Northeast Utilities
Energy Action Program
Profile #34, 1992

Executive Summary

Northeast Utilities' Energy Action Program (EAP) offers incentives to large commercial and industrial customers who retrofit existing facilities with energy-efficient equipment in the service territories of both Connecticut Light & Power and Western Massachusetts Electric Company. Non-residential customers whose monthly demand exceeds 250 kW, facilities such as schools and institutional buildings, hospitals, offices, commercial buildings, colleges and universities, and industrial facilities are eligible for the program. EAP's incentives stimulate lighting retrofits, HVAC improvements, motor retrofits, and the installation of energy management systems. Through EAP, the payback period for retrofit projects is reduced to one to three years.

The focus of EAP is total energy management, including industrial process improvements. Manufacturing measures eligible for incentives from EAP include motors, compressors, and process controls, and are eligible for incentives that allow for a one-year payback. Comfort measures (such as chillers, condensers, evaporators, or any other equipment involved in electric cooling systems) and nonmanufacturing measures (such as lighting and domestic hot water heating equipment) are eligible for incentives that bring the project cost down to a three-year payback, with the maximum percentage of the installed cost of 50%.

The EAP target market is comprised of approximately 1,700 commercial customers and 1,000 industrial customers. With 1,000 EAP participants to date, or 37% of the target group, EAP is well along in meeting its goals for participation. (Furthermore, of those participants who install ECMs, about 90% of the recommended measures are actually installed.) In its present form, EAP will have reached the entire target market within the next few years. However, as technologies and costs change, the program is expected to be revised to accommodate such changes, potentially making additional retrofit opportunities cost-effective.

EAP was initiated in 1988 and has generated total annual energy savings of 86.5 GWh and summer demand savings of 13.2 MW in the four-year period 1988 to 1992. Approximately 113 projects have been completed as of the end of 1992, with another 363 underway.

NU has overcome institutional barriers to energy efficiency in a customer class whose energy bills constitute only a small fraction of total costs. Similar barriers are likely to exist throughout North America, and can be effectively overcome with programs similar to EAP.

Energy Action Program

Utility:	Northeast Utilities
Sector:	Commercial and Industrial
Measures:	Lighting, HVAC improvements, motor retrofits, energy management systems.
Mechanism:	Energy analysis surveys and incentives
History:	Started in 1988.

1990 Program Data

Energy savings:	17.8 GWh
Lifecycle energy savings:	267.7 GWh
Peak capacity savings:	2.63 MW Summer
	2.25 MW Winter
Cost:	$5,541,200

Cumulative Data (1988-1990)

Energy savings:	28.7 GWh
LIfecycle energy savings:	355.8 GWh
Peak capacity savings:	3.54 MW Summer
	3.05 MW Winter
Cost:	$9,068,500
Participation rate:	37%

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.

Utility Overview

In June and July of 1992 Northeast Utilities (NU) greatly expanded its role in New England as an electricity supplier when it successfully completed a buyout/merger of the bankrupt Public Service Company of New Hampshire. The acquisition has added 5,445 square miles to NU's prior service territory of 5,890 square miles with 4,400 square miles in Connecticut and 1,490 square miles in Massachusetts. For the sake of this section and the next, data is reported that reflects NU prior to the addition of PSNH's service territory and assets.

Prior to July of 1992 NU was a holding company which maintained three electric operating subsidiaries:

The Connecticut Light and Power Company (CL&P),
Western Massachusetts Electric Company (WMECO), and
Holyoke Water Power Company.

The service territory of these three subsidiaries is divided into six operating regions, five in Connecticut and one in Massachusetts. Generally, each region is further subdivided into three districts, each of which has its own management office and personnel. Districts generally contain between three and twenty towns, with a total of 25,000 to 120,000 customers in each district.[R#1] Most of these divisions existed as the service territories of NU's predecessor utilities. In the next few years, the regions and possibly the districts will be restructured.

NU 1991 STATISTICS

Number of Customers	1,264,928	
Energy Sales	29,300	GWh
Revenue from Energy Sales	$2.753	billion
Summer Peak Demand	5,000	MW
Net Capacity Available	5,941	MW
Reserve Margin	18.81%	
Average Electric Rates		
Residential	10.45	¢/kWh
Commercial	9.3	¢/kWh
Industrial	8.5	¢/kWh

NU's original service territory is undergoing a transition from a heavy manufacturing base to a high-tech and service-related base. The commercial sector is thus becoming NU's fastest growing load component, both in numbers of customers and in demand per facility. While the commercial sector represents less than 10% of NU's total customers, it accounts for more than 30% of total electric sales. Data from 1990 illustrates the large growth of the commercial sector. Commercial electricity consumption rose 2.5% in 1990, much larger than the rise in total electric sales which was a modest one-fifth of one percent.[R#2] In 1991, however, commercial and total electric sales dropped by .9% and 1.1% respectively.[R#3]

Utility DSM Overview

In 1980, NU began offering conservation services under an umbrella DSM program called, The 80's and 90's Program. The program was mostly informational and geared to the residential sector. In 1986 NU shifted the focus of its umbrella DSM program from the residential sector to the commercial and industrial sectors and changed its name to Energy Alliance. The utility came to understand that the C/I sectors had the potential for achieving greater energy savings with fewer buildings (customers) and at lower cost per kWh than did the residential sector. Later, during the Connecticut Light and Power rate case proceedings of 1987, the now famous New England Collaborative Process was born. In Connecticut, CL&P entered into an ongoing, collaborative DSM program planning process with the following organizations: The Connecticut Office of the Consumer Counsel; The Energy Division, Office of Policy and Management; The Prosecutorial Division of the Department of Public Utility Control; and The Conservation Law Foundation of New England.

Utility DSM Overview Table	DSM Expenditure ($1000)	Annual Energy Savings (GWh)	Annual Summer Capacity Savings (MW)
1981	$0	20.6	2.2
1982	$8,775	54.1	9.7
1983	$8,462	57.2	10.2
1984	$9,816	60.8	11.3
1985	$9,645	60.9	12.1
1986	$16,344	58.7	12.3
1987	$17,098	77.7	10.3
1988	$18,047	62.8	108.7
1989	$24,240	58.1	11.6
1990	$49,351	148.5	29.4
Total	$161,777	659.5	217.9

CURRENT DSM PROGRAMS AT CL&P

RESIDENTIAL

Energy Value Water Heating

Energy Crafted Home

Energy Conservation Loan Program

Operation Solar

Mass Save

Residential Energy Audit

SPECTRUM

- Electric Heat-Single Family
- Electric Heat-Multifamily
- Public Housing Authority
- Domestic Hot Water
- Neighborhood Program
- Lighting Catalog
- Appliance Pick-up

Weatherization Residential Assistance Partnership (WRAP)

- NU-Neighborhood Housing Services Revolving Loan Program

COMMERCIAL / INDUSTRIAL

Energy Saver Lighting Rebate Program

Energy Action Program

Energy Conscious Construction

Energy CHECK Conservation Services

State Buildings Program

Connecticut Hospital Association Loan Fund

Customer Initiated Program

Streetlight Conversion

Time-of-Day (TOD) Rates

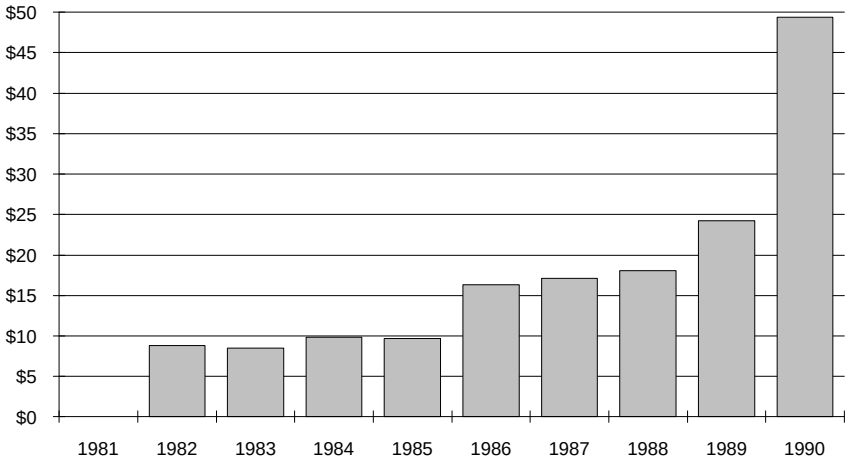
Interruptible Rates

Technical Training

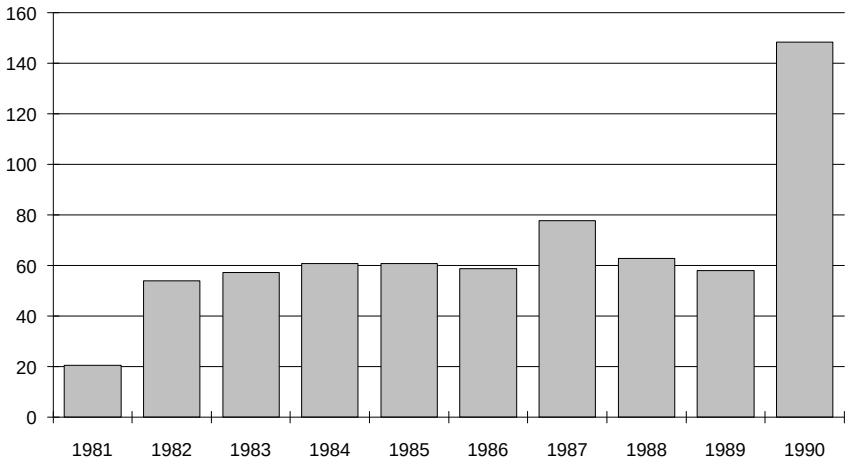
The first year of the collaborative process, 1988, was a very important transition year for Energy Alliance. Virtually all DSM programs were reviewed and redesigned. The collaborative's program planning concentrates on three large customer groups: 1) residential, 2) low-income residential, and 3) commercial/industrial. Services formerly offered under separate programs have, in many cases, been packaged into comprehensive programs aimed at specific target customer groups within each market sector. This approach allows for better target marketing of customers who have similar efficiency needs, barriers, and adoption requirements. The primary issues addressed by the collaborative include DSM program design, implementation, cost effectiveness, recovery of DSM expenditures, program monitoring and evaluation, and resource planning.

NU is pursuing DSM from a position of surplus capacity. The need for new generating capacity is not projected to occur until 2005. By the summer of 2001 and the winter of 2001/02, DSM resources are projected to provide 875 MW and 946 MW, respectively, 9.8% and 10.1% of the total required capacity. By the summer of 2011 and the winter of 2011/12, DSM resources are projected to provide 1,270 MW and 1,305 MW, respectively (11.3% and 11.2% of the total required capacity).[R#3]

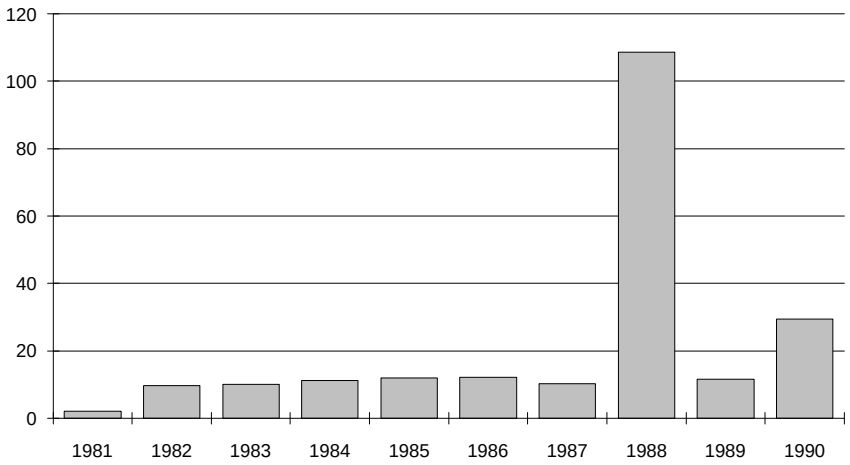
ANNUAL DSM EXPENDITURE ($1,000,000)



ANNUAL ENERGY SAVINGS (GWH)



ANNUAL SUMMER CAPACITY SAVINGS (MW)



Program Overview

NU's Energy Action Program (EAP) offers incentives to large commercial and industrial customers who retrofit existing facilities with energy-efficient equipment. Lighting projects, HVAC improvement, motor retrofits, and energy management system implementation are examples of the types of projects eligible for incentives. Through EAP, the payback period for retrofit projects is reduced to one to three years. There is a cap on incentives of 50% of the total project cost for non-industrial conservation measures.

EAP is implemented in the Connecticut Light and Power (CL&P) service area, and on a smaller scale in the Western Massachusetts Electric Company (WMECO) service area. Most program savings are realized from the CL&P program.

The program is marketed to non-residential customers whose monthly demand exceeds 250 kW: schools and institutional buildings, hospitals, offices, commercial buildings, colleges and universities, and industrial facilities. Although the program is not limited to these customers with larger demand, smaller customers are encouraged to participate in NU's other incentive programs – the Energy CHECK and Energy-Saver Lighting Rebate programs.

The program is primarily implemented through seven "contractor/arrangers" or C/A's. C/A's are independent consultants who, under contract with NU, provide financial and technical services to EAP participants. For customers who have their own in-house expertise, the Customer Initiated Program allows customers to receive incentives for energy-efficiency retrofit projects without the assistance of the C/A.

Participation in the program is initiated by one of NU's Engineering and Marketing Services representatives, or through the project administrators located at one of six regional offices. Eligible customers are put into contact with a C/A. The C/A then performs a detailed energy analysis survey (EAS), after first confirming the potential for significant energy saving through a preliminary facility evaluation (PFE). Recommended energy conservation measures are analyzed for cost-effectiveness and, after approval by NU, the project enters the construction phase. Prior to entering the construction phase, an implementation plan is developed, which sets forth the conditions under which incentives will be paid.

EAP was initiated in 1988 and has generated total annual energy savings of 86.5 GWh and summer demand savings of 13.2 MW in the four-year period 1988 to 1992. Approximately 113 projects have been completed as of the end of 1992, with another 363 underway.

MARKETING AND DELIVERY

EAP is marketed through NU's Customer Engineering and Marketing Services (CE&MS) representatives to all large non-residential customers with monthly demand greater than 250 kW. In 1988, when the program was initiated, CE&MS representatives at NU contacted 273 customers. [R#4]

Additional marketing is covered by project administrators in each of NU's six regional offices. Typically, the project administrator will inform potential participants of the program and determine their level of interest. The project administrator also conducts a pre-participation screening which includes an evaluation of some or all of the following factors: whether the customer has the financial resources to pursue a major retrofit; what the customer's current equipment consists of and whether, on a superficial level, there exists opportunity for energy-efficiency improvements; and what the program budget and backlog are, which determines whether the program can handle a new participant.

After it has been determined that a customer is eligible, appropriate, and interested, a preliminary facility evaluation is conducted by the C/A. Through this first stage, conservation potential is assessed and a written evaluation regarding possible costs, savings, and incentives is prepared. The cost of the evaluation is always covered by EAP, regardless of whether participation in the program is pursued.

If the potential for cost-effective energy conservation measures is identified, then an Energy Analysis Survey (EAS) is conducted by the C/A. The cost of the EAS is set in advance, and the customer signs an agreement stating the conditions of payment. The participant pays the full cost of the EAS, and is reimbursed for 50% of the cost after the retrofit project is completed. Reimbursement is contingent upon the installation of measures that will result in at least 80% of the savings predicted by the EAS. [R#14]

The EAS identifies cost-effective Energy Conservation Measures (ECMs) which would be appropriate for the customer facility. Measures are separated into three categories, each with their own cost-effectiveness limit:

Manufacturing ECMs	6¢/lifetime kWh saved
Non-manufacturing Cooling ECMs	7¢/lifetime kWh saved
Non-manufacturing ECMs	5¢/lifetime kWh saved

Each EAS includes detailed descriptions of existing equipment, proposed energy conservation measures, and estimates of costs, savings, and incentives for which they would be eligible. The EAS is presented to the customer along with possible financing strategies. If the customer agrees to implement the suggested measures, a Conservation Program Participation Agreement is signed which stipulates the amount of the incentive the project can qualify for and the terms under which incentives will be paid. The agreement also includes a self-generation exclusion clause, by which the participant agrees to return a pro-rated portion of the incentive amount if, within 3 years after the final incentive payment, the customer increases the amount of electricity obtained from sources other than a NU system company.

After the agreement is signed, the C/A develops a specific implementation plan and timeline. Bid specifications are prepared by the customer, who may select the vendor of their own choice. The C/A reviews the bid specifications to ensure correlation with the EAS, monitors work in progress, inspects the vendor's work, and arranges for the final inspection of the project by a quality control contractor.

Incentives are paid based on the actual project costs. The implementation plan may include up to four specific milestones which, upon completion, make the project eligible for partial payment of the incentive. Thus, the full incentive amount may be paid in up to four installments. In this way, customers whose projects are delayed or partially completed may still receive incentives if some energy-efficiency improvements are made. In no case are incentive payments made until the installations are verified by the Quality Assurance contractor. If changes are made in the project during construction, they must be approved in order to be eligible for the agreed-upon incentives. [R#10,11]

MEASURES INSTALLED

Incentives are paid based on the actual project costs and the predicted energy-saving performance of the measures installed. Manufacturing ECMs, which include motors, compressors, and process controls, are eligible for incentives that allow for a one-year payback. Non-manufacturing Cooling ECMs and Nonmanufacturing ECMs are eligible for incentives that bring the project cost down to a three-year payback, with a maximum incentive of 50% of the installed cost. Non-manufacturing Cooling ECMs include chillers, condensers, evaporators, or any other equipment involved in electric cooling systems, but not related to a manufacturing process.

Nonmanufacturing ECMs are those which do not fit into either of the other two categories, such as lighting, HVAC, and domestic hot water equipment.[R#4,5]

The focus of EAP is total energy management. One project initiated in 1990 involved installation of variable speed drives, removal of a 500 kVA transformer, installation of electronic ballasts in mailroom light fixtures, and expansion of the building automation system.[R#4]

Another project at a cutting tool manufacturing facility is expected to result in annual energy savings over 1.5 GWh. The ECMs identified and implemented were primarily process improvements. A vacuum furnace will replace a salt bath, generating 71% of the savings. The replacement of standard motors with high efficiency motors and the conversion of a cyanide bath process to a fluidized sand bed process will account for 14% of the savings. The remaining 15% will result from lighting efficiency improvements.[R#15]

STAFFING REQUIREMENTS

At NU's central office, EAP is implemented primarily by the program manager, Jan Sayko, and three staff. Additionally, staff in the evaluation department, and marketing services are involved in the program. At each of NU's six regional offices, a project administrator is dedicated to EAP. Thus, the total NU staff needs are greater than 10 FTEs.

Additionally, there are seven C/As, mostly engineering firms, with a wide range of staffing levels. There are two quality assurance contractors, one of whom spends 100% of his time performing inspections and verifications; the other quality assurance contractor is less than full time.[R#11]

MONITORING

EAP activities are tracked via a PC-based tracking system. Inputs regarding projects are entered into the system by personnel in each regional office of CL&P and WMECO. The Quality Assurance Contractor also checks and updates information contained in the tracking system as necessary.[R#4,14]

EVALUATION

The incentive structure of the CL&P EAP was analyzed in 1990, and some changes in the program were made as a result. First, the number of categories of Energy Conservation Measures eligible for rebates under the program was expanded to four (lighting, manufacturing, non-manufacturing cooling, and non-manufacturing measures). Second, the cost-effectiveness limit was raised from 4 ¢/kWh to 5 - 7 ¢/kWh, in order to accommodate more projects. Finally, the incentive rates for manufacturing measures were increased from a three-year payback to a one-year payback.[R#4,11]

CL&P also completed a process evaluation of EAP in 1992. The evaluation was based on interviews with participants, non-participants, and other parties involved in program implementation, including C/As, Quality Assurance Contractors (QACs) and NU staff. Site visits and a review of published program documents were also included in the process evaluation. Additionally, focus groups, mail surveys, and telephone surveys were used. The evaluation examined the program objectives and goals, program design and implementation, and its integration with other DSM programs. Recommendations were made regarding many areas where the program could enhance its performance. The program design was found to be successful, with the main recommendation being simplification of the preliminary facility evaluation. The main finding regarding program implementation was that the program time limits should be reduced from the current three-year period. The evaluation reported that, "Virtually all perspectives conclude that the length of time it takes to complete a project is too long."[R#14]

NU recently developed a comprehensive impact evaluation plan, which will be completed in three phases. The first phase, or Historical Projects Study, will determine measure retention for projects completed in 1988, 1989, and 1990. The second phase, or Current Projects Study, will analyze energy savings due to measures installed during 1991 and 1992 using three methods: (1) a billing analysis; (2) site assessments, including interviews with customers and comprehensive on-site verification of measures installed, including a compilation of data from data loggers, strip charts, and other non-billing data; and (3) site specifics, which will not include measurements, but will include a look at bills in the context of information gained from on-site visits and customer interviews. Additionally, the second phase will include a detailed assessment of free-ridership.

The third phase, or Future Projects Study, will seek to establish a basis by which to assess the impact of EAP in the future. The Future Projects Study will build upon the second phase of the evaluation project, utilizing the evaluation methods determined to be most appropriate through the Current Projects Study.[R#12,13]

DATA QUALITY

The costs and savings presented in this profile are as presented in the WMECO and CL&P annual filings for 1988, 1989, and 1990.[R#4,5] The 1991 results were not available.

EAP is unique in that projects initiated through the program are completed over a three-year period. Savings reported are from actual completed measures installed and do not include those in progress. Nor do the savings include those projects where construction has not yet begun, but the EAS has been completed and accepted by the customer. Inclusion of these in-progress and committed projects in the savings and costs for each year would reflect the large scope of EAP.

The 1989 costs far exceeded the amount of savings realized in that year. NU must expend money for program administration and preliminary facility evaluations regardless of whether a project is completed. With a comparatively inordinate number of projects in their beginning stages in 1989, few energy savings were realized due to measures installed in comparison to the costs for that year. In 1990, with the completion of many more projects, the relationship between program costs and savings began to better reflect the success of EAP. These changes are seen in the Cost per Participant and Cost of Saved Energy calculations found in the Cost of the Program section.

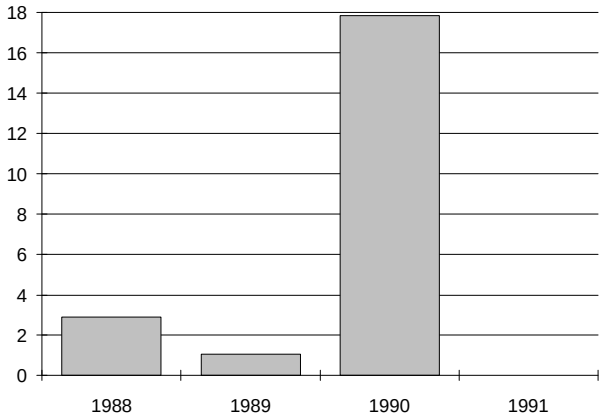
With EAP still in its early years, and with results available only from the first three years of the program, in which many projects begun have not been completed, the true impact of the program is not easily represented. Nonetheless, the data presented in this profile accurately depict the savings and costs realized by the program in the time period for which data have been available. After completion of the impact evaluation planned for 1993, NU will refine its savings and costs data for EAP.

Program Savings

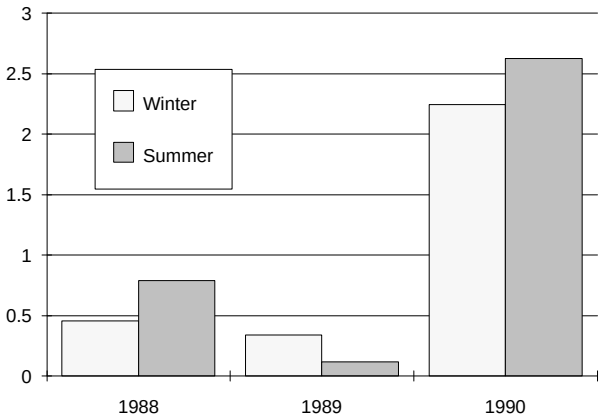
Savings Overview Table	Annual Energy Savings (MWh)	Cumulative Energy Savings (MWh)	Lifecycle Energy Savings (MWh)	Annual Summer Peak Capacity Savings (MW)	Cumulative Summer Peak Capacity Savings (MW)	Annual Winter Peak Capacity Savings (MW)	Cumulative Winter Peak Capacity Savings (MW)
1988	2,909	2,909	61,083	0.79	0.79	0.46	0.46
1989	1,057	3,965	26,994	0.12	0.91	0.34	0.80
1990	17,848	21,813	267,720	2.63	3.54	2.25	3.05
Total	21,813	28,688	355,798	3.54		3.05	

[R#4,5]

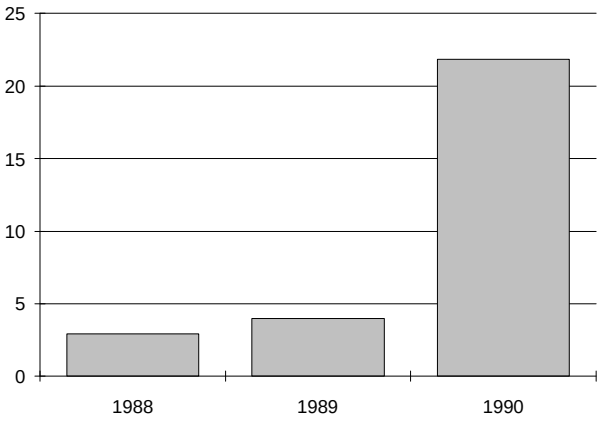
ANNUAL ENERGY SAVINGS (GWH)



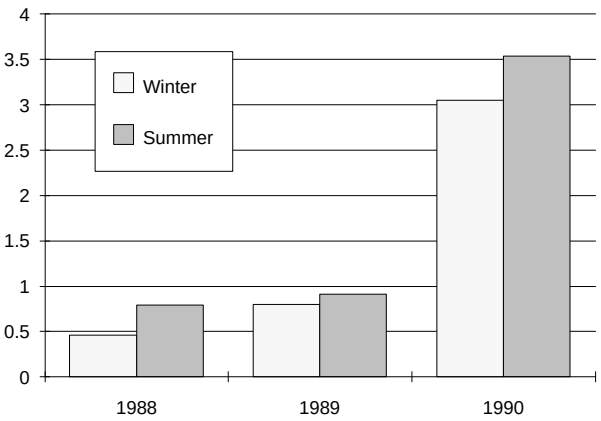
ANNUAL PEAK CAPACITY SAVINGS (MW)



CUMULATIVE ENERGY SAVINGS (GWH)



CUMULATIVE PEAK CAPACITY SAVINGS (MW)



In the first three years of the program, from 1988 to 1990, annual energy savings from measures installed totaled 21.8 GWh, total cumulative savings were 28.7 GWh, and lifetime savings were in excess of 355 GWh. Summer and winter peak capacity savings were significant, at 3.54 MW and 3.05 MW, respectively. Because projects take three years to complete, annual savings due to the program will not reach a steady level until the program has been in existence long enough to have a stabilized participation and project completion rate. NU estimates that total annual savings attributable to the program for the period 1988 to 1992 are 86.5 GWh, and total summer demand savings are 13.2 MW.

PARTICIPATION RATES

As shown in the Participation Table, the number of projects initiated in each year far exceeds the number of projects completed. Again, this is due to the fact that projects

Participation Table	Number of Projects Initiated	Number of Projects Completed	Annual Energy Savings per Completed Project (kWh)
1988	264	39	74,583
1989	219	8	132,088
1990	219	N/A	N/A
1991	108	N/A	N/A
1992	44	N/A	N/A
Total	854	113	

[R#4,5,19]

may take up to 3 years to complete. The number of projects completed in 1990, 1991 and 1992 was not available.

The EAP is designed for, but not always limited to, large commercial and industrial customers whose monthly demand exceeds 250 kW. This target market is comprised of approximately 1,700 commercial customers and 1,000 industrial customers. With 1,000 EAP participants, or 37% of the target group, EAP is meeting its goals for participation.[R#11]

MEASURE LIFETIME

Because most EAP projects are comprised of several different measures being installed, average lifetime varies from project to project, and from year to year. Average lifetimes in each year are shown below:

1988	21 years
1989	26 years
1990	15 years

The drop in lifetime between 1989 and 1990 was due to the change in incentive structure for EAP and other NU programs. Before 1990, the commercial and industrial lighting rebate program (called Energy-Saver Lighting Rebate) had offered prescriptive rebates for lighting projects, attracting a large number of participants who might otherwise have pursued such projects under EAP. In 1990, the incentive structure for the Energy-Saver Lighting Rebate program was changed to better correspond with the rebates that customers would get under EAP. Thus, in 1990, comparatively more lighting measures, with shorter lifetimes, were included in the EAP programs than in previous years.[R#11]

PROJECTED SAVINGS

In 1992, NU forecast loads and resources through the year 2011. In 2011, annual energy savings due to EAP are projected to be 747 GWh for CL&P, and 160.5 GWh for WMECO, for a total of 907.5 GWh. Summer demand reduction is projected at 189.7 MW, with 153.8 MW from CL&P and 35.8 MW from WMECO. Winter demand reduction is expected to be 158.2 MW in 2011, with 130.5 MW from CL&P and 27.7 MW from WMECO.[R#3]

In its present form, EAP will have reached the entire target market within the next few years. However, as technologies and costs change, the program is expected to be revised to accommodate such changes, potentially making new types of projects cost-effective. Thus, some customers who have already installed all identified cost-effective measures could later find that new projects are eligible for incentives under EAP.[R#3,11]

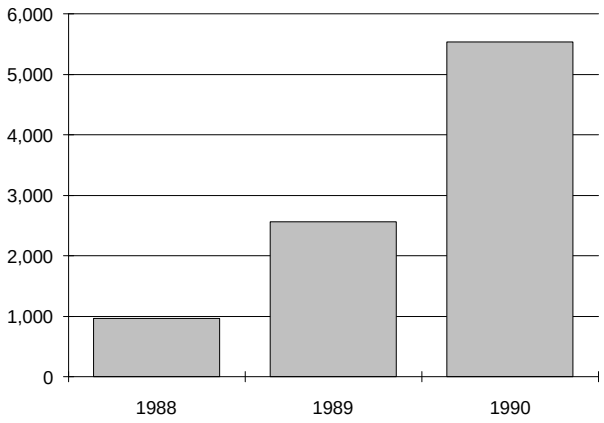
Cost of the Program

Costs Overview Table	WMECO Cost (x1000)	CL&P Cost (x1000)	Total Program Cost (x1000)	Cost per Completed Project
1988	$228.0	$733.6	$961.6	$24,657
1989	$386.1	$2,179.6	$2,565.7	$320,716
1990	$970.3	$4,570.9	$5,541.2	*
Total	$1,584.4	$7,484.1	$9,068.5	

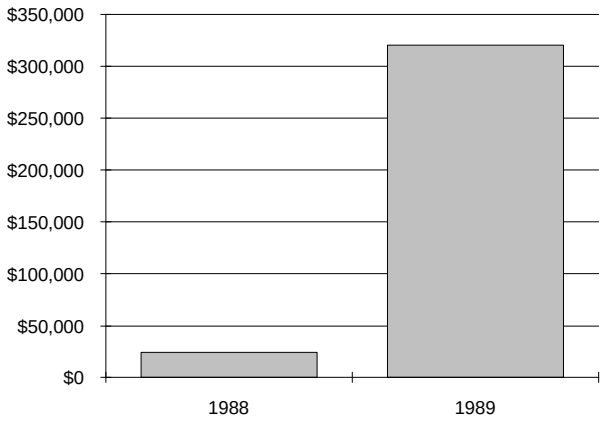
[R#4,5]

* Number of completed projects in 1990 was not available.

TOTAL PROGRAM COST (x1,000)



COST PER COMPLETED PROJECT



Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1988	2.14	2.36	2.58	2.81	3.05	3.30	3.56
1989	13.74	15.35	17.04	18.81	20.67	22.59	24.57
1990	2.60	2.79	2.99	3.20	3.41	3.63	3.85

Between the years 1988 and 1990, CL&P spent almost $7.5 million, primarily on incentives, on EAP. WMECO costs have been $1.6 million in the three-year period 1988 to 1990, with total costs for EAP at $9.1 million for that period.[R#5]

COST EFFECTIVENESS

In order to be eligible for incentives under EAP, measures must meet the cost-effectiveness criteria. This is determined by dividing the estimated cost of installing the measures by the projected lifetime kWh savings that will result. Measures must have lifetime costs of between 5 and 7 ¢/lifetime kWh saved, depending upon the type of measure.

The Results Center calculated the cost of saved energy for each program year, based on the total program expenditures and savings from completed projects for each year. In 1989, many expenditures (e.g. for preliminary facility evaluations) were made for projects not yet completed, thus skewing the cost of saved energy calculation for that year. At a discount rate of 5%, the cost of saved energy was 2.58 ¢/kWh in 1988, 17.04 ¢/kWh in 1989, and 2.99 ¢/kWh in 1990.

COST PER PARTICIPANT

The Results Center calculated total EAP costs per completed project at $24,657 in 1988 and $320,716 in 1989. The cost per participant in 1989 appears high due to expenditures that were applied toward projects not yet completed, and thus not included in the participant data.

FREE RIDERSHIP

Data presented by CL&P and WMECO in its conservation and load management reports is adjusted for free-riders by 5.1% for commercial customers, and 3.8% for industrial customers, however the estimate is not based on any empirical evidence. NU currently has studies underway which will attempt to quantify free-ridership.

For many EAP participants, electricity costs represent only 3% to 5% of their overall costs. For such customers, the incentives from EAP are the primary motivation for improving energy-efficiency. EAP tries to catch these customers when they are already planning to change their process equipment or implement other changes. NU does not believe that these customers would be inclined to implement many energy-cost saving measures in the absence of EAP. In fact, some companies have decided not to install identified ECMs even when as much as 90% of the total measure costs could be covered by EAP.[R#11]

COST COMPONENTS

CL&P payroll costs were $0.7 million, or 9.4% of the total program cost. Payments to C/A's and quality assurance contractors account for an additional 10% of the program costs, with the remaining 80% going directly toward incentive payments.[R#4,11]

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%	61,850,000	1,467,000	297,000	30,000
B	10,000	1.20%	65,953,000	568,000	192,000	142,000
	Controlled Emissions					
A	9,400	2.50%	61,850,000	147,000	297,000	2,000
B	10,000	1.20%	65,953,000	57,000	192,000	9,000
C	10,000		65,953,000	379,000	189,000	9,000
	Atmospheric Fluidized Bed Combustion					
A	10,000	1.10%	65,953,000	174,000	95,000	47,000
B	9,400	2.50%	61,850,000	147,000	119,000	9,000
	Integrated Gasification Combined Cycle					
A	10,000	0.45%	65,953,000	117,000	19,000	47,000
B	9,010		59,326,000	42,000	14,000	3,000
Gas	**Steam**					
A	10,400		35,974,000	0	82,000	0
B	9,224		31,241,000	0	196,000	9,000
	Combined Cycle					
1. Existing	9,000		31,241,000	0	120,000	0
2. NSPS*	9,000		31,241,000	0	57,000	0
3. BACT*	9,000		31,241,000	0	8,000	0
Oil	**Steam--#6 Oil**					
A	9,840	2.00%	52,068,000	789,000	93,000	88,000
B	10,400	2.20%	55,224,000	783,000	117,000	57,000
C	10,400	1.00%	55,224,000	112,000	94,000	30,000
D	10,400	0.50%	55,224,000	328,000	117,000	18,000
	Combustion Turbine					
#2 Diesel	13,600	0.30%	69,108,000	138,000	214,000	12,000
Refuse Derived Fuel						
Conventional	15,000	0.20%	82,047,000	211,000	278,000	62,000

Avoided Emissions Based on 28,687,614 kWh Saved (1988-1990)

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 environmental costs are beginning to be factored into utility resource planning. 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 NU's level of avoided emissions saved through its Energy Action 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.

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.

*** Acronyms used in the table**

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

LESSONS LEARNED

EAP has been particularly successful in achieving significant energy savings from customers for whom energy-efficiency is not necessarily a priority. Through close customer contact, EAP staff are able to identify customers who are planning to implement changes in their facilities, and inform them of the potential for increased savings through EAP. Program Manager Jan Sayko says that one of the biggest hurdles is getting the customers to decide to initiate a retrofit project. Once the decision is made, EAP makes it easy to finish a project, by assisting with project planning, design, and implementation. Additionally, EAP provides expertise and advice to help overcome any obstacles that may be encountered along the way.

Although EAP is targeted toward customers with demand greater than 250 kW, smaller customers are not excluded from participation. This flexibility has enhanced the number of program participants and allowed the program to realize savings that may not otherwise have been obtainable. Some of EAP's most successful projects have been at regional school systems and universities. Most primary and secondary schools do not have demand that exceeds 250 kW, however the total demand of a school system is usually greater than the limit.

Because customers are screened before participation in the program is encouraged, few projects are initiated that are not carried through to completion. On average, most participants install about 80% of the measures that are recommended in the Energy Analysis Survey.

NU has found that the incentive payment schedule must be carefully set up in order to avoid payment for partially completed projects that do not achieve a majority of the identified savings. Implementation plan milestones are selected to ensure that incentive payments correspond with actual energy-efficiency improvements. NU tries to avoid situations where customers install only the most expensive of the eligible measures if those measures represent a relatively small proportion of the total potential energy savings.

EAP also has a subtle educational component. Implementing super-efficient technologies in large commercial, industrial, and institutional facilities exposes the users of these facilities to concepts of energy-efficiency which they may not be familiar with. Whether a first grade student is told that the new lights in the elementary school are saving electricity, or a newspaper reporter notices that the building climate is less variable and more comfortable with the new automated heating and cooling system, through EAP, energy users are introduced to the positive aspects of energy-efficiency.

TRANSFERABILITY

The program concepts presented in this profile of EAP are readily transferable to other service territories. NU has overcome institutional barriers to energy efficiency in a customer class whose energy bills constitute only a small fraction of total costs. Similar barriers are likely to exist throughout North America, and can be effectively overcome with programs similar to EAP.

Northeast Utilities' Energy Action Program is subject to a different incentive mechanism in each of NU's operating subsidiaries' service territories located in Massachusetts and Connecticut. The following information provides a brief sketch of integrated resource planning and DSM cost recovery in Massachusetts, and the specific incentive mechanism for NU's Massachusetts subsidiary Western Massachusetts Electric, followed by a similar discussion specific to Connecticut and NU's subsidiary Connecticut Light and Power.

MASSACHUSETTS

The Massachusetts Department of Public Utilities (DPU) has eliminated virtually all financial barriers to DSM by allowing all utilities in the state to recover DSM program costs and approving a mechanism for lost revenue recovery proposed by Western Massachusetts Electric Company (WMECO). In 1990, and again in 1991, the DPU approved shareholder incentive mechanisms for the state's two largest investor-owned utilities, WMECO and Massachusetts Electric Company (MECo).[R#17]

DPU orders in 1988, 1989, and finalized in 1990 established an IRP process based on competitive all-source bidding. The DPU instituted a collaborative process among utilities and intervenors for the design of utility DSM programs in August of 1988. Utilities are required to submit annual resource plans to the DPU that consider DSM programs on a level playing field with supply resources.[R#17,18]

Utilities in Massachusetts may expense or capitalize DSM expenditures. Each utility must propose to the DPU the specific treatment that it prefers. Beginning in mid-1991 the DPU ordered each electric company to institute a separate conservation charge to collect all DSM related costs including incentive and lost revenues that can be reconciled.[R#17,18]

The DPU expects that after sufficient time to evaluate a full year's program experience, the utilities should move to a performance-based recovery system of cost recovery. MECo and WMECO were ordered to include in their proposed preapproval contract for 1992 a recovery mechanism that ties cost recovery to actual savings performance.

WESTERN MASSACHUSETTS ELECTRIC'S INCENTIVE MECHANISM

The incentive mechanism available for WMECO's DSM programs is based on the savings that the programs produce for ratepayers. The Massachusetts Department of Public Utilities (DPU) approved WMECO's incentive structure based upon the idea that an "incentive bonus should not be based only on dollars spent since this rewards the Company for spending money rather than producing savings." The Massachusetts DPU, therefore, allows WMECO to collect an incentive based upon measured energy and capacity savings. The incentive is equal to 5% of the net benefits of the program after achieving at least 65% of the savings. (Net benefit is defined as the difference between total cost, including customer cost, and total benefit, and does factor in environmental externalities which are based on the company's proxy power plant which drives avoided cost.)[R#6,18]

Prior to each program year, the incremental values of each kWh and kW of capacity saved are set, as well as a target savings level for the program. The utility can only earn an incentive if it has achieved at least 65% of the target savings. Beyond 65%, WMECO earns a fixed amount for each measured kWh and kW saved. The incentive structure is designed so that if WMECO achieves 35% above the threshold, which equals 100% of the target savings level, it will receive the full target incentive. If WMECO achieves 135% of the target savings level, it will have doubled the amount of savings on which an incentive is available and, similarly, it will have also doubled the incentive which it will earn.[R#4,8,9,18]

If WMECO spends more than it has budgeted for the program, the threshold before which it can earn an incentive rises proportionately. The value of each kWh and kW saved is constant throughout the program year, regardless of threshold increases. Programs that do not meet the threshold are simply ineligible for incentives; there is no further penalty.[R#4,8,9]

CONNECTICUT

Integrated Resource Planning is in practice in Connecticut through requirements that utilities submit conservation

and load management plans to the DPUC annually. A comprehensive IRP filing is currently required biannually. By law, Connecticut's utilities may recover the costs of DSM programs by capitalizing and amortizing most expenditures and including them in the ratebase.

The Connecticut Department of Public Utility Control (DPUC), has taken action to reduce or eliminate most of the financial disincentives to DSM and has put in place a financial incentive for utilities to promote cost-effective DSM. Both United Illuminating and Connecticut Light and Power (the state's largest utility) have conservation sales adjustment clauses and incentive mechanisms for a bonus rates of return on conservation and load management activities.[R#17,16]

A 1988 statute allows the DPUC to grant utilities an additional 1-5% rate of return on ratebased DSM investments. The statute also directed the DPUC to allow private power producers, both supply-side and demand-side to sell blocks of power or savings to utilities. The DPUC issued the regulations to carry out the statute in 1989.[R#17]

A 1991 statute authorizes the DPUC to direct utilities to implement DSM programs consistent with IRP principles and allows the DPUC to award utilities a bonus rate of return on DSM program expenditures treated not only as ratebased expenditures but as operating costs. The act also set forth policies to promote programs for economic development, conservation, and load management.[R#17]

THE CONNECTICUT INCENTIVE MECHANISM

Northeast Utilities and the Connecticut Department of Public Utility Control have finalized a modified shared savings plan for DSM programs implemented by CL&P. The approved plan is a modified product of the New England Collaborative Process. It will allow CL&P to earn a bonus above its normal rate of return on its aggregate demand-side management expenditures. (Each program is scored individually, though the ultimate incentive is based on the aggregate of the programs' scores.)

The bonus rate of return is a function of the "aggregate performance score" (APS). The APS is a relationship between achieved and planned results for all DSM programs added together. The greater the value of the APS, the higher the rate of return that CL&P is allowed on its DSM expenditures.

Also determined prior to the program year are the minimum performance standards (MPS) which each program must achieve. (The MPS is 60% of planned net savings for the year.) CL&P is assessed a "penalty" for programs that do not meet the MPS. In cases in which CL&P has implemented a program as designed and yet the program has not met its MPS for reasons outside of CL&P's control, the DPUC can waive the MPS if it so chooses.

Although termed a penalty, the "incentive penalty" only removes certain program expenditures from earning a bonus rate of return. These expenditures are still eligible to receive the normal rate of return that the DPUC has approved for capital expenditures. Therefore, the "penalty" is actually just the absence of a reward. The utility loses no revenue.

The net bonus incentive payment is calculated by taking into account both the "gross bonus incentive payment" and the "incentive penalty." These values are calculated at the end of each program year. First, the APS is calculated to determine the bonus rate of return that CL&P can earn on its total DSM expenditures for that year. The bonus rate of return is then added to the normal rate of return and applied to the entire DSM expenditure, yielding the gross bonus incentive payment. Next, the same rate of return is applied to the total of all expenditures for all programs that did not meet the MPS. This value is the incentive penalty. The penalty is subtracted from the gross bonus incentive payment to yield the net bonus incentive payment. This is the utility's reward for implementing its DSM programs in the program year.[R#4,8,9,16]

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