficient energy reductions would have to pay more for electricity.[1]

Technical Potential for Cost-Effective Conservation

In its original analysis of the potential for energy conservation in New York State, the ACEEE concluded that if all conservation measures that are technologically cost-effective to society were implemented, electricity use in the State and by LILCO could be reduced by about one-third.[2] Estimates were made of the "technology-cost potential savings" in the residential, commercial, and industrial sectors of each of New York's seven privately owned electric utilities. Technology-cost potential savings are the total energy savings potential below cost-effectiveness thresholds based only on the technical costs (equipment and installation) of the energy conservation measures. The technical costs represent estimates of end-user costs. The full costs of achieving these savings through utility-sponsored or other types of programs are therefore not included.

Cost-effectiveness thresholds are established appropriate to three points of view. From the consumer perspective, the thresholds are the average electricity rates in 1986. From the utility and societal perspectives, the thresholds are based on long-range marginal costs for each utility as developed by the New York Public Service Commission.

Cost-effectiveness is calculated from these three points of view by assuming different discount rates. A 10 percent real discount rate is assume for the utility perspective, 6 percent for the consumer perspective, and 3 percent for the societal perspective. These are "explicit" discount rates representing external conditions, such as interest rates. They can be distinguished from "implicit" discount rates which may be revealed by actual behavior in the marketplace; for example, the implicit tradeoff between initial cost and subsequent energy savings. Implicit discount rates are typically much higher than explicit discount rates because of inadequate information, limited product choices, third party purchases, and other imperfections in the marketplace.

The objective is to detemine the technical and economic potential for electricity saving in (then) current building and equipment stock, not to forecast future electricity demand. The energy conservation measures appropriate to the Long Island residential, commercial, and industrial sectors are listed in Tables D.1, D.2, and D.3, ranked in order of marginal "cost of saved energy" (CSE in the tables) which is the cost of reducing electricity consumption over the lifetime of the measure.

It can be seen that the residential sector measures are dominated by improved appliances, the commercial sector by lighting and heating, ventilation and air-conditioning, and the industrial sector by motors and lighting.

The ranked data in Tables D.1 to D.3 can be plotted as an "electricity conservation supply curve," illustrated for all New York State in Figure D.1.

The technology-cost potential of electricity and peak demand savings are shown in Table D.4 for the consumer, utility, and societal perspective. The potential savings in electricity consumption due to these conservation measures, assuming only technical costs, is estimated to be 31.8 percent if determined by the consumer perspective, 27.6 percent by the utility perspective, and 32.2 percent from by the societal perspective.

Lessons Learned in Commercial/Industrial DSM Programs

ACEEE's second study[3] reported on the experience of 58 utilities across the country with over 200 conservation and load management programs for commercial and industrial customers. It found that typical programs reached less than 5 percent of eligible customers and reduced energy by less than 10 percent. The most successful programs, however, reached 70 percent or more of targeted customers and reduced customer electricity use by 10 to 30 percent, depending upon end-use and building type. Nearly all of the programs cost utilities less than $0.04 per kilowatt-hour saved, which is less than the long-term avoided cost of all New York State

Table D.1. ACEEE Electricity Conservation Assessment of LILCO Residential Sector

Source: ACEEE, The Potential for Electricity Conservation in New York State (1989), p. 255.

Discount rate = 6%

Area	Option	Marginal CSE ($/kWh)	Potential Savings (GWh/yr)	Cumulative Savings (GWh/yr)	Net Percent Savings (%)
FRE	Current sales average (1986)	0.004	55	55	0.88%
REF	Current sales average (1986)	0.010	286	341	5.46%
REF	Best current (1988)	0.011	285	626	10.01%
REF	Near-term advanced	0.013	119	745	11.92%
EWH	Traps & blanket (EF=0.9)	0.013	17	762	12.20%
FRE	Best current (1988)	0.014	38	801	12.81%
FRE	Near-term advanced	0.015	19	820	13.11%
ESH1	Infiltration reduction	0.017	76	896	14.34%
RAN	Improved oven	0.022	43	939	15.03%
ESH2	Storm windows	0.024	3	942	15.07%
RAN	Improved cooktop	0.025	15	957	15.31%
ESH2	Low-emissivity film	0.026	1	958	15.33%
LTG	Tungsten halogen lamps-300 h/y	0.027	102	1,060	16.97%
LTG	Energy saving lamps-620 hr/yr	0.030	12	1,073	17.16%
LTG	Energy saving lamps-1,240 h/y	0.030	14	1,087	17.39%
EWH	Front loading clothes washer	0.034	29	1,116	17.85%
LTG	Compact fluorescents-1240 h/y	0.036	162	1,278	20.44%
LTG	IRF lamps - 300 hr/yr	0.044	119	1,397	22.35%
LTG	Compact fluorescents-620 h/y	0.045	135	1,532	24.50%
ESH1	Heat pump #1 (HSPF=7)*	0.047	79	1,611	25.77%
ESH1	Heat pump #2 (HSPF=8)*	0.062	8	1,619	25.89%
ECD	Heat pump clothes dryer	0.065	198	1,817	29.06%
RAC	RAC: 8.5 EER	0.072	45	1,861	29.78%
ESH1	Low-emissivity film	0.079	22	1,883	30.13%
RAC	RAC: 10.0 EER	0.115	28	1,911	30.58%
CAC	Window film	0.128	22	1,933	30.92%
CAC	CAC: 10.0 SEER	0.132	26	1,959	31.34%
RAC	RAC: 12 .0 EER	0.146	29	1,988	31.81%
CAC	Variable speed drive	0.192	17	2,005	32.08%
CAC	CAC: 12.0 SEER	0.258	15	2,020	32.32%
CAC	CAC: 14.0 SEER	0.407	11	2,032	32.50%
ESH1	Add 3" fiberglass in roof/ceiling	0.439	3	2,035	32.56%

Notes:

1. 1986 residential electricity consumption: 6,251 GWh
2. REF: refrigerator; FRE: freezer; EWH: electric water heater; LTG: lighting; RAC: room air conditioner; CAC: central air conditioner; RAN: cooking range; ECD: electric clothes dryer; ESH1: electric space heating in single-family and small (2-4 units) multi-family homes; ESH2: electric space heating in large (5+ units) multi-family homes.

Table D.2. ACEEE Electricity Conservation Assessment of LILCO Commercial Sector

Source: ACEEE, The Potential for Electricity Conservation in New York State (1989), p. 258.

Discount rate = 6%

Area	Option	Marginal CSE ($/kWh)	Potential Savings (GWh/yr)	Cumulative Savings (GWh/yr)	Net Percent Savings (%)
LTG	Delamping	0.001	21	21	0.41%
REF	Floating head press. control	0.001	26	47	0.91%
REF	Refrig. compressor eff.	0.003	32	79	1.54%
HVAC	Reset supply air temperature	0.005	161	240	4.66%
LTG	Reflectors	0.010	541	781	15.15%
HVAC	Fan motor efficiency	0.010	38	819	15.88%
LTG	High-efficiency ballast	0.011	65	884	17.14%
HVAC	VAV conversion	0.013	324	1,208	23.44%
LTG	Energy saving fluorescents	0.017	79	1,329	25.79%
HVAC	Economizer	0.017	42	1,250	24.26%
HVAC	Pump motor efficiency	0.018	3	1,332	25.85%
HVAC	VSD on fan motor	0.021	387	1,719	33.35%
LTG	Occupancy sensors	0.033	64	2,026	39.31%
REF	Refrigerated case covers	0.044	8	2,034	39.47%
HVAC	Re-size chillers	0.045	243	1,962	38.07%
LTG	Daylighting controls	0.048	209	2,244	43.53%
LTG	VHE bulbs and ballasts	0.058	142	2,386	46.29%
HVAC	VSD on pump motor	0.062	28	2,414	46.83%
SHELL	Window films (S&W)	0.128	25	2,439	47.32%
SHELL	Low-E windows (all)	0.303	22	2,461	47.76%
SHELL	Roof insulation	0.697	3	2,464	47.81%
SHELL	Low-E windows (N)	0.788	1	2,465	47.83%

Notes:
1. 1986 commercial electricity sales: 5,154 GWh
2. HVAC: heating, ventilation and air conditioning; LTG: lighting; SHELL: building shell; REF: refrigeration

Table D.3. ACEEE Electricity Conservation Assessment of LILCO Industrial Sector

Source: ACEEE, The Potential for Electricity Conservation in New York State (1989), p. 260.

Area	Option	Marginal CSE ($/kWh)	Potential Savings (GWh/yr)	Cumulative Savings (GWh/yr)	Net Percent Savings (%)
MOT	>125 HP: retire	0.008	0.6	0.6	0.0%
MOT	21 - 50 HP: retire	0.008	1.9	2.4	0.2%
MOT	51-125 HP: retire	0.008	0.7	3.1	0.2%
LTG	Energy saving lamp	0.009	13.4	16.5	1.1%
MOT	5.1-20 HP: retire	0.012	4.7	21.2	1.4%
LTG	Metal halide lamp	0.020	4.8	26.0	1.8%
LTG	High-efficiency ballast	0.027	4.1	30.1	2.0%
MOT	>125 HP: VSD	0.036	107.5	137.6	9.3%
MOT	1-5 HP: retire	0.037	0.5	138.2	9.3%
LTG	High-pressure sodium	0.043	15.8	153.9	10.4%
MOT	21-50 HP: rebuild	0.044	5.3	159.2	10.7%
MOT	51-125 HP: VSD	0.045	79.0	238.2	16.1%
MOT	5.1-20 HP: rebuild	0.051	2.5	240.7	16.2%
MOT	51-125 HP: rebuild	0.064	9.0	249.7	16.8%
MOT	21-50 HP: VSD	0.087	40.7	290.4	19.6%
MOT	>125 HP: rebuild	0.090	8.1	298.5	20.1%
MOT	<1 HP: retire	0.103	0.1	298.6	20.1%
MOT	5.1-20 HP: VSD	0.129	27.4	325.9	22.0%
MOT	1-5 HP: VSD	0.373	1.9	327.8	22.1%

Notes:
1. 1986 industrial electricity sales: 1,482 GWh
2. MOT: Motor efficiency measure; LTG: Lighting efficiency measure

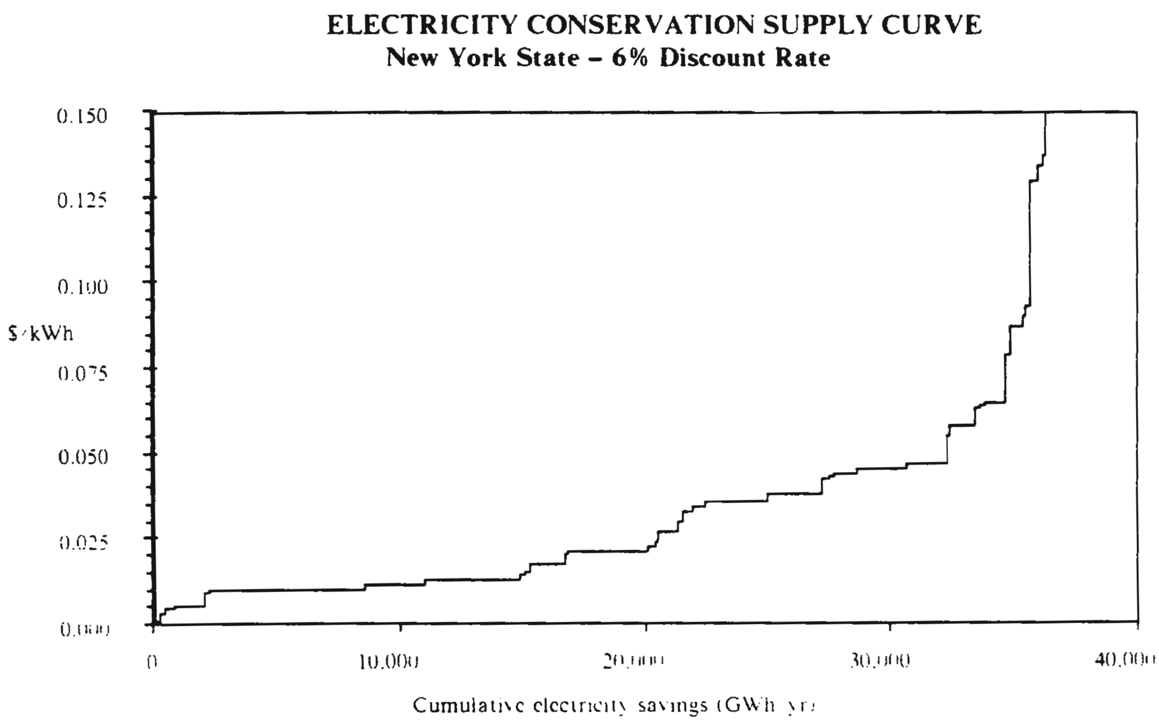


Figure D.1. ACEEE Electricity Conservation Supply Curve for New York State

Source: ACEEE, The Potential for Electricity Conservation in New York State (1989), p. S-9.

Table D.4. ACEEE Estimate of Technology-Cost Potential Electricity and Peak Demand Savings in LILCO Service Area

Source: ACEEE, The Potential for Electricity Conservation in New York State (1989), p. 254.

Savings and percent of total

CONSUMER PERSPECTIVE

Sector	Electricity consumption (GWh/yr)	(%)	Summer peak demand (MW)	(%)	Winter peak demand (MW)	(%)
Residential	1,911	30.6%	379	21.6%	276	21.6%
Commercial	2,414	46.8%	569	41.9%	301	29.5%
Industrial	250	16.9%	34	16.8%	43	16.9%
Total	4,575	31.8%	982	29.7%	620	24.3%

UTILITY PERSPECTIVE

Sector	Electricity consumption (GWh/yr)	(%)	Summer peak demand (MW)	(%)	Winter peak demand (MW)	(%)
Residential	1,735	27.8%	698	39.8%	388	30.4%
Commercial	2,000	38.8%	469	34.6%	253	24.8%
Industrial	238	16.1%	32	16.1%	41	16.1%
Total	3,973	27.6%	1,199	36.2%	682	26.8%

SOCIETAL PERSPECTIVE

Sector	Electricity consumption (GWh/yr)	(%)	Summer peak demand (MW)	(%)	Winter peak demand (MW)	(%)
Residential	1,966	31.5%	731	41.7%	448	35.1%
Commercial	2,414	46.8%	656	48.3%	301	29.5%
Industrial	250	16.8%	34	16.8%	43	16.9%
Total	4,630	32.2%	1,421	42.9%	792	31.1%

*Discount rates for each perspective are: 6% - consumer, 10% - utility, 3% - societal utilities, including LILCO, and therefor is cost-effective by the Utility Cost test.

The report stresses the value of comprehensive programs which combine regular personal contacts with eligible customers, comprehensive technical assistance, and financial incentives that pay the majority of the cost of installation. Typically, these comprehensive programs cost about $0.03 per kilowatt-hour saved. Comprehensive programs may be particularly appropriate for small customers, who are the least likely to participate in other programs, and for new construction where there is a one-time opportunity to capture substantial savings at only the marginal cost of efficient equipment over standard equipment.

Rebate programs are by far the most common type of program for commercial and industrial customers. The most successful rebate programs have reduced electricity use by approximately 5 percent at costs to the utility of about $0.01 per kilowatt-hour saved. These programs have proven effective at promoting basic lighting and heating, ventilating, and air-conditioning equipment improvements. Most have not been effective in promoting "system" improvements which involve the interaction of different equipment.

Performance contracting, usually through energy service companies (ESCOs) have proven expensive and in some respects inadequate. The ESCOs choose to concentrate on the largest customers and the most lucrative energy-saving measures, particularly lighting and cogeneration, "skimming the cream," and leaving other worthwhile but less profitable conservation measures undone.

For commercial and industrial customers, information-only programs have low participation rates and low savings.

Even though the most successful programs achieved substantial energy savings, the ACEEE concluded that the savings achieved fall far short of the full technical potential that is cost-effective to end-users.

Conservation Potential Achievable by LILCO

The 1989 New York State Energy Plan concludes that electric utilities should be encouraged to implement demand-side management programs that will achieve statewide annual electric savings of 8 to 10 percent by 2000, and 15 percent by 2008 if economically justified.[4] The third ACEEE study addresses the question of whether these goals are achievable. Prototypical demand-side management projects are evalauated for three New York State utilities using the Comprehensive Market Planning and Analysis System (COMPASS) of the Synergic Resource Corporation.

In the case of LILCO, the study concludes that by 2000 the prototypical set of conservation measures examined could achieve reductions of 2,658,000 megawatt-hours in electric energy as well as peak reductions of 447 and 418 megawatts in summer and winter. These amount to 9.2 to 11.9 percent reductions in projected sales and peak demands, meeting New York State targets. However, the 15 percent target for 2008 cannot be achieved by the demand-side management programs considered.[5]

The programs that contribute to these energy savings are listed in Tables D.5 and D.6 which show energy and peak savings, and program costs and benefit-to-cost ratios, respectively. In 2000, lighting programs are the leading energy savers. For lamps, luminaires, and motors, only program savings due to efficiencies beyond those now being considered by the U.S. Department of Energy, New York State, and other states were counted as energy savings. The demand-side management programs considered do not include the possibility of fuel switching or the use of cogeneration.

Program costs over the 1991-2011 period total approximately $1.16 billion and represent an average annual program cost of about $55 million annually (or $731 million 1991 present value dollars). The pattern of energy savings and program costs over time is shown in Figure D.2. Note that program costs peak from 1994 through 2002, while energy savings do not reach their maximum until 2006.

The monetary commitment needed to meet the New York State Energy Office targets is substantially higher than PSC-approved 1990 demand-side management budgets, and would almost triple the 1990 amounts in 1991 and thereafter.

Although the demand-side management programs analyzed for LILCO do not reach the 15 percent energy reduction target by the year 2008, the New York State Energy Office considers it likely that they could in combination with load management, fuel switching, cogeneration, and likely improvements in technology.

None of the programs passed the Rate Impact Test as indicated by nonparticipant benefit-cost ratios less than one in Table D.6. The Public Service Commission has stated that the Rate Impact Test "should not be considered the primary determinant of a program's cost-effectiveness."[6] Nevertheless, this means that electricity costs would rise for persons not achieving conservation savings sufficient to compensate for higher electrical rates.

Table D.5. New York State Estimates of Energy Savings from Prototypical LILCO DSM Projects

Source: New York State Energy Office (1990), p. 31.

	2000			2008		
		Winter	Summer		Winter	Summer
Program Name	GWh	MW	MW	GWh	MW	MW
R ENERGY FITNESS - LIGHT	75	35	4	14	6	1
R ENERGY FITNESS- WTR HTG	20	2	2	12	1	1
R ENERGY FITNESS-WEATHRZTN	8	2	0	8	2	0
R LIGHT COUPON 91-96	64	31	3	0	0	0
R LIGHT COUPON 97-2003	73	34	4	74	34	4
R WATER HEAT RETROFIT	13	2	1	8	1	1
R HOUSE DOCTOR	18	4	1	17	4	1
R HOME INSULATION	7	2	0	9	3	0
R HIGH EFFICIENCY REFRIG	73	10	10	111	15	15
R HEAT PUMP WATER HEATER	31	4	3	119	14	13
R NEW CONSTRUCTION	32	8	3	73	20	6
C LIGHT REB.-COMPACT BULB	6	1	1	1	0	0
C LIGHT REB.- COMPACT FIXT	46	5	8	24	3	4
C LIGHT REB.- REFLECTORS	171	20	32	90	11	17
C LIGHT REB.-BALLAST 91-94	49	6	9	26	3	5
C LIGHT REB.-BALLAST 95-99	48	6	9	110	13	20
C LIGHT REB.- HID RETROFIT	54	9	6	21	4	2
C LT. REBATE OCC.SENS	32	8	6	18	4	3
C LIGHT REB.-DAYLIGHT CNTL	38	0	10	23	0	6
C HVAC CHILLER REBATE	43	10	33	95	22	72
C HVAC PKGD SYSTEM REBATE	64	6	24	142	12	54
C REFRIGERATION REBATES	302	34	43	371	41	52
C MOTOR REBATE	58	7	8	92	11	12
C ADJUSTABLE SPEED DRIVE	77	9	10	125	15	16
C CUSTOM MEASURE	137	18	22	81	11	13
C AUDIT PROGRAM	122	16	20	40	5	7
C SM.DIRECT INSTALL-GEN'L	502	60	93	578	69	107
C SM.DIRECT INSTL-COMPACT	19	2	3	5	1	1
C SM.DIRECT INSTL-OCC SENS	34	9	6	31	8	5
C MED/LG DIRECT INSTALL	182	24	30	370	50	61
C RENOVATION - LIGHT 91-94	11	1	2	11	1	2
C RENOVATION-LIGHT 95-2010	56	7	10	144	17	27
C NEW CONSTRCTN 1991-2000	146	20	24	146	20	24
C NEW CONSTRCTN 2001-2010	0	0	0	177	24	29
INDUS NEW CONST/MODERNZTN	47	6	6	95	11	12
TOTAL	2,658	418	447	3,260	456	593

R = Residential

C = Commercial and industrial

Table D.6. New York State Estimates of Program Costs and Benefit-Cost Ratios from Prototypical LILCO DSM Projects

Source: New York State Energy Office (1990), p. 33.

Program Name	BENEFIT COST RATIOS Utility	Participant	Non-Partic	Total Res.	Societal	Sum of Program Costs (1991 $) (1000's)
R ENERGY FITNESS - LIGHT	1.15	5.03	0.44	1.65	1.96	$40,171
R ENERGY FITNESS- WTR HTG	4.41	14.78	0.58	4.67	5.48	4,065
R ENERGY FITNESS-WEATHRZTN	3.31	8.36	0.47	2.91	3.55	2,221
R LIGHT COUPON 91-96	3.06	7.89	0.50	3.76	4.40	22,356
R LIGHT COUPON 97-2003	4.14	16.88	0.56	6.92	8.14	17,947
R WATER HEAT RETROFIT	7.40	37.47	0.61	7.74	9.08	1,575
R HOUSE DOCTOR	1.72	4.70	0.46	1.76	2.10	10,378
R HOME INSULATION	1.28	3.44	0.39	1.08	1.32	6,145
R HIGH EFFICIENCY REFRIG	5.65	2.70	0.61	1.66	1.95	17,794
R HEAT PUMP WATER HEATER	2.99	4.63	0.57	2.35	2.75	29,870
R NEW CONSTRUCTION	2.74	3.96	0.53	2.07	2.46	22,701
C LIGHT REB.-COMPACT BULB*	5.44	18.50	0.70	7.71	8.94	1,502
C LIGHT REB.- COMPACT FIXT	15.82	66.60	0.79	26.83	30.74	3,372
C LIGHT REB.- REFLECTORS	5.90	8.81	0.73	6.14	7.09	33,981
C LIGHT REB.-BALLAST 91-94	4.23	5.90	0.69	3.97	4.59	14,108
C LIGHT REB.-BALLAST 95-99	18.15	11.03	0.84	8.92	10.28	5,522
C LIGHT REB.- HID RETROFIT	4.31	6.06	0.65	3.66	4.32	13,040
C LT. REBATE OCC.SENS	6.28	6.08	0.71	4.07	4.69	6,035
C LIGHT REB.-DAYLIGHT CNTL	3.15	2.94	0.68	1.98	2.24	15,820
C HVAC CHILLER REBATE	8.87	10.18	1.01	7.45	8.11	19,079
C HVAC PKGD SYSTEM REBATE	15.16	27.82	0.97	13.41	15.06	11,792
C REFRIGERATION REBATES	1.82	2.89	0.56	1.60	1.88	205,223
C MOTOR REBATE	5.51	6.67	0.70	4.05	4.77	15,661
C ADJUSTABLE SPEED DRIVE	3.03	3.10	0.63	1.97	2.31	38,882
C CUSTOM MEASURE	4.76	4.21	0.69	2.67	3.11	30,361
C AUDIT PROGRAM	3.37	6.81	0.63	2.07	2.41	46,127
C SM.DIRECT INSTALL-GEN'L	2.79	5.01	0.70	3.46	3.98	225,366
C SM.DIRECT INSTL-COMPACT*	2.50	7.36	0.67	3.78	4.36	6,992
C SM.DIRECT INSTL-OCC SENS	4.34	5.23	0.75	3.73	4.30	9,908
C MED/LG DIRECT INSTALL*	3.88	4.16	0.69	2.59	3.02	90,198
C RENOVATION - LIGHT 91-94	4.57	9.06	0.71	4.45	5.14	3,636
C RENOVATION-LIGHT 95-2010	4.27	7.30	0.73	4.39	5.06	32,507
C NEW CONSTRCTN 1991-2000	2.75	4.83	0.64	2.54	2.96	65,324
C NEW CONSTRCTN 2001-2010	1.92	3.39	0.59	1.76	2.05	71,002
INDUS NEW CONST/MODERNZTN	3.38	5.23	0.65	2.99	3.51	25,180
TOTAL	3.35	4.89	0.67	2.89	3.34	1,165,841

R = Residential

C = Commercial and industrial

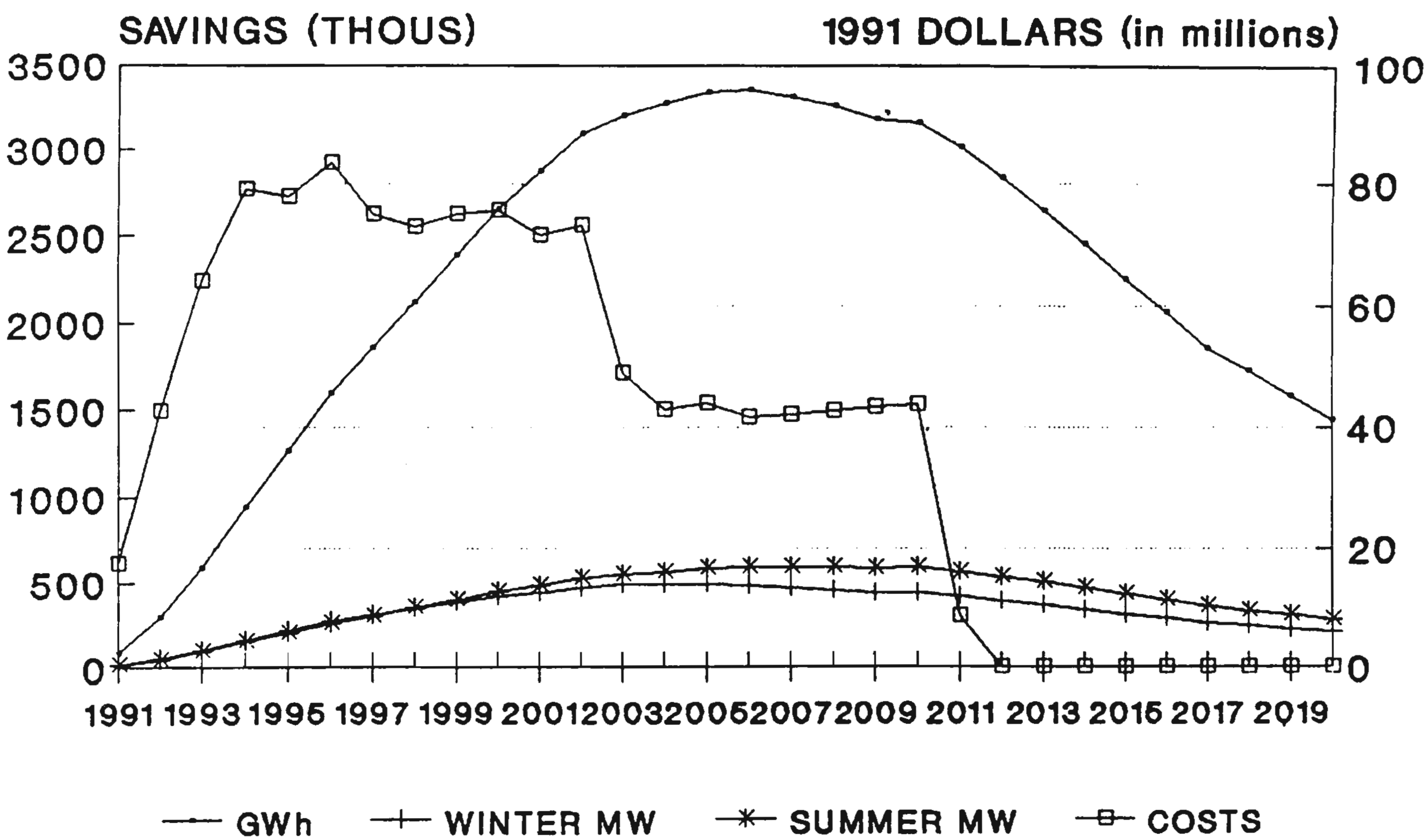


Figure D.2. Pattern of Energy Savings and Program Costs from Prototypical LILCO DSM Projects.

Source: New York State Energy Office (1990), p. 35.

REFERENCES

1. Guinn, C. R., letter to Laurence DeWitt, August 10, 1990, with enclosure, Meeting the State Energy Plan DSM Goals: An Analysis of Prototypical DSM Programs for Niagara Mohawk Corporation, Consolidated Edison Company of New York, Inc., and Long Island Lighting Company, New York State Energy Office (August 1990).

2. Miller, P.M., J. H. Eto, and H. S. Geller, The Potential for Electricity Conservation in New York State, New York State Energy Research and Development Authority, Report 89-12 (September 1989).

3. Nadel, S., Lessons Learned: A Review of Utility Experience with Conservation and Load Management Programs for Commercial and Industrial Customers, New York State Energy Research and Development Authority, Report 90-8 (April 1990).

4. Cotter, W. D., T. C. Jorling, and P. A. Bradford, New York State Energy Plan (September 1989), p. 8.

5. New York State Energy Office, Meeting the State Energy Plan DSM Goals: An Analysis of Prototypical DSM Programs for Niagara Mohawk Corporation, Consolidated Edison Company of New York, Inc., and Long Island Lighting Company, New York State Energy Office (August 1990), p. 30.

6. Public Service Commission Order of December 29, 1989, concerning Demand-Side Management Plans staff recommendations referenced in the Order at page 7. Additionally, the PSC in Opinion 88-20 and the December 23, 1988 Order also rejected the use of the Rate Impact Measurement test as the primary determinant of program cost-effectiveness.

APPENDIX E

TELLUS INSTITUTE PROPOSAL FOR LILCO DSM

TELLUS INSTITUTE PROPOSAL FOR LILCO DSM

On behalf of the Long Island Power Authority, the Tellus Institute submitted to the New York Public Service Commission a critique of the LILCO demand-side management plans and offered its own set of programs. The Tellus analysis used a draft of the third ACEEE report[1], prepared with the New York State Energy Office for the New York State Energy Research and Development Authority, as the primary standard for assessing LILCO's electricity conservation programs and recommending its own. Tellus does not present its results as an illustrative example, however, but as an alternative the Public Service Commission should direct LILCO to pursue. If for any reason LILCO does not pursue them, Tellus says, "alternative delivery mechanisms" should be found.[2]

The Tellus program achieves about the same electric energy reductions as the ACEEE/SEO example in the years 2000 and 2008, but it achieves natural gas reductions as well. Table E.1 shows a comparison of the LILCO, ACEEE/SEO, and Tellus estimates of demand-side management energy savings with earlier estimates by the New York Power Pool and for a reference scenario in the draft New York State Energy Plan.

The cost of the program recommended by Tellus of about $1.2 billion, measured by present value in 1990 or 1991, is about half again as much as the ACEEE/SEO example and more than triple the LILCO base case.

Tellus believes that LILCO is not laying a sufficient foundation for long-term conservation efforts, citing these specific limitations:

- Gas conservation is not pursued to any significant degree.

- Substitution of gas for electricity is not pursued aggressively.

- In the residential sector, LILCO limits the use of significant financial incentives to encourage efficiency improvements in swimming pool pumps and central air conditioning.

- LILCO's nonresidential efficiency financial incentive programs are largely driven by rebates for specific devices and do not embody comprehensive approaches that will systematically promote advanced technology.

- LILCO relies on questionable estimates of savings from consumer information programs in projecting reduction in electricity use due to its programs.

Table E.1. Comparison of LILCO, ACEEE, and Tellus Demand-Side Management Program Totals

	Annual Energy Savings 1993		2000		2008		Program Cost ($mill.pres.val.)	
Total LILCO GWh								
NYPP	17,806		18,975					
NYS Plan	19,495				27,788			
NYS Plan (GWh)			485	(2.5%)				
NYPP (GWh)	402	(2%)	1,128	(6%)				
LILCO DSM base case (GWh)	713	(4%)	1,712	(9%)	2,143	(8%)	$372	(1990)
ACEEE/NYSEO (GWh)			2,658	(14%)	3,260	(12%)	$731	(1991)
Tellus/LIPA								
Elec (GWh)	557	(3%)	2,622	(14%)	3,090	(11%)	$1,214	(1990)
Gas (bill.Btu)	552		2,377		2,052			

Sources: Draft New York State Energy Plan, Vol. IV, p. 15, 21; New York Power Pool, Load and Capacity Data, 1990-2006, p. 12, 13; LILCO 1990 Long Range Electric Conservation and Load Management Plan, pp. 210ff.; New York State Energy Office, Meeting the State Energy Plan DSM Goals, pp. 30; Tellus Institute, Comments on the LILCO 1991-92 Electric Conservation and Load Management Plan, etc., Vol. I, p. S-5.

- LILCO is not budgeting for conservation at the levels required to tap the substantial achievable and cost-effective energy efficiency potential identified by Tellus and ACEEE; indeed, it is not spending at its own budget levels.
- LILCO uses a piecemeal marketing approach.[3]

Tellus presents its own conservation plan for LILCO which consists of the following programs:[4]

- o Residential Direct Installation Program: direct installation of cost-effective efficiency measures in houses.

  Basic program
  Senior Citizen program
  Low Income program

- o Residential Appliance Efficiency and Fuel Choice Program: financial incentives for choice of high-efficiency refrigerators and gas heating and water heating equipment, and for choice of efficient gas over electricity for heating and water heating where cost-effective.

- o Small Business Direct Installation Program: direct installation of cost-effective efficiency measures in small to medium sized businesses.

- o Comprehensive Commercial/Institutional/Industrial Efficiency Program: an integrated approach to feasibility studies and incentives for multi-measure efficiency retrofits in facilities of all sizes.

  Basic program
  Lighting program
  Industrial program

- o New Construction Program: design assistance, training, and performance incentives for developers and builders of new and renovated facilities to substantially exceed standard energy-efficiency levels.

  Residential program
  Nonresidential program

Tellus argues that the choice of natural gas where it is less costly than electricity on a life cycle basis is a conservation measure if it reduces the direct and indirect costs of providing energy services. Tellus therefore recommends that LILCO include programs to promote the choice of efficient gas equipment in residential and commercial/institutional buildings. At the same time, demand-side management should be promoted in gas applications. As a combined gas and electric utility, LILCO is in a position to market, not just electricty and gas, but higher efficiency in electricity and gas use. However, LILCO's gas substitution program appears to be primarily a stepped-up gas marketing program rather than an effort to reward customers for switching from electricity to gas in appropriate end-uses.[5]

Gas cooling is not "uniformly" cost-effective at this time, according to Tellus, and LILCO should not offer standardized incentives for gas cooling in its Dollar and Sense program; limited support for gas cooling technologies should be maintained as a pilot activity to help commercialize, demonstrate, and evaluate alternative gas cooling technologies.[6]

An innovative demand-side management proposed by Tellus is its Industrial Comprehensive Program targeted at 50 customers per year of an estimated 600 to 1000 suitable industrial or manufacturing facilities. Tellus says it is incorrect to use a generic approach in the industrial sector, basing the conservation program on separate measures such as provision of low-temperature heat, motor drive, or the efficiency of pumps, fans, and compressors, and offering rebates for specific devices. Industry uses hundreds of different production processes, and the emphasis should be on manufacturing process improvements. A program of incentives is needed for specific projects, not individual conservation measures. Tellus envisions teams combining generalists and production process specialists with heavily subsidized engineering assistance of high quality for auditing. Audit costs would average $10,000 per audit. Manufacturers would pay only about 30 percent of the installed cost of conservation investments.

With LILCO reporting that 17 percent of its largest customers account for one-third of its commercial/industrial sales, big industry clearly deserves demand-side management attention. However, the Tellus plan raises some questions. During the past two decades, industry has made the largest and most consistent improvements in energy conservation. Bigger companies are more likely to be aware of energy costs, more likely to have the technical staff to effect energy conservation, and more likely to manage its financing. Large companies on Long Island have already contracted for cogeneration plants, for example. LILCO has previously concentrated its demand-side management marketing efforts on big commercial accounts. If large companies were seeking technical services to deal with their own unique manufacturing processes, it seems unlikely that they would turn to LILCO rather than specialized consultants.

Tellus faults LILCO for failing to offer programs to major residential customer segments and for a number of residential end-uses. Residential customers accounted for 44 percent of LILCO's 1989 system sales of electricity and 62 percent of its system sales of gas. Cost-effective opportunities exist in almost all the specific areas of residential energy consumption: space heating and cooling, water heating, refrigeration, and lighting, among others. Except for central air conditioning and swimming pool pumps, however, most of the residential funding goes to information programs. Tellus charges that LILCO's ascribing energy savings to information programs is questionable, and recommends that LILCO's general awareness programs be discontinued.[7]

The underfunding of demand-side management in the residential sector raises questions of the overall equity of LILCO's program, according to Tellus. All LILCO customers, residential as well as commercial, need opportunities to participate in demand-side management programs because of the bills they face, first, from the cost of the Shoreham settlement, and, second, because rates may increase further due to demand-side management expenditures. The way to address equity issues concerning DSM expenditures is to spread them among as many programs as possible. More inclusive programs would reduce the number of nonparticipants.[8]

Tellus includes in its residential programs a Low Income Direct Installation Program. Low income customers need to be treated as a separate market segment for two reasons. First, low income customers cannot afford any contribution toward the costs of conservation measures. Second, low income housing stock is often in a dilapidated or deteriorated condition. Extensive home repairs often need to be made to realize the estimated energy savings from installed measures, frequently to replace furnaces or boilers and roofs. Furthermore, the energy-using behavior of low income customers is typically very wasteful. Intensive, on-site education is needed to gain real benefits from the conservation installations.

For these reasons, it is difficult to design effective low income programs that are justified from the point of view of cost-effectiveness. From the standpoint of equity, however, Tellus believes that low income programs should nevertheless be included in demand-side management.[9]

Even the most successful efforts to spread conservation measures more widely will leave some "nonparticipants," however, and the likelihood is that the proportion of nonparticipation will be highest at low income levels. Tellus seems to shrug off LILCO's argument about the effect of more ambitious demand-side management programs on its already high electric rates. The problem of LILCO's escalating electric rates will be exacerbated to the extent that electric customers are converted to gas customers, as recommended by Tellus. Despite its concern for equity, Tellus simply notes that actual bills would (probably?) decline for cost-effective demand-side management investments, that is, for participants. Tellus reports that the Public Service Commission is developing a strong utility financial incentive system to reward LILCO for conservation achievement, which can only mean even higher rates.[10]

The proposed Tellus program, undoubtedly current with the state of the art in demand-side management throughout the country, may not fully reflect the extraordinary circumstances faced by LILCO and Long Island electricity ratepayers.

REFERENCES

1.. Nadel, S., and H. Tress, The Achievable Conservation Potential in New York State from Utility Demand-Side Management Programs, American Council for an Energy-- Efficient Economy (draft), July 1990.

2.. Nichols, D., and A. Bachman, Long Island Power Authority Comments on the LILCO 1991-92 Electric Conservation and Load Management Biennial Plan and the LILCO 1990 Long Range Electric Conservation and Load Management Plan, Vol. I, Tellus Institute (September 17, 1990), p. S-6.

3.. Nichols, D., and A. Bachman, p. S-2, S-3.

4.. Nichols, D., and A. Bachman, p. S-3, S-4.

5.. Nichols, D., and A. Bachman, p. 16, 19, 24.

6.. Nichols, D., and A. Bachman, p. 20.

7. Nichols, D., and A. Bachman, p. 15, 17, 25, 26.

8. Nichols, D., and A. Bachman, p. 15, 19.

9. Nichols, D., and A. Bachman, p. 7, 34.

10. Nichols, D., and A. Bachman, p. 15, S-9.

APPENDIX F

A REALITY CHECK: THE ENERGY ADVISORY SERVICE TO INDUSTRY

A REALITY CHECK: THE ENERGY ADVISORY SERVICE TO INDUSTRY

The extent to which energy conservation can reduce future demand for electricity and other energy seriously affects Long Island's energy planning. We have seen that the uncertainty ranges from LILCO's proposed 9 percent for the year 2000, for example, to 14 percent estimated by ACEEE/SEO and Tellus Institute. The former reflect LILCO's interests as well as its experience; the latter are based on prototypical conservation measures evaluated by a standardized computer model. What to believe?

Fortunately, there are some data in the public domain that give evidence of the practical limits of conservation on Long Island in the commercial and industrial sectors.

Since 1979, the New York State Energy Office has sponsored the Energy Advisory Service to Industry (EASI) program for firms of less than 400 employees in commerce, industry, and agriculture.[1] EASI offers free on-site surveys that identify energy-saving improvements and estimate cost and payback periods for recommended measures. A trained advisor typically spends most of a day inspecting a plant and working directly with company personnel in reviewing utility, fuel and water use data to assess the firm's opportunities to reduce energy use in building structures and equipment.

The business receives a written report detailing the advisor's findings, recommendation for energy-saving measures, and all appropriate energy and cost calculations. Typically, six or eight energy conservation measures are proposed. More extensive measures that require further evaluation, such as cogeneration, are identified where appropriate, but they are not included in the specific recommendations. Follow-up surveys indicate that about two-thirds of the recommended energy conservation measures are subsequently installed.

From 1987 to 1990, over 3,000 EASI surveys were performed in the State, 543 of them in Nassau and Suffolk Counties. A check list of 238 energy conservation measures is considered which may reduce any kind of fuel, not just electricity. (By comparison, the 1989 ACEEE evaluation of the potential electrical energy savings in New York State considered 22 options for commercial buildings and 15 electric motor and 4 lighting options for Long Island.) The EASI data were compiled and, with proprietary data removed, made available by the New York State Energy Office.[2]

The data for energy savings and cost are the advisors' estimates. They have not been verified or corrected by the subsequent experience of the companies. Thus, they are not "actual" conservation data, but they are a long step in that direction from prototypical estimates. These hitherto unpublished data are presented here as a reality check on estimates of potential Long Island electricity savings.[3]

Table F.1 lists the 43 energy conservation measures recommended in 338 manufacturing establishments for a total of 1,060 cases. This sample constitutes 7 percent of the establishments with Standard Industrial Classification (SIC) Codes 20 through 39 on Long Island.

The energy conservation measures marked with an asterisk in the Table are for lighting and electric motors, comparable to the ACEEE list in Table D.3. These can be seen to be the energy conservation measures most commonly recommended, but they do not comprise a majority of the types of measures used. For each energy conservation measure, the energy savings per investment cost is calculated for all cases. The energy conservation measures are listed in order of the greatest energy saving per unit investment.

The data of Table F.1 is plotted as a form of "energy conservation supply curve" in Figure F.1a. In plotting successive energy conservation measures by the average value of energy savings per unit investment for the total sample, this figure is similar to the ACEEE electricity conservation supply curve for New York State (Figure D.1) in which each energy conservation measure is represented by a single-valued estimate.

Alternatively, all 1,060 energy conservation measures can be sequenced by the value of energy savings per unit investment of each individual application. This results in Figure F.1b, which is a truer representation of the energy savings that can be achieved for a given cost.

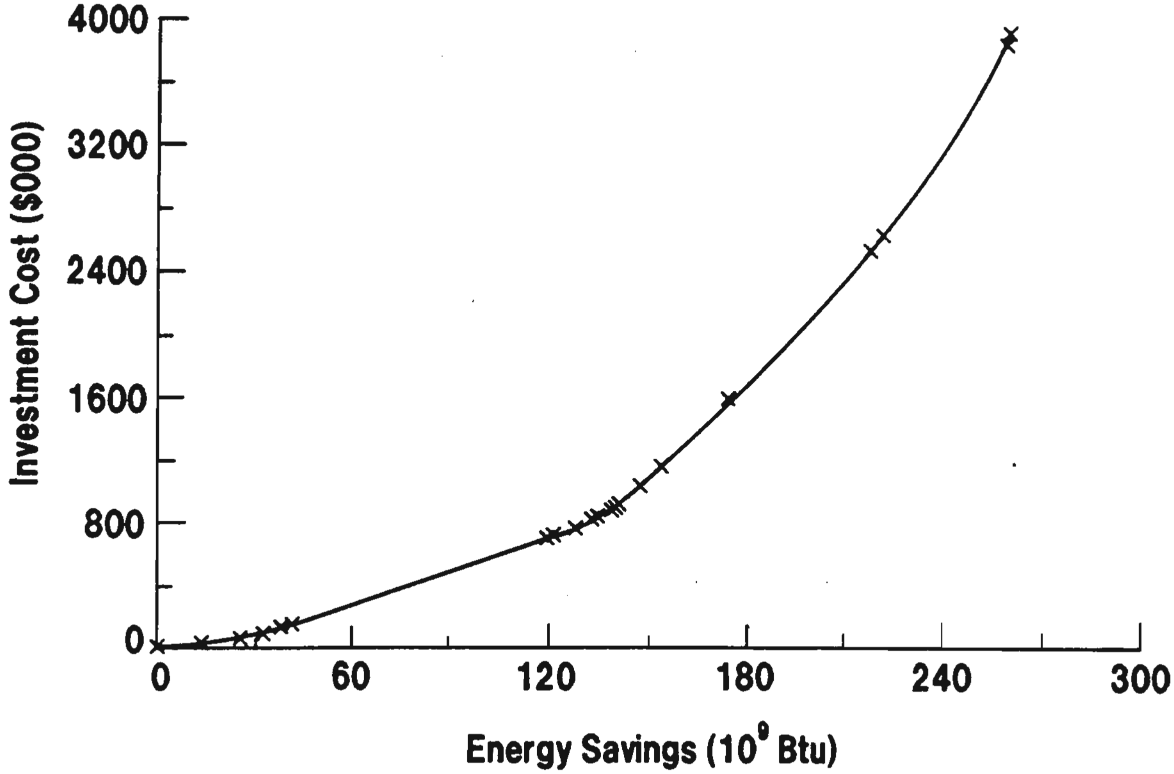
Note that Figure F.1b is more convex than Figure F.1a. The beginning and end points are the same. At intermediate points, however, the energy savings achievable for a given cost are greater than indicated by Figure F.1a. On the other hand, as the limit of energy savings is approached, the incremental cost of additional energy savings is higher.

The difference in the two curves is due to the fact that the energy savings per unit investment varies from one establishment to another. Some are cheaper than the average, some more expensive.

In order to compare these costs of conservation with LILCO's cost of electric supply, the investment costs must by converted to a cost per kilowatt-hour. This requires that the service life of the energy conservation measures be estimated and that a discount rate be assumed. The service

Table F.1. EASI Electricity Conservation Measures Ranked for 338 Long Island Manufacturing Establishments

	Energy Conservation Measure (ECM)	Energy Savings	$ Savings	$ Investment	Energy/ Investment	# of Cases	Fuel Type	SIC Code	CC
	Duty cycling of fans	461.10	3475.00	100.00	4.611	1	Elec	3674	52
	Equipment scheduling charges	267.24	7612.00	143.00	1.869	6	Elec	****	**
	Reduce motor run time	154.40	14658.00	100.00	1.544	1	Elec	3677	52
	Install daylight sen to con int lighting	1056.75	252.00	899.00	1.175	1	Elec	2711	52
	Install storm windows and doors	143.68	221.00	135.00	1.064	1	Elec	2711	52
	Other process	12102.32	16695.30	21760.00	0.556	4	Elec	****	52
	Insulate bare HW lines	533.23	4456.00	1120.00	0.476	2	Elec	****	**
	Insulate attic or roof	660.04	6259.00	1400.00	0.471	1	Elec	2821	30
	Install nighttime thermostat setback	114.61	1067.00	270.00	0.424	1	Elec	3832	52
	Other lighting	10070.36	79600.00	39421.00	0.255	8	Elec	****	**
	Install destratification fans	6862.68	58292.00	28805.00	0.238	17	Elec	****	**
	Install compr air int in cool location	5918.62	57334.00	29302.00	0.202	117	Elec	****	**
	Add photocontrols	3383.24	34224.00	18384.00	0.184	28	Elec	****	**
	Install occu sensors to cont inter light	551.95	4995.00	3546.00	0.156	3	Elec	****	52
*	Use higher efficiency lamps	77567.80	728581.00	548583.00	0.141	368	Elec	****	**
	Provide local switching for lighting	251.23	2575.00	1789.00	0.140	7	Elec	****	**
	Other insulation	1429.04	11865.00	10475.00	0.136	4	Elec	****	**
	Wire exhaust fan to lighting circuit	388.70	3686.00	2922.00	0.133	1	Elec	3089	52
	Replace inefficient air conditioners	6121.11	52878.00	53000.00	0.115	2	Elec	****	**
	Const wind screen/install air curtain	292.37	3054.00	2800.00	0.104	2	Elec	****	52
*	Replace inc w/fluor	4931.04	47629.00	48693.00	0.101	63	Elec	****	**
	Other heating and cooling measures	14.67	167.00	150.00	0.098	1	Elec	3646	30
	Maximize use of daylight	113.42	949.00	1272.00	0.089	2	Elec	3089	30
*	Install HID fluor replace inc	1792.33	14365.00	21668.00	0.083	3	Elec	****	**
	Switch fuels for water heating	3571.93	34754.00	44299.00	0.081	29	Elec	****	**
*	Install ballast add-on devices	1175.53	11155.00	15073.00	0.078	2	Elec	****	52
	Add timer control to lighting circuits	219.38	2543.00	3116.00	0.070	4	Elec	****	52
	Replace burners with more efficient type	702.64	6469.00	10190.00	0.069	3	Elec	****	**
	Ins htg pipe fit and cond line	559.15	5975.00	8722.00	0.064	2	Elec	****	52
	Reduce illumination levels	6121.83	58910.00	115682.00	0.053	34	Elec	****	**
	Switch fuels	6035.06	56998.00	117785.00	0.051	9	Elec	****	**
*	Replace inc w HPS/MV/MH	20751.76	194489.00	414716.00	0.050	88	Elec	****	**
	Install plastic strip wind screen	95.42	958.00	1900.00	0.050	2	Elec	****	30
	Install infrared heaters	133.40	1328.00	2750.00	0.049	1	Elec	3663	52
*	High efficiency motors	43458.65	373194.99	927932.99	0.047	82	Elec	****	**
	Recover heat from exhaust air	137.85	1129.00	3200.00	0.043	1	Elec	3672	52
	Install reflectors in fixtures	3305.05	31272.00	95736.00	0.035	4	Elec	****	**
*	Use energy efficient ballasts	37477.92	356363.00	1219058.99	0.031	138	Elec	****	**
	Other plant and dist system measures	1148.16	17198.00	72100.00	0.016	6	Elec	****	**
	Demand control	0.00	43863.00	212000.00	0.000	7	Elec	****	52
	Exemp state/local tax on elect	0.00	2008.00	400.00	0.000	2	Elec	****	52
	Cogeneration	0.00	0.00	0.00	0.000	1	Elec	2542	52
	Thermal storage	0.00	0.00	0.00	0.000	1	Elec	2834	52
	*** Total ***	260075.66	2353496.29	4101397.98		1060			



ENERGY CONSERVATION SUPPLY CURVE (No ECM Grouping)

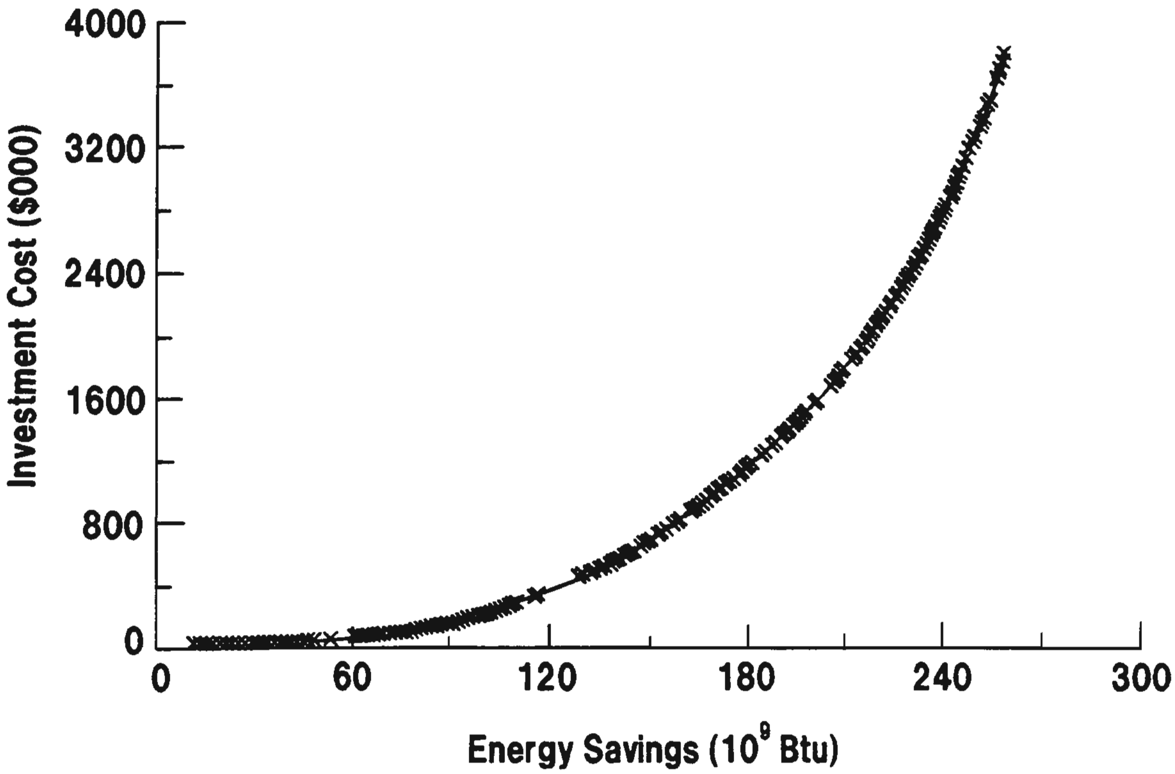


Figure F.1. EASI Electricity Conservation Supply Curves for 338 Long Island Manufacturing Establishments lives of individual energy conservation measures were not estimated in the EASI audits. It was therefore assumed that, on average, their service lives ranged between 10 and 15 years. Three discount rates were assumed--3, 6,and 10 percent--to correspond to the societal, consumer, and utility perspectives assumed by ACEEE (see page D 8).

The range of avoided costs reported by LILCO[4] (for 1990: 5.44 to 6.41 cents per kilowatt-hour; for 2000, 8.76 to 9.44) was reduced by a factor of 0.965 to adjust prices to the 1987-1990 time period in which the EASI cost estimates were made.

For all Long Island manufacturing, the comparison is made for an assumed average service life of 10 years in Figure F.2a and 15 years in Figure F.2b. For the 1990-2000 decade, the electricity savings range from about 4 to less than 7 percent, as indicated by the arrow. For all Long Island commercial establishments--including wholesale and retail trade and services--electricity savings range from 7.5 to 11 percent, as shown in Figure F.3. The difference is plausible: manufacturing establishments are likely to use additional electricity in process applications not evaluated in an EASI survey.

EASI-type energy conservation measures constitute the lower limit of potential energy savaings inasmuch as they do not include the possibility of cogeneration or manufacturing process changes. However, they would appear to be quite typical of the types of measures that might be taken as a result of LILCO demand-side management programs. At the steep right end of the curves--the upper limit--it is quite clear that marginal costs of energy conservation measures are becoming quite expensive. Further electricity reductions would require a different class of energy conservation measures.

With all due caveats, the EASI data are consistent with the LILCO estimates of about 9 percent electricity savings in 2000 from its proposed demand-side management program. They are not inconsistent with the ACEEE/SEO and Tellus estimates that project half again as much energy savings at two or three times the cost.

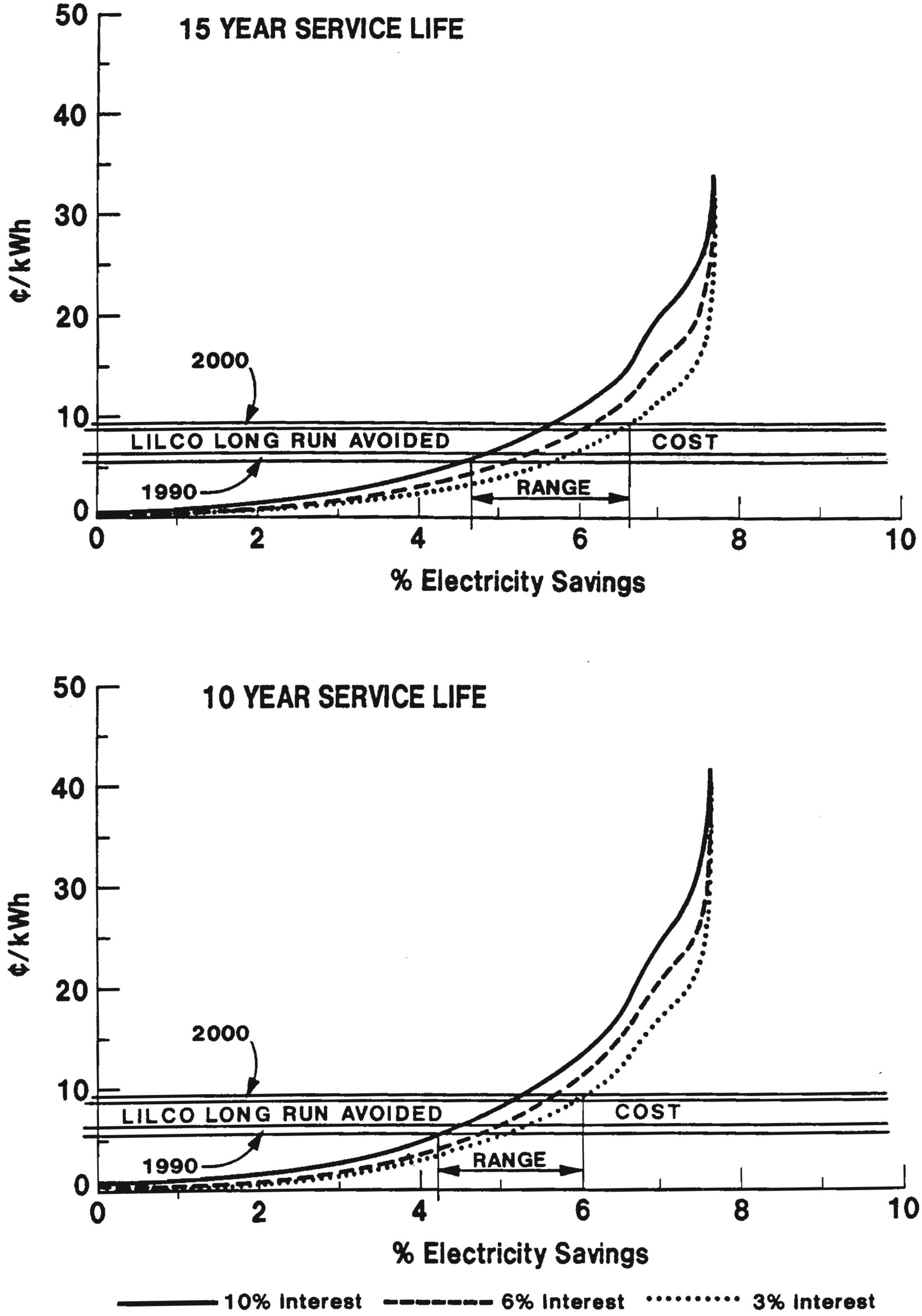
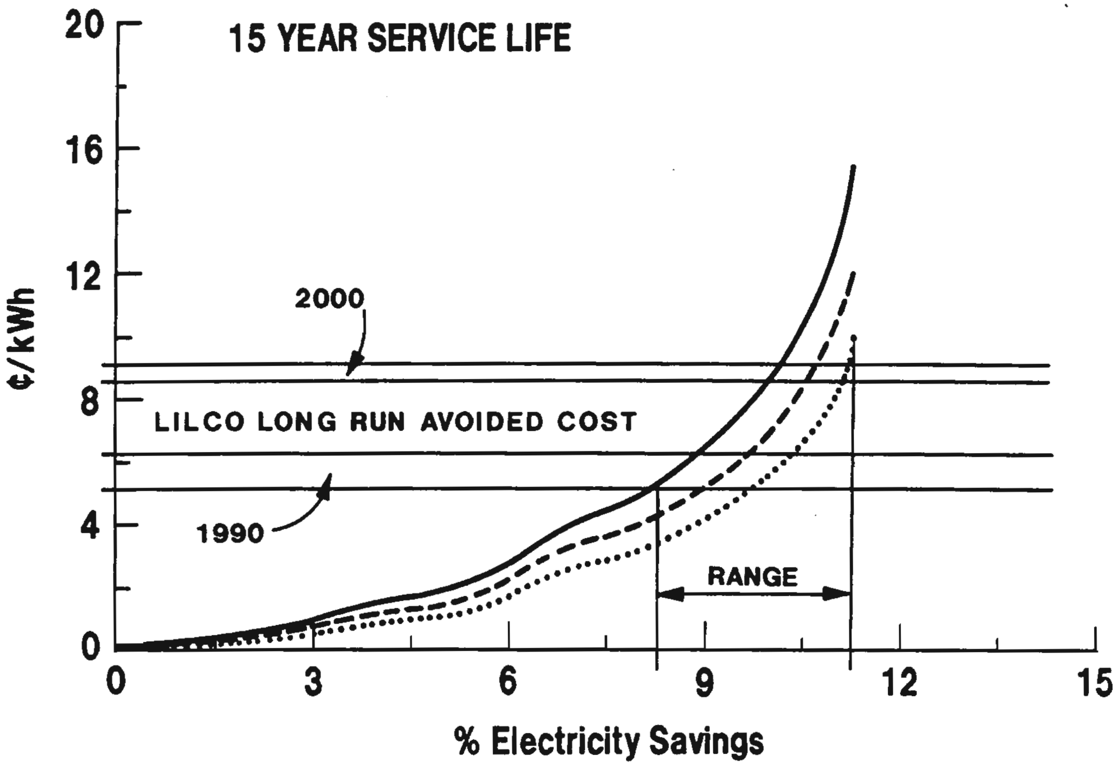


Figure F.2. Breakeven in Electricity Conservation Supply Curves with LILCO Long Run Avoided Cost for 338 Manufacturing Establishments



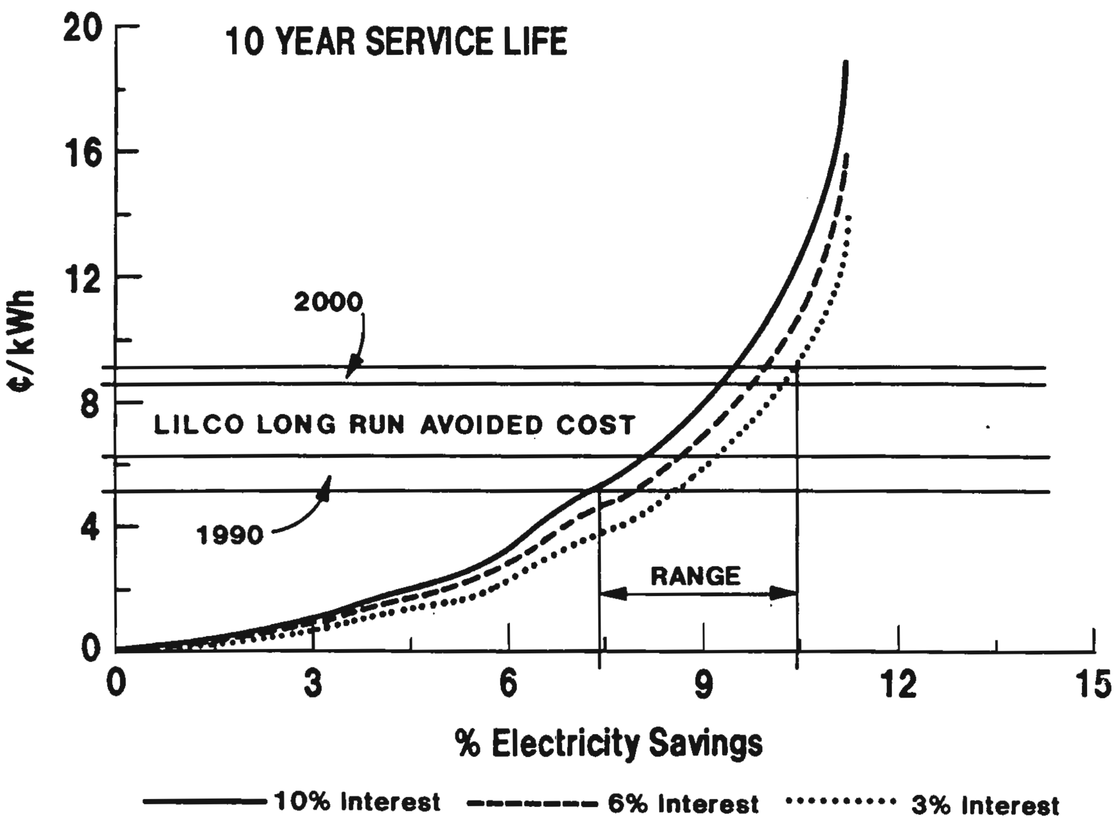


Figure F.3. Breakeven in Electricity Conservation Supply Curves with LILCO Long Run Avoided Cost for 148 Commercial Establishments

REFERENCES

1.. New York State Energy Office, New York State Energy Office Energy Conservation Programs (undated) p. 5.

2.. We are indebted to Elizabeth Donati, EASI Program Manager, New York State Energy Office, for making these data available.

3.. Hill, D., Preliminary Analysis of EASI Data: Nassau and Suffolk, unpublished briefing notes (24 May 1990).

4.. Long Island Lighting Company, Request for Proposals for Purchase of Electric Capacity and Energy, RFP #1 (November 8, 1989) Table 1.

APPENDIX G

NEW YORK STATE ENERGY OFFICE CONSERVATION PROGRAMS

NEW YORK STATE ENERGY OFFICE CONSERVATION PROGRAMS

The Energy Advisory Service to Industry (EASI) is not the only program for energy conservation sponsored by New York State. New York State sponsors myriad programs through the State Energy Office as well as programs through the Public Service Commission and Department of State. Funding is provided by the Federal and State governments, in large measure tapping petroleum overcharge restitutionary funds. Exploiting these programs to achieve energy conservation therefore has the decided advantage of not leading to higher LILCO electricity rates.

The State Energy Office offers an almost bewildering array of programs targeted to different types of energy users. Long Island has received its bare share of these programs, but apparently fails to take advantage of the possibility of assistance in a few important areas. This section will describe the programs in which Long Island might seek a larger share of support. (Low-income programs will be discussed in the next section.)

Here is a listing of New York State programs funded all or in part by petroleum overcharge restitutionary funds:[1]

Energy Investment Load Program
Institutional Conservation Program and
Supplemental Institutional Conservation Program
Weatherization Assistance Program
Energy Conservation Bank
Publicly Assisted Housing Energy Conservation Program
Not-for-Profit Energy Conservation Program
Not-for-Profit Energy Conservation Grant Program
Appliance Rebate Program
Oil Heat Furnace and Boiler Rebate Program
Technical Assistance to Industry and Small Business
Agricultural Energy Conservation Programs
Radon Programs
Residential Conservation Assistance
Transportation Energy Conservation Programs
Energy Code and Appliance Efficiency
State Facilities Energy Conservation Program
Waste Oil Management and Reuse Program
Institute on Superconductivity
Transportation Capital Improvement Energy Conservation
 Program
Local Resource Reuse and Development Program
New York State Solid Waste Combustion Institute

Energy Conservation Services Program
Alternative Energy Development Program

Each of these program is targeted at a certain type of energy user, and presumably those users have heard about the programs for which they are eligible. Somebody at the sending end in Albany probably comprehends how these programs perform in their totality. It is probably safe to say that there are few people at the receiving end--for example, in a geographical area like Long Island--who comprehend the local possibilities in their totality.

As a start toward understanding the implications of these programs for Long Island, the 1989 funding that has been identified by county is summarized in Table G.1. Programs are listed in decreasing order of the Long Island share of the funding, or, where funding is not reported, Long Island's share of the number of grants.

Long Island seems to have done very well in rebates on air conditioners and oil heaters, things that are important here, and not so well on multifamily investment loans, which are probably more important elsewhere. In total, Long Island received about 14 percent of the State funding. By comparison, Nassau and Suffolk Counties comprise 14.7 percent of the State's population, and undoubtedly contribute more than that percentage to State taxes. Thus, Long Island is clearly not being overlooked in these programs, but it would not be grasping to try to exploit a few areas further.

The dotted line in the table separates those programs in which Long Island received more than a 14 percent share of the funding from those in which it received less. In most programs, it received less. Three areas in which Long Island might try to do better are:[2]

- o Institutional Conservation Program (and its Supplement)
- o Not-for-Profit Energy Conservation Program and Energy Conservation Grant Program
- o Agricultural Energy Conservation Programs.

<u>Institutional Conservation Program</u>

The Institutional Conservation Program seeks to improve energy efficiency of institutional buildings through capital improvements and operations and maintenance measures. These facilities include public and private nonprofit schools, colleges, hospitals, local government buildings, and public care facilities.

Two types of financial assistance are available. First, institutions may receive 50 percent matching grants to perform Technical Assistance (TA) studies of their
buildings. A TA study is a detailed engineering analysis of a building to determine the cost-effectiveness of making

Table G.1. Long Island Share of NYS Conservation Programs

Program	Long Island No.	%	Grant $	%	New York State No.	Grant $
Air conditioner rebates	17,216	75%	$796	75%	23,022	$1,054
Oil heat rebates	3,845	60	701	61	6,425	1,156
Refrigerator rebates	23,851	48	2,131	47	50,118	4,516
Transport. cap. imprvmt	11	33	1,003	27	33	3,701
Automotive techn train.	528	27			1,925	
Alt. energy development	4	17	163	19	23	861
Institutional ECM grants	25	12	5,679	18	206	31,342
Indstry & bus.EASI surveys	591	17			3,528	
Transport. systems mgmt			367	16		2,343
Fleet trans. program Implementation assist.	13	16			83	
Indl/comml investmt loan	11	13	237	13	86	3,075
Enrgy consrvtn bank grants	759	13	1,452	13	5,626	11,210
Signal timing opt. progrm			81	13		648
Not-for-profit conservatn			1,700	12		13,997
Fleet trans. program Operational surveys	18	12			145	
Agricult. EASI surveys	17	8			219	
Enrgy consrvtn bank subsds	387	9	202	7	4,372	2,854
State facilities program	5	23	134	7	22	1,969
Inst. on superconductivity	2	5	105	7	37	1,598
Indstry & bus.SBEEP audts	747	6			11,827	
Weatherization assist.	1,896	5			41,853	
Not-for-profit grants	9	4	101	5	249	2,234
Agricult. SBEEP surveys	62	4			1,662	
Publicly assisted housing	2	13	443	3	72	13,172
Supp. grants for local govt & public care facilities	5	9	77	3	56	2,464
Radon detectors distrib.	1,509	3			48,242	
Radon det. results dist.	536	2			23,014	
Multifamily investmt loan	4	2	118	2	236	6,826
Institutional tech assist study grants	11	5	20	1	227	2,670
Indstry & bus. TFS studies	0	0	0	0	11	48
Agricult. TFS studies	0	0	0	0	6	25
Agricult. EILP loans	0	0	0	0	16	683
Local resource reuse & devpt		0		0		1,654
2ary matls feasblty study	0	0	0	0	8	351
			$15,511	14%		$110,452

Notes: Dollar amounts are in rounded thousands.
- EASI Energy Advisory Service to Industry Program
- EILP Energy Investment Loan Program
- ECM energy conservation measure
- SBEEP Small Business Energy Efficiency Program
- TFS Technical Feasibility Study Program

Source: New York State Energy Office, 1989 Report of Petroleum Overcharge Restitutionary Funds operational and maintenance modifications and implementing higher cost energy conservation measures in the building.

Second, upon completion of a TA study, schools and hospitals may apply for 50 percent matching grants for energy conservation measures. These may include installing improved heating, ventilating and air-conditioning equipment, weatherizing, or installing cogeneration or waste heat recovery systems.

Supplemental hardship awards, ranging from 60 to 90 percent of total project cost, are available to qualifying schools and hospitals. Local governments and public care facilities are excluded by Federal law from receiving grant funding for energy conservation measures, but they are eligible to receive TA grants.

Historically, public and private nonprofit K-12 schools have not fared as well as colleges and hospitals because the application scoring methodology is based on the energy conservation potential. With colleges and hospitals having longer hours of operation and large facilities, they generally have greater energy savings opportunities than K-12 schools. Under a new provision, however, K-12 schools can receive grants for measures with payback periods of up to 15 years whereas only two-to-ten year paybacks are otherwise required.

The original 1986 funding of $38 million led to grants for 592 TA studies and 246 energy conservation measure programs. Over $15 million has been awarded towards the construction of 31 cogeneration or waste heat recovery projects at 17 hospitals, 7 colleges, 4 K-12 schools, and 3 public care facilities; these are expected to save these institutions $14.3 million annually while generating 31 megawatts of capacity. An additional $7.5 million appropriated in 1989 will fund about 240 TA grants to school, hospital, local government and public care buildings, and 60 grants for capital improvements in schools and hospitals.

Not-for-Profit Energy Conservation Programs

The objectives of the Not-for-Profit Energy Conservation Program include:

- to inform and educate the staff and boards of directors of not-for-profit organization on the importance of improving energy efficiency
- to provide training and technical assistance to not-for-profit organizations to help them assess the energy needs of their facilities and identify the most effective ways to improve their efficiency
- to assist not-for-profit organizations in implementing energy conservation measures, including providing financial incentives, and help in securing various form of financing from other sources, and

- to promote the leveraging of public and private resources for energy conservation activities benefiting not-for-profit organizations.

The program is operated through a network of the State's community foundations, including the Long Island Community Foundation which has been allocated $1,700,453 of the the program's $14 million for direct funding; that is, 12 percent.

The activities of this program in 1989 can be summarized as follows: 642 energy audits, 754 audit follow-ups, 1,324 referrals to other programs, 34 technical assistance studies, 543 rebates for boiler/furnace and air conditioner cleaning and tuning, 1,192 technical services, 98 workshops, and 16 financial incentives.

Initially, $2.8 million was allocated for interest subsidies on energy conservation capital improvements, but this offer has drawn little response.

Agricultural Energy Conservation Programs

New York's agri-business sector is generally comprised of small businesses: farmers, dairymen, and food processors. The Agricultural Energy Conservation Programs consist of the Energy Advisory Service to Industry (EASI), the Small Business Energy Efficiency Program (SBEEP), and the Energy Investment Load Program (EILP).

$5 million was appropriated for this program in 1986. This will fund 585 energy surveys and 65 technical feasibility studies under EASI, 2,000 on-farm energy surveys and 35 specialized energy seminars under SBEEP, and approximately 40 agri-business loans under EILP.

The EASI energy audits have been described previously. Of 219 agricultural EASI surveys, Long Island has received 17 (8 percent). Also under the EASI program, on-site technical feasibility studies are provided by engineering firms, with one-half of the study cost paid by the State up to $5,000. There have been none on Long Island.

The SBEEP contractor is Cornell University whose energy technicians recommend no-cost or cost-effective capital improvements that save energy, such as more efficient utilization of refrigeration equipment and pre-coolers, waste heat exchangers for dairies and poultry operations, and more efficient cold storage and grain drying. Cornell works through its County Cooperative Extension network to develop and conduct seminars on energy topics of special interest to farmers.

Low-interest financing of either 6 or 8.5 percent is provided to agri-businesses, usually following EASI or SBEEP programs. There have been no such loans on Long Island.

New York State Energy Conservation Funding

About half of the petroleum overcharge restitutionary funds, which were appropriated in 1986 and 1987, remain to be committed, as shown in Table G.2. The proportion so far committed ("encumbrances") among the three programs discussed here are ranges from about one-quarter for agriculture to two-thirds for institutional conservation.

Table G.2. Status of Petroleum Overcharge Funding of New York State Energy Office Conservation Programs

Program	Appropriation	Encumbrances	% Committed
All programs	$124,625,000	$59,033,938	47%
Institutional Conservation	38,000,000	25,376,134	67%
Not-for-Profit Conservation	15,000,000	7,641,703	51%
Agricultural Conservation	5,000,000	1,411.995	28%

Source: New York State Energy Office, 1989 Report on Use of Petroleum Overcharge Restitutionary Funds, p. 213.

The $15,511,000 granted to Long Island projects to date, shown in Table G.1, can be compared with LILCO's annual budget for demand-side management of $34 or $35 million per year during the early 1990s. In addition, New York State funding pays about $2.25 million annually for the SAVINGPOWER program administered by LILCO.

REFERENCES

1. New York State Energy Office, 1989 Report on Use of Petroleum Overcharge Restitutionary Funds (1990).

2.. Suggested by Ruth Horton, New York State Energy Office, personal communication, 24 October 1990.

APPENDIX H

THE SHOREHAM SETTLEMENT

THE SHOREHAM SETTLEMENT

To resolve the long controversy over the Shoreham nuclear power plant, an agreement was reached between LILCO and the State of New York in February 1989. Under its terms, LILCO agreed to surrender ownership of the Shoreham plant to the Long Island Power Authority for decommissioning in return for promised approval of electricity rate increases and certain other matters such as the settlement of pending lawsuits. LILCO was in effect promised $4 billion to be paid in increased electricity rates over the next 40 years with a planned schedule of rate increases for the first ten years.

Whether or not the rate increases would have been greater if the Shoreham plant had opened is a matter of dispute. An analysis of the agreement by the New York State Department of Public Service concludes that electricity rates will be less during the first ten years than if Shoreham had opened, although they would eventually be lower.[1] A study for the Federal government [2] finds that the rates with Shoreham open would be unequivocally lower. It is not the purpose of the this report to fuel this controversy. Indeed, inasmuch as we assume that the Shoreham nuclear plant remains closed, the question is moot.

The impact of a $4 billion dollar assessment on Long Island's electricity ratepayers is entirely germane to plans for its energy future, however. This section therefore elaborates on the terms of the Shoreham Settlement and its implications for the cost of electricity.

On the basis of Shoreham settlement, LILCO entered an asset on its December 31, 1989 balance sheet of $3,988,344,000, the value of the "Base Financial Component" after the first year's amortization of $50,485,000 (discussed hereafter in round numbers as $4 billion and $50 million).[3] This asset is to be amortized over 40 years with straight-line depreciation. This means that the company can charge $100 million per year ($50 million in the first and last years) as depreciation on its books, as indicated in Figure H.1. In other words, $100 million dollars per year can be collected from its electricity ratepayers to cover this "expense."

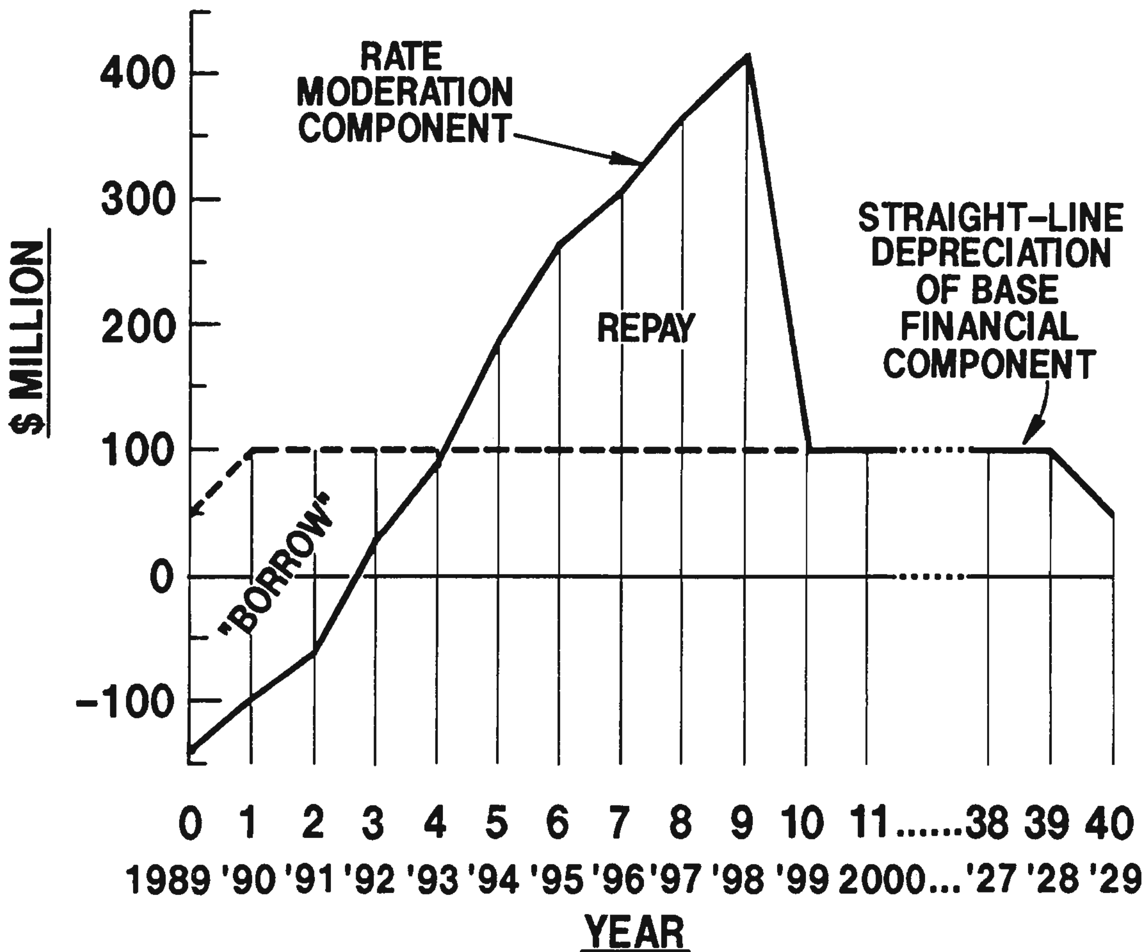


Figure H.1. Schedule of Payments by LILCO Ratepayers Under Shoreham Settlement

Source: N.Y.S. Department of Public Service (1989)

In order to avoid an abrupt increase in electricity rates, however, a "Rate Moderation Component" is introduced as shown in Figure H.1. According to the Department of Public Service analysis [4], the amortization schedule for the Rate Moderation Component is as follows:

1989	($189.3 million)
1990	($195.8 ")
1991	($161.4 ")
1992	($70.8 ")
1993	($10.4 ")
1994	$88.2 "
1995	$137.9 "
1996	$206.4 "
1997	$267.8 "
1998	$312.9 "

(The actual 1989 Rate Moderation Component recorded by LILCO was $131,167,000, but the Department of Public Service schedule serves as an illustration.)

Figures shown in parentheses are shown as a credit in LILCO's books, meaning that ratepayers are relieved of paying this much to LILCO. Figures shown without parentheses are an expense, meaning that LILCO ratepayers are charged this additional amount. The net draw on LILCO ratepayers, taking into account both the Base Financial Component and the Rate Moderation Component, is shown by the solid line in Figure H.1.

In effect, LILCO ratepayers "borrow" from LILCO to reduce rates during the first five years and repay a larger amount of money during the second five years. The fact that the amount repaid is larger indicates that the loan is being repaid with interest. This schedule of borrowed and repaid money can be calculated to be the equivalent of a loan of $570 million drawn during the first five years and repaid during the second five years at 8 percent interest. Any extension of the repayment period beyond ten years, as now proposed by LILCO [5], in effect increases the interest paid by ratepayers.

How do the terms of the Shoreham settlement affect LILCO electricity rates? This can be estimated from the Department of Public Service analysis, as shown in Figure H.2.

The Department of Public Service projection made in April 1989 is shown in the figure by the solid lines extending from 1989 on. Under the Shoreham settlement, LILCO rates will increase steadily from about 12 cents per kilowatt-hour in 1989 to over 18 cents in 1998, dropping back to near 17 cents in 1999. (The final schedule of rate increases reported by LILCO is shown by the higher broken line.[6] LILCO's proposal for rate increases would apparently freeze rates at the 1998 level for two more years, in effect increasing the amount of the repayment of its implicit "loan" to ratepayers.)

At 19 cents per kilowatt-hour, the annual cost of electricity to the average residential ratepayer would be over $1,600 per year, compared to the 1989 cost of about

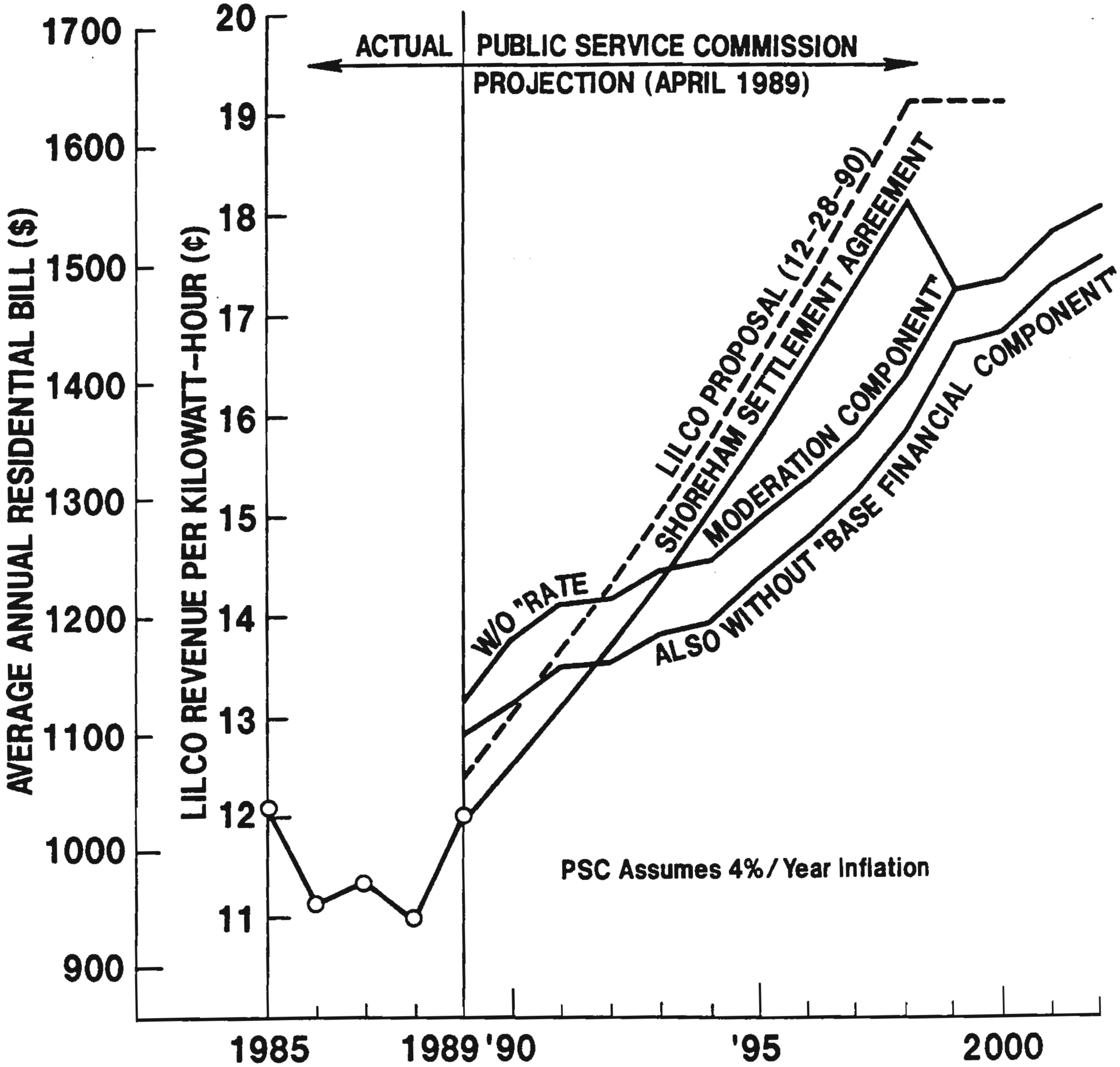


Figure H.2. Projected Electricity Rates Under Shoreham Settlement

Sources: LILCO 1989 Annual Report, LILCO 1989 Form 10-K, N.Y.S. Department of Public Service (1989), Wilson (1990).

$1,000. (To estimate the annual residential bill, it is assumed that the average ratepayer consumes 7,932 kilowatt-hours at a rate 8 percent higher than the systemwide average, as in 1989.)

Without the Rate Moderation Agreement, LILCO' 1989 rate would have had to be about 13.2 cents per kilowatt-hour rather than 12 cents, according to the Department of Public Service figures, which would have been an increase of 10 percent in the electricity rate. Of this increase of 1.2 cents, about one-third of a cent is due to the Base Financial Component amortization of $50 million. In 1990, this amount doubles as $100 million is amortized. By the later 1990s, the rate impact of the short-term Rate Moderation Component is much larger than the long-term Base Financial Component.

At the peak planned rate in 1998, LILCO's electricity will cost 2.3 cents per kilowatt-hour, or 14.5 percent, more than it would without the cost of Shoreham. For the average residential customer, this is about $200. For the average industrial/commercial customer consuming 85,943 kilowatt-hours of electricity at 95 percent of the systemwide rate as in 1989, the additional cost is about $1,875.

Considering the relatively stable LILCO rates from 1985 through 1988 shown in the figure [7], this anticipated rapid increase, even without the cost of Shoreham, bears examination since it provides the rationale for the promised annual "5 percent" increases.

The Department of Public Service estimated LILCO's revenue requirements by summing the components shown in Figure H.3: depreciation, operating taxes, operations and maintenance expenses, fuel, and "pre tax return." Most of these appear to be plausible extensions of the trends during the past five years, dominated by a continuing increase in the cost of fuel. An exception is the step increase in depreciation of about $100 million per year. This may represent the amortization of the Base Financial Component, although properly, the increase in 1989 should be only $50 million. The undefined "pre tax return," which follows a jagged path, appears to consist of all LILCO expenses other than the four defined.

The basis for these estimates can be guessed from Figure H.4 which is plotted on logarithmic grids. In this figure, a constant annual rate of increase is shown as a straight line. The same values for the components of LILCO revenue requirements shown in Figure H.3 are plotted in the lower part of the figure. Operations and maintenance expenses and operating taxes are seen to increase at about 5 percent per year, slightly higher than the 4 percent assumed inflation rate. Depreciation plausibly increases at a rate lower than

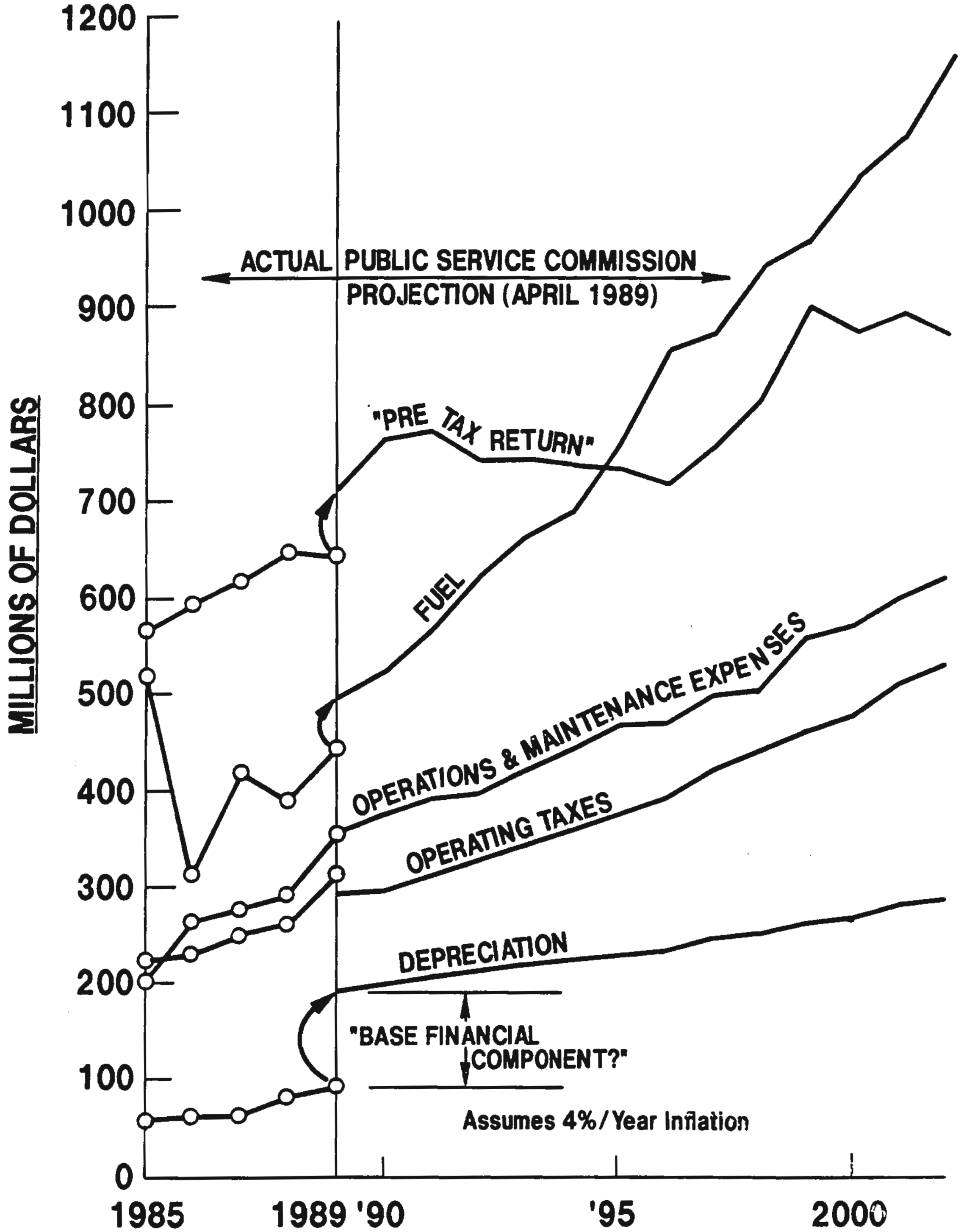


Figure H.3. Components of LILCO Revenue Requirement

Sources: LILCO 1989 Annual Report, N.Y.S. Department of Public Service (1989).

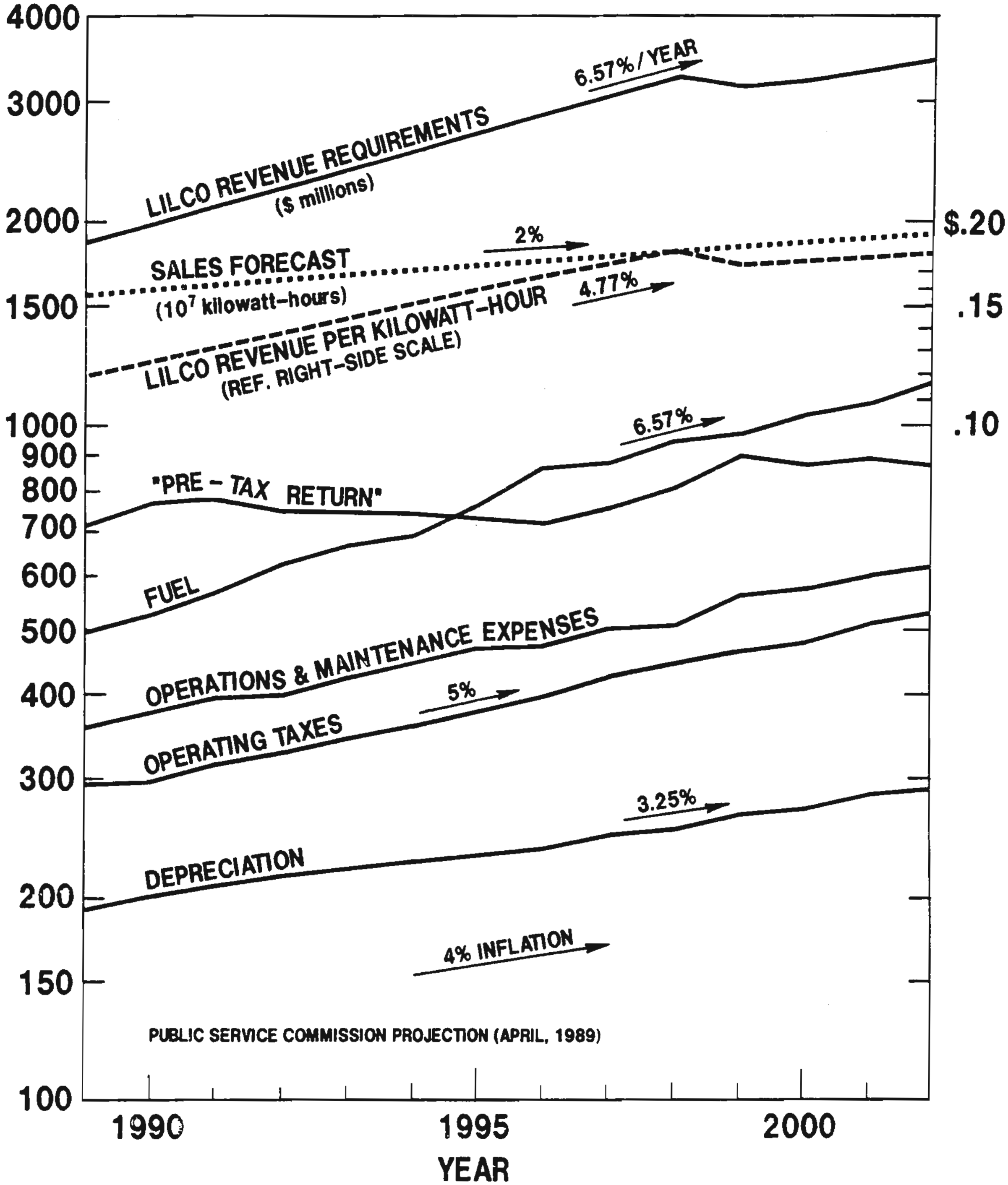


Figure H.4. Comparative Growth Rates in LILCO Expenses, Sales. Revenue Requirements, and Electricity Rates

Source: N.Y.S. Department of Public Service (1989).

inflation, inasmuch as the amount depreciated does not increase with inflation. Fuel cost escalates at about 6.57 percent per year.

Together with "pre tax return," these components add up to the LILCO revenue requirements shown as the top line. The fact that this varied collection of components adds up to revenue requirements that increase at precisely 6.57 percent per year (similar to the trend in fuel expense) suggests that the remaining component, "pre tax return" was calculated to make up the difference.

With annual sales, measured in kilowatt-hours, assumed to increase at 2 percent per year as shown, LILCO's revenue requirements per kilowatt-hour--that is, its electricity rates--increase at 4.77 percent per year through 1998, the "four and one-half to five percent" increase usually cited.

Given these assumptions, the "pre tax return" indicates that LILCO's other costs must decline from 1991 through 1996 in the face of inflation at 4 percent. Even with annual rate increases of four and one-half to five percent, LILCO will need to tighten its belt, according to these trends.

Actual conditions in the next ten years can be expected to be different from any assumptions made in 1989. A sales growth of less than 2 percent per year will further strain LILCO. On the other hand, an inflation rate of less than 4 percent should ease its problems. A range of projections in the future price of LILCO electricity is discussed in Appendix A.

REFERENCES

1. Department of Public Service, State of New York, Comparative Economics of Shoreham Settlement and Shoreham In-Service (April 14, 1989), p. 1.

2. Hausker, K., The Economics of the Shoreham Nuclear Plant, Committee on Energy and Natural Resources, U.S. Senate (July 1989).

3. Long Island Lighting Company 1989 Annual Report, p. 22,

4. Department of Public Service, ibid. Table 1.

5. Wilson, K., LILCO Seeks 3 5% Rate Increases, NEWSDAY (December 29, 1990), p. 5.

6. Long Island Lighting Company, 1989 Annual Report to Securities and Exchange Commission, Form 10-K, December 31, 1989, p. 38.

7. LILCO 1988 Annual Report, p. 44.

GLOSSARY

GLOSSARY

Biomass

Unfossilized material of biological origin. Organic compounds that are embodied in biological materials and produced by living organisms, for example, wood, other vegetation, and animal excrement.

Btu British thermal unit

A unit of energy; 1/180 the amount of heat required to raise the temperature of one pound of water from 32 to 212 degrees Fahrenheit.

Cogeneration

The joint production of electricity and useful heat. The generation of electricity by increasing the temperature and/or the pressure of heat required for process use, extracting part of the heat for electricity production and discharging the remainder at appropriate conditions for process requirements.

Combined Cycle

In a combined cycle generating plant, electricity is produced from two successive stages of the process. First, for example, fuel is used to drive a combustion turbine that drives an electric generator. The hot exhaust gases from the turbine then pass through a heat recovery steam generator that produces steam for a conventional steam turbine/electric generator. As a result, more energy is extracted from the fuel, producing efficiencies as high as 39 to 42 percent, compared to 22 to 25 percent for a conventional combustion turbine and 30 to 33 percent for a conventional steam turbine.

Combustion Turbine

A turbine similar to an aircraft gas turbine that is fueled usually by light distillate oil (kerosene) or natural gas to drive an electric generator.

Con Ed Consolidated Edison of New York, Inc.

CNG Compressed Natural Gas

Natural gas compressed to 3,000 pounds per square inch to be stored for use as motor fuel. Natural gas has an octane rating of 130 compared to approximately 90 for most gasoline. making much higher combustion efficiency possible.

CRS Center for Regional Studies, State University of New York at Stony Brook

DOE U.S. Department of Energy

DSM Demand-Side Management

Demand-side management programs provide incentives, other than market price incentives, for utility customers to change the level or pattern of their energy demands (or to allow the utility to change demands in the case of direct load control options).

EIA Energy Information Administration, U.S. Department of Energy

EPRI Electric Power Research Institute

Ethanol

Grain alcohol (C_2H_5OH) now produced as a fuel primarily by fermentation of corn for blending into gasoline.

Fossil Fuel.

Any naturally occurring solid, liquid, or gaseous fuel of a fossilized organic nature; principally coal, petroleum, and natural gas.

Fuel Cell

Fuel cells are electrochemical devices that are similar to batteries, except that instead of producing electricity from internally stored energy, the fuel cell produces direct-current electricity by combining externally supplied hydrogen and oxygen (the latter from the air). Since fuel cells do not have the thermomechanical limitations of conventional power plants, they can produce electricity at very high efficiencies. However, their primary fuel must be hydrogen or a fuel that can be converted to hydrogen. One type of fuel cell, the phosphoric acid fuel cell, of 4.5 megawatts capacity has been tested in New York City and Tokyo. Demonstration of an 11-megawatt unit is under way in Tokyo.

GDP Gross domestic product

GNP Gross national product

GRP Gross regional product

Greenhouse Effect

Warming of the earth's atmosphere that occurs when carbon dioxide and other greenhouse gases absorb infrared radiation from the earth's surface that would otherwise radiate into space.

Greenhouse Gases

The principal greenhouse gases are carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons. Carbon dioxide accounts for about half the greenhouse effect because of the immense quantitities emitted and its long life in the atmosphere. Methane, molecule for molecule, has 20 to 30 times the heat-trapping effect of carbon dioxide. Chlorofluorocarbons (CFCs) are man-made chemicals used in refrigeration, as solvents, and in plastic foams.

GRI Gas Research Institute

GWh Gigawatt-hours

One billion watt-hours; a unit of energy used to measure an amount of electricity.

HEAP Home Energy Assistance Program

Program administered by the New York State Department of Social Services for direct payment of fuel costs.

Heat Pump

A device that transfers heat from a colder to a hotter reservoir by the expenditure of mechanical, electrical or thermal energy, when the primary purpose is heating the reservoir. A reversible refrigeration system that provides either space heating or cooling in relation to seasonal needs.

HIECA Home Insulation and Conservation Act

New York State legislation that authorizes the utility-operated SAVINGPOWER program which provides energy audits and loans to householders.

HUD U.S. Department of Housing and Urban Development

Hydroelectricity

Electricity generated from falling water.

Hydro-Quebec

The electric utility operated by the provincial government of Quebec, Canada.

IPP Independent Power Producer

A company that is not a utility that generates electric power, in New York State consisting of small hydroelectric plants, refuse incinerators, and cogenerators. Under the Public Utility Regulatory Policies Act of 1978 (PURPA), utilities are required to purchase electric power at reasonable prices from IPPs. In New York State, this is established by the "six-cent law" which requires that a minimum of six cents per kilowatt-hour by paid to qualifying non-utility generators.

kWh Kilowatt-hour

One thousand watt-hours; a unit of energy used to measure an amount of electricity; equal to 3,413 Btu.

LIHEAP Low-Income Home Energy Assistance Program

Federal program, administered by the U.S. Department of Health and Human Services, that is a source of U.S. funding for weatherization of low-income housing.

LILCO Long Island Lighting Company

LIPA Long Island Power Authority

The Long Island Power Authority is a nonprofit corporate municipal instrumentality created by New York State in 1986. It is authorized and empowered to exercise essential governmental and public powers to acquire all or any part of LILCO, provided LIPA first determines that utility rates projected to be charged by LIPA will not be higher than rates projected to be charged by LILCO if the acquisition did not occur. LIPA is required to close and decommission the Shoreham Nuclear Power Plant. It is further authorized to pursue a full-range of options providing adequate, dependable, and affordable gas and electric service to Long Island.

LNG Liquefied natural gas

LNG is natural gas that is cooled and maintained at -160 degrees Celsius as a liquid, reduced in volume nearly 600-fold. When shipped by tanker transport, it is typically vaporized at the receiving terminal for pipeline transport and use.

LPG Liquefied petroleum gases

Liquefied petroleum gases (propane, butanes, and propane-butane mixes) are a byproduct of crude oil and natural gas production and of refinery operations.

mW Megawatt

A million watts. A unit of power, that is, the time rate of transferring or transforming energy.

Methane

A flammable gas (CH_4) formed by the decomposition of organic matter. Methane is the major constituent of natural gas.

Methanol

A light, flammable, poisonous liquid alcohol (CH_3OH) which can be used as fuel, for example, in internal combustion engines, often blended with gasoline. Formed either synthetically or from the destructive distillation of wood. Also called wood alcohol and methyl alcohol.

Natural Gas

Naturally occurring mixtures of hydrocarbon gases and vapors; mostly methane.

NEPOOL New England Power Pool

NPCC Northeast Power Coordinating Council

For the purpose of maintaining an operationally reliable energy supply for North America, electric utilities, both investor-owned and publicly owned, voluntarily established nine regional reliability councils encompassing virtually all of the power systems in the U.S. and Canada. The regional councils constitute the North American Electric Reliability Council which coordinates the activities of the councils. The responsibility of each of the regional councils is to review the overall planning and operation of the electric power supply systems in its region. The regions develop criteria to evaluate reliability of the supply of electric energy. The Northeast Power Coordinating Council consists of Hydro-Quebec, Ontario Hydro, New Brunswick Power, Nova Scotia Power, New England Power Pool, and New York Power Pool.

NYPA New York Power Authority

The New York Power Authority is a nonprofit, public-benefit energy corporation established by New York State to furnish low-cost electricity, initially from Niagara Falls. It sells this energy to companies, to private utilities for resale without profit to their customers, and to authorized public agencies and publicly owned utilities. NYPA does not use tax revenues or State funds or credit. It finances construction of its projects through bond sales to private investors and repays the bonds with proceeds from operations. It operates the St.

Lawrence-Franklin D. Roosevelt (hydroelectric) Power Project, the Niagara (hydroelectric) Project, the Blenheim-Gilboa Pumped Storage Power Project, the James A. FitzPatrick Nuclear Power Plant, the Indian Point 3 Nuclear Power Plant, and various other energy facilities.

NYPP New York Power Pool

A consortium of the seven major investor-owned electric utilities in New York State, including LILCO, and the New York Power Authority. The basic purpose of the New York Power Pool is to coordinate the development and operation of the members' electric production and transmission facilities in order to obtain optimum reliability of service and efficiency of operation from their interconnected systems.

Peak Shaving, or Peak Clipping

A DSM program that is aimed at reducing peak load on the highest peak load days, which occur on Long Island in the summer. Any energy savings are incidental. These programs can be implemented both by rate incentives and by remote controlled curtailments of customer load.

PURPA

The Public Utility Regulatory Policies Act of 1978 which requires utilities to purchase electric power at reasonable prices from IPPs.

Renewables

Energy sources that are perpetual or replenishable. Solar, biomass, geothermal, wind, waves, and ocean tides are examples.

SAVINGPOWER

Program administered by the utilities under the direction of the New York State Public Service Commission that provides free home energy surveys and subsidized financing through loans to householders.

SEO New York State Energy Office

Six-Cent Law

The New York State Alternate Energy Act of 1980 which guarantees a rate of six cents per kilowatt-hour of energy delivered to the utility by qualifying non-utility generators.

Solar Energy

Energy in the form of solar radiation.

Utility

A company or institution that exists to provide specific services via contractual arrangements. Certain characteristics typify the public utility, as follows:

> Government approved or supported monopolies to supply continuous or repeated services between the plant of the supplier and the premises of the consumers.
>
> Control of its rates of charges for services is typically vested in public regulations which also limit maximum profitability.
>
> Regulations primarily protect the public in the role of consumers.
>
> There is a legal requirement to serve every financially responsible consumer in the service area at reasonable rates and, within the class of service, without discrimination.

VMT Vehicle-miles traveled

One VMT equals one vehicle traveling one mile.

Weatherization

Energy conservation measures for low-income housing.

INDEX