Northeast Utilities
Lighting Catalog Program
Profile #21, 1992

Executive Summary

Northeast Utilities' Lighting Catalog Program is a relatively simple program designed to correct the market imbalance between conventional residential lighting sources and far more efficient, yet more costly, energy-efficient lighting products. NU developed a mail order program, based on a catalog that is circulated to its residential customers, to increase the penetration of energy-efficient lighting in the residential sector by offering subsidized prices for the equipment. For instance, while integral compact fluorescent lamps have list prices ranging between $15-22, NU offers the same lamps to its customers for $4 each!

The program began in September of 1990 and follows a basic process. First, the program is marketed using advertisements in newspapers and bill stuffers, both of which refer customers to a toll-free number: 1-800-5-BRIGHT. By calling the number, the customer receives the lighting catalog which describes 38 energy-efficient lighting products and includes an order form with a postage-paid envelope and a phone number that customers can call if they have questions. (Orders are handled by an independent contractor.) All products ordered carry a 30-day money back guarantee for anyone who is not completely satisfied with any product purchased though the program.

The program to date has outstripped its planners' projections. The initial print run of 100,000 catalogs was expected to last a year but was depleted after 6 months. Between September 1990 and October 1992 38,700 orders were filled, with orders averaging 10.7 products each. The estimated average savings per Lighting Catalog order is approximately 510 kWh/year. The program has resulted in annual energy savings of 19,800 MWh and lifecycle energy savings of more than 198 GWh. To date only 3% of NU's eligible customers have participated in the program.

NU's customers have spent a total of $1.8 million on products ordered from the Lighting Catalog program. Through 1992, NU spent a total of approximately $3.9 million on the program, or just over $100 per participant, compared to the average customer cost of about $50. The utility's cost for 1992 resulted in a cost of saved energy of 2.62¢/kWh at a 5% discount rate, although the first year cost of saved energy was considerably higher due to program startup costs.

NU has avoided restraint-of-trade criticism by encouraging manufacturers, wholesalers, distributors, and certain retailers to bid on the supply of catalog products. However, as the market changes, it seems likely that the Lighting Catalog prices will have to be increased in order to allow for fair competition with retail suppliers. Eventually, the Lighting Catalog will be phased out in favor of a mail-in rebate program that emphasizes retail availability of energy-efficient lighting products.

NU Lighting Catalog Program

Utility:	Northeast Utilities
Sector:	Residential
Measures:	Energy-efficient lighting
Mechanism:	Utility sells lighting products through catalog below wholesale cost
History:	Began in 1990 and continues through the present

1992 Program Data

Energy savings:	8.24 GWh
Lifecycle energy savings:	82.39 GWh
Cost:	$1,668,917

1990 - 1992 Program Data

Cumulative savings:	31.9 GWh
Lifecycle energy savings:	198.1 GWh
Cost:	$3,915,793
Participation:	3%

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'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]

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

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:

CURRENT DSM PROGRAMS AT CL&P

RESIDENTIAL

Energy Value Water Heating

Energy Value Home

Energy Conservation Loan Program

Operation Solar

SPECTRUM

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

Weatherization Residential Assistance Partnership (WRAP)

- Energy Care
- 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

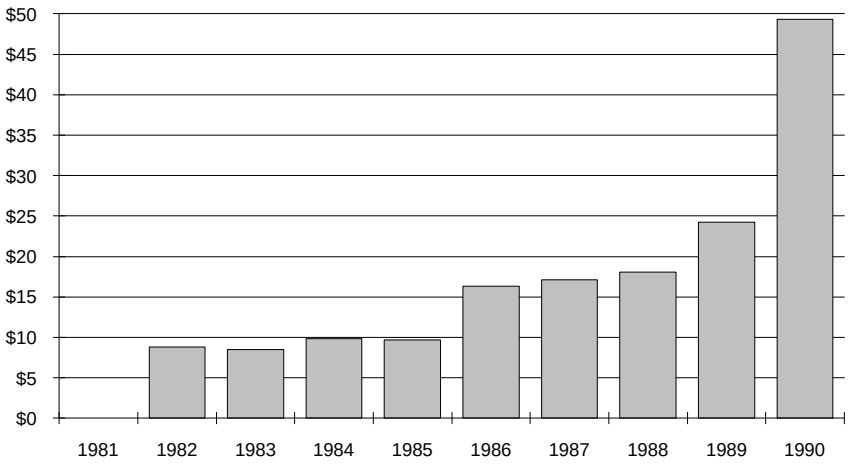
Utility DSM Overview Table	DSM Expenditure ($1000)	Annual Energy Savings (GWh)	Annual Summer Capacity Savings (MW)
1981	$0	20.6	2.2
1982	$8,775	54.1	9.7
1983	$8,462	57.2	10.2
1984	$9,816	60.8	11.3
1985	$9,645	60.9	12.1
1986	$16,344	58.7	12.3
1987	$17,098	77.7	10.3
1988	$18,047	62.8	108.7
1989	$24,240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

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.

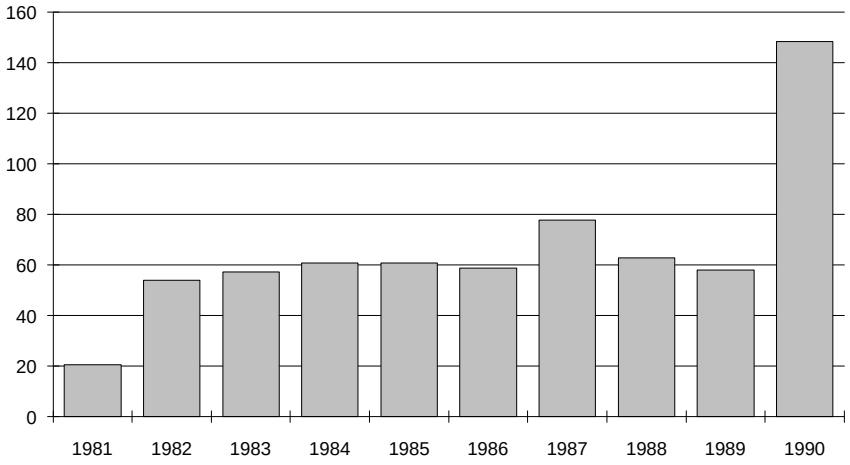
The first year of the collaborative process, 1988, was a very important transition year for Energy Alliance. Virtually all DSM programs were reviewed and redesigned. The collaborative's program planning concentrates on three large customer groups: 1) residential, 2) low-income residential, and 3) commercial/industrial. 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]

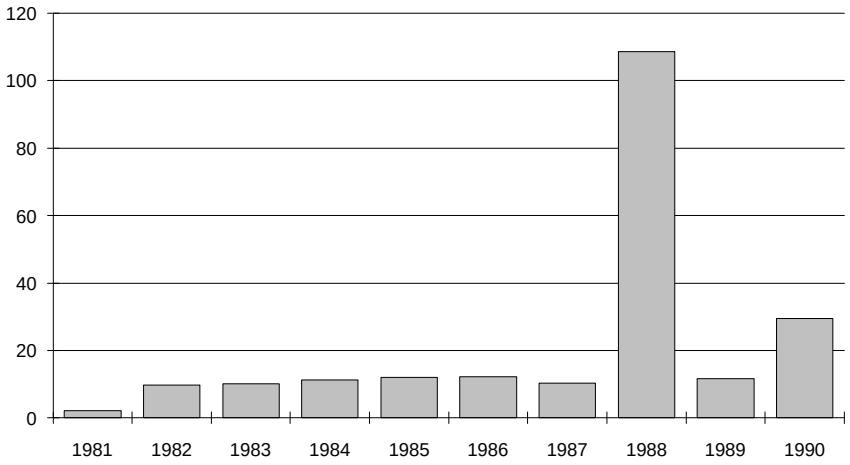
ANNUAL DSM EXPENDITURE ($1,000,000)



ANNUAL ENERGY SAVINGS (GWH)



ANNUAL SUMMER CAPACITY SAVINGS (MW)



Program Overview

The Lighting Catalog Program is a mail order program designed to increase the penetration of energy-efficient lighting in the residential sector. Through the program, energy-efficient lighting products are offered at subsidized prices to NU's residential customers. The program began in September of 1990 and is currently an active DSM program.

Customer participation in the program is simple. First, the customer obtains a free Lighting Catalog. The catalog is promoted through newspaper ads and utility bill stuffers, and may be ordered by calling a toll-free number. It is also available at the Company's field offices and at trade and home shows. The customer may choose from 38 energy-efficient lighting products from the listings in the catalog. The catalog includes a postage-paid envelope and a phone number that customers can call if they have questions. Upon receipt of their order, the customer is responsible for installing the lamps and fixtures.

The Lighting Catalog program is part of NU's SPECTRUM programs for residential customers. The program evolved from NU's direct installation program, which has been operating since 1987 and is still active. The direct-installation lighting program originally focussed on low-income customer-assistance, but has been expanded to include installations in conjunction with all conservation and load management site visits. Through the collaborative process, the Lighting Catalog concept was born, designed to reach a larger customer base than the direct-installation program, and to provide an easy means for direct-installation participants to replace the lamps which had already been installed in their homes. NU is also implementing a mail-in rebate program for lighting products. After some market transformation has been accomplished, the Lighting Catalog program will be phased out and more emphasis will be placed on the mail-in rebate program.

NU learned quite a bit from the direct-installation program about customer's receptivity to energy-efficient lighting products. Participants' comments on the products were carefully considered in the development of the Lighting Catalog program. For example, a common complaint was that some free-standing lamps were made top-heavy after installation of a compact fluorescent bulb. As a result, the Lighting Catalog specifically mentions this possibility and describes how customers can determine whether tipping will be a problem with their new product.

NU selected the products to be included in the catalog, considering product availability, quality, and applicability. To this end, NU drew on its experience with the direct-installation program. Thus, harp adapters and socket adapters are offered through the catalog. Indoor and outdoor lamps and fixtures are included, with suggestions for appropriate uses of each product appearing in the catalog description.

After two years of operation, the Lighting Catalog program has proven to be very successful. Customers' requests for catalogs far exceeded NU's projection. The initial print run of 100,000 catalogs, which was expected to last 1 year, was depleted after 6 months. Between September, 1990 and October, 1992, 38,700 orders were filled, with orders averaging 10.7 products each.

MARKETING AND DELIVERY

The Lighting Catalog program has been implemented with a minimum of advertising and promotion. Bill stuffers, newspaper ads, and displays are used to convey basic information about energy-efficient lighting products to customers who may not be familiar with the technology. The bill stuffers and advertisements explain that energy-efficient light bulbs last longer, use less energy, and save money. The copy discusses the discounts that customers can receive through NU's Lighting Catalog, and includes the toll-free number through which customers can request a catalog. Displays of the products available through the Lighting Catalog are set up at all seventeen of NU's local offices, providing customers with an easily accessible opportunity to see the products in operation before ordering them.

The catalog itself provides extensive information on the products and their suggested uses. Pictures and graphs explain the energy and monetary saving advantages of compact fluorescent lights, as well as the variety of applications. Photographs of each product appear along with a table indicating the dimensions of the product and its appropriate incandescent equivalents. The catalog includes a 30-day money back guarantee for anyone who is not completely satisfied with any product purchased though the program. In order to encourage customers to tell others about the program, there is a request on the last page of the catalog to "...please pass [it] along to a friend or neighbor".

Lighting Catalog Products	Manufacturer's Suggested Price Range	Lighting Catalog Price Range
Quad Tubes	$9 - $13	$4
Circular Bulbs	$13	$4
Compact Fluorescent Integral Units	$15 - $22	$4
Crystal Light Indoor Fixtures	$40 - $64	$15 - $23
Circular Indoor Fixtures	$32 - $69	$12 - $25
Harp or Socket Adapter	$2 - $3	$1
Motion Control Switch	$63	$15
Outdoor Fixtures	$35 - $116	$20 - $40
Outdoor Floodlight	$76	$27
Replacement Bulbs	$5 - $38	$1 - $10

The catalog lists over thirty products, including replacement lamps, from which the customers can choose. Customers can place their orders by mail or telephone, (the toll-free number is easy to remember -- 1-800-5-BRIGHT). To prevent people from outside NU's service territory from ordering these highly subsidized lighting products, the purchaser is required to give his or her residential electric service account number. Once an order is made customers are told to allow four to six weeks for delivery.

MEASURES INSTALLED

The products offered through the Lighting Catalog and the range of prices are shown in the Lighting Catalog Products Table. Prices shown are in 1992 dollars and represent the range for varying styles for each product.

Compact fluorescent lamps in 18, 22, 13, and 9 watt styles represent fully 92% of all sales, at 36%, 28%, 22% and 6%, respectively. The remaining 8% of orders were distributed among the other catalog products.

STAFFING REQUIREMENTS

Inventory maintenance and order fulfillments are handled through a contract with Resource Conservation Inc. (RCI) located in Stamford, Connecticut. Most orders thus come directly to RCI, however sometimes calls regarding the program come into NU's offices, and NU's staff is available to answer questions before passing customers on to RCI. Approximately 10 full time equivalent staff perform functions related to the Lighting Catalog at RCI.

Staffing at NU for the Lighting Catalog program requires approximately one-half of a full-time equivalent, split among the NU director of residential programs and several other NU staff. [R#10]

Monitoring and Evaluation

MONITORING

Lighting Catalog orders received by the contractor, Resource Conservation, Inc., are entered into a database on a daily basis. The database tracks the details of each order, including customer information. To ensure that the lighting products sold through the catalog are installed in NU's service territory, customers' orders must be accompanied by their residential electric account number. Although this mechanism by no means precludes the installation of the products outside the service area, such installations have been at least limited.

EVALUATION

An independent group, Bourget Research Group, conducted the 1991 evaluation of the Lighting Catalog Program. Participants and non-participants in NU's service territory were surveyed by telephone and in-person interviews were conducted during the month of October 1991. The survey generated specific information on product installations and also sought to determine how well the program is meeting its objectives.

In order to improve annual and lifecycle energy savings estimates, the survey determined the answers to the following questions:

- Which of the purchased items had been installed within NU's service territory?
- What was the wattage of the lighting products replaced?
- How many hours per day were the new lighting products used?
- How many hours per day were the old lighting products used?

The survey revealed that over 99% of the participants installed the lighting products within NU's service territory. Thus, the practice of requiring a customer's residential electric account number as part of the purchase order was deemed sufficient for limiting the distribution of lighting products to NU's target group.

The survey also determined the wattages and typical hours of use for 2,569 lamps that survey respondents had replaced with Lighting Catalog products. Typically the wattage of the old lamps ranged from 40 to 150 watts while the new replacement lamps ranged from 13 to 22 watts. The weighted average wattage difference between the old and new lamps was ~56 W. The new products were reportedly not used any differently than the old lamps, with average usage of approximately 4.5 hours per day for the old lamps and their new replacements.

The survey also determined the number of products actually installed by the purchasers. The average purchase order was for 10.7 items. Fifty-one percent of the survey respondents indicated that they had installed all of the products they had ordered, 47% installed some of the products, and 2% had not installed any. The average percentage installed was 64.3%, or 6.88 products per order. Many customers purchased lamps specifically for use as replacements which had not yet been necessary at the time of the survey.[R#4]

There was some discontinued use of Lighting Catalog products. Of the participants surveyed 13% said that they had stopped using at least some (average of ~2) of the products that they had purchased and installed. If this response is typical of all users then ~4% of all installations were removed. The main reasons given for discontinued use of the catalog bulbs and fixtures were that the bulbs were not bright enough, the products did not work properly, or the bulbs were too big.

DATA QUALITY

Because the savings estimates were based on participants' responses and not measured data, estimates are greatly affected by the accuracy of the customers responses. Many people are not likely to know the exact answer to questions regarding the average daily hours of use of lamps and the wattage of the old lamp which was replaced. Additionally, savings estimates for the program as a whole were extrapolated from the results of the survey. That is, the reported installation and usage patterns of 582 program participants who had installed 2,606 products were assumed to mimic the installation and usage patterns of all participants. Nonetheless, the estimates are well within typical values for other residential lighting programs.

The savings figures presented in the Savings Overview Table were provided by NU, as was the average measure lifetime for each year. The estimate of the measure lifetime was calculated based on a weighted average of the manufacturers' specified lifetime of each product purchased in each year and the customers' reported daily hours of use. Average lifetime was reported by NU to be 7.2 years in 1990, 10.14 years in 1991, and 10.0 years in 1992.

Cost data for 1991 were provided by NU, while 1990 costs are as reported in the WMECO and CL&P DSM reports.[R#7,12] The utility cost per participant was calculated by The Results Center for the period September, 1990 to December 31, 1991 by dividing the summed expenditures from 1990 and 1991 by the total number of orders shipped in that period.

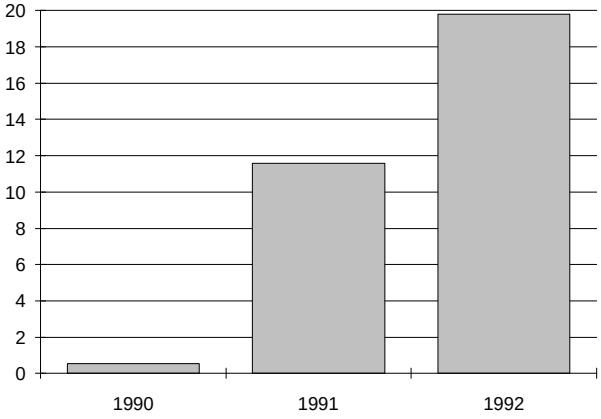
Throughout this profile, information on number of orders includes only those orders shipped during given periods, not orders placed. Similarly, the customers costs are for the orders that have been shipped, and do not include any pre-payments for orders not yet filled.

Program Savings

Savings Overview Table	Annual Energy Savings (MWh)	Cumulative Energy Savings (MWh)	Lifecycle Energy Savings (MWh)
1990	552	552	3,996
1991	11,013	11,565	111,708
1992	8,235	19,800	82,393
Total	19,800	31,918	198,097

ANNUAL ENERGY SAVINGS (GWH)

CUMULATIVE ENERGY SAVINGS (GWH)



The estimated average savings per Lighting Catalog order is about 510 kWh/year. More than 22,000 orders were filled from the program start in late 1990 through the end of 1991, accruing annual energy savings of 11.6 GWh. Between January 1, 1992 and October, 1992, 16,105 orders were filled, with energy savings of 8.2 GWh. The lifecycle savings for the program to date total more than 198 GWh.[R#4,10]

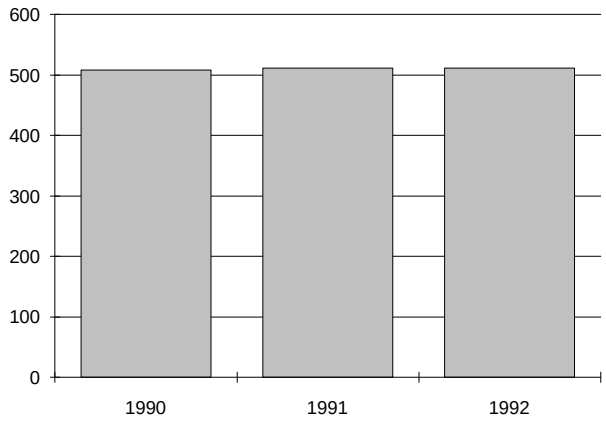
MEASURE LIFETIME

The average measure lifetime used by NU has varied from 7.2 years in 1990 to 10.14 years in 1991. For 1992, lifetime is estimated to be 10.0 years. Lifetime was determined from the weighted average of the manufacturers specified product life for each product sold, and the assumption that each product is used an average of 4.5 hours per day.

Participation Table	Number of Orders Shipped	Annual Energy Savings per Order (kWh)
1990	1,087	508
1991	21,529	512
1992	16,105	511
Total	38,721	

[R#10]

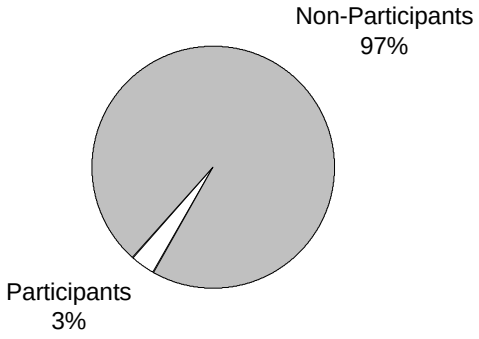
ANNUAL ENERGY SAVINGS PER CUSTOMER



PARTICIPATION RATES

A total of 38,721 orders have been shipped between September, 1990 and October, 1992. In 1990 and 1991, 22,616 orders were shipped, and 16,105 were shipped between January 1 and October, 1992.[R#10]

In 1991 NU had 1,150,357 residential customers, who represent the target group for the Lighting Catalog program. Because the program is fairly new there is a high probability that there are few repeat customers. Thus, with 38,721 orders placed, the participation rate is about 3%.



PROJECTED SAVINGS

If the 1992 rate of 1,600 orders per month is maintained, then at 510 kWh/order and 19,200 orders per year, annual energy savings of 9.8 GWh will be accrued each year that the program continues. This estimate is likely to be conservative, as the annual energy saving per order estimate is based on a 64.3% installation rate, which does not account for installations of replacement bulbs that may have been included in each order. The actual per order energy savings are likely to be somewhat higher than 510 kWh, and the resulting projected saving would thus be correspondingly increased.

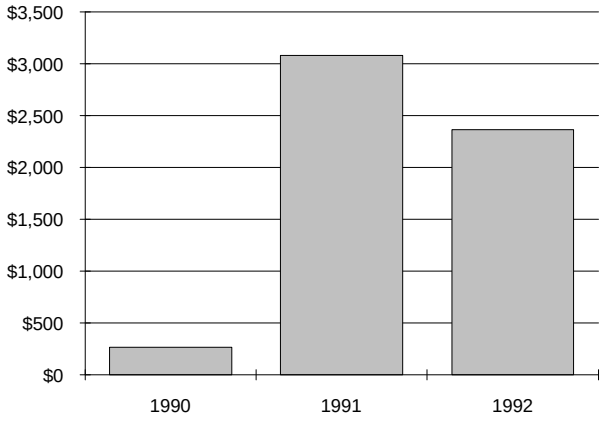
Cost of the Program

Costs Overview Table	WMECO (x1000)	CL&P (x1000)	Utility Cost (x1000)	Utility Cost per Participant	Customer Costs (x1000)	Total Program Cost (x1000)
1990	$95.5	$170.4	$265.9	$244.62	*	$265.9
1991	N/A	N/A	$1,981.0	$92.01	$1,102.8	$3,083.8
1992	$257.0	$1,411.9	$1,668.9	$103.63	$698.5	$2,367.4
Total	$352.5	$1,582.3	$3,915.8	$101.13	$1,801.4	$5,717.2

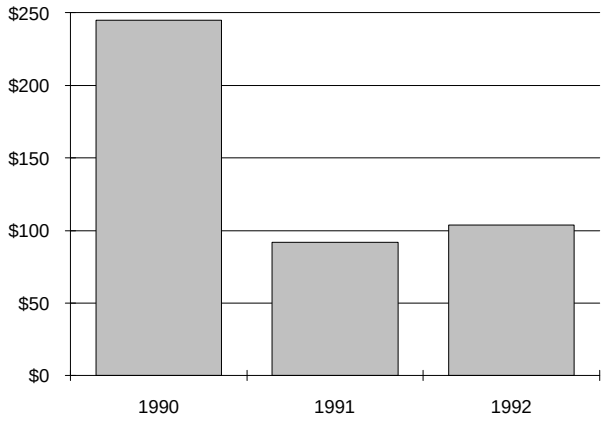
[R#4,7,10,12]

* 1990 Customer costs are included in the 1991 figure.

TOTAL PROGRAM COST (x1,000)



UTILITY COST PER PARTICIPANT



Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1990	7.53	7.83	8.13	8.43	8.74	9.05	9.37
1991	2.08	2.19	2.30	2.42	2.54	2.66	2.78
1992	2.38	2.50	2.62	2.75	2.89	3.02	3.16

Between September, 1990 and the end of 1991, NU customers spent $1.1 million on Lighting Catalog products. In 1992, customers spent $0.7 million on orders filled by October 16. NU costs were $0.27 million in 1990, $2.0 million in 1991, and $1.7 million in 1992.

COST EFFECTIVENESS

In its 1992 filing, WMECO reported a benefit/cost ratio for the Lighting Catalog at 2.48 from a revenue perspective and 2.37 from a societal perspective. For CL&P, the benefit/cost ratio was 2.28 from the revenue perspective and 1.62 from the societal perspective.[R#10]

The Results Center calculated the cost of saved energy based on the utility costs for 1990, 1991 and 1992. The calculated cost of saved energy fell dramatically between 1990 and 1991, due to the comparatively low annual energy savings realized in the startup year. At a 5% discount rate, the 1990 cost of saved energy was 8.13 ¢/kWh, while the 1991 cost was 2.30 ¢/kWh, and the 1992 cost was 2.62 ¢/kWh.

COST COMPONENTS

Most of NU's costs are payments to RCI for implementation of the Lighting Catalog program. Additional costs are incurred by NU for administration, marketing, and program evaluation.

COST PER CUSTOMER

The Results Center calculated NU's cost per customer for 1990 at $245. NU's per-customer costs fell in 1991 and 1992 to $92 and $103, respectively. Customer costs remained relatively constant, at $49 per customer in 1990/91 and $43 per customer in 1992. These figures suggest that customer orders have not changed dramatically over the course of the program.

FREE RIDERSHIP

Nineteen percent of the customers surveyed indicated that they had purchased energy-efficient lighting products prior to the Lighting Catalog program implementation. Of the remaining 81%, 42% indicated that they had thought about buying such products prior to the catalog program. However, there was no way of determining whether the customers' previous purchases were actually energy-efficient products. Additionally, the survey did not address whether there was any continued interest in purchasing such products from a retail store, nor whether such customers would have purchased such products in the same quantities as they did through the catalog. For these reasons, NU did not feel that this information was adequate to determine the level of free-ridership. NU plans to address the issue of free-ridership in future studies.[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%	68,814,000	1,633,000	330,000	33,000
B	10,000	1.20%	73,379,000	632,000	213,000	158,000
	Controlled Emissions					
A	9,400	2.50%	68,814,000	163,000	330,000	3,000
B	10,000	1.20%	73,379,000	63,000	213,000	11,000
C	10,000		73,379,000	421,000	211,000	11,000
	Atmospheric Fluidized Bed Combustion					
A	10,000	1.10%	73,379,000	193,000	105,000	53,000
B	9,400	2.50%	68,814,000	163,000	132,000	10,000
	Integrated Gasification Combined Cycle					
A	10,000	0.45%	73,379,000	130,000	21,000	53,000
B	9,010		66,006,000	47,000	16,000	3,000
Gas	**Steam**					
A	10,400		40,025,000	0	91,000	0
B	9,224		34,758,000	0	218,000	10,000
	Combined Cycle					
1. Existing	9,000		34,758,000	0	133,000	0
2. NSPS*	9,000		34,758,000	0	63,000	0
3. BACT*	9,000		34,758,000	0	9,000	0
Oil	**Steam--#6 Oil**					
A	9,840	2.00%	57,931,000	878,000	104,000	98,000
B	10,400	2.20%	61,442,000	871,000	130,000	63,000
C	10,400	1.00%	61,442,000	124,000	105,000	33,000
D	10,400	0.50%	61,442,000	365,000	130,000	20,000
	Combustion Turbine					
#2 Diesel	13,600	0.30%	76,890,000	153,000	238,000	13,000
Refuse Derived Fuel						
Conventional	15,000	0.20%	91,285,000	235,000	310,000	69,000

Avoided Emissions Based on 31,917,667 kWh Saved (1990 - 1992)

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 Lighting Catalog 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

After only two years in existence, NU's Lighting Catalog has proven to be highly successful and popular. Through the catalog, more than 370,000 energy-efficient lighting products have been purchased by NU customers, and about two-thirds of those products are already in use in customers' homes.

The program has been successful due in large part to the effort put into evaluating customers' needs as part of the program design process. NU effectively drew upon its previous experiences with lighting retrofits to determine which products would best meet their customers' needs. Additionally, NU commissioned a study that confirmed the existence of an imbalance in the market for compact fluorescent lamps and electronic ballasts, thus verifying the viability of the program as planned.

Because customers must first order the catalog prior to making a purchase, they have already become active before any measures are installed or savings are realized. With this first customer-initiated step there is a greater likelihood that an order will be placed and the lamps installed.

NU has responded to the major customer complaint that the bulbs ordered were not bright enough. The Lighting Catalog now provides customer information on the appropriate replacements for particular types of lamps, and differentiates product selection by task as opposed to by general use application. As in other programs where customers are unfamiliar with the new technology, there is a significant need to explain exactly what the customer should expect from their new lamps.

TRANSFERABILITY

The Lighting Catalog program could be implemented in a variety of locations, however it may be less popular in an area where there is no market imbalance for energy-efficient lighting technologies. The products in the Lighting Catalog are offered at such a large discount that virtually no retailer would be able to compete. NU has avoided restraint-of-trade criticism by encouraging manufacturers, wholesalers, distributors, and certain retailers to bid on the supply of catalog products.[R#4] However, as the market changes, it seems likely that the Lighting Catalog prices will have to be increased in order to allow for fair competition with retail suppliers. NU's long term plan to phase out the Lighting Catalog and place increased emphasis on the mail-in rebate program reflects the utility's sensitivity to anticipated changes in the market.

Northeast Utilities' Lighting Catalog 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.

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.[R#11]

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#11,14]

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#11,14]

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#6,14]

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#7,8,9,14]

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#7,8,9]

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#11,13]

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#11]

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#11]

CONNECTICUT LIGHT & POWER'S 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#7,8,9,13]

References

1. Jeff Kotkin, Corporate Communications Officer, Northeast Utilities, personal communication, March 1992.

2. Northeast Utilities, "Annual Report," 1990.

3. Northeast Utilities, "1992 Forecast of Loads and Resources for 1992-2011," March 1, 1992.

4. Bourget Research Group, "Spectrum Conservation Services Lighting Catalog Program, Telephone and On-Site Survey: Final Report", Northeast Utilities, February 1992.

5. Bruce Wall, Senior Residential Program Administrator, "Short-Term Market Intervention: The Key to Long-Term Benefits", Proceedings of ACEEE 1992 Summer Study on Energy Efficiency in Buildings.

6. The Commonwealth of Massachusetts Department of Public Utilities, "D.P.U 91-44, Petition of Western Massachusetts Electric Company for approval by the Department of Public Utilities in accordance with 220 CMR 9.00, of its application for Cost Recovery and Preapproval of its 1991 Conservation and Load Management Programs," July 1, 1991.

7. Connecticut Light & Power, "Conservation and Load Management Programs, Annual Report for 1990," April 1991.

8. State of Connecticut Department of Public Utility Control, "Application of the Connecticut Light and Power Company to Amend Rate Schedules -- Phase II, Docket 90-12-03, Decision," August 1, 1991.

9. State of Connecticut DPUC, "Application of the Connecticut Light and Power Company to Amend Rate Schedules -- Phase II, Docket 90-12-03, Decision," October 30, 1991.

10. Bruce Wall, Senior Residential Program Administrator, Northeast Utilities, personal communication, October - December 1992.

11. National Association of Regulatory Utility Commissioners, "Incentives for Demand-Side Management," Committee on Energy Conservation, January 1992.

12. Western Massachusetts Electric Company, "1990 Annual Report on Conservation and Load Management" (D.P.U. 86-36-F), April 1991.

13. Mark Quinlan, Associate Rate Analyst, Connecticut Department of Public Utility Control, personal communication, November 1992.

14. Ms. Theo MacGregor, Conservation Coordinator, Massachusetts Department of Public Utilities, personal communication, October - November 1992.

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