New England Electric System
Small Commercial & Industrial
Profile #1, 1992

Executive Summary

The New England Electric System's "direct installation" Small Commercial and Industrial Program (Small C/I Program) addresses the unique needs of small businesses with power requirements of less than 50 kW, a customer class that is vital to the resilience of the local economy. Small C/I customers have been hard to attract with rebates for the purchase of energy-efficient equipment, but by paying 100% of the cost of auditing customers' facilities and installing energy-efficient equipment and backed by the credibility of the utility, this program has demonstrated the potential for very high penetration rates while remaining cost effective.

Perhaps the most elegant aspect of the program is that it is administered by a skeleton staff in coordination with regional labor and product vendors. These trade allies market the program, do the retrofit analyses, provide the equipment, and do the installations. This keeps the utility's overhead low (and thus administrative costs low) and stimulates business in the local economy. All product is purchased locally to stimulate local distribution of energy-efficient goods while bolstering the economy.

While the NEES Companies do a first rate job of analyzing DSM program data, their programs are relatively young and thus critical impact evaluations are not yet complete. Many of the assumptions built into the savings data therefore are based on early estimates from the program's Rhode Island pilot. NEES uses adjustment factors, based on limited subsets from the pilot, for estimating savings for the system-wide program

In 1991 the Small C/I program resulted in average customer savings of 7,256 kWh, up significantly from its pilot average of 4,011 kWh. To date the program has resulted in total cumulative savings of 54 GWh when factoring in NEES's engineering estimate of savings. The measures installed in 1991 had an average measure lifetime of 15 years. In terms of capacity the program has delivered a total of 14.27 MW of peak summer capacity.

This program has been a key example of the cost effectiveness of direct installation. Since the program's inception NEES has spent nearly $20 million on this effort, resulting in an a 1991 cost of saved energy of 5.15 cents per kWh. While paying an average of nearly $5,000 per installation, and nearly $17,000 for schools, NEES has demonstrated the benefit to the utility and to its ratepayers of such a program. NEES has pioneered incentive mechanisms that has made its DSM activities profitable for consumers and shareholders alike. Perhaps most encouraging are a host of lessons learned through the program, further lowering administrative costs and resulting in the implementation of efficiency measures in over 95% of solicited customers.

Small Commercial / Industrial Program

Utility:	New England Electric System
Sector:	Small commercial and industrial (less than 50kW)
Measures:	Lighting, some HVAC and water heating
Mechanism:	Utility pays full cost of implementation of efficiency measures
History :	Pilot in 1989, systemwide program 1990-present

1991 Program Data

Energy savings:	18,095,437 kWh
Peak capacity savings:	7.98 MW Summer, 6.84 MW Winter
Lifecycle energy savings:	271,431,555 kWh
Cost:	$9,181,643

Cumulative Data

Energy savings:	34,808,861 kWh
Peak capacity savings:	14.27 MW summer 12.38 MW winter
Lifecycle energy savings:	481,376,675 kWh
Cost:	$19,813,000
Participation:	9.5%

Conventions

For the entire 1992 profile series all dollar values have been adjusted to 1990 U.S. dollar levels unless otherwise specified. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the International Monetary Fund's International Financial Statistics Yearbook: 1991.

The Results Center uses three conventions for presenting program savings. **Annual savings** refer to the annualized value of increments of energy and capacity installed in a given year, or what might be best described as the first full-year effect of the measures installed in a given year. **Cumulative savings** represent the savings in a given year for all measures installed to date. **Lifecycle savings** are calculated by multiplying the annual savings by the assumed average measure lifetime. **Caution:** cumulative and lifecycle savings are theoretical values that usually represent only the technical measure lifetimes and are not adjusted for attrition unless specifically stated.

The New England Electric System (NEES) is a public utility holding company with several subsidiaries including three retail operating companies, Massachusetts Electric Company, Narragansett Electric Company located in Rhode Island, and Granite State Electric Company in New Hampshire. (In this report the operating companies of NEES are collectively referred to as the "NEES Companies" or the "retail companies.") In aggregate, the NEES service territory includes about one-half of Massachusetts, most of Rhode Island, and a small fraction of New Hampshire. Another subsidiary, New England Power Service Company (NEPSCO), develops and manages DSM programs for the three retail utilities which are then implemented by conservation and load management personnel in each service territory. (Of the three retail companies Massachusetts Electric is the largest by far, serving 904,000 customers in 1990, followed by Narragansett Electric Company (319,000 customers), and Granite State Electric (34,000 customers).

NEES owns two wholesale generating companies (the New England Power Company which operates 21 generating stations and Narragansett Energy Resources Company which owns 20% of the Ocean States Power Project, a gas-fired plant in Rhode Island), and three transmission service companies.

In 1990 NEES experienced a decline in electricity sales of 0.1%. This was in sharp contrast to a 5.9% positive growth rate in 1988 and a 3.0% positive growth rate in 1989 and was significantly lower than the average 3.2% load growth the system had experienced for the past five years. The negative growth, or decline, was primarily due to the recession which hit New England early and particularly hard. The negative load growth was expressed for both energy and capacity.

NEES 1991 STATISTICS

Number of Customers	1,256,656	
Energy Sales	20,470	GWh
Energy Sales Revenue	$1.838	billion
Summer Peak Demand	4,250	MW
Generating Capacity	5,645	MW
Reserve Margin	32.82	%
Average Electric Rates		
Residential	9.10	¢/kWh
Commercial	8.38	¢/kWh
Industrial	7.62	¢/kWh

[R#21]

Over the next twenty years — by the year 2010 — NEES projects to fulfill 39% of required generation level peak capacity through conservation and load management programs for a total of 1,094 MW of summer peak reduction. By the year 2000 alone, NEES programs are forecasted to reduce summer peak demand by approximately 12.3%. [R#4]

Utility DSM Overview

NEES formally entered the business of demand-side management in January of 1987 with the introduction of a set of programs called "Partners in Energy Planning". Since then NEES has quickly become recognized as one of the leading DSM utilities in the United States. By the end of 1989 NEES had a dozen DSM programs in place and was working with the Conservation Law Foundation in the renowned "New England Collaborative". Between 1987 and 1990 it invested over $150 million in DSM resulting in savings of 175 MW in installed capacity. Furthermore, NEES was spending a total of about $75 per customer for energy efficiency, about double the expenditure levels of many of the large U.S. utilities with progressive DSM programs. By the end of 1991 the utility had invested a total of $221.5 million in DSM for total summer peak capacity and energy reductions of 303 MW and 499.8 GWh. [R#18] (Partners in Energy Planning also aimed to reduce approximately 1,000 tons/year of SO_2.) [R#1]

For the commercial and industrial customers the "Energy Initiative" DSM program was introduced in 1989 to promote the installation of a broad array of efficiency measures in existing buildings. Another program started at the same time, "Design 2000", constitutes the companion program for new construction and major renovations. Thus these two programs cover all commercial and industrial customers. The Small C/I Program discussed in this profile was added to ensure that small businesses are well served by the NEES DSM effort.

NEES DSM PROGRAMS 1991

Commercial and Industrial
- Cooperative Interruptible Service
- Design 2000
- Energy Initiative
- **Small C/I Program**
- Standby Generation

Residential
- Appliance Efficiency
- Energy Crafted Homes
- Energy Fitness
- Home Energy Management
- Multi-Family Retrofits
- Residential Lighting
- Residential Space Heating
- Water Heater Rebate

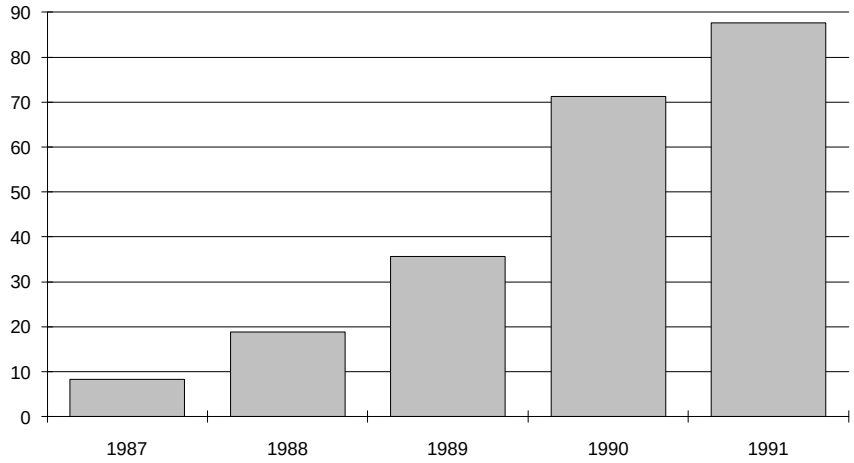
In 1990, both Massachusetts and New Hampshire regulators joined Rhode Island in allowing an incentive to be earned on DSM activities, clearing the way for a full utility commitment to DSM. Thus NEES budgeted a record $85 million, and spent $87.6 million, for conservation and load management programs in 1991. (The 1991 program expenditure represented 5% of gross utility sales.) By the year 2000 NEES projects to save 571 MW of peak capacity and annual savings of 1,651 GWh. NEES DSM programs are forecasted to reduce summer peak demand by 12.3% by the year 2000.

Utility DSM Overview Table	Annual DSM Expenditure (x1000)	Annual DSM Energy Savings (GWh)	Annual DSM Capacity Savings (MW)
1987	$8,287	14.2	36.00
1988	$18,791	58.0	93.00
1989	$35,571	100.0	65.00
1990	$71,243	147.0	49.60
1991	$87,597	180.6	59.68
Total	$221,489	499.8	303.28

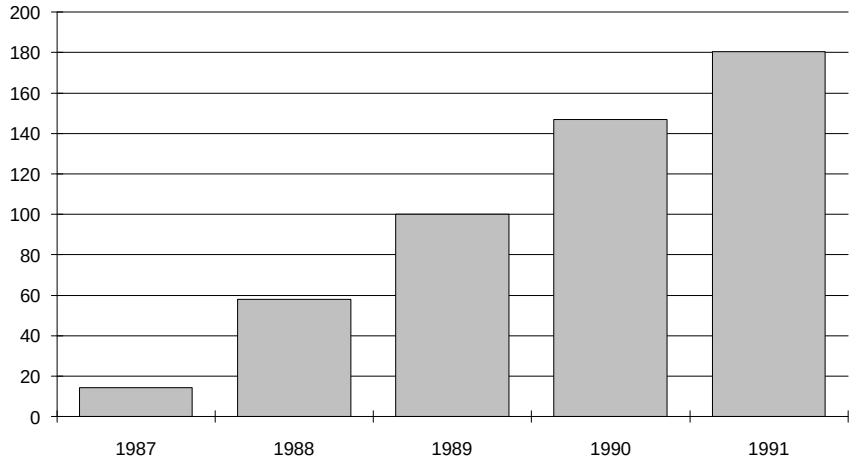
In the next two decades the utility plans to reduce the amount of additional power demand by more than one-third, saving 1,094 MW of generation level supply-equivalent capacity through DSM activities. [R#4]

To complement its efforts, and state its intent to be an environmental leader as well as to continue to be one of the nation's leading DSM utilities, in 1991 NEES announced NEESPLAN-3, a far-reaching environmental initiative that can only be accomplished in parallel with a highly successful energy efficiency initiative. NEESPLAN-3 calls for reducing projected greenhouse gas emissions from its operations by 45% in the 1990s, 9% of this (or 4% overall) will come from conservation and load management activities. NEESPLAN-3 provides a blueprint of the utility's commitments to reduce environmental impact, maintain stable, competitive prices, and maintain a diverse, competitively-procured supply.

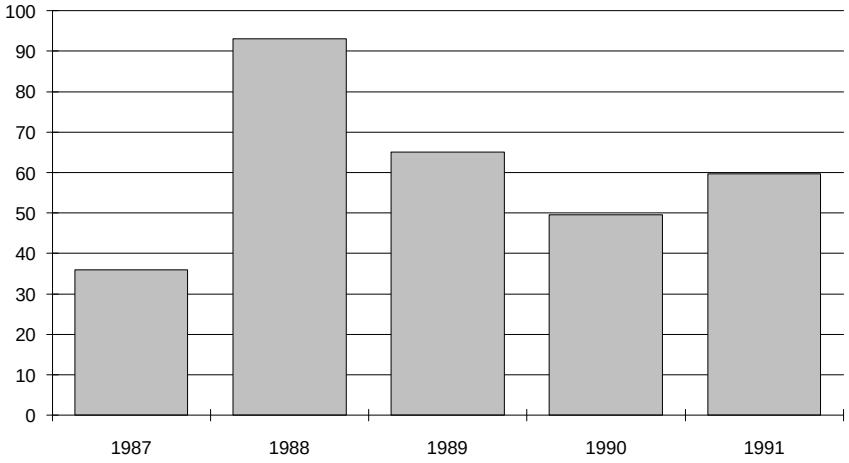
ANNUAL DSM EXPENDITURE ($1,000,000)



ANNUAL DSM ENERGY SAVINGS (GWH)



ANNUAL DSM CAPACITY SAVINGS (MW)



Program Overview

The NEES Small Commercial and Industrial Program is a "direct-installation" program that provides energy efficiency analyses and installs measures at no charge to small commercial and industrial customers. Small companies are frequently inhibited from investing in energy-efficient equipment either because they are unaware of the potential savings or because they cannot afford the initial capital costs of the efficient hardware even when they are aware of the attractive energy savings that the equipment provides. The direct-installation approach was chosen as a simple and effective method of overcoming this basic barrier to energy efficiency implementation encountered by small companies.

The Small C/I Program was originally developed in collaboration with the Rhode Island Least-Cost Planning Committee as part of the Statewide Lighting Program. (Members of the committee included representatives from NEES, the Rhode Island Public Utilities Commission, Eastern Utility Associate's Blackstone Valley Electric, Newport Electric, RISE [a non-profit energy service company], and the Governor's Office of Energy Assistance.) The pilot version of the program, "The Rhode Island Lighting Program" (RILP), was implemented in 1989 at The Narragansett Electric Company and was limited to energy-efficient lamps. During the first year, 666 facilities were served resulting in an average lighting load reduction per customer of 1.4 kW. After analyzing the costs of implementing the program and the benefit produced by the 908 kW coincident peak demand reduction [R#2], NEES decided to expand the program system-wide beginning in the second half of 1990.

The current NEES system-wide Small C/I Program began in June, 1990 and is scheduled to run through 1995. At that time a five-year extension of the program is planned for 1996 through 2000.

MARKETING AND DELIVERY

While the pilot program run in 1989 relied on television advertisements and a toll-free utility number for potential customers to call for an audit appointment, the current system-wide program is both marketed and delivered by private energy service companies (ESCOs) that bid and are selected to carry out the program. NEES refers to these companies as "labor vendors". They market the program and perform the installations while NEES oversees the process with a "skeleton" staff. According to the program's 1991 Implementation Plan, "No [NEES] promotional efforts are planned to publicize the Small Commercial/Industrial Program at the present time since there are adequate leads to meet the goals and keep within current budget limitations."

Each labor vendor selected to deliver the program is given a list of the eligible customers in the districts they are servicing, as well as corresponding utility bill information, and program promotional materials. Vendors use these materials to recruit participants by telephoning eligible customers. The ongoing system-wide program has met with such widespread acceptance that it requires only minimal marketing. In fact, of eligible customers contacted the refusal rate is less than 1%.

In addition to this direct sales approach carried out by labor vendors, a toll-free number is also available for unsolicited customers who wish to participate in the program. Utility district departments also submit customer referrals to NEPSCO which are then forwarded to labor vendors for scheduling. While installations are pursued on a town-by-town approach to take advantage of geographic economies of scale, NEES maintains the right to specify clients who the labor vendors must serve.

Periodically NEES solicits bids for lighting and non-lighting products from "product vendors." Product vendors are local lighting distributors and electrical suppliers who enter into formal agreements to provide products at a specified price for a specified period of time. (Pricing adjustments are usually made on an annual basis.) Product vendors are responsible for delivering some products directly to the customers' facilities as directed by the labor vendors. Product vendors are also required to deliver other products, ordered directly by the NEES Companies, to designated warehouses. As of January 1992, the NEES Companies had an inventory of approximately $1,000,000 in products stored in eight vendor warehouses. To meet the program's equipment requirements in 1992 for example, NEES projects that it will need 150,000 four-foot fluorescent lamps, 75,000 eight-foot lamps, 130,000 ballasts for four-foot lamps, 60,000 ballasts for eight-foot slimline fluorescent tubes... and the list goes on. [R#3]

When an eligible customer elects to participate in the Small C/I Program, after obtaining written authorization from the customer, the labor vendor conducts a walk-through audit to develop a complete inventory of all lighting systems and some of the HVAC and water heating equipment currently being used. The survey is also used to evaluate the needs of the business, identify appropriate energy-saving measures, and develop savings estimates. The identification of the eligible measures is done by the vendor based on a prescriptive approach developed by NEPSCO. After the customer signs a "Terms and Conditions" form consenting to the utility-approved retrofit, the labor vendor installs all the measures approved by the customer. The labor vendor generally completes the installation within 25 business days. When complete, the labor vendor records all measures installed and reports all results to NEPSCO to support program evaluation efforts. Incidentally, NEPSCO retains the right to address an unhappy customer's claims by making the vendor fix the problem.

INSTALLED MEASURES

NEES will replace:

- Existing standard fluorescent lamps with energy-efficient lamps, and lampholders if necessary. (Wherever possible, T8 fluorescent lamps with a Color Rendering Index over 80 are installed. Vendors are also responsible for disabling the contact pins of all standard efficiency lamps, thereby rendering them unusable).
- Existing standard efficiency ballasts with energy-efficient ballasts in interior lighting applications. (High power factor ballasts are required for fluorescents, all compact fluorescents, and HIDs. Vendors must cut off the wire leads of removed ballasts and store the old ballasts, about 50% of which contain toxic PCBs, in 9 mil polyethylene bags for collection and approved disposal by a NEES agent.)
- Existing surface mounted fluorescent fixtures and surface mounted or recessed incandescent fixtures with energy-efficient, surface mounted fluorescent fixtures, in interior applications.
- Existing incandescent lamps with modular screw-in

compact fluorescent lamps in low duty factor applications (typically under 20 hours per week).
- Interior and exterior wall or ceiling mounted incandescent fixtures (in high duty factor applications) with hard-wired compact fluorescent fixtures.
- All existing incandescent exit signs with compact fluorescent exit sign fixtures or kits.
- Existing PAR lamps with energy-efficient PAR lamps in applications that do not lend themselves to other light sources.
- Existing line voltage track lighting with low voltage energy-efficient track lighting systems in applications that warrant the "cream of the crop" of energy-efficient lighting technologies.
- Existing incandescent, fluorescent, quartz, or mercury vapor lights in both high and low ceiling interior applications with metal halide or high pressure sodium fixtures.
- Existing incandescent, fluorescent, quartz and mercury vapor fixtures used for exterior security/flood lighting with high pressure sodium fixtures.
- Existing light switches with wall or ceiling mounted occupancy sensors.

FURTHERMORE, NEES WILL INSTALL:
- Programmable time clocks to control the operation of exterior high intensity discharge lighting.
- Specular reflectors where practical to reduce the quantity of existing ballasts and lamps.
  Notes: Individual lamp sockets or light fixtures with multiple lamp sockets which are energized less than a "threshold" number of hours per week are eligible for the installation of energy-efficient lamps only, but are not eligible for further measures.

HVAC AND WATER HEATING MEASURES ADDED IN 1991
- Installation of fiberglass insulation jackets on all electric water heaters.
- Installation of programmable thermostats to regulate the temperature of areas which are heated or cooled with electricity.

One aspect of the program that has required special attention is ballast disposal. Since PCBs in the capacitors of the ballasts are highly toxic, proper disposal of ballasts is of highest concern to New England Electric. The company has a commitment to incineration of ballasts in the short term, and a long term commitment to promote recycling of ballasts (the 80% that do not contain toxic materials) and to continue incineration of the capacitors.

Michael Horton, the Small C/I Program manager, claims that ballast disposal is a "major part" of the program. He personally spends much of his time driving around collecting used ballasts, what he endearingly calls "the milk run". Note in the program cost section of this profile that ballast disposal costs NEES fully 8% of the entire program costs.

STAFFING REQUIREMENTS

Like many programs that are one of a utility's portfolio of programs all administered by the same staff, it is difficult to accurately assess the staffing requirements of the Small C/I Program. NEES suggests that from the program's inception in 1989 to late 1990 the program required 1 full-time manager and 1 full-time professional staff plus support staff and information processing capabilities. From late 1990 to January of 1992 the program was run by one full-time manager and two full-time professional staff. In January of 1992, another full time professional was added, raising the number of full-time staff to four.

As mentioned above the bulk of the work is carried out by labor and product vendors who service the program. These vendors are organized by service districts. In 1990, 26 lighting dealers supplied program equipment and 7 labor vendors, including two non-profit groups, were responsible for lighting analyses, program data entry, and equipment installation. Approximately 20 electrical contracting crews were required to perform the actual installations.

After the installation, NEES company retirees do site verifications. These former employees, typically 6-8 former licensed linemen or electricians, check wiring, quantities of lamps and other equipment installed, as well as the types of equipment installed. They are paid both a moderate hourly wage and mileage costs from the program's overall budget.

In addition to the professionals at NEES a good deal of insight and guidance has been provided to NEES by the staff of the Conservation Law Foundation and the consultants hired through the collaborative process.

INSTALLATION CASE STUDY: THE JACOB EDWARDS LIBRARY, SOUTHBRIDGE, MASSACHUSETTS

One unusually large direct installation performed in 1991 was the Jacob Edwards Library in the Town of Southbridge, Massachusetts. New England Electric System's ratepayers spent $24,100 to retrofit the library, resulting in annual savings to the Town of Southbridge of $3,933. The retrofit, which involved 514 fluorescent lamps, 66 fluorescent ballasts, 166 fluorescent fixtures, 30 energy-efficient incandescent screw-in units, and 9 compact fluorescent hard-wired fixtures, reduced the library's 47.8 kW load by 20.7 kW, to 27.1 kW. The library's electric bill was cut in half, and according to the library's manager Harry Williams, "They cut the number of lamps in half and the quality of light is excellent!" The retrofit resulted in savings far larger than the 1991 3.2 kW average for the Small C/I Program. Williams notes that, "You don't get a lot of treats like labor, material, and disposal of toxic ballasts for free. Everything was handled by the utility at no charge, ...that's a pretty good deal!"

In addition to the energy savings the retrofit had another benefit. Earlier in the year, due to fiscal constraints, the library was forced to lay off its custodian who had been responsible for replacing lamps. The library has a vaulted ceiling and thus replacement of the lamps is inconvenient and even somewhat dangerous. Williams notes that the long life bulbs keep librarians on the floor, instead of precariously high up on ladders replacing burnt-out incandescents!

MONITORING

NEPSCO provides labor vendors with computer terminals that are connected to its computer system providing up-to-date program information on the customer data base. All labor vendors are required to use the NEPSCO project management system to record all activity related to the Small C/I Program. The database tracks participating and non-participating customers, estimates of electrical savings expected from each installation, the products installed, and all customer inquiries, complaints, and subsequent resolutions. The tracking system also provides inventory control for equipment installed by the labor vendors. To ensure that the data base remains current, NEPSCO makes payments to vendors based on installations entered into the data base. Program operations are also monitored through on-site verifications performed by NEPSCO staff, telephone surveys of participating customers, and inspections of all vendor invoices approved by NEPSCO.

EVALUATION

NEES performs two kinds of evaluations for all its DSM programs, process and impact evaluations. Process evaluations focus on the program's development and design. Impact evaluations focus on savings and costs. A process evaluation of the Small C/I Program was conducted in 1991 by HBRS, Inc., a consulting firm, for the period of June 1990 to April 1991. (A process evaluation was also completed on the Rhode Island pilot.) A preliminary billing analysis of the original pilot was completed in early 1991. This billing analysis yielded savings of approximately 60% of engineering estimates.

To date there has not been an impact evaluation released on the system-wide program though at the time of this writing it is underway. In an effort to better evaluate energy and demand savings estimates for the Small C/I Program, NEES has contracted for short-term end-use metering of lighting and total building loads before and after retrofits at Small C/I Program sites. Results of this study will be available in late 1992 and will include billing analysis of the system-wide program.

The HBRS Process Evaluation for the first year of the program's system-wide implementation provides some interesting insights about who the customers are, how satisfied they have been, and where problems have occurred with program design. Of a total population of 2,643 program participants, 60% were interviewed for around 20 minutes each. (HBRS also surveyed a limited number of eligible customers who elected not to participate. Forty-four percent thought that the utility funding for the program for the year had been extinguished.) [R#8]

More than two-thirds of customers surveyed were "very satisfied" with the program. Another 21% were somewhat satisfied. Only 6% expressed dissatisfaction, due to concerns that the vendors were not installing what the customers wanted, equipment failure, perceived poor quality of the equipment, and delays in picking up replaced ballasts. The program's ballast pickup schedule, coordinated by the utility, is computerized and prioritized by the vendors' data entry into the common database.

Forty-five percent of the program participants reported improvements in the quality of the lighting at their facilities. Almost a third, however, reported a decrease in the quality of lighting with particular reference to the amount of light. (The HBRS evaluation noted that this perception could result in an erosion of savings as additional light could be added by end-users.) In the Rhode Island pilot for all Rhode Island utilities, 42% had indicated that lighting quality was better, 19% worse, and 35% saw no change in quality. [R#2]

Some customers complained that they had not achieved the bill savings projected by the labor vendors. Labor vendors suggested that the confusion regarding savings was due to system-wide NEES rate increases which had eroded the projected bill savings.

Despite the sophistication of the data base tracking system, the HBRS process evaluation uncovered aspects of the data base that could be enhanced. Labor vendors wanted to be able to use the data base for inventory and bill reconciliation and were frustrated with the lack of flexibility in the software. In particular, they were concerned that it did not include pricing information which would allow them to do savings analyses for customers. Vendors claimed that they had to keep redundant computer files and encouraged NEPSCO to combine the functions into the central database. As of May 1, 1992, new software developed as part of a one-

year NEES effort is expected to provide vendors with all the information that they need and to solve the issue of redundant computer files.

The process evaluation of the Rhode Island Pilot was limited to a small subset of around 100 customers. Fully 80% of the participants indicated that they had no problems with their levels of satisfaction about the program. The survey found that the breakdown between participating building owners and renters was evenly split. By far the largest number of facilities treated were offices (31%). Offices were followed by "non-food" retail business (19%) and industrial facilities (12%). Retail food stores and restaurants represent less than 10% of the facilities treated. The average size of the facilities was 7,100 ft^2 of heated space, 7,600 ft^2 enclosed space, and 2,900 ft^2 of air-conditioned space. Sixty-eight percent of the installations surveyed reported no equipment failures while another 13% said that less than one-percent of the equipment installed had failed.

NEPSCO also commissioned a "Commercial and Industrial Program Participant Survey of Building Operating Schedules." This study consisted of an extensive telephone survey of Small C/I Program participants. The two primary objectives of this research were to collect detailed data on operating schedules and equipment usage patterns, and to evaluate the effectiveness of telephone surveys in providing data for measures installed by the retail companies' commercial and industrial programs. The results of this project are used to estimate program impacts on demand, load shape, and energy use.

DATA QUALITY

NEES uses three basic measures of savings for its programs: saved kWh, summer peak capacity savings, and winter peak capacity savings. NEES presents its energy savings information in two basic formats: "Incremental Installed" kW and kWh indicate the theoretical future capacity and annual energy savings value of all program resource installations completed in the year in question. (Thus a measure installed in December would still bear a 12-month energy savings.) "Cumulative Actual" kW and kWh indicate estimated actual impacts or reductions in a particular year resulting from installations performed in the same and previous years. Measures that reach the end of their useful lives are subtracted from the cumulative savings.

To calculate the coincidence of the efficiency measures installed in this program with the utility's peak load, diversity factors have been assigned. (NEES system summer peak 12 noon-5pm; winter peak 5-7pm.) Diversity factors are the ratio of the estimated demand savings captured during peak periods to the estimated potential demand savings of the equipment. Summer and winter diversity factors were taken from the results of the survey of building operating schedules mentioned above. The net result is that the measures installed in this program generally coincide with summer peak demand over 80% of the time, and coincide with winter peak over 60% of the time.

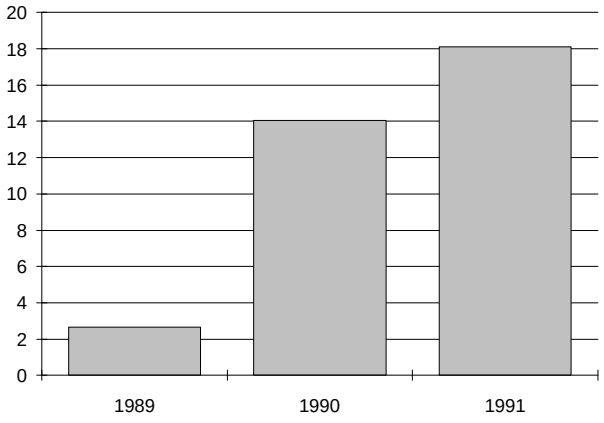
NEES uses engineering estimates for calculating all programs' savings. The factor used for the Small C/I Program, theoretically to reconcile the difference between calculations of savings and actual savings, was developed using one year of pre/post billing data analysis for the Rhode Island Lighting Program (RILP). The adjustment factor for MWh saved (0.5886) is based on installations of lamps only, and therefore is suspect and will likely be refined after the 1992 impact evaluation results are in. Thus the results to date of the system-wide Small C/I Program must be considered preliminary.

Unadjusted engineering estimates of demand savings were determined for each measure installed, based on hours of operation as recorded in the program tracking database and on specific wattage reductions using a standardized lighting system "wattage list". The wattage list was developed from a survey of major lighting manufacturers and is updated as necessary. These engineering estimates were then adjusted by free-ridership (discussed in the program cost section) and calculated diversity factors.

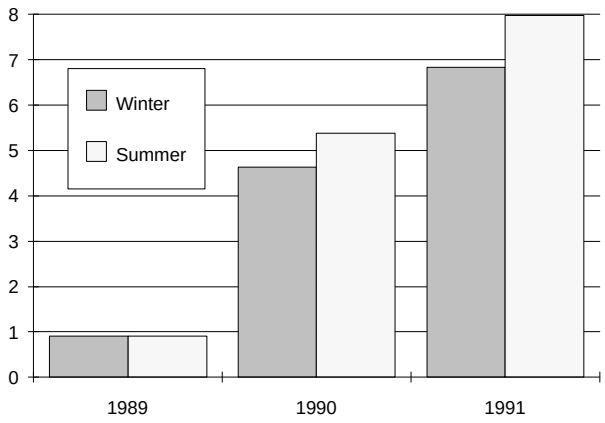
Program Savings

Savings Overview Table	Annual Energy Savings (kWh)	Cumulative Energy Savings (kWh)	Lifecycle Energy Savings (kWh)	Annual Winter Capacity Savings (MW)	Annual Summer Capacity Savings (MW)	Cum. Winter Capacity Savings (MW)	Cum. Summer Capacity Savings (MW)
1989	2,671,424	2,671,424	13,357,120	0.91	0.91	0.91	0.91
1990	14,042,000	16,713,424	196,588,000	4.63	5.38	5.54	6.29
1991	18,095,437	34,808,861	271,431,555	6.84	7.98	12.38	14.27
Total	34,808,861	54,193,709	481,376,675	12.38	14.27		

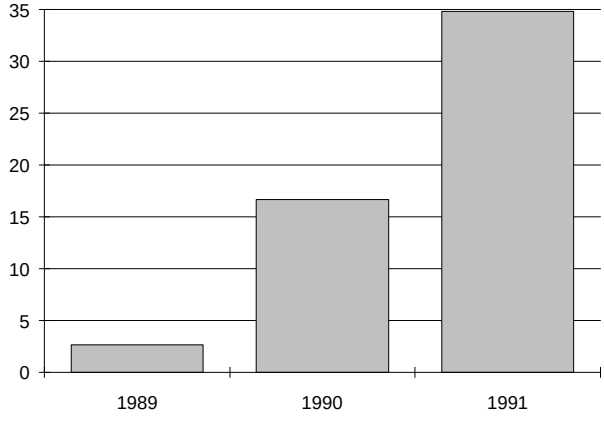
ANNUAL ENERGY SAVINGS (GWH)



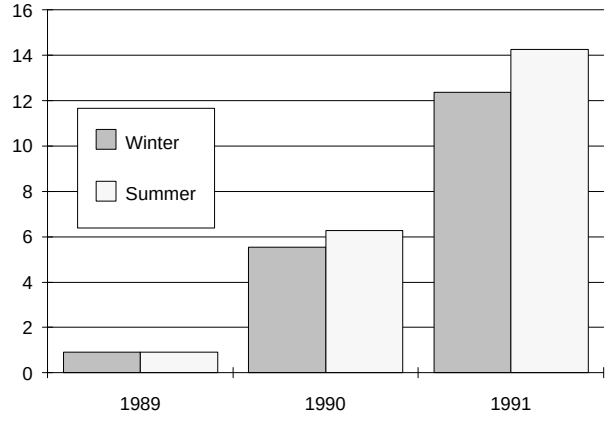
ANNUAL PEAK CAPACITY SAVINGS (MW)



CUMULATIVE ENERGY SAVINGS (GWH)



CUMULATIVE PEAK CAPACITY SAVINGS (MW)



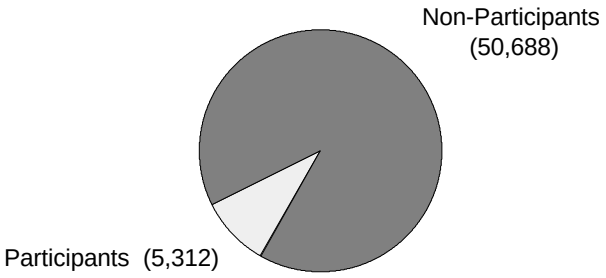
The Small Commercial and Industrial Program had accumulated installed savings of 34,808,861 kWh by the end of 1991. In terms of peak, the program had avoided the need for 12.38 kW winter peak and 14.27 MW summer peak. [R#1, 4, 13, 18]

MEASURE LIFETIME

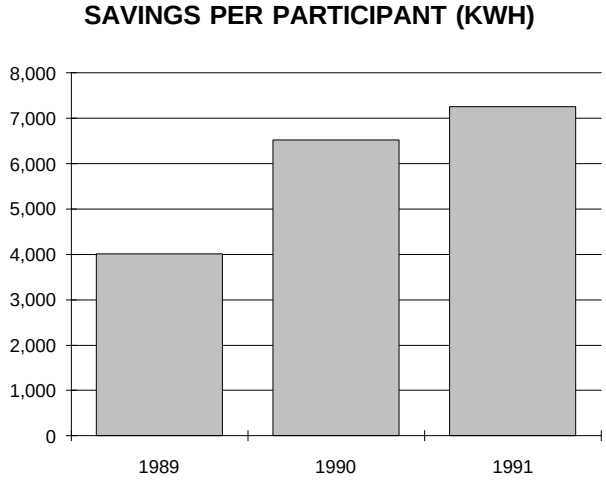
For the Rhode Island pilot program an average measure lifetime of five years was assumed. For the 1990 system-wide program the average calculated was 14 years, and 15 years for 1991. The average lifetimes reflect the growing sophistication of the program, from a screw-in lighting replacement program where the assumed lives of the measures was short, to the installation of hard-wired, far more systematic lighting retrofits that provide much longer measure lifetimes.[R#2]

PARTICIPATION

There are approximately 120,000 small commercial and industrial accounts serviced by the New England Electric System. Two eligible groups are not specifically targeted for the program: seasonal customers and those with very small energy use (under 500 kWh per month). The target market for the program consists of 55,000 eligible customers. By the end of 1990 the Small C/I Program had captured 5.1% (or 2,816) of the eligible customers. By the end of 1991 the program had captured 9.5% of the eligible customers. (In 1989, the Rhode Island pilot treated 1.2% of the total eligible customers system-wide, in 1990 the system-wide program captured another 3.8%, and in 1991 the program captured another 4.5%.) [R#1, 18, 13]



Customers Serviced Table	Participants	Annual Energy Savings per Participant (kWh)
1989	666	4,011
1990	2,152	6,525
1991	2,494	7,256
Total	5,312	



Between 1991 and 1995 NEES expects that this program will reach 16,575 customers, and then another 21,151 customers in 1996-2000. At this rate of treating approximately 3,000 customers each year, the overall market penetration for the program will be 75% by the year 2000 — a participation level higher than NEES projects for any other DSM program. [R#4]

PROJECTED SAVINGS

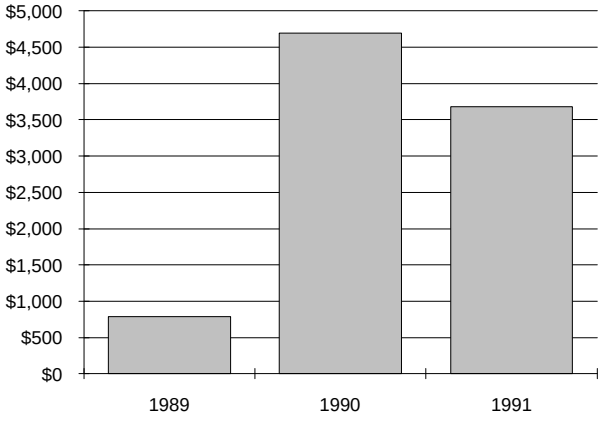
Over the course of the planned program (1989-2000), NEES projects that 40,000 customers will participate in the Small C/I Program with installed summer peak savings of 85 MW, installed winter peak savings of 74 MW, and annual energy savings of 326 GWh. [R#2]

Cost of the Program

Costs Overview Table	Expense Cost (x1000)	Payroll Cost (x1000)	Advertising Cost (x1000)	Other Cost (x1000)	Total Program Cost (x1000)	Cost per Participant
1988	$0.0	$0.0	$1.2	$0.0	$1.2	
1989	$469.9	$39.2	$14.8	$0.0	$523.9	$786.57
1990	$9,406.5	$127.7	$58.0	$514.1	$10,106.3	$4,696.24
1991	$8,858.0	$307.6	$16.0	$0.0	$9,181.6	$3,681.48
Total	$18,734.4	$474.5	$90.0	$514.1	$19,813.0	

TOTAL PROGRAM COST (x1,000)

COST PER PARTICIPANT



Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1989	4.62	4.75	4.89	5.02	5.16	5.30	5.44
1990	6.60	7.05	7.53	8.02	8.52	9.04	9.57
1991	4.51	4.82	5.15	5.48	5.83	6.18	6.54

1991 administrative cost of saved energy at 5% = 0.57

The Small Commercial and Industrial Program cost a total of $10,106,300 in 1990 (a twenty-fold increase over the pilot program in 1989). In 1991 NEES spent $9,181,643 on the program. To date the program has cost a total of $19,813,000. (NEES does not include DSM planning, evaluation, and research and development costs in its reported costs for its individual DSM programs though they are reflected in the overall utility DSM expenditure.) [R#4, 18]

COST EFFECTIVENESS

NEES uses a cost effectiveness test to determine which conservation and load management (C&LM) programs to undertake. The present worth of a resource option's costs, in this case a DSM program's cost, is compared to the present worth of its benefits over its lifetime. The benefits of the option are measured as the avoided energy and capacity costs to the NEES system. In addition, cost effectiveness of the program is determined for each of the three utility service territories. In Massachusetts, environmental externalities are included in the cost effectiveness analysis. [R#15]

COST PER PARTICIPANT

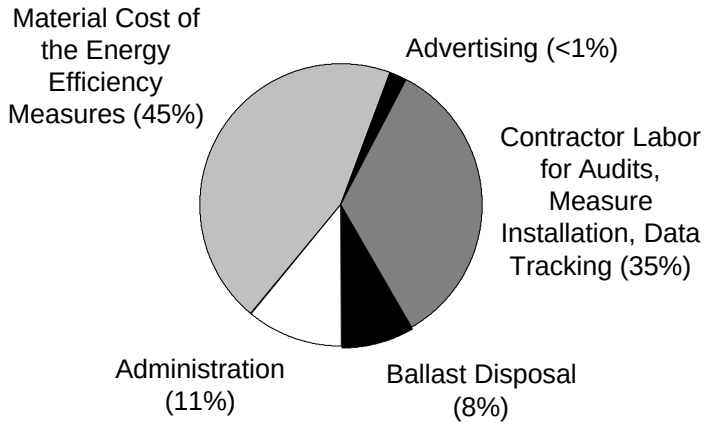
The 1990 total program cost of $10,106,300 served a total of 2,152 customers for a dramatic increase over the pilot program in average cost per participant to $4,696. The largest expenditures for a particular customer type have been for schools where NEES has spent an average of $16,844. (The average cost per participant for the Rhode Island pilot is not indicative of the financial commitment of the system-wide program. The pilot's 1989 total cost was $523,900 spread among 666 customers for an average cost of $787. [R#8] In 1991, NEES spent $9,181,643 to serve 2,494 customers for an average participant cost of $3,681. The decrease in cost per installation was primarily due to the decrease in size criteria for program eligibility from 100 kW to 50 kW in January 1991. [R#13]

FREE RIDERSHIP

Free-ridership factors were based on the evaluation of the Rhode Island Lighting Program (RILP). The range of factors was quite dramatic. Ballasts, had 4% free ridership factor; reduced wattage incandescents were assigned a factor of 15%. For the remainder of the categories (interior and exterior HID systems, hard-wired compact fluorescents, and occupancy sensors), free-ridership of 5% was used. Note that free-ridership was not directly applied to engineering estimates of MWh since it was implicit in the MWh adjustment factor developed in the billing analysis.

COST COMPONENTS

Fully 45% of the total program cost went directly into energy-efficient equipment. Another 35% was paid to the contractors who performed the audits, installed the measures, and input the data for program tracking. [R#4]



Environmental Benefit Statement

Marginal Power Plant	Heat Rate (BTU/kWh)	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
Coal	**Uncontrolled Emissions**					
A	9,400	2.50%	116,842,000	2,772,000	560,000	56,000
B	10,000	1.20%	124,591,000	1,073,000	362,000	268,000
	Controlled Emissions					
A	9,400	2.50%	116,842,000	277,000	560,000	4,000
B	10,000	1.20%	124,591,000	107,000	362,000	18,000
C	10,000		124,591,000	715,000	358,000	18,000
	Atmospheric Fluidized Bed Cumbustion					
A	10,000	1.10%	124,591,000	328,000	179,000	89,000
B	9,400	2.50%	116,842,000	277,000	224,000	17,000
	Integrated Gasification Combined Cycle					
A	10,000	0.45%	124,591,000	221,000	36,000	89,000
B	9,010		112,073,000	80,000	27,000	5,000
Gas	**Steam**					
A	10,400		67,959,000	0	155,000	0
B	9,224		59,017,000	0	370,000	17,000
	Combined Cycle					
1. Existing	9,000		59,017,000	0	227,000	0
2. NSPS*	9,000		59,017,000	0	107,000	0
3. BACT*	9,000		59,017,000	0	15,000	0
Oil	**Steam--#6 Oil**					
A	9,840	2.00%	98,362,000	1,490,000	176,000	167,000
B	10,400	2.20%	104,323,000	1,478,000	221,000	107,000
C	10,400	1.00%	104,323,000	211,000	178,000	56,000
D	10,400	0.50%	104,323,000	620,000	221,000	34,000
	Combustion Turbine					
#2 Diesel	13,600	0.30%	130,553,000	260,000	404,000	22,000
Refuse Derived Fuel						
Conventional	15,000	0.02%	154,994,000	399,000	526,000	117,000

Avoided Emissions Based on 54,193,709 kWh Saved (1989-1991)

In addition to the traditional costs and benefits there are several hidden environmental costs of electricity use that are incurred when one considers the whole system of electrical generation from the mine-mouth to the wall outlet. These costs, which to date have been considered externalities, are real and have profound long term effects and are borne by society as a whole. Some of environmental costs are beginning to be factored into utility resource planning and, in NEES's case, are indirectly factored into the shareholder incentives discussed later. Because energy efficiency programs present the opportunity for utilities to avoid environmental damages, environmental considerations can be considered a benefit in addition to the direct dollar savings to customers from reduced electricity use.

The environmental benefits of energy efficiency programs can include avoided pollution of the air, the land, and the water. Because of immediate concerns about urban air quality, acid deposition, and global warming, the first step in calculating the environmental benefit of a particular DSM program focuses on avoided air pollution. Within this domain we have limited our presentation to the emission of carbon dioxide, sulfur dioxide, nitrous oxides, and particulates. (Dollar values for environmental benefits are not presented given the variety of values currently being used in various states.)

HOW TO USE THE TABLE

1. The purpose of the previous page is to allow any user of this profile to apply NEES's level of avoided emissions saved through its Small C/I Program to a particular situation. Simply move down the left-hand column to your marginal power plant type, and then read across the page to determine the values for avoided emissions that you will accrue should you implement this DSM program. Note that several generic power plants (labelled A, B, C,...) are presented which reflect differences in heat rate and fuel sulfur content.

2. All of the values for avoided emissions presented in both tables includes a 10% credit for DSM savings to reflect the avoided transmission and distribution losses associated with supply-side resources.

*** Acronyms used in the table**

TSP = Total Suspended Particulates
NSPS = New Source Performance Standards
BACT = Best Available Control Technology

3. Various forms of power generation create specific pollutants. Coal-fired generation, for example, creates bottom ash (a solid waste issue) and methane, while garbage-burning plants release toxic airborne emissions including dioxin and furans and solid wastes which contain an array of heavy metals. We recommend that when calculating the environmental benefit for a particular program that credit is taken for the air pollutants listed below, plus air pollutants unique to a form of marginal generation, plus key land and water pollutants for a particular form of marginal power generation.

4. All the values presented represent approximations and were drawn largely from "The Environmental Costs of Electricity" (Ottinger et al, Oceana Publications, 1990). The coefficients used in the formulas that determine the values in the tables presented are drawn from a variety of government and independent sources.

NEES AVOIDED EMISSIONS

New England Electric System is a utility at the forefront of integrating environmental concerns with its operations. The company's plan for the 1990s, NEESPLAN-3, Environment, Economy, and Energy, has three basic goals: To continuously reduce the environmental impact of its electric service, to maintain the competitiveness of its electricity prices, and to enhance its diversity and competitively procured power supply. To accomplish its environmental objectives NEES plans to reduce net air emissions from its operations by an estimated 45% by the year 2000, "continue the nation's leading energy conservation program", and to purchase renewable energy and emissions offsets. [R#7]

New England Electric System has been able to defer some construction and purchase of additional generating capacity due in part to its energy efficiency initiatives. Currently, the New England Electric System's marginal power plant, or "proxy" power plant, is a gas-fired steam turbine.

Lessons Learned / Transferability

Cheryl LaFleur, Vice President for Demand-Side Management at NEPSCO, notes that there had been two important lessons learned from NEES's DSM efforts to date. First, success in marketing DSM programs on a large scale is related to the ease with which customers can participate. "We observed that customers are more likely to agree to install conservation measures if the proposals are easy to understand and the cost savings are clear. The more the customer has to work to understand a proposal, the more questions that will arise, the more skepticism the customer has, and the less likely the customer will feel comfortable proceeding with the conservation measures." The second lesson learned, according to LaFleur, is that teamwork both within the utility and with parties outside the utility (such as the Conservation Law Foundation) can enhance a program's effectiveness.[R#16]

"There is a lot being learned in New England and from the Small C/I Program in particular. There is only one way to learn about how to run a demand-side management program: you've got to get out on the street and do it, then evaluate it and refine it. NEES is doing just that." *Joe Chaisson, Conservation Law Foundation*

In addition to these general comments, several more specific lessons have been learned:

• The program ran into some conflict with product vendors who argued that the program constituted restraint of trade. These claims were dismissed by the utility commissions, but NEES lowered the customer eligibility cutoff from 100 kW to 50 kW in order to reduce the perceived infringement. Product vendors who were not selected to participate in the Small C/I Program have the option of pursuing the same markets through the NEES Energy Initiative program. The incentives for the Energy Initiatives program were comparable to the Small C/I Program for similar measures through 1991. However, Energy Initiatives program incentives will be reduced in 1992, so conflicts may resurface.

• The pilot project identified the need for product and labor vendors to guarantee their work, warranty their products, and make contractors responsible for problems that might arise. NEES's program manager also felt it was important to pay vendors based on performance, rather than hourly.

• NEES program planners initially hoped that one ballast manufacturer would be able to provide all ballasts for the program. Unfortunately, this supplier could not keep up with the program demand. The supplier was dropped from the program and replaced by three separate ballast manufacturers who have been able to successfully supply all the ballasts needed by the program. This points to maintaining inventory and keeping the supply of energy-efficient lighting equipment flowing despite periodic shortfalls in product availability.

• At the onset of the program some ballasts were installed that would operate either T8 or T12 fluorescent lamps. When it came time to recover costs, regulators discounted the value of the savings based on the possibility of the user later installing less efficient T12 lamps in the place of energy-efficient T8s. Now if a fluorescent fixture is retrofitted with a ballast and/or reflector, it is configured for use with T8 lamps only.

• During the Rhode Island pilot, utility personnel told participating customers that if the lighting equipment is not used for more than 20 hours per week (for fixture changes) and 50 hours a week (for lamps), that the program is not cost effective for the utility. This caused some participants to overstate the number of hours of operation of their lamps — and thus utility representatives and labor vendors dropped this awareness building in favor of more accurate customer assessments.

• Due to high levels of participation, program funds began to run out prematurely in 1991. Thus NEPSCO limited the number of installations for any given vendor to 10-20 per month. This led to vendors concentrating on larger customers where they could install many efficiency measures. Thus, NEES changed the limit to a fixed dollar value per vendor per month to cap the activities.

• While lighting and other energy-efficient products can be bought cheaper in bulk by the utility by ordering outside the region, NEES made a conscious decision to buy products from existing vendors within their service territory to boost the regional economy.

• Both labor and product vendors believe that there is a considerable demand to add metal halide lighting to the list of eligible measures. They feel that it is needed for car dealerships, for example, where color rendition is critical to sales.

Regulatory Incentives and Shareholder Returns

Most of the following information was prepared by NEPSCO Rate Analyst, Monica Bushnell, except where specifically referenced to another source. [R#14]

While the principal beneficiaries of NEES's Small C/I Program are certainly those customers served with energy efficiency upgrades, one of the striking aspects of NEES's rise in prominence in the DSM arena has been the utility's commitment to developing incentives so that NEES shareholders earn a favorable return on their DSM investments. NEES has been a pioneer with incentives for DSM and has worked out equitable incentive packages with not one, but three, utility commissions. In 1989, NEES, along with the Conservation Law Foundation of New England, filed their 1990 DSM program plans for approval with the regulatory commissions of Massachusetts, Rhode Island, and New Hampshire. Each of the three retail utility companies put forth a method by which it could earn a DSM-related incentive. The objectives of the incentive approach were to:

- Guarantee that customers are not negatively impacted by incentives paid to shareholders;

- Share the avoided costs savings in a fair manner, with the majority going to the customers; and

- Ensure that the company would be paid only for performance;

Prior to 1990, conservation and load management programs for Narraganset Electric, Massachusetts Electric and Granite State Electric were designed and implemented by New England Power (NEPSCO), the system's wholesale electric generating and transmission company. NEPSCO's costs associated with these programs were recovered from each of the retail utility companies through NEPSCO's wholesale rates, and the retail companies were reimbursed by assessing customers through their respective Purchased Power Adjustment mechanism. No financial incentives structures at NEPSCO or the retail utility company level were in place at the time.

In the fall of 1989 each of the System's three retail utility companies filed separate C&LM programs with their respective commissions for the 1990 program year. Included in those filings were mechanisms for the collection of financial incentives. Decisions made by each of the three state commissions made the NEES Companies among the first in the country to be allowed incentives for DSM program performance. All three commissions allowed the program costs to be expensed and recovered in the rates the year they occur.

In Rhode Island and New Hampshire, the commissions approved a shared-savings approach which based each company's incentive on the value created by the C&LM programs. In both jurisdictions the utility companies were able to earn a Maximizing Incentive equal to 5% of the value created (adjusted for customer direct costs and evaluation costs). In addition, the retail companies could earn an Efficiency Incentive equal to 10% of the net value (the difference between the value created and the costs of the DSM program including the maximizing incentive). The remaining savings would flow to customers. In Rhode Island, however, the Commission adopted a minimum performance threshold, resulting in Narraganset Electric earning an incentive on savings above a base value specified by the Commission.

The Department of Public Utilities (DPU) in Massachusetts adopted a different approach. Rather than basing Massachusetts Electric's incentive on a shared-savings mechanism, the DPU established a per kW and kWh bounty for each kW and kWh saved above minimum performance thresholds for kW and kWh. For example, if the utility does not attain 50% of the projected energy savings, no incentive kWh is paid.

For the 1991 program year, the Massachusetts and Rhode Island incentive mechanisms remained virtually unchanged. However, the New Hampshire Public Utilities Commission added a minimum performance threshold.

NEES's 1990 DSM results produced approximately $161 million in savings (or value) for customers. In the same year NEES spent $71 million to procure DSM resources. The $71 million was recovered through a "current recovery" mechanism with the cost of the program spread across all kWh sales. In 1990, NEES shareholders will earn an estimated $8.4 million return on investment (ROI) from DSM program investments. The retail companies will earn between 12-28% on their DSM investments. (The Massachusetts portion of the incentive has not yet been finalized and will be subject to a second evaluation.)

SIMPLE SUMMARY OF 1990 DSM INCENTIVES

Total generated value	$161.0 million
DSM program cost	$71.0 million
Net benefit to customers	$80.0 million
C&LM earned incentive	$8.4 million

[R#9]

In its 1991 annual report to shareholders NEES reported that its DSM incentives contributed 7 cents per share to its consolidated earnings. [R#15]

As stated above the incentive paid to shareholders is based on energy and capacity savings. Nevertheless, the overall incentive value can be used to calculate the one-year return on investment (ROI) that shareholders receive for the DSM investments. The following table is presented as a guide to expenditures and incentives for each retail company's DSM spending.

Notes: The different incentives indicate the influence and variation of DSM policies in each of the three states. Second, the total expenditures slated below do not add up to the expenditures listed in the table above. The difference represents NEPSCO's DSM costs which are recovered using a current recovery methodology. These costs, approximately $15 million in 1990, are recovered through wholesale electricity rates to the retail companies under the regulation of the Federal Energy Regulatory Commission.

RETURN ON 1990 DSM INVESTMENTS

	Expenditure	Incentive
Massachusetts Electric	$40,309,500	$4,986,461
Narragansett Electric	$14,317,698	$2,891,748
Granite State Electric	$1,690,360	$480,419

[R#14]

1992 INCENTIVE MODIFICATIONS

All three retail utility companies recently entered into settlements and received approval from their respective commissions for their 1992 programs. There were some changes from the 1991 programs. For example, Granite State will now be required to establish and meet certain thresholds for its residential, commercial, and industrial customer classes. In addition, the Maximizing Incentive for C/I programs was dropped from 5% to 3.5% of value created.

Massachusetts Electric's 1992 C&LM incentive structure has also been changed significantly. For 1992, a two-part mechanism is in place. This mechanism rewards the utility company based on the size and the efficiency of the savings achieved. The Maximizing Incentive will be calculated in essentially the same manner as Massachusetts Electric's current incentive is determined with the exception that it will only represent half of the expected bonus. In addition, the threshold will no longer be fixed, but rather will adjust according to the level of actual spending. The second component, or Efficiency Incentive, will be based on the efficiency of the overall program. Massachusetts Electric will earn the other half of its target bonus if the target benefit/cost ratio is achieved. The actual Efficiency Incentive earned will increase if the target benefit/cost ratio is improved, and decreased if the target ratio is not met. In addition, a penalty will be imposed if the actual customer value created by the overall program is less than the total expenditures. If this should occur, Mass Electric's cost recovery will be limited to the customer value created.

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