Green Mountain Power

Equipment Replacement & Remodelling

Profile #70

Executive Summary

Green Mountain Power began its Equipment Replacement and Remodeling (ERAR) program at the end of 1991 in conjunction with the launch of seven other new DSM programs all developed within a collaborative process between the utility, its regulators, and interveners. The program's replacement component is designed to allow customers to replace equipment at the end of its useful life with new energy efficient equipment at zero marginal cost. The remodeling component, which includes a technical assistance aspect, is specifically targeted at national accounts such as hotel and restaurant chains, to allow facility upgrades during periodic renovation cycles.

One of the most intriguing aspects of the program is that it is run in a utility context characterized by a large reserve margin, nearly 40%, and by the lowest retail rates of any major utility in New England. Thus the program is intended to leverage savings at low cost and this is why the replacement and remodelling aspect of the program is so important. At these times, the utility only has to pay the marginal cost of efficiency upgrades, allowing it to stretch its dollars and leverage maximum savings at the least possible cost. GMP has been very pleased with its program to date, as savings have outstripped projections and costs have been less than projections!

The ERAR program is distinctly different from GMP's Large C&I Retrofit program that is designed to replace functioning equipment with more energy-efficient equipment. However, GMP has attempted to link these programs by ensuring that all participants in the Large C&I retrofit program are informed of the ERAR program. In fact, the utility's Large C&I Retrofit program provides labels for the installed technology containing information on the ERAR program. GMP believes that this linkage will allow efficient technologies installed under the retrofit umbrella to eventually be replaced with other efficient technologies, maintaining persistence of savings for the customer and the utility.

Finally, both GMP and the Vermont Public Service Board recognize that incentives for replacing efficient equipment cannot be provided indefinitely as the market for these technologies will likely change in response to the current incentives. Thus without changes, the program could experience high levels of free ridership. However, both the utility and the Board feel that the current market for efficient technologies needs stimulation and that the utility can provide this valuable service. An evaluation of the effects of the ERAR program on the market is due in 1994, and the program will be adjusted accordingly, possibly by ratcheting up the minimum efficiency requirements of eligible technologies to reflect market conditions.

Equipment Replacement & Remodeling

Utility:	Green Mountain Power
Sector:	Commercial and Industrial
Measures:	Lighting and motor applications; also space conditioning, refrigeration, and industrial process improvements on a customized basis
Mechanism:	Incentives to replace equipment at end of useful life or failure, or to retrofit for efficiency during normal cycle of remodelling
History:	Started in winter 1991

1992 Program Data

Energy savings:	1,051 MWh
Lifecycle energy savings:	14,714 MWh
Capacity savings:	0.37 MW
Cost:	$359,900

Cumulative Data (1991 - 1992)

Energy savings:	1,059 MWh
Lifecycle energy savings:	14,745.5 MWh
Capacity savings:	0.37 MW
Cost:	$508,900

Conventions

For the entire 1993 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 U.S. Federal Reserve's foreign exchange rates.

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.

Green Mountain Power (GMP) is an electricity generation and distribution company based in South Burlington, Vermont that has provided service for 100 years. GMP currently supplies electricity to one-third of the population of Vermont and sells wholesale electricity to other utilities, three of which receive almost all of their power requirements from the company. GMP also transmits power for the State of Vermont, which distributes the power to residential and farm customers by using facilities leased from GMP. GMP's cost of electricity is one of the lowest among New England utilities and in 1992 GMP had the lowest retail rates of any major New England utility, even after implementing a 5.6% rate increase.[R#1]

GMP has the distinction of serving one of the most rural and least-populated states in the country. Vermont is mostly mountainous, dominated by the Green Mountains, an extension of the Appalachian range. GMP is based in South Burlington, which along with Burlington (which is served by Burlington Electric Department) is one of the largest metropolitan areas in the state. Traditionally, Vermont's economy has been based on dairy farming but tourism has become increasingly important to the state's economy and is currently Vermont's second largest industry, with more than four million skier day visits in 1991. Vermont has recently seen an influx of new industry such as the manufacture of computer chips. Finally, the state is still well known for the production of granite and marble, as well as wood and paper products.[R#1]

Green Mountain Power serves customers in a cold and cloudy part of the United States. The 30-year mean annual temperature in the Burlington area is 44.1°F, with average snowfall of 77.1 inches and a total of 156 days when temperatures drop below freezing. The 30-year average of heating degree days for Burlington is 7,953, contrasted with an average of 379 cooling degree days.[R#2]

To serve its customers the utility employed 388 workers in 1992 on a full or part-time basis. The average number of electric customers in 1992 was 78,543, with 79,100 electric customers at year-end. In 1992, GMP served 67,201 residential customers (85.6%), 11,245 small commercial and industrial (14.3%), 24 large commercial and industrial, and 73 others (the latter two customer groups accounting for the remaining 0.1% of the total customers).

Total 1992 sales and lease transmissions were 2,068,073 MWh of which 505,234 MWh were sales to residential customers and 58,374 MWh were lease-transmitted to residential customers. Sales to small commercial and industrial customers totaled 582,594 MWh, and sales to large commercial and industrial customers were 539,665 MWh. GMP 1992 sales to municipal and cooperative utilities totaled 102,807 MWh, sales to other customers totaled 6,312 MWh, and other sales for resale were 273,087 MWh.[R#1]

GMP 1992 STATISTICS

Number of Customers	78,543	
Energy Sales (including lease transmissions)	2,068	GWh
Operating Revenues	$134.94	million
Peak Demand	314.4	MW
Generating Capacity	439.9	MW
Reserve Margin	39.9	%
Average Electric Rates		
Res. (including lease $)	8.22	¢/kWh
Small C/I	7.27	¢/kWh
Large C/I	5.47	¢/kWh

GMP has an ownership interest in generation facilities that supply 40% of its total capacity. Of these generation facilities, the utility has outright ownership of several hydro plants, as well as diesel and gas turbine plants that together generated roughly 27% of the 1991 average monthly net capacity. The remaining 60% of the energy GMP distributes is purchased from other utilities.

The utility has a peak generating capacity of 439.9 MW and a peak demand (that last occurred in December of 1991) of 314.4 MW, for a reserve margin of 39.9%. GMP derives most of its net system capability from hydroelectric sources (160.6 MW or 36.5% of its capacity in 1992), with the remainder coming from nuclear (24.9%), conventional steam (21.6%), internal combustion (10.8%), combined cycle (4.9%) and lease transmissions (1.3%). Much of the hydropower is purchased under a contract with Hydro-Quebec. GMP also has pursued development of wood-fired and wind generation. The company operates two 100 kW wind turbines, while the McNeil wood-fired plant located in Burlington provides 0.9% of the utility's energy generation.[R#1] ■

History of Efficiency Programs at GMP

Transmission & Distribution	Ongoing
Storage Heat	1975
Ripple Water Heater Control	1975
Power Factor Incentive	NA
Voluntary Time-Of-Use Rate Codes	1976
RCS Audit Program	1978
"Widget" Flow Restrictions	1978
Water Heater Setback	1978
"Wrap It Up" Water Heater Jacket	1979
"Gidget" Outlet and Switch Gaskets	1979
Energy Shaver Window Wedges	1980
Rate 14- Removal of Block Rate	1981
Seasonal Rates	1982
Common Sensor Heating Cost Monitor	1982
"Watt a Lite" Efficient Nite Light	1982
Energy Watt Electricity Cost Estimator	1983
Power Factor Incentive - Improved	1984
Commercial Energy Audit Program	1984
Incandescent Street Lighting	1984
Do It Yourself Calculator	1984
Flow Restrictor Program (New)	1984
GMP Merchant Co-op Networks	1984
Appliance Efficiency Program	1984
Seal It Up	1984
Plumbing Supply Wholesales	1984
HVAC Dealers	1984
Building Materials Contractors	1984
Energy Management Action Seminar	1984
Bill Enclosures with Efficiency Info	1984
Welcome Aboard Packet	1984
Direct Load Control	1984
Residential Lighting Program	1984
Residential Energy Audit Program	1985
Electric Studio	1985
Dual Fuel Program	1985
Highgate Housing Efficiency Project	1987
Demand Analysis Service	1987
Efficient Water Heater Rental Program	1987
Mandatory Time of Use Rate	1989

GMP has provided various energy conservation services since the mid-1970s although planning for a comprehensive package of DSM programs did not take place until 1991 and the utility's full-scale DSM initiative began in earnest in 1992. The attached list is a chronology of programs, rate schedules, and customer information campaigns that GMP has offered over the years.

GMP has used a unique methodology to determine the savings that it can attribute to the ad hoc DSM efforts it pursued during the 1970s and 1980s. By comparing its customers' energy use (residential, commercial, and industrial) with average aggregate values for the entire state, and then weather-normalizing the data, GMP's staff has attempted to determine what they call the "embedded DSM," or energy savings, within GMP's service territory.

For example, the utility estimates that in 1991 each of its residential customers was saving on the order of 745 kWh as compared to other Vermont residents. This "saving," or "negawatt" value, represents an approximation of the amount of annual energy saved as a result of GMP's long history with conservation and efficiency programs, and is equal to about 9% of the average annual residential consumption. For commercial customers, the utility estimates that each customer similarly saved approximately 3,243 kWh in 1991, or 6% of the annual energy use for the sector. For GMP's large commercial and industrial customers, the embedded DSM value in 1991 was 6,731 kWh, or approximately 4% of the weather-adjusted, total energy used in that sector.

THE COLLABORATIVE AND THE CURRENT SITUATION

In 1991, GMP engaged in the Vermont collaborative planning process that included the Conservation Law Foundation of New England, the Vermont Department of Public Service, the Vermont Natural Resources Council, and the Vermont Public Interest Research Group. GMP agreed to participate in the collaborative process as part of a rate settlement.

As a result of the collaborative, GMP designed a comprehensive group of DSM programs that were intended to reach as many customers as possible. GMP spent $1,303,000 in 1991 planning its DSM programs, most of which ($1,275,210) went towards administrative costs.[R#4]

GMP CURRENT DSM PROGRAMS

Residential

- Residential Retrofit
- Residential New Construction
- Energy-Efficient Appliances & Lighting
  - Refrigerator Recycling
  - Mail Order Lighting
  - Trade Ally Lighting
  - Blue Ribbon Appliance

Farm

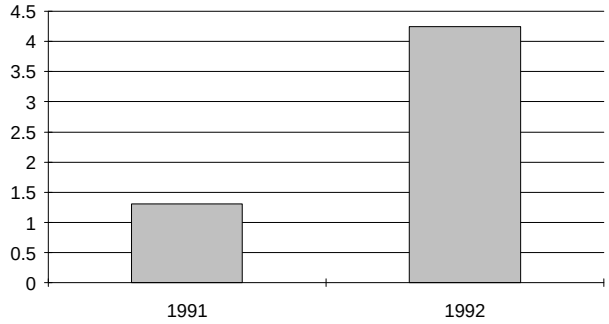
- Farm Energy Efficiency

Commercial & Industrial

- Small C & I Retrofit
- Large C & I Retrofit
- **Equipment Replacement & Remodeling**
- New Construction

In 1992, GMP offered its customers eight DSM programs under the Power$avers umbrella, including the C&I Equipment Replacement and Remodeling Program that is the subject of this profile, and the Small C&I Retrofit Program (see The Results Center Profile #48). GMP's currently available DSM programs cover the commercial, industrial, residential, and agricultural sectors and are contained in the attached list. Note that four sub-programs are embedded under the Energy-Efficient Major Appliance and Lighting program.

ANNUAL DSM EXPENDITURES (MILLIONS)



GMP spent a total of $4,245,000 on its DSM programs in 1992, the equivalent of 3% of the utility's 1992 gross revenues. These DSM programs accounted for 9,698 MWh in energy savings and 2,375 kW in coincident peak savings for the year. A large majority of the savings gained from these programs were from lighting retrofits that accounted for 7,054 MWh in energy savings and 1,497 kW in coincident peak savings.[R#4]

DSM expenditures for 1993 are projected to be slightly over $9,400,000 (unlevelized). This expenditure would represent 7.2% of GMP's revenues [R#4], an order of magnitude above the national average of 0.7% of revenue expended by a utility on DSM.[R#9] The ERAR program budget is scheduled to increase correspondingly by over $200,000 (unlevelized), a 45% increase above the 1992 budget level of $359,900. ■

Program Overview

The Equipment Replacement and Remodeling (ERAR) program is available to all of Green Mountain Power's commercial and industrial customers. GMP provides technical and financial assistance to participants in the program.[R#4]

This program was developed in conjunction with GMP's other DSM programs during 1991, approved by the Vermont Public Service Board (Board) in September of 1991, and implemented at the end of that year. As noted previously, all of GMP's current DSM programs were developed through a collaborative process with regulators and other interveners. GMP views the ERAR program as a "state-of-the-art" application of demand-side management because of its ability to target customers and buy down energy savings at a low cost. The program will be modified as necessary, based on the results of two to three years of implementation experience.[R#5]

The program has two components. The replacement component allows customers to install energy-efficient equipment when their existing equipment fails or reaches the end of its useful life, rather than replacing that equipment with a standard product. The remodeling component of the program is targeted specifically at national and regional accounts (i.e., chains of hotels and restaurants like Holiday Inns and McDonalds) to allow them to qualify for upgrades during their periodic renovations. GMP's market research has found these upgrades typically consist of lighting applications.[R#5]

There are significant economic advantages to pursuing efficiency at time of replacement rather than through retrofit. Incentive costs can be minimized to include only the incremental cost of efficient technology, rather than the full cost of a new product. Therefore, many technology options that might not be cost-effective to retrofit are cost-effective to replace. Costs for participants may also be decreased by replacing equipment during the normal cycle of operation. In some cases, the ERAR program incentive may exceed other incentives offered by the utility for projects with low simple paybacks. In fact, under the ERAR program, participants pay no costs for efficiency upgrades, since the utility buys down the full incremental cost of an efficient technology. Replacement also allows the utility to leverage its resources, again by only paying marginal costs versus total costs. This leveraging makes replacement programs a particularly attractive option for any utility with limited resources.

The ERAR program has both a prescriptive and a customized path. GMP has developed a schedule of prescriptive incentives for a number of eligible measures, including lighting and motor applications. Space conditioning, refrigeration and industrial process efficiency measures are considered on a case-by-case custom basis. The utility will also provide technical assistance to a customer seeking to implement other measures. To date, the majority of participants have chosen to implement ballast and fixture upgrades, motor replacements, and industrial process improvements.[R#4]

Finally, GMP has chosen to implement the program by working with trade allies throughout its service territory. These distributors and contractors have been recruited by GMP, and provided with complete information on the program to allow them to assist customers with selection of measures and preparation of the paperwork necessary to secure GMP's incentive.

The ERAR program is distinct from GMP's large and small C&I retrofit programs that are designed to replace functioning equipment with more energy-efficient equipment. However, GMP has attempted to link these programs, by ensuring that all participants in the large C&I retrofit program are informed of the ERAR program. This linkage is being extended by the utility to the small C&I market this year. The utility believes that this linkage will allow efficient technologies installed under the retrofit umbrella to eventually be replaced with other efficient technologies, maintaining persistence of savings for the customer and the utility.[R#4] By regularly ratcheting up the minimum standards for equipment in the ERAR program in response to the state of the market, the utility can increase its efficiency benefits and avoid free ridership. ■

CASE STUDY: ESSEX JUNCTION RECREATION AND PARKS DEPARTMENT

The Essex Junction Recreation and Parks Department replaced the incandescent lamps at its Park Street softball field with metal halide lamps. This replacement saved Essex Junction $616 a year in electricity costs, and reduced the City's energy consumption by almost 9,000 kWh while providing 20% more light on the field. An incentive of $1,800, more than one-fourth of the total project cost, was paid by GMP to Essex Junction to buy down the costs of the more efficient lighting. [R#3]

MARKETING

Green Mountain Power employs what it terms an integrated marketing approach to the ERAR program. Utility representatives meet with commercial and industrial customers to present the program as well as other GMP DSM offerings available to these classes of customers. In cases where the customer was referred by another party, the utility will initially pursue that customer over the telephone.

As noted in the Program Overview, GMP attempts to link its DSM programs to ensure that retrofit applications are replaced with similarly or more efficient technologies, so that persistence of savings is maintained. In fact, the utility's Large C&I Retrofit program provides labels for the installed technology containing information on the ERAR program.[R#4] Both GMP and the Vermont Public Service Board (Board) recognize that incentives for replacing efficient equipment cannot be provided indefinitely, as the market should change in response to the current incentives. However, both the utility and the Board feel that the current market for efficient technologies needs stimulation, and that the utility can provide this valuable service. An evaluation of the effects of the ERAR program on the market is due in 1994, and the program will be adjusted accordingly, possibly by ratcheting up the minimum efficiency requirements of eligible technologies to reflect standard practice at that time.[R#12, 13]

GMP uses trade allies to sell and deliver the program. As of March 1, 1993, over sixty contractors and distributors were certified as ERAR trade allies. These allies are recruited, trained, and provided with information on the program so they can assist customers to select eligible measures and complete GMP's application for an incentive. Additionally, GMP provides its allies with counter displays and encourages them to stock or install efficient products. The trade allies benefit from the program through increased sales and installation of more efficient products that are typically among the more expensive products. To minimize confusion among trade allies and customers, the GMP Motor Incentive Form was redesigned to include other participating electric utilities in Vermont.

The utility has also secured the services of a contractor for the ERAR program to work in the field promoting customer awareness of the program and supporting the program's network of current and potential trade allies.

Finally, GMP has employed a number of advertising and promotional techniques. For example, feature articles have been placed in "Energy Today," GMP's newsletter for its commercial and industrial customers. These articles included a description of the program and details, such as utility contacts, phone numbers, and addresses, and how to participate. The newsletter is distributed in customers' bills. In addition, case studies have been prepared for customer credibility building purposes. Also, a number of advertisements have run in the local and state press, including the Burlington Free Press, the Barre/Montpelier Times Argus, and the Vermont Business Magazine. GMP has also been actively promoting all of its DSM programs at various trade shows to persuade customers to participate.[R#3]

DELIVERY: THE STEP BY STEP PROCESS

To participate in the program, a customer completes the required paperwork and sends it to GMP. Often, GMP's trade allies assist customers in completing the necessary forms that consist of a brief application and checklist of eligible measures. If the total incentive is to exceed $1,000, pre-approval of the project is highly recommended. For customized projects, GMP staff or a GMP contractor visit the site, develop an engineering estimate of the costs and energy savings, and screen the project for cost-effectiveness. Screening is based on the cost differential between standard and high-efficiency equipment, and cost-effectiveness measured in comparison to the utility's avoided cost. GMP uses a societal cost-effectiveness test for the screening process.

Incentives are then provided upon completion of the installation of the measures. For all projects a post-installation inspection is performed, with the exception of ballast installations of less then ten units.

Under the current application process an average of two to three weeks pass between receipt of an application by GMP and payment of an incentive to the customer. However, this time varies according to the completeness of the initial application and the scheduling of an inspection if required. GMP assumes the responsibility to contact the customer to secure any information not contained on the initial application and to schedule an inspection. This contact is currently done over the telephone, however, the utility has recognized that a significant increase in participants in the ERAR program could require a different approach.[R#6] ☞

MEASURES INSTALLED

A number of measures are eligible to be implemented under the ERAR umbrella. The prescriptive pathway provides incentives for ballast and lamp replacement and three-phase motors. Industrial process improvements, refrigeration, cooking, space conditioning, and water heating are evaluated on a custom basis. Additionally, GMP is required by the State to provide information on the estimated costs and benefits of fuel switching from electricity to another fuel source for space heating and water heating. Thus, the ERAR program provides this information, however, there are no incentives provided for fuel-switching.

During 1991-1992, 65 projects were performed under the ERAR program. Of these, 55 were lighting applications, five were industrial process, three were motors, one was HVAC, and the other was a fuel-switching project for space heating. The range of incentives provided was quite broad as a result of the prescriptive and customized pathways and the range of available measures. For projects completed under the prescriptive umbrella, incentives ranged from $10 for a single electronic ballast to $12,605 for 767 electronic ballasts. The attached table shows prescriptive lighting incentives. Incentives for motors are based on horsepower, minimum efficiency, and revolutions per minute (rpms). These incentives range from just over $30 to above $2,600.

STAFFING REQUIREMENTS

The ERAR program is administered by Dan Gaherty who devotes approximately 50% of his time to the program. The utility's field staff work on all of the available DSM programs. However, GMP has estimated that the equivalent of fifty percent of a full-time employee is devoted solely to the ERAR program. Additionally, the C&I coordinator at GMP is also considered one-half of a full-time employee for the ERAR program, and the C&I program manager devotes one-fifth time. Finally, GMP's contractor provides one full-time employee to promote awareness of the program, for an approximate total of 2.7 FTEs. [R#10] ■

PRESCRIPTIVE LIGHTING INCENTIVES

Measures Installed	*Incentive*	*Minimum Hrs/wk*
Ballasts		
2-Lamp T12	$10	40
3,4 Lamp T-12	$8	16
2-Lamp T-8	$17	40
3,4 Lamp T-8	$12	16
2-Lamp F-96	$24	50
2-Lamp F-96 HO	$7	12
Interior HIDs		
H.P. Sodium	$28	20
Metal Halide	$19	20
Exterior HIDs		
<200 Watts	$50	32
>200 Watts	$75	32

MONITORING

The ERAR program is monitored by a database tracking system developed specifically to track GMP's demand-side management programs. The database contains a variety of information for each program applicant, including measures installed, costs, and the resulting energy and capacity savings. Information for entry into the tracking system is collected by GMP field inspectors or, in the case of energy benefits, computed by program administrators. A program administrator has responsibility to ensure the data is entered into the tracking system, which is used not only to monitor program implementation but to generate information for the payment of incentives.

Projects implemented under the ERAR program are verified by a post-installation inspection, including all customized projects and all ballast replacements involving more than ten ballasts. Once inspection has verified that the measures have been implemented, the energy benefits of the project are computed. For measures installed under the prescriptive pathway, GMP program administrators calculate the energy savings according to defined values for the equipment that was replaced and the equipment installed, and enter this information into the tracking system. For customized measures, an engineering analysis is performed.

EVALUATION

The utility has not yet implemented a metering effort to gauge the effects of installed measures. However, a contractor for GMP (Xenergy, Inc. of Burlington, MA) has drafted a metering plan describing criteria for site selection and options for implementing such a plan. GMP intends to meter ten projects to validate the savings from the ERAR program, and to perform a telephone survey of 25 participants to evaluate the implementation process.[R#4]

A formal evaluation of the process and effects of the ERAR program has not yet been completed, however, such an evaluation is currently being drafted by Xenergy for GMP. A preliminary review of the tracking system resulted in some recommendations for data collection and entry modification, primarily concerned with timely and complete entry and the ability of the system to generate evaluation reports for the utility. These issues have since been resolved.[R#4,6]

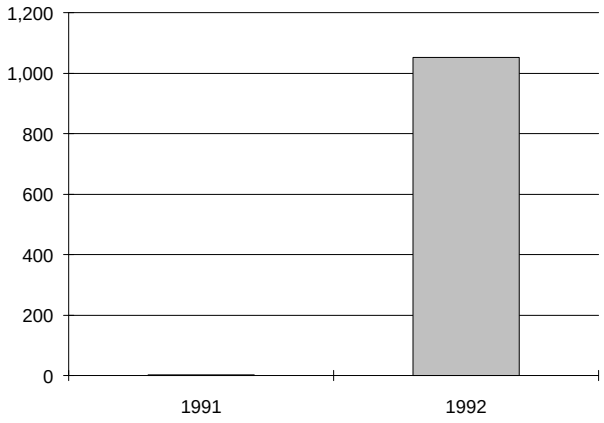
The utility is required by the Board to file a report of its DSM program activity on a yearly basis (the first such report, for 1992, is referenced throughout this profile). In this report, the utility compares projected expenditures and savings against actual figures. The Board and GMP have agreed to wait for the results of a formal monitoring and evaluation of the ERAR program before making significant adjustments to the program. Such an evaluation is likely to be completed during 1993-1994, so that it includes data from more than one year of program implementation.

Analysis of program savings is found in the next section of this profile, however, it should be noted that GMP adjusts both its projections and the calculations of actual energy savings for this program by 15% to account for free-riders.[R#4] GMP also adjusts savings to account for avoided waste heat effects. Since most buildings in Vermont are heated for at least eight months, removal of inefficient lighting requires more space heating to compensate for the loss of internal heat gain. GMP applies this adjustment to heating-only building projects; savings from buildings with both heating and cooling are not adjusted.[R#4,7] ■

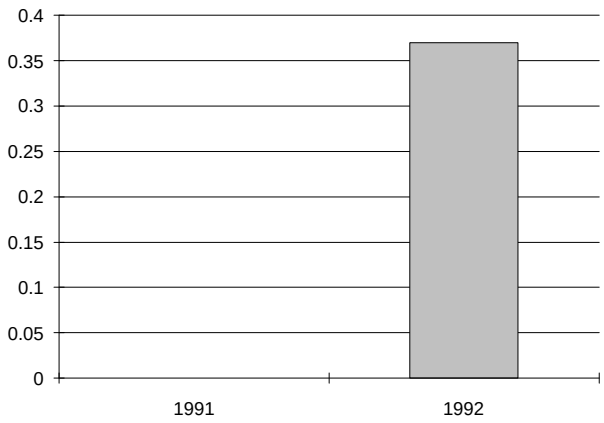
Program Savings

Savings Overview	*Annual Energy Savings (MWh)*	*Cumulative Energy Savings (MWh)*	*Lifecycle Energy Savings (MWh)*	*Annual Peak Capacity Savings (MW)*	*Cumulative Peak Capacity Savings (MW)*
1991	4	4	31.5	0.000	0.000
1992	1,051	1,055	14,714.0	0.370	0.370
Total	1,055	1,059	14,745.5	0.370	

ANNUAL ENERGY SAVINGS (MWH)



ANNUAL PEAK CAPACITY SAVINGS (MW)



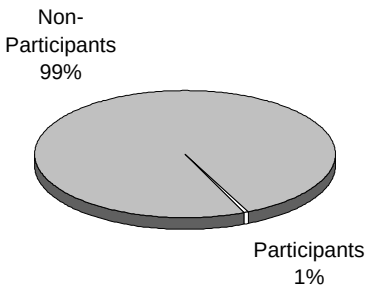
Data Alert: Savings presented are "net" savings based on engineering estimates of a given technology's performance and hours of operation. Savings include a 15% reduction to account for free riders and also include a waste heat adjustment where appropriate (see Monitoring and Evaluation). Capacity savings presented are coincident peak demand savings.

The ERAR program began in 1991 with one participant saving 3.5 MWh in annual energy savings and 0.4 kW in demand. GMP calculated a measure lifetime of 9 years for this project, resulting in lifecycle savings of 31.5 MWh for 1991.[R#4]

In 1992, the program began in earnest and it's 64 participants realized a total of 1,051 MWh in annual savings, and 369.6 kW of demand reduced, above the projected

savings of 1,029.4 MWh and 189.6 kW, respectively. With a weighted measure lifetime of 14.1 years for projects performed that year, lifecycle savings were 14,714 MWh. Slightly over half of the 1992 energy savings (563 MWh) can be attributed to lighting applications, with the remainder from motor and industrial process upgrades and space heat fuel switching. Peak demand reduction for 1991 and 1992 was divided between lighting (171 kW), industrial process (155 kW), motors (31 kW), and space heat (12 kW).[R#4]

Total annual savings for the program are 1,055.4 MWh and 370 kW. With a weighted lifetime of 14 years for all of the measures installed during 1991-1992, lifecycle energy savings are 14,745.5 MWh. Energy savings per participant are calculated to be 16.2 MWh.[R#4]



PARTICIPATION RATES

Program participants are defined by the utility as completed projects. Sixty-five projects were completed during 1991-1992 for a variety of commercial and industrial customers, including an auto repair shop, a school building, a waste-water treatment facility, and the Vermont Statehouse. Since all 11,269 C&I customers are eligible for this program, participation in what was essentially the program's initial year was under one percent. However, GMP has based its projections for the ERAR program not on the number of projects undertaken, but on the energy and demand savings as a result of those projects.[R#4]

Participation	*Participants*	*Annual Energy Savings per Participant (kWh)*
1991	1	3,500
1992	64	16,422
Total	65	16,223

FREE RIDERSHIP

GMP agreed to provisions to account for free riders in each of its DSM programs during the collaborative process. For some programs, such as the Small C&I Retrofit program (see Profile #48), the collaborative agreed not to incorporate any provisions for free riders. However, for the ERAR program, the level of free ridership was set at 15%. Accordingly, all of the energy benefits calculated by GMP and presented in this profile include the 15% adjustment, or derating, of savings.

MEASURE LIFETIME

GMP weights the lifetime of measures installed under the ERAR program according to accepted industry standards. For the program to date, the weighted lifetime of all installed measures has been fourteen years. This figure is similar to values used in other commercial and industrial demand-side management programs profiled by The Results Center, where values have ranged from 6.8 to 26 years, with a concentration around 15 years.[R#8] However, there is a disparity with the measure lifetime used by GMP in its own Small C&I Retrofit program where the estimated lifetime was calculated to be 6.1 years. This disparity is due to a high level of small business turnover and a corresponding amount of measure attrition.[R#7]

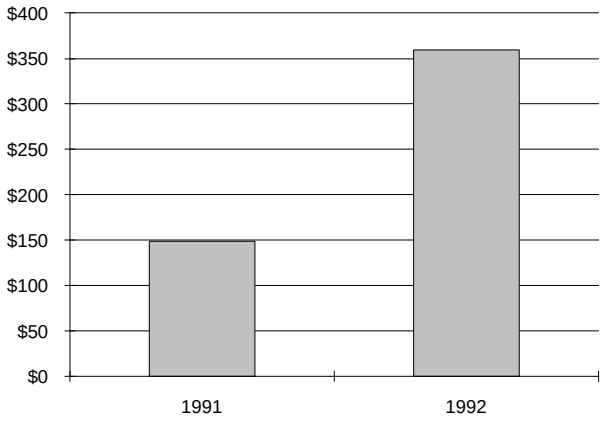
PROJECTED SAVINGS

Green Mountain Power projected savings of 1,029.4 MWh and 189.6 kW for 1992, and realized actual savings of 1,051.9 MWh and 369.6 kW, respectively. For 1993, GMP has increased its projected energy savings significantly to 1,769.7 MWh and its capacity savings to 323 kW. With savings well above projections and costs below budget (see the following section) GMP strongly believes the ERAR program has been successfully designed and implemented to date. ■

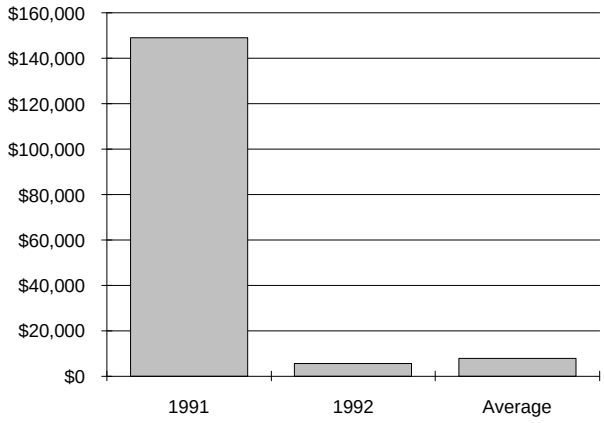
Cost of the Program

Costs Overview	*Administration (x1000)*	*Incentives (x1000)*	*Audits (x1000)*	*Evaluation (x1000)*	*Total Program Cost (x1000)*	*Cost per Participant*
1991	$145.5	$0.0	$0.0	$3.5	$149.0	$149,026.32
1992	$207.0	$93.0	$3.6	$56.2	$359.9	$5,622.71
Total	$352.5	$93.0	$3.6	$59.7	$508.9	$7,828.92

TOTAL PROGRAM COST (x1000)



COST PER PARTICIPANT



Cost of Saved Energy (¢/kWh)	*Discount Rates*						
	3%	4%	5%	6%	7%	8%	9%
1991	376.94	403.09	430.15	458.09	486.87	516.47	546.85
1992	3.03	3.24	3.46	3.68	3.92	4.15	4.40
Average	4.27	4.57	4.88	5.19	5.52	5.85	6.20

Total costs for the Equipment Replacement and Remodeling program during 1991-1992 were $508,900. The bulk of this money, $359,900, was spent in 1992, with the remainder spent the previous year.

COST EFFECTIVENESS

A formal process and impact evaluation of the ERAR program, including an analysis of cost-effectiveness, has not been completed. However, cursory examination of the actual program costs for 1992, $359,900, shows them to be below the projected budget of $447,400. The bulk of these savings can be attributed to the incentive payments that were approximately 60% below projected levels. Combined with the larger than projected energy and demand savings from this program, GMP considers the program to be highly cost-effective.[R#4] The utility attributes this cost-effectiveness to several customized projects that provided relatively high energy benefits at a low incremental cost between baseline and high-efficiency technologies.[R#4]

The Results Center calculates the cost of saved energy for the ERAR program in 1992 to be 3.46 ¢/kWh at a 5% real discount rate. A higher cost of saved energy during 1991 was attributable to the administrative costs of beginning the program and a lone participant. However, the simple average cost of saved energy (at a five percent discount rate) over the life of the program is 4.88 ¢/kWh.

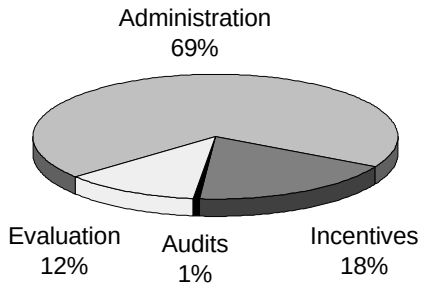
COST PER PARTICIPANT

In 1991, the program had only one participant, consequently the utility's cost-per-participant of $149,026 is not a valid yardstick for the program. The 1992 cost per participant was $5,622, more reflective of the actual cost per participant given the much larger number of projects completed during this year. The simple average cost per participant for the program during 1991-1992 was $7,829.

Because incentives for the ERAR program are structured to overcome the incremental cost of efficient technology, participants in the program bear no additional costs.

COST COMPONENTS

The majority of the costs for this program to date have been administrative. These costs, $352,500, represent just over 69% of the total program costs. Costs for 1991 are especially dominated by administrative costs due to the expenses involved in establishing the program. The remaining costs are split among incentives, $93,000, evaluation, $59,700, and audits, $3,600. GMP notes the administrative costs, while over budget, are not unreasonable for program development and initial implementation. The additional costs are attributed to developing the DSM tracking system and purchasing the computers necessary to implement and monitor all of the utility's DSM programs.[R#4] ■



Environmental Benefit Statement

AVOIDED EMISSIONS: Based on 1,059,000 kWh saved 1991 - 1992

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%	2,283,000	54,000	11,000	1,000
B	10,000	1.20%	2,435,000	21,000	7,000	5,000
	Controlled Emissions					
A	9,400	2.50%	2,283,000	5,000	11,000	0
B	10,000	1.20%	2,435,000	2,000	7,000	0
C	10,000		2,435,000	14,000	7,000	0
	Atmospheric Fluidized Bed Combustion					
A	10,000	1.10%	2,435,000	6,000	3,000	2,000
B	9,400	2.50%	2,283,000	5,000	4,000	0
	Integrated Gasification Combined Cycle					
A	10,000	0.45%	2,435,000	4,000	1,000	2,000
B	9,010		2,190,000	2,000	1,000	0
Gas	**Steam**					
A	10,400		1,328,000	0	3,000	0
B	9,224		1,153,000	0	7,000	0
	Combined Cycle					
1. Existing	9,000		1,153,000	0	4,000	0
2. NSPS*	9,000		1,153,000	0	2,000	0
3. BACT*	9,000		1,153,000	0	0	0
Oil	**Steam--#6 Oil**					
A	9,840	2.00%	1,922,000	29,000	3,000	3,000
B	10,400	2.20%	2,039,000	29,000	4,000	2,000
C	10,400	1.00%	2,039,000	4,000	3,000	1,000
D	10,400	0.50%	2,039,000	12,000	4,000	1,000
	Combustion Turbine					
#2 Diesel	13,600	0.30%	2,551,000	5,000	8,000	0
Refuse Derived Fuel						
Conventional	15,000	0.20%	3,029,000	8,000	10,000	2,000

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 accomanying page is to allow any user of this profile to apply Green Mountain Power's level of avoided emissions saved through its Equipment Replacement and Remodelling 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 include 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

GMP'S AVOIDED EMISSIONS FOR THE ERAR PROGRAM (Tons)

Year	*SOx*	*NOx*	*Particulates*	*CO2*	*CO*	*VOCs*
1993	4.923	2.272	0.568	883.556	0.694	1.136
1994	3.910	2.729	0.332	958.947	0.664	0.701
1995	5.280	2.315	0.546	1092.472	0.624	0.624
1996	8.596	2.253	0.812	1420.81	0.507	0.832
1997	7.306	2.070	0.644	1217.747	0.470	0.539
1998	6.178	2.615	0.642	1253.881	0.688	0.673
1999	5.877	2.861	0.634	1296.628	0.747	0.691
2000	5.509	2.762	0.599	1227.375	0.731	0.643
2001	5.923	2.423	0.623	1246.946	0.609	0.666
2002	5.832	2.484	0.631	1344.809	0.645	0.686
2003	3.926	1.402	0.441	1041.644	0.574	0.481
2004	3.599	1.361	0.406	1151.722	0.589	0.445
2005	1.736	1.697	0.244	1054.304	0.707	0.231
2006	0.954	1.192	0.163	953.509	0.715	0.213
Total	69.549	30.436	7.285	16144.35	8.964	8.561

Data for 1993 installed measures with a weighted measure lifetime of 14 years & projected 1993 energy savings of 1769.7 MWh

GMP'S AVOIDED EMISSIONS

Green Mountain Power has run extensive calculations of the environmental benefits, in the form of avoided emissions, from the ERAR program. These calculations can be found in the above table, "GMP's Avoided Emissions from the ERAR Program," provided by GMP's DS Planning group. These calculations are based on pre- and post-DSM cases modeled by the utility using its integrated resource planning tool. The emissions begin to tail off after 1995 for many pollutants given the reduction strategies implemented by GMP to comply with the Clean Air Act Amendments of 1990, as well as projected changes in the utility's fuel mix at that time. ■

LESSONS LEARNED

By both fiscal and energy measures, the ERAR program can only be considered successful. The program secured both energy and demand savings above its first year targets at a cost below budget. Coincident peak demand savings were especially noteworthy.

The desired energy targets were achieved despite a relatively low level of direct marketing of the program by the utility to its customers. The use of numerous trade allies to promote the program and to assist customers with selecting eligible measures and filling out the necessary forms allowed the utility to devote resources to other aspects of the program rather than marketing.

Perhaps the most substantial economic lesson learned is the value of a replacement program. Replacement has proven to be economically attractive to both the consumer and Green Mountain Power. Customers realize substantial energy (and thus bill) savings from replacing equipment with efficient technologies during the normal cycle of operation. The utility secures these energy benefits through low-cost incentives.

GMP feels that the linkage of the ERAR program to its other, complementary demand-side management programs (notably the C&I Retrofit programs) is the most valuable design and implementation lesson to be learned. The utility hopes to forge a strong link between the retrofit programs and the ERAR program, so that when equipment installed under a retrofit umbrella eventually reaches the end of its useful life, it will be replaced with more efficient equipment. Such a replacement would mitigate any potential "snapback" effects, where the benefits of efficiency are lost when an efficient technology fails. An effective replacement program should allow GMP to have full confidence in the persistence of the savings gained under its DSM portfolio. Ultimately, the number of customers that make the link from retrofit to replacement program will be telling as to the strength of the linkage GMP is able to build, and therefore the persistence of the energy and demand savings. Of course this data does not yet exist.

Two brief budgeting lessons appear. First, total incentive payments for the ERAR program have been substantially lower than projected. This factor seems to validate the replacement concept, suggesting that incentives need not be proportionally high to convince customers to participate as long as the incremental cost of an efficient technology is overcome. Notably, the customized pathway for participating may also provide substantial savings at a relatively low cost to the utility by encouraging participants to undertake well-planned, comprehensive improvements. Finally, start-up costs for the ERAR program, a new program, were higher than projected, primarily due to one-time expenditures for program tracking materials such as computers and software.

For the future, GMP intends to incorporate a greater linkage to the retrofit programs, particularly among small commercial and industrial customers.

TRANSFERABILITY

GMP's ERAR program could be implemented relatively unchanged in any other service territory. This type of program may be particularly attractive to utilities with limited resources seeking to leverage relatively small incentive payments to substantial energy benefits during a customer's remodeling or replacement cycle of operation. In fact, many of the design and implementation components of this program – the use of trade allies, incentives tied to the incremental cost of efficiency, and certainly the measures eligible – have been used in other successful programs. However, the combination of these factors with the linkage GMP is establishing between its DSM programs is the critical element that should be captured by replicas of the ERAR program.

Ultimately, the incentives paid for replacing equipment (particularly equipment already considered efficient), as well as the minimum levels of efficiency necessary to qualify that equipment for an incentive may have to be adjusted by GMP in response to changes in standard practice. Certainly any utility that adopts the ERAR model should carefully evaluate the market for efficiency measures and any incentive structure adopted to effect that market to prevent development of a program vulnerable to excessive free ridership (on one hand) and cream-skimming (on the other). ■

Traditional utility ratemaking, where each and every kilowatt-hour sold provides profit, is a major barrier to utilities' implementation of energy efficiency programs. Several state regulatory commissions and their investor-owned utilities have been pioneers in reforming ratemaking to: a) remove the disincentives in utility investment in DSM programs, and b) to provide direct and pronounced incentives so that every marginal dollar spent on DSM provides a more attractive return than the same dollar spent on supply-side resources.

The purpose of this section is to briefly present exciting and innovative incentive ratemaking mechanisms where they're applied. This we trust, will not only provide some understanding to the reader of the context within which the DSM program profiled herein is implemented, but the series of these sections we hope will provide useful snapshots of incentive mechanisms being used and tested across the United States. (Note that the dollar values in this section have not been levelized.)

VERMONT OVERVIEW

Many of the financial disincentives to investments in energy efficiency in Vermont have been removed by regulatory commission orders. The Public Service Board, referred to as the "Board," is the state's regulatory commission, similar to PUCs and PSCs in other states. A second agency, the Department of Public Service has several related functions, one of which is serving as the state's ratepayer advocate and as such intervening in regulatory proceedings before the Board.

Utilities in Vermont are required to submit implementation plans every three years that include integrated resource plans, i.e., plans that consider both supply- and demand-side resource acquisitions. In 1990, the Public Service Board made extensive adjustments and refinements to the integrated resource planning (IRP) process and allowed cost recovery of DSM costs. The resulting April 1990 order also established the "ACE" mechanism (Account Correcting for Efficiency) which allowed for the recovery of lost revenues resulting from DSM activities. These costs, which like direct DSM costs are accounted for in an interest-bearing (AFUDC) deferred account until approved in a rate case, are ultimately ratebased and amortized over a five-year period. All program costs deemed by the Board to be "used and useful" are eligible for cost recovery and lost revenue recovery.[R#14,15]

In 1991, a collaborative effort, similar to the collaborative pioneered by the New England Electric System and the Conservation Law Foundation of New England, began in Vermont. It included the state's major investor-owned utilities (GMP and Central Vermont Public Service), the Conservation Law Foundation of New England, the Vermont Public Interest Research Group, the Vermont Natural Resource Defense Council, and the Vermont Department of Public Service. The intent of the collaborative was to jointly design and implement comprehensive energy efficiency programs, to jointly track their progress through careful monitoring and evaluation, and to make any necessary midcourse corrections. In addition, the collaborative would jointly address any regulatory barriers to energy efficiency.

Late in the collaborative process the issue of DSM incentives was raised. Several witnesses in the hearings proposed shared-savings mechanisms (see Profile #41 that presents Niagara Mohawk's shared-savings incentive in detail). Despite the fact that the Department of Public Service adamantly opposed incentives, the Board's sentiment was clearly in favor of incentives, although it stopped short of endorsing any particular mechanism.[R#15]

GREEN MOUNTAIN POWER OVERVIEW

Green Mountain Power entered the collaborative effort in Vermont with a high degree of caution. GMP was already proceeding with existing demand-side management programs, planning others, and was therefore concerned that entering the collaborative planning process would slow down those efforts. As part of a rate case settlement in 1989, GMP did agree to join a collaborative and undertake a comprehensive demand-side management planning process. GMP wanted assurances that if it moved forward in good faith with program plans that had been agreed upon in advance, that costs would indeed be recovered and no potential retroactive penalties would be imposed.[R#15]

What GMP was able to achieve with the Department and the Board was an agreement for a pre-approval process whereby cost recovery and lost revenue adjustments would be determined proactively, unlike many of the re-

covery mechanisms used around the United States. By getting all parties in the collaborative to agree up-front to the planned DSM programs and implementation plans (including program designs, incentive levels, free ridership, etc.), as well as costs and projected savings, there would be no second-guessing of utility plans or projected savings. The utility could be assured of cost recovery and lost revenue adjustments based on the planned savings. (Naturally, GMP will still be reviewed for prudency to ensure that it has delivered the programs in a manner consistent with the approved program implementation plans, and to prevent fraud, misrepresentation, or gross mismanagement.) While cost recovery is not a lock, the grounds upon which expenditures can be challenged are greatly narrowed.[R#15]

Under the pre-approval systems, even if savings were actually only half or double the planned savings, the cost recovery and lost revenue recovery will still be based on the planned and agreed upon levels. However, the plans are not static. GMP must file any changes in assumptions (for example, changes in engineering estimates and thus savings value of a particular technology, or changes in methodology to determine savings), with the Department before being submitted to the Board for approval. Incidentally, parties such as the Department only have a limited time, typically two weeks, to comment or challenge those changes. Only when the Board has formally approved the change do the rules for cost recovery and lost revenue adjustment change, and from that point forward the utility recovers money based on the new rules. No retroactive accounting is conducted – eliminating the possibility of "gaming" with M&E results, protecting GMP and ratepayers from possible disallowances based on new evidence. This proactive approach made it possible for GMP to aggressively pursue DSM and to put 11 new programs "out on the street" in one year with ambitious goals for energy savings.[R#15]

Incidentally, the salaries of the DSM program staff are expensed annually, while the program costs including contractor payments, customer incentives, monitoring and evaluation, etc. are recovered when approved by the Board and are then amortized over a five year period. The reason for the split between DSM salaries and other costs was to mitigate any future rate impacts and to lessen the total amount of money in the deferred account. When the DSM salaries were initially expensed, they represented about 25% of total DSM costs. Now, as the programs have been ramped up, the DSM salaries account for only about 10% of the total DSM costs and thus its mitigating effect is considerably less. The use of a five-year amortization period also will have the effect of lessening the annual impact of DSM program costs as they enter the ratebase.[R#15]

In 1991, in a regulatory hearing in which the Board approved GMP's new DSM programs, Green Mountain Power opted to trade the ability to file an incentive mechanism and possibly reap the rewards of such an incentive for the assurance of cost recovery and lost revenue adjustments as described above. Ironically, GMP is now facing the unusual problem of having a rather large deferred account which will not be "emptied" until a rate case. The account currently stands at about $10 million and will grow to nearly $20 million by the end of 1993. Since there are no rate cases planned, staff at GMP are considering requesting that the Board convene a special DSM case to simply rectify the deferred account.[R#14,15]

GMP did not, however, permanently give up the right to file for an incentive, and may file for shareholder incentives in the future. But since GMP is a relatively small utility with limited resources for extensive monitoring and evaluation and for time-consuming regulatory hearings that could potentially be avoided, there is a question of whether an incentive would in fact be a good thing for the utility. Would the costs required to verify savings necessary to receive incentives outweigh the potential benefits of incentives? If so, then of course the quest for incentives would not be at all beneficial.

NOTES ON THE EQUIPMENT REPLACEMENT AND REMODELLING PROGRAM

The ERAR program raises interesting free ridership issues. A program that pays for the replacement of equipment must ultimately face the possibility of replacing efficient equipment that the utility has already subsidized. This issue may be raised early in the game for GMP given the utility's attempts to link its retrofit and replacement programs. However, current thinking at both GMP and the Board suggests that the market in Vermont is not yet to the stage where this issue is a substantial concern. Both parties are aware of the potential problem. Preliminary solutions may include an adjustment of the free ridership level used in derating savings, ratcheting up the efficiency levels for equipment, or fundamentally modifying the program, for example moving away from incentive payments to an information-based program. ■

References

1. Green Mountain Power Corporation, "Annual Report, 1992."

2. U.S. Bureau of the Census, "Statistical Abstract of the United States: 1991," (111th edition) Washington, D.C., 1991.

3. Green Mountain Power Corporation, "Energy Today," C & I Newsletter, Fall 1992, Volume 1 Number 2.

4. Green Mountain Power Corporation, "Demand-Side Management Programs 1992 Annual Report," 1992.

5. Green Mountain Power Corporation, "Integrated Resource Plan: Demand-Side Management Plan," October 1991, pp. 6-5–6-6.

6. Green Mountain Power Corporation, "Demand-Side Management Programs 1992 Annual Report: Attachments," Attachment 3: Record-Keeping and Tracking System Review, August 1992.

7. The Results Center, "Profile #48, Green Mountain Power, Small Commercial and Industrial Retrofit," 1993.

8. The Results Center, see Profiles 1, 4, 6, 8, 13, 18, 25, 31, 33, 34, 37 and 48 for commercial and/or industrial program profiles containing an assessment of measure lifetime.

9. Hirst, Eric, "Electric Utility DSM Programs: 1990 Data and Forecast to 2000," Oak Ridge National Laboratory, 1992.

10. Personal communication, Dan Gaherty, ERAR Program Administrator, Green Mountain Power, July - September 1993.

11. Public Utilities Fortnightly, "Courts and Commissions: Other Rulings," Vol 131, #15, August 1, 1993, p. 47.

12. Personal communication, Tim Kelley, Green Mountain Power Company, July 1993.

13. Personal communication, Paul Peterson, Vermont Public Service Board, July 1993.

14. National Association of Regulatory Utility Commissioners, "Incentives for Demand Side Management," Energy Conservation Committee, Second Edition, March 1993.

15. Mike Weedall, Director Energy Management Services, Green Mountain Power Corporation, personal communication, January - April 1993.

Special thanks to Dan Gaherty, Kristine Rich, and Tim Kelley of Green Mountain Power, and Paul Peterson of the Vermont Public Service Board, for their assistance and guidance throughout the development of this profile.