
Central Maine Power Operation Lightswitch Profile #19, 1992

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Executive Summary

Central Maine Power's Operation Lightswitch® has been a program characterized by three discrete phases and is a powerful example of a program that has evolved from one of limited effect to quite significant effect, and perhaps most importantly has begun to transform the market for residential energy-efficient lighting in the State of Maine. While compact fluorescent lamps were all but non-existent in Maine a few years ago, now they are commonly on the retail store shelves at relatively low prices. Furthermore, 25% of the program's participants say that they will now buy the energy-efficient, compact fluorescents without any utility incentives at all!

The program began in 1988 when CMP began to work with the Lions Club to distribute halogen lamps. "Six-packs" of halogens were distributed through the Lions for a nominal charge. In the program's second phase, the Lions were used again, but this time to purchase compact fluorescent lamps from CMP for \$1, and to sell them to residential customers for \$3. (Note that the lamps offered had a list price of \$18.75 and that all the lamps were distributed in the first week of the program phase!) In the third phase of the program CMP initially gave customers two, \$9 coupons for compact fluorescent lamps which customers could find in chain stores throughout Maine. Later, after an initial coupon redemption rate that was slightly disappointing, CMP made the coupons available at the point of purchase.

As a result of Operation Lightswitch® approximately 20% of CMP's residential customers have installed energy-efficient lighting in their homes. Fully 486,000 halogen lamps were distributed and 256,200 compact fluorescents were distributed, in a total of 90,740 homes in CMP's service territory. This has been accomplished at a total cost of \$4.6 million and has resulted in annual energy savings of over 30 GWh and lifecycle savings of 163.8 GWh.

CMP's efforts with residential lighting present a positive example of program evolution and market transformation. As the program evolved, the lighting technology that it promoted became more sophisticated, resulting in larger energy savings. The program also evolved toward decreased utility financial exposure, as customers became more aware of the benefits of the advanced lighting technologies and were thus willing to pay more for them. Through a careful process of educating customers, working with trade allies (such as the Lions Club and regional chain stores), CMP has been able to effectively transform customer awareness and perceptions of energy-efficient lighting for the home.

Operation Lightswitch ®

Utility: Central Maine Power
Sector: Residential
Measures: Halogen and compact fluorescent lamps
Mechanism: Customers are provided opportunities to purchase lamps at a discount
History: Implemented in three discrete phases, starting in 1988

Phase III Data

Energy savings: 12,882 MWh
Lifecycle energy savings: 77,548 MWh
Peak capacity savings: 2.05 MW
Cost: \$1,743,000

Cumulative Data (1988 - 1992)

Cumulative energy savings: 58.2 GWh
Lifecycle energy savings: 163.8 GWh
Capacity savings: 5.97 MW
Cost: \$4,550,500
Participation rate: 21%

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

Central Maine Power (CMP) is an investor-owned utility that provides power to more than 490,000 customers. CMP's service area covers 11,000 square miles and contains more than 100 cities and towns, most with populations under 10,000. Ninety percent of CMP's customers are residential. These customers account for 33% of total energy sales and 40% of the total service area revenues. CMP's commercial customers purchase 26% of its total energy sales and generate 27% of its energy revenues. Industrial customers account for most of the remaining 41% of sales and 33% of revenues. [R#1]

A number of industries are located in CMP's service area. In 1991, the lumber, wood and paper products industries purchased over 2,500 MWh of electricity from CMP. Additionally, the transportation equipment industry is active, using over 200 MWh in 1991, mostly at the Bath Iron Works, Maine's largest employer. Other major industries in the area include electrical and electronic machinery, chemicals and related products, and textile mill products. There are also several colleges and universities in the service area. [R#1,2]

The recession has hit Maine particularly hard, with the loss of over 30,000 jobs between the third quarter of 1990 and the end of 1991. As a result, CMP experienced a 1.2% decline in total service area sales, from 9.2 GWh in 1990 to 9.1 GWh in 1991. Residential construction activity slowed significantly, resulting in fewer new residential customers and accompanying sales. Additionally, with real per-capita income declining by 3.3% in 1991, residential customers used less electricity in an attempt to control their own costs. [R#1]

Much of the energy CMP sells is purchased from non-utility generators (38% of the total kWh sales). These generating projects include paper-mill cogeneration, municipal waste burners, private hydroelectric plants, biomass boilers, and wind turbines. Additionally, through its Power Partners

CMP 1991 Statistics

Number of Customers	490,506
Energy Sales	9,106 GWh
Revenue from Energy Sales	\$734 million
Winter Peak Demand	1,416 MW
Generating Capacity	2,069 MW
Reserve Margin	46 %
Average Electric Rates	
Residential	9.8 ¢/kWh
Commercial	8.5 ¢/kWh
Industrial	6.2 ¢/kWh

[R#1]

program, energy efficiency vendors hold contracts to provide energy savings worth over 16.8 MW in annual demand reduction. Together, these non-utility resources comprise 540 MW or 26% of CMP's 2,069 MW capacity. Nuclear facilities generate 30% of the kWh sales, or 19% of the total capacity. Oil, hydropower, and Canadian purchases account for the remaining energy sales and capacity production. [R#1]

Utility DSM Overview

In 1991, CMP spent \$17.2 million, or 2.3% of total energy revenues, on DSM programs. The State of Maine has a progressive energy policy that requires reduction in oil-fired power generation and increased diversity of energy resources, including enhanced development of renewable resources and the prioritization of conservation as a resource. CMP has been supporting the State's policies through its diverse and comprehensive DSM programs, many of which have been active for five years or more.

CMP DSM PROGRAMS

RESIDENTIAL

- Energy Audits
- Bundle-Up
- Energy Efficient New Home Design
- Operation Lightswitch®**

COMMERCIAL/INDUSTRIAL

- Bundle-Up
- Energy Audits
- Loan Program
- Retrofit and New Construction Programs
- Motor Rebates
- Lighting Rebates
- Custom Rebates
- Efficiency Buy-Back
- Design Assistance

OTHER

- Power Partners

ization and insulation services program was recently suspended, as it was believed to be less cost-effective than a similar program being implemented through the Power Partners program.

The Power Partners program represents a strong commitment by CMP to treat conservation on the same ground as supply-side resources. Through a competitive bidding process, energy service companies can propose energy saving projects which are then considered side-by-side with other conservation projects and supply-side options. Nine contracts have been signed with the potential to save approximately 262,000 MWh/year. Two industrial projects and a lighting retrofit have been completed, and a contract for more than 20,000 residential home weatherizations was recently extended.

CMP's DSM programs for commercial customers include energy audits, a loan program, and rebates for retrofitting motors, lights, and other equipment with efficient replacements. Since 1986, the commercial lighting rebate program alone has accumulated over 65,000 MWh in annual savings. CMP offers similar programs for commercial customers who are constructing new facilities and want to include efficient motors, lights, or other equipment.

The Efficiency Buy-Back program is aimed at larger commercial and industrial customers who want to upgrade the efficiency of their facilities or manufacturing processes. CMP helps pay for up to half the installed cost of an approved efficiency project, usually reducing the pay back period to two years. Customers submit detailed proposals for projects expected to save more than 500,000 kWh per year. More than 31,000 MWh have been saved through this program since 1986.

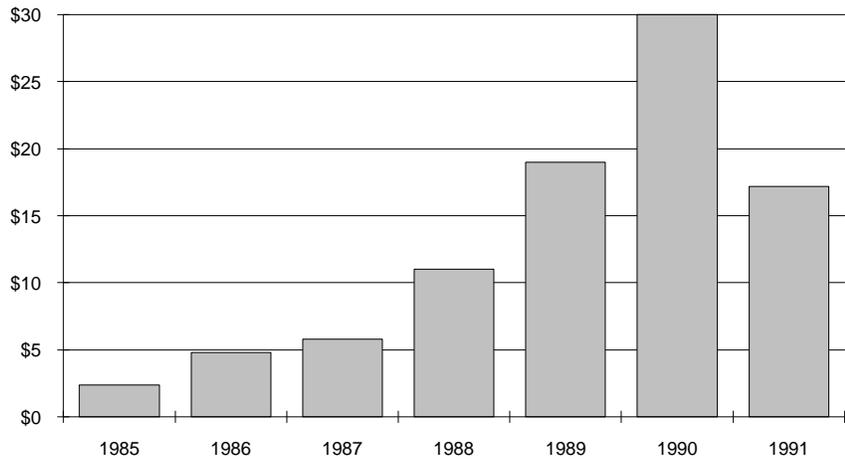
Like many utilities, CMP first entered DSM with a load management program. Kilowatt Savings Time was introduced in 1975 to help minimize peak demand by asking all customers to avoid using non-essential electrical equipment during occasionally declared periods. Since then, CMP's programs have become more focused on efficiency. Significant energy savings are realized through the residential Bundle-up Program, a water heater efficiency improvement program that includes a water heater wrap, pipe insulation, sediment removal, thermostat adjustment, and flow restrictor installation for a nominal fee. This program has accumulated over 37,000 MWh in annual energy savings and 5.9 MW in annual capacity savings since its introduction in 1984.

Other residential programs include a free energy audit program and the subject of this profile: Operation Light switch® has led to the sale of 256,200 compact fluorescent lamps and 486,000 tungsten halogen bulbs. CMP's weather-

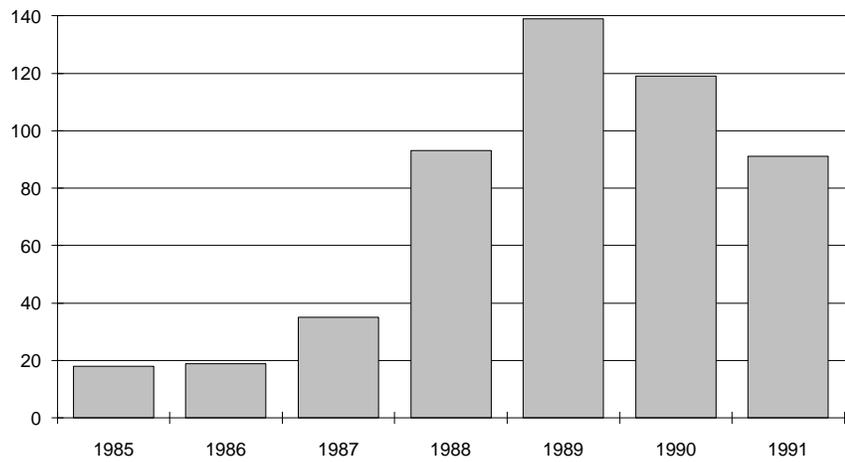
DSM Overview Table	Annual DSM Expenditure (x1000)	Annual Energy Savings (GWh)	Annual Capacity Savings (MW)
1985	\$2,400	18	6
1986	\$4,800	19	0
1987	\$5,800	35	4
1988	\$11,000	93	5
1989	\$19,000	139	12
1990	\$30,000	119	20
1991	\$17,200	91	16
Total	\$90,200	514	63

[R#3,4]

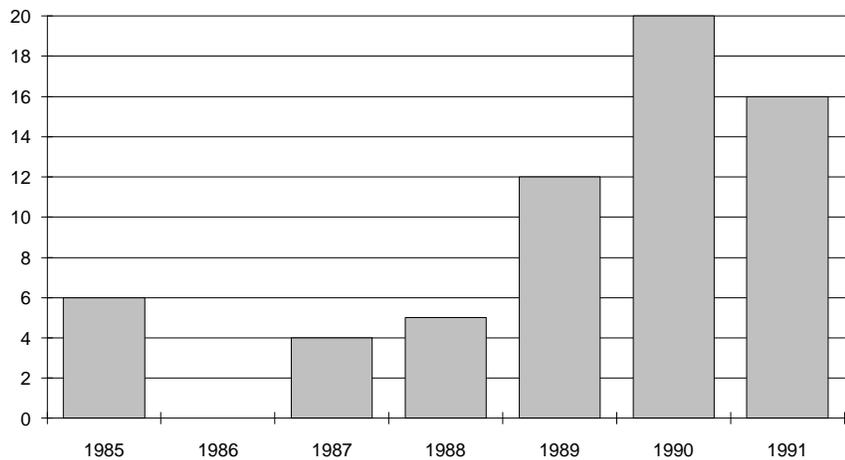
**ANNUAL DSM
EXPENDITURE
(\$1,000,000)**



**ANNUAL ENERGY
SAVINGS (GWH)**



**ANNUAL CAPACITY
SAVINGS (MW)**



Program Overview

In a three-phase program between 1988 and 1991, CMP customers were provided opportunities to purchase efficient lightbulbs. In the first phase, conducted over a 5 month period in 1988, over 486,000 halogen lamps were sold by Lions Club members for \$5 for six bulbs. In the second phase in 1989, Lions Club members again distributed the bulbs, this time OSRAM 15 watt compact fluorescent bulbs. CMP sold bulbs to the Lions Club at a cost of \$1 per bulb, and the Lions in turn sold them within their communities for \$3. In the third phase coupons were distributed to all residential customers through their monthly bills. The coupons were valid at one of three participating retail store chains (two grocery stores and one drug store) all of which had numerous outlets throughout the CMP service area. Each coupon was worth \$9 toward the purchase of a 15, 18, or 20 watt electronic ballast compact fluorescent lamp.

Throughout the first two phases of the program, data were collected in regard to customer preferences and needs. This important information was used in the design of the third phase of the program. Phase II had been successful far beyond what was anticipated by program planners. All of the lamps available through the Lions Clubs had been sold within one week of the start of the program, and customers flooded CMP with calls, trying to find out where they could purchase the lamps for such a good price. As a result of the Phase II program, CMP realized that although customers would like to purchase and install compact fluorescent lamps, they were not willing to pay the going retail price of \$18.75. Additionally, CMP found that only about half of the participants in Phase II who had looked for compact fluorescents in retail stores were able to find them. [R#5] Thus, Phase III was developed

with a primary goal of promoting retail availability of efficient light bulbs. At the same time, CMP hoped to effect significant energy savings.

"By all accounts, the Residential Lighting Efficiency Program was a success" concluded a process and impact evaluation conducted for CMP. Each program phase built upon the previous one, slowly introducing CMP's customers to energy-efficient lighting technologies, thus creating a market for the products. The third phase combined creation of both demand and supply. Customers were encouraged to go to retail stores to purchase the lamps, and retailers were given assurance that the product would move off their shelves. Phase III also served to show retailers that the demand existed for energy-efficient lighting products and would be likely to continue even in the absence of a coupon incentive.

In all, the three phases of the program have cost CMP about \$4.6 million, and produced lifecycle savings of 163.8 GWh. Approximately 21% of CMP's residential customers have participated in the program. Most importantly, the program has succeeded in transforming the market for energy-efficient lighting technologies by increasing customer awareness and encouraging retailers to stock the products that customers demand.

MARKETING AND DELIVERY

CMP's Operation Lightswitch® has been delivered in three discrete phases, each lasting from 3 weeks to 5 months. The first phase, implemented for 5 months starting in October, 1988, was delivered by the Lions Club. Tungsten halogen lamps were sold in six-packs containing three 42 watt bulbs, one 52 watt bulb, and two 72 watt bulbs. Each six-pack was sold for \$5, and included an educational insert that explained the energy benefits of the bulbs. Most of the customers who purchased bulbs during Phase I knew the Lions Club member from whom they purchased the bulbs. [R#6]

In Phase II, 15 watt compact fluorescent lamps were sold for \$3 each by Lions Club members. Phase II began October 1, 1989, and all bulbs were sold by the end of the first week. The Lions had intended to sell and distribute the lamps door-to-door, however the response to advertisements prior to the official start of the program was so great that door-to-door sales were unnecessary. Most customers either called the Lions Club directly to place an order or were told how to get in touch with the Lions after dialing CMP's toll-free customer service line. Some bulbs were sold at shopping centers or other locations that the Lions Clubs had arranged in advance of the program. [R#5]

Phase III was offered for three months starting September 23, 1991 and running through December 31, 1991. Each residential customer received two coupons worth \$9 toward the purchase of one of 4 types of compact fluorescent lamps. The coupons were redeemable at one of three participating retail chains that had a total of more than 100 stores in the CMP service area. Two supermarket chains and one drug store chain had agreed to stock qualifying electronic compact fluorescent bulbs. The retailers purchased the lamps from their own vendors, and set their own retail price. With the coupon, most customers ended up paying \$4 to \$5 per lamp.

Customers received one coupon with their September electric bill, and one with their October bill. However, with

this distribution, the redemption rate was slower than CMP desired, and CMP decided to make the coupons available at the point of purchase. Coupons were distributed to customer service counters at most of the participating stores. In order to limit use of the coupons by non-CMP customers, stores located on the edge of CMP's service territory did not receive coupons. [R#7]

CMP employed several different strategies in marketing the three phases of Operation Lightswitch®. All three phases were publicized through television, radio, and newspaper advertisements, the CMP newsletter, and with displays at CMP district offices. In the second phase, press releases were submitted to local newspapers and television stations, and news features were aired on several hundred national stations. [R#5]

Phase III was widely promoted by CMP's advertising department. Television, radio, and newspaper advertisements were run throughout the service area. Additionally, bill inserts and in-store displays were utilized. Feature stories were run in newspapers and television, and an article appeared in the Wall Street Journal. The process evaluation completed in 1992 indicated that bill inserts had the widest impact on participants. [R#7,8]

MEASURES INSTALLED

Through Operation Lightswitch® 486,000 halogen lamps and 256,200 electronically ballasted compact fluorescent lamps were installed in 90,740 homes within CMP's service area, as shown below. [R#5,6,7,8]

STAFFING REQUIREMENTS

CMP staff within many departments have been involved in the implementation of the three phases of Operation Lightswitch®. The departments most concerned with the program are: Energy Management Planning Department, Commercial and Residential Marketing, Advertising, and Evaluation.

Program Component	Duration	Lamp Manufacturer and Name	Wattage	Lamp Type	Number Sold
Phase I	Oct. 1988 - Feb. 1989	Sylvania Capsylite	42, 52 or 72	tungsten halogen	486,000
Phase II	Oct. 1989	OSRAM Dulux EL 15	15	compact fluorescent	85,200
Phase III	Sept. - Dec. 1991	OSRAM Dulux EL	15 or 20	compact fluorescent	171,000
		Philips Earth Light SL	18	compact fluorescent	
		Sylvania soft-white	18	compact fluorescent	

[R#5,6,7,8]

Monitoring and Evaluation

MONITORING

No end-use metering is conducted as part of Operation Lightswitch. Energy savings are estimated using engineering estimates in conjunction with information generated through customer surveys.

Tracking forms were developed for use during the Phase II portion of the program. These forms included information on customers who purchased the bulbs -- their name, address, phone number, and number of bulbs they purchased. However, the forms were completed for only about one-half of the bulbs sold. Additionally, some records were kept of calls to CMP's toll-free customer service line during Phase II. Customer service representatives kept track of where customers were referred when they did not succeed in getting the bulbs from a Lions Club member.

In Phase III, customers were asked to fill in each coupon with their name and address prior to redemption. The retail stores had been told by CMP that they would not be reimbursed for coupons that were not filled out with customer information, and as a result, most coupons were completed. Coupons were then randomly selected for inclusion in the data analysis.[R#11]

EVALUATION

An outside contractor conducted much of the program evaluation for CMP. Evaluations were based primarily on customer surveys. In Phases I and II, customers were asked to complete a short questionnaire after they had installed the lamps they purchased. Followup telephone interviews were conducted of both respondents and non-respondents. Additionally, CMP conducted a detailed process evaluation in which comments were solicited from CMP staff, Lions Club members, and other project participants. The Phase I evaluation concluded that the majority of the customers were pleased with their purchase. Most Phase I participants indicated that they would be interested in purchasing energy-saving light bulbs from the Lions Club in the future, but that they would not be willing to pay the going retail price for the bulbs.

The Phase II evaluation concluded that the price of the compact fluorescent bulb could have been set higher, given the amount of interest shown by participants. The evaluation revealed some confusion by Lions Club members over the proper selling price of the bulbs, and some dissatisfaction by CMP customers over the bulb delivery mechanism. As in Phase I, most bulbs were sold to people who knew a Lions Club member, in effect excluding customers who did not have a Lions Club contact.

The third phase process and impact evaluation was based on interviews with 6 individual CMP employees who were directly involved in the program design, marketing, and implementation. Additionally, customers were surveyed in order to determine the efficacy of the program in meeting its goals and to estimate energy impacts. Customers were asked to provide the wattage of incandescent bulbs removed and of the compact fluorescent that they installed. This information was used to calculate and verify energy saving estimates.

The Phase III process evaluation found that the program was a success. Approximately 25% of the participants said that in the future they would be likely to purchase a compact fluorescent lamp without a coupon. Additionally, the program appears to have had a positive impact on the retail price and availability of compact fluorescents. Whereas the average price prior to the program was \$20, after the program, the price had dropped to \$15. Additionally, after the program, the participating chains began to carry the bulbs in their stores located outside of the CMP service area.[R#7]

DATA QUALITY

The detail with which CMP has conducted its impact evaluations has increased with each phase. During the first phase, energy savings were calculated based on the results of

a customer survey that indicated the average hours of use of the bulbs and the wattages of the bulbs replaced. The calculation assumes that all of the bulbs are installed over a three year period. Savings were further reduced by 5% to reflect the incidence of premature bulb burnout. Phase I savings were not reduced for free-ridership. CMP calculated lifecycle savings over the years 1989 to 1994 at 40,636 MWh, with the weighted average lifetime of the halogen bulbs determined to be 4.04 years. For simplicity and to standardize all profiles prepared by The Results Center, we have calculated the Phase 1 annual energy savings by dividing 40,636 MWh by 4.04 years, resulting in 10,058 MWh. (CMP presents annual energy savings of 5,205 MWh, 8,809 MWh, and 10,159 MWh... for each of the first three years, and then continues with savings for a total of six years for the reasons stated above. For a full accounting of CMP's more sophisticated methodology, see R#6.)

Similarly, the Phase II savings were calculated based on the results of the Phase II impact evaluation, which revealed time of use and seasonal effects. These results were checked for reasonableness by comparison to the results of a similar analysis conducted by the New York State Electric and Gas Corporation. CMP calculated lifecycle savings of 45,600 MWh with an average lifetime of 6.02 years. Again, for simplicity The Results Center presents annual energy savings that are based on CMP's reported lifecycle savings, divided by the measure life of 6.02 years. CMP's methodology is more complex and more accurate, spreading savings over a 12-year period. [R#5]

Phase III energy savings were based in part on the time and seasonally differentiated load shape data generated as part of the Phase II evaluation. The average lifetime of the bulbs was assumed to be the same at 6 years, and average bulb impacts of 48 watts saved per bulb. The gross savings were adjusted by 2% for free riders and an additional 4% for bulb removals. The final gross, or lifecycle, energy savings reported in the Phase III impact evaluation was 77,548 MWh. Annual energy impacts were reported to be 10,727 MWh for the 6 year lifetime (48 watts * 1,679 hours * 83% of 171,000 bulbs installed, reduced by 6% for free riders and bulb burnout). The remaining 17% of the bulbs were considered to be installed over the subsequent 6 years, at annual energy savings of 2,202 MWh. Thus the lifecycle energy savings are 77,548 MWh (10,727 MWh * 6 years + 2,202 MWh * 6 years). To facilitate comparison in the Savings Overview Table in the Program Savings section, The Results Center reports Phase III annual energy savings as 77,548 MWh divided by 6.02 years, or 12,882 MWh. [R#7]

The number of households participating in each phase of Operation Lightswitch was estimated by CMP from their surveys of participants. [R#11]

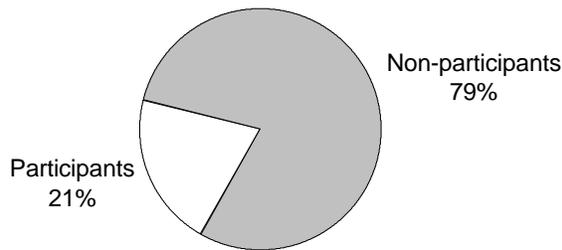
Program Savings

Annual energy savings due to the three phases of the Residential Lighting Efficiency program have exceeded 30 GWh. Lifecycle savings are 163.8 GWh.

PARTICIPATION RATES

Participation Table	Number of Households Participating	Annual Energy Savings per Household (kWh)
Phase I	34,640	290
Phase II	13,100	580
Phase III	43,000	300
Total	90,740	

[R#5,6,7,8]



In the first phase of the program, six-packs of halogen lamps were sold to 34,641 participants.[R#6] In the second phase, 85,200 compact fluorescents were sold to 13,100 customers.[R#5] In the third phase, 171,000 compact fluorescents were purchased by over 43,000 residential customers.[R#7] Although some of these customers may be repeat participants, the total of 90,740 customers represents about 21% of CMP's 441,000 residential customers.

MEASURE LIFETIME

For the halogen lamps, average life was determined based on an expected 3,500 hour life and reported annual hours of use as determined from customer surveys. The weighted average lifetime for the bulbs installed in the first phase was 4.04 years.[R#6]

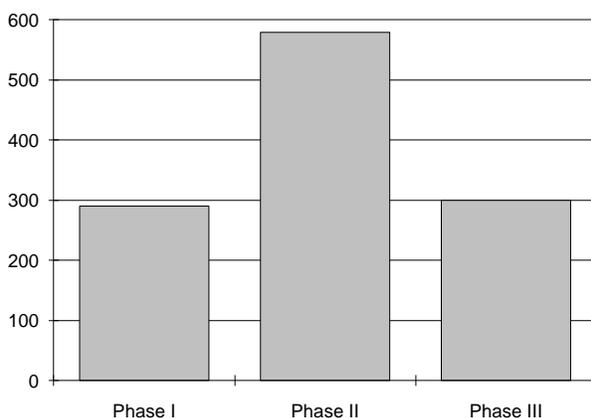
The lamp used in the second phase of the program, the OSRAM Dulux EL 15, has a rated life of 10,000 hours. Based on 1,662 hours annual usage, the average lifetime of these bulbs was calculated to be 6 years.[R#5]

The lifetime for the third phase is virtually the same as for the second phase. Three wattages of compact fluorescent lamps were eligible for rebates under the coupon program. Customers could choose from 15, 18 or 20 watt compact fluorescent lamps. The rated life of the eligible bulbs averaged 10,000 hours. Based on 1,679 hours of annual usage, the average lifetime was calculated at 6 years.[R#7]

PROJECTED SAVINGS

For the first phase, lifecycle savings were determined to be 40.6 GWh, based on the assumption that no lamp would be installed until an incandescent bulb had burned out, and that lamp installation would occur at the same rate for two years until all lamps had been installed. Savings were reduced by 5% to reflect the incidence of premature burnout or breakage.[R#6] Lifecycle savings for the second phase were calculated using an empirical calculation based on 1,662 hours per year, 6 years, 53.57 watts saved per lamp sold, and 85,200 lamps sold, or 45.6 GWh.[R#5] Lifecycle savings for the third phase were based on 1,679 hours of use per year, 6 year lifetime, and 48 watts saved per lamp sold, with 171,000 lamps sold. After adjustment for free riders and bulb removal, the lifecycle savings attributable to the third phase of the program is 77.5 GWh.[R#7]

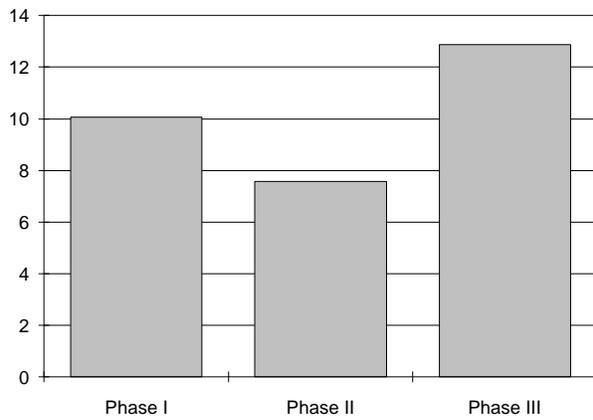
ANNUAL SAVINGS PER PARTICIPANT



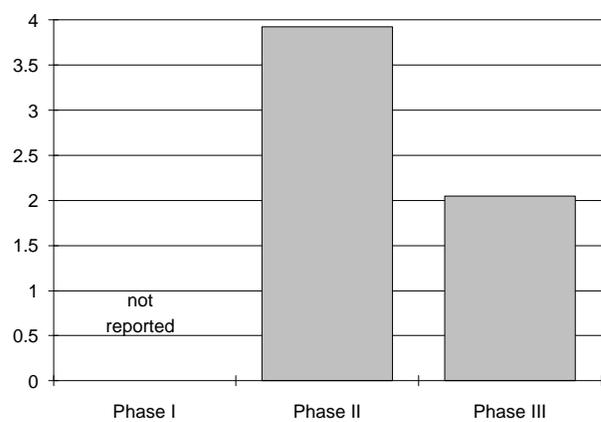
Savings Overview Table	Annual Energy Savings (MWh)	Cumulative Energy Savings (MWh)	Lifecycle Energy Savings (MWh)	Annual Winter Peak Capacity Savings (MW)	Cum. Winter Peak Capacity Savings (MW)
Phase I	10,058	10,058	40,636	not reported	
Phase II	7,575	17,633	45,600	3.92	3.92
Phase III	12,882	30,515	77,548	2.05	5.97
Total	30,515	58,206	163,783	5.97	

[R#5,6,7]

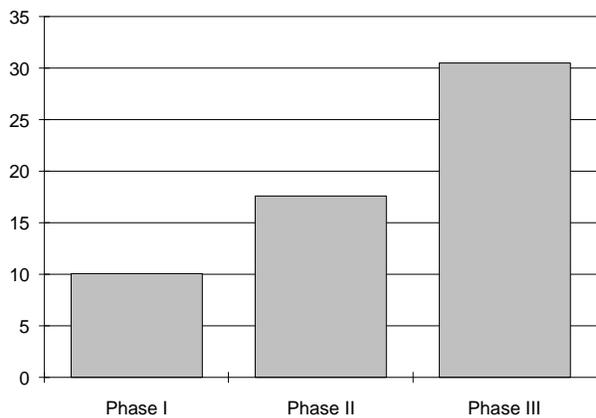
ANNUAL ENERGY SAVINGS (GWH)



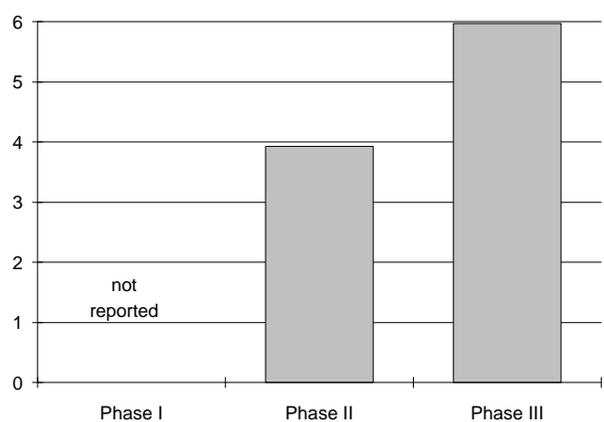
ANNUAL PEAK CAPACITY SAVINGS (MW)



CUMULATIVE ENERGY SAVINGS (GWH)



CUMULATIVE PEAK CAPACITY SAVINGS (MW)



Cost of the Program

The first phase total costs, which were actually incurred in the latter part of 1988 and the first quarter of 1989, were \$1.26 million. [R#6] The second phase total costs were \$1.56 million. [R#5] Phase III total costs were \$1.74 million. [R#7] Total levelized costs have been \$4.56 million.

COST EFFECTIVENESS

CMP calculated benefit-cost ratios for each phase of Operation Lightswitch®. The Phase I benefit-cost ratio was 1.23; the Phase II ratio was 1.29; and the Phase III ratio was 1.51. In accordance with the Maine Public Utilities Commission ruling, CMP considers any program with a benefit/cost ratio greater than 1 to be cost-effective.

The Results Center calculated the cost of saved energy for each of the three program phases. At a 5% discount rate, the cost of saved energy ranged from 2.65 to 4.03¢/kWh.

COST PER PARTICIPANT

The cost per participating household was much higher in Phase II, due to the greater number of bulbs purchased by each household. In Phase I, the 34,641 households purchased an average of 2 six-packs per home, whereas in Phase II, each household purchased an average of 6 bulbs. In Phase III, the average purchase was 4 per household.

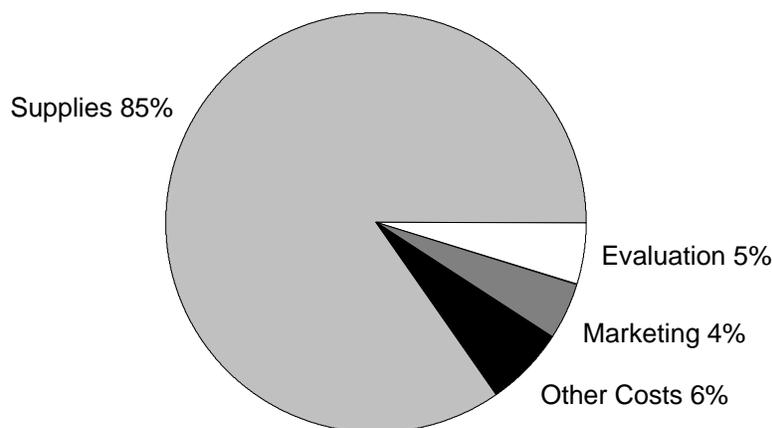
FREE RIDERSHIP

Free riders were not considered in the first phase. [R#6] In the second phase, the number of free riders was considered to be negligible because the going retail rate for compact fluorescent lamps at the time was considered to be prohibitive at \$24. [R#5]

Free-ridership was analyzed in Phase III, and determined to be 2%. Participant surveys conducted as part of the process and impact evaluation indicated that 2% of the participants had purchased a compact fluorescent bulb prior to the program and would be likely to purchase a bulb without a coupon in the future. [R#7]

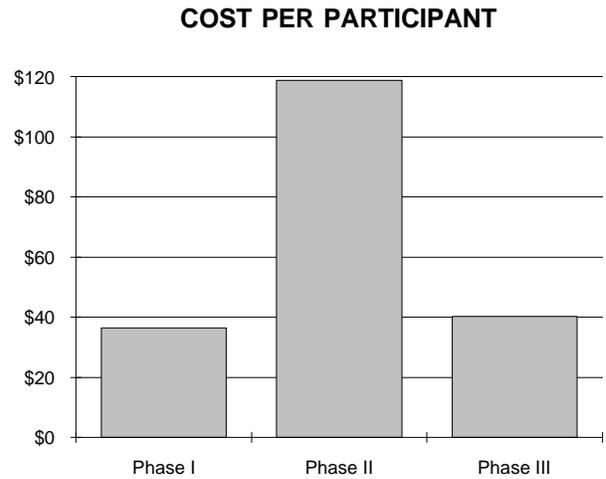
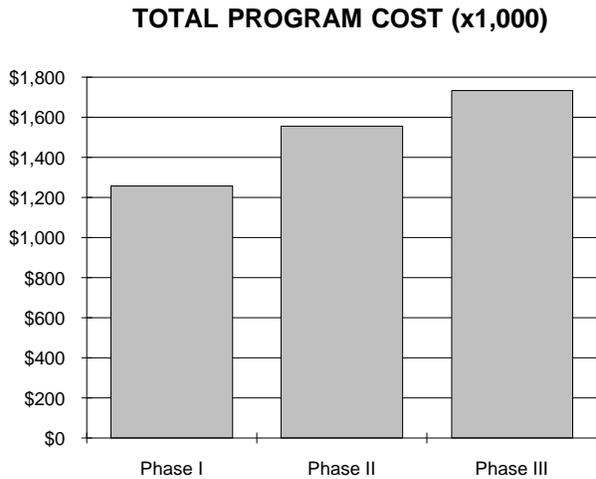
COST COMPONENTS

Most of the costs incurred in implementing the three phases of the Residential Lighting Efficiency program were in purchasing the bulbs sold by the Lions Clubs, and in paying the \$9 reimbursement to the retailers who redeemed the coupons in Phase III. Additionally, significant costs were incurred in marketing and evaluation. The average breakdown of cost components for all three phases of the program is shown in the pie chart.



Costs Overview Table	Supplies -- General (x1000)	Evaluation (x1000)	Marketing (x1000)	Other Costs (x1000)	Total Program Cost (x1000)	Cost per Household
Phase I	\$1,001.6	\$75.2	\$114.1	\$68.5	\$1,259.3	\$36
Phase II	\$1,398.5	\$104.8	\$50.6	\$1.6	\$1,555.4	\$119
Phase III	\$1,477.1	\$27.1	\$23.8	\$207.8	\$1,735.7	\$40
Total	\$3,877.2	\$207.0	\$188.4	\$277.9	\$4,550.5	

[R#5,6,7]



Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
Phase I	3.34	3.42	3.50	3.58	3.66	3.75	3.83
Phase II	3.78	3.91	4.03	4.16	4.30	4.43	4.57
Phase III	2.48	2.56	2.65	2.73	2.82	2.91	3.00

Environmental Benefit Statement

Marginal Power Plant	Heat Rate BTU/kWh	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
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Coal Uncontrolled Emissions

A	9,400	2.50%	125,000	3,000	1,000	0
B	10,000	1.20%	134,000	1,000	0	0

Controlled Emissions

A	9,400	2.50%	125,000	0	1,000	0
B	10,000	1.20%	134,000	0	0	0
C	10,000		134,000	1,000	0	0

Atmospheric Fluidized Bed Combustion

A	10,000	1.10%	134,000	0	0	0
B	9,400	2.50%	125,000	0	0	0

Integrated Gasification Combined Cycle

A	10,000	0.45%	134,000	0	0	0
B	9,010		120,000	0	0	0

Gas Steam

A	10,400		73,000	0	0	0
B	9,224		63,000	0	0	0

Combined Cycle

1. Existing	9,000		63,000	0	0	0
2. NSPS*	9,000		63,000	0	0	0
3. BACT*	9,000		63,000	0	0	0

Oil Steam--#6 Oil

A	9,840	2.00%	106,000	2,000	0	0
B	10,400	2.20%	112,000	2,000	0	0
C	10,400	1.00%	112,000	0	0	0
D	10,400	0.50%	112,000	1,000	0	0

Combustion Turbine

#2 Diesel	13,600	0.30%	140,000	0	0	0
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Refuse Derived Fuel

Conventional	15,000	0.20%	166,000	0	1,000	0
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Avoided Emissions Based on 58,206 kWh Saved (1988 - 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 Central Maine Power's level of avoided emissions saved through its Operation Lightswitch® 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 / Transferability

LESSONS LEARNED

CMP's Operation Lightswitch® has evolved as three distinct phases, with each subsequent phase building on the lessons learned from the previous one. Together, the three phases accomplished CMP's goal of transforming the market for energy-efficient light bulbs.

During the first phase, CMP realized the benefit of delivery through the Lions Club. The Lions had already established an interested customer base through previous similar activities. In fact, most people who purchased bulbs in the first phase indicated that they would be more likely to purchase bulbs from the Lions Club than from a retail store. Thus, Phase II followed by offering the compact fluorescent lamps through the familiar Lions delivery method.

Delivery through the Lions Clubs, however, was excluding many members of the general public who did not know or have contact with a Lions Club member. Because Phase II was heavily advertised, many CMP customers became aware of the program, but then were not able to participate because they had no personal Lions contacts. Thus, the coupon delivery mechanism was developed for the third phase, in a successful attempt to broaden the reach of the program.

CMP's goal and strategy for Phase III was further influenced by the results of Phase II. In the second phase, most participants indicated that they would not be willing to pay more than \$10 for a compact fluorescent lamp, and that they preferred to purchase their lightbulbs at a supermarket. Some participants had complaints about the brightness of the new lamps. Retailers interviewed as part of the Phase II evaluation agreed that a price of less than \$10 would be necessary to stimulate demand for compact fluorescents. The Phase III design took these findings into account. With the coupon, customers costs were about \$5 per lamp. The lamps were available at two grocery store chains and a drug store chain. Three different wattages of lamps were available, and program promotion included suggested replacement wattages for typical incandescent bulbs.

The Phase III evaluation concluded that the program had been successful in getting retailers to stock energy-efficient lighting products. However, the evaluation also pointed out that in order to keep the new products on the shelves, customer demand would have to be maintained. The evaluation concluded that CMP should further develop the retail market by continuing the existing relationship with retailers and by further fostering consumer interest in energy-efficient lighting products. The evaluation indicated that CMP could accomplish these goals through informational and educational campaigns. With the groundwork laid by the coupon campaign, additional promotions in that vein may no longer be necessary.

TRANSFERABILITY

Other utilities have implemented similar programs designed to increase awareness and distribution of energy-efficient lighting technologies. In particular, Boston Edison has successfully used the Lions Club delivery mechanism and is considering implementing a retail store coupon program in 1992 (see Profile #23 in The Results Center 1992 series). Interestingly, Boston Edison had the same problem as CMP did with the Lions Clubs being overwhelmed with requests for compact fluorescent lamps. In both programs, the Lions Clubs had planned to deliver the compact fluorescents door-to-door, but demand was so high that the Lions had to change their delivery strategy after the program was underway. Both utilities found that delivery of these programs through the Lions Clubs enhanced the utility image in the community and produced a significant number of positive comments.

Similar lighting efficiency programs could thus be developed mimicking either of CMP's delivery mechanisms. The program is not limited by any regional constraints and, with appropriate marketing support, is likely to be successful whether delivered through a highly visible community service group, or through a coupon campaign.

Regulatory Incentives and Shareholder Returns

In the State of Maine most of the financial barriers to demand-side management have been effectively eliminated thanks in large part to Maine's forward thinking regulatory commissioners and staff, intervenors, as well as utility staff involved in the proceedings and putting together the stipulations. Utilities are allowed to recover DSM program costs, utility revenues have been decoupled from energy sales, and the commission has used its statutory authority to approve a penalty/reward mechanism for Central Maine Power. (Much of the following discussion is derived from the National Association of Regulatory Commissioner's review of "Incentives for Demand-Side Management". [R#9])

DSM PROGRAM COST RECOVERY

Special cost recovery for DSM was instituted in Maine in 1986. Utilities are allowed to ratebase with balancing account recovery (over ten years) most DSM expenditures. Administrative costs for DSM, such as advertising and evaluation, are expensed on a current year basis with annual reconciliation.

DECOUPLING SALES AND REVENUES

After allowing Maine's utilities to recover their DSM costs, it became clear that it was also necessary to remove the disincentive created by DSM regarding lost revenues. (The more effective the DSM initiatives, the higher the utilities' lost revenues.) Decoupling total sales and total revenues has been addressed in Maine with the use of a special form of ERAM (Electric Revenue Adjustment Mechanism). Maine instituted an "ERAM per customer" mechanism which was approved by the commission in May 1991. The mechanism serves to adjust electric rates (up or down) to maintain a constant level on nonfuel revenue per customer as determined in the most recent electric rate case. As a result, if average electric use falls for any reason -- including effective utility conservation activities -- rates will be increased in the following year to assure that in the end the utility collects as much revenue per customer as it would in the absence of changes in consumption.

The Maine statutes, however, required that the MPUC adopt a mechanism that limits the rate impact of ERAM. Thus, on August 28, 1991, the MPUC issued an order that places a 1% cap (equivalent to about \$9 million) on the ERAM-per-customer adjustment made at the end of the first

year of the three-year trial period. Thus no single DSM program can have a rate impact of greater than 1%. Excess amounts are deferred for future recovery through rates.

The provisions of this order were implemented in the first year, when sales revenues were lower than the allowed per customer amount. CMP thus filed with the MPUC to begin collecting \$19.7 million of unbilled ERAM revenues, along with energy-management incentives discussed in the next paragraph earned in 1991. [R#1]

THE TRIAL INCENTIVE MECHANISM

Central Maine Power's incentive mechanism was put in place in May 1991 on a three-year trial basis. CMP is eligible to earn a shared-savings incentive for a three-year trial period. The incentive, which is calculated on a uniform basis for all DSM programs, may not exceed the value of 1% of common equity. If the net benefits of DSM activity are negative, the utility will be assessed a penalty of 10% of the net benefit.

The incentive is calculated using two formulas. The first sets a maximum payment based on 50% of the difference between measured net program benefits and 80% of net program benefits achieved during the baseline year (approximately \$13 million in 1990).

The second formula, put in place to address the equity issue among customer classes, calculates the "Y factor" which equals one less 50% of the utility cost/gross ratio. The utility then receives the value of the product of maximum payment and Y factor. The Y factor is intended to encourage the utility to keep its program costs low by shifting as many DSM costs to the program participants as possible without losing participation. This is done by providing declining portions of the maximum incentive payment, down to one-half, as the utility's own costs approach full avoided cost for all its achieved savings.

One of the unique features of the Maine incentive mechanism is that it is rooted in measurement and validation of persistent savings. All DSM programs run in 1991, 1992, and 1993 and their respective incentives will be reevaluated in 1997. This ties DSM performance to the durability of the savings achieved. Incentive payments are based on two measurements. At the time of the first measurement, one year after the installations are performed, the utility can collect 50% of the incentive. The remaining 50% will be paid in 1997 when savings are reevaluated.

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