DOER report

1999 Energy Efficiency Activities in Massachusetts

Division of Energy Resources

Commonwealth of Massachusetts

Office of Consumer Affairs and Business Regulation

Introduction

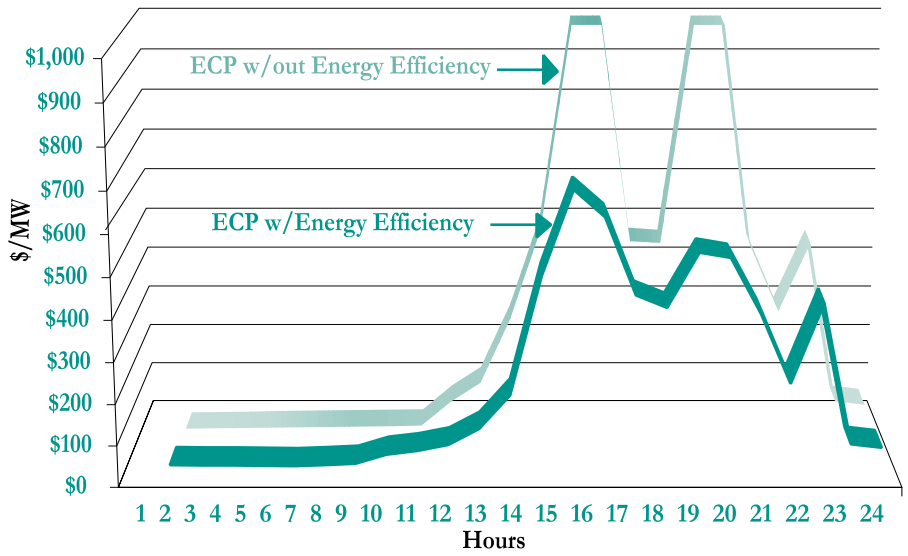
Massachusetts law requires customers of electric distribution companies to contribute a portion of their electricity charges to support activities that reduce electricity consumption. Enacted as part of the 1997 Electric Industry Restructuring Act, the policy recognizes that energy efficiency investments can: lower the overall cost of electricity without reducing comfort or convenience, lower the emission of harmful air and water pollutants, create jobs, and stimulate the economy. The investments provide for the installation of high efficiency lighting, motors, air conditioners and appliances; the construction of high efficiency homes and commercial buildings; and more.

This summary provides an overview of the Division of Energy Resources' (the Division) second annual legislative report on the status of energy efficiency in the Commonwealth.

1999 Highlights

- ***Energy efficiency programs improved reliability and lowered wholesale electricity prices through demand reduction.***
- ***Participants saved an estimated $20 million in 1999 electricity costs.***
- ***These savings are projected to grow to approximately $285 million over the lifespan of the installed measures.***
- ***Participating customers and ratepayers invested $159 million to achieve the savings.***
- ***The cost to conserve electricity is 60% less than the cost to buy it over the life of these energy efficiency measures.***

Figure 1: Potential Impact of Demand Reduction on Wholesale Energy Clearing Prices (ECP) on June 7, 1999



A Publication of the Massachusetts Division of Energy Resources

Spring 2001

The Commonwealth of Massachusetts

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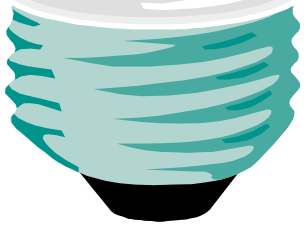
Energy Efficiency Investments Improved Reliability and Lowered Wholesale Electricity Prices

The 1999 energy efficiency programs provided system-wide benefits by enhancing the reliability of the generating system and local transmission and distribution networks during peak usage periods. The programs also appeared to help avoid higher wholesale energy clearing prices. As an illustration of this potential, the Division estimates that on June 7, 1999 alone (over a 13-hour peak period), energy efficiency programs reduced demand by 115 MW, thus avoiding over $6 million in additional costs to the system – costs that would likely have been passed on to all customers (see Figure 1 on the previous page.)

What is Energy Efficiency?

According to the Massachusetts Department of Telecommunications and Energy, energy efficiency is "the implementation of an action, policy or measure, which entails the application of the least amount of energy required to produce a desired or given output and includes demand-side management and energy conservation measures." Improvements can include replacing equipment, such as lights, motors, appliances, and air conditioners with more efficient electrical equipment. Increased energy efficiency can also be realized through changes in behavior, such as turning off or dimming lights, & raising air conditioning thermostats (or lowering heating thermostats) in unused spaces.



Residential Customer Improves Efficiency of Home

Description: Mr. Roger Mason of Acushnet, residential single family home
Provider: Commonwealth Electric Company
Program: Residential High Use Program
Efficiency Activities: Installation of energy efficient lighting (bulbs and fixtures), air sealing, attic insulation, ventilation, and duct sealing measures.
Annual Savings: 5,981 kWh, or $718
Lifetime Savings: 113,674 kWh, or $13,000
Total Project Costs: $3,903
Customer Rebate: $447

1999 Program Participants Saved Money

Program participants saved over $20 million on their 1999 electricity bills. Assuming that the energy efficiency equipment installed in 1999 remains in place for its full lifetime (an average of 14 years), total savings are projected to grow to approximately $285 million. Average 1999 electricity bill savings for Low-Income participants was 10 percent, compared to 4 percent for all other Residential participants. Average savings for Small, Medium and Large Commercial and Industrial (C&I) customers were 7, 3, and 3 percent, respectively.

Table 1: 1999 Average Bill Impacts from Energy Savings

Customer Sector	Total Annual Bill Reductions for Participants	Avg. Annual Bill Savings
Low-Income	$837,387	$47
Residential	$4,878,359	$30
Small C&I	$1,764,520	$797
Medium C&I	$2,030,042	$1,089
Large C&I	$10,871,997	$7060
Total/Average	$20,382,306	$109

Source: Division of Energy Resources

Program participation levels in 1999 varied among the different customer sectors (see Table 2). Low-Income customer participation rates were less than residential levels, reflecting the need to improve outreach to households with incomes at or below 175% of the federal poverty line. Large C&I customers had the highest participation rate, reflecting that large electricity users reap substantial benefits from improving the efficiency of their buildings/facilities, and often participate in programs more than once during the year. Smaller C&I customers typically face greater barriers to investing in energy efficiency, and thus have lower participation rates. Over the past decade, however, the cumulative participation rate for Small C&I customers is between 25-35 percent.

Table 2: 1999 Energy Efficiency Program Participation

Customer Sector	# of Participants	Percent Served
Low-Income	17,867	4
Residential	163,978	10
Small C&I	2,215	2
Medium C&I	1,864	3
Large C&I	1 ,540	25
Total/Average	187,464	8

Source: Division of Energy Resources

Nortel Networks Improves Efficiency of its Chiller System

Description: Nortel Networks, Chelmsford, Multiple facilities to manufacture network solutions
Provider: Massachusetts Electric Company
Program: Design 2000 & Energy Initiative Programs
Efficiency Activities: Installed high efficiency lighting systems, and converted existing chiller plants to comprehensive chiller system in several facilities
Annual Savings: 1,818,263 kWh or $145,146
Lifetime Savings: 36,322,070 kWh or $ 2,902,920
Total Project Costs: $1,286,945
Customer Rebate: $965,634

Major Electricity Consuming Equipment

Residential: space heating and cooling, water heating, refrigeration, lighting, and household appliances

Commercial: lighting, heating ventilation and air conditioning (HVAC), motors, and refrigeration

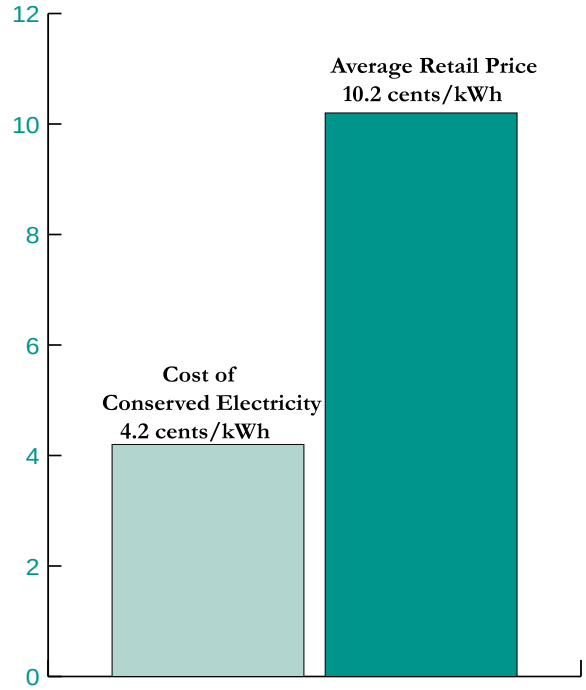
Industrial: lighting, HVAC, motors, boilers, air compressors, and process equipment

Source: Division of Energy Resources

Energy Efficiency is Cheaper than Buying Electricity

A total of $159 million was invested in energy efficiency program activities in 1999 (comprised of $125 million collected from ratepayers and $34 million in participant costs), and an estimated 3,822 million kilowatt-hours will be saved over the lifetime of those investments. This equates to a cost of conserved energy of 4.2¢/kWh – almost 60 percent less than the projected average retail electricity price of 10.2¢/kWh over the same period.

Figure 2
Cost of Conserved Electricity vs. Average Retail Price



Source: Division of Energy Resources

Energy Efficiency Programs Improve Air Quality in Massachusetts and the Region

1999 ratepayer-funded energy efficiency activities reduced the amount of air polluting emissions released by electricity generating units and will likely continue to do so over the lifetime of the energy conservation measures installed. While it is difficult to attribute energy efficiency-derived emissions reductions to any specific Massachusetts generating facility, it is fair to say that overall emissions by the regional power system were reduced. The annual emission reductions for the three most critical pollutants – nitrogen oxides (NOx), sulfur oxides (SO_2), and carbon dioxide (CO_2) – were 453 tons, 770 tons, and 145,000 tons, respectively. The NOx emission reductions are equivalent to roughly the annual emissions of 34,000 passenger cars. The SO_2 emission reductions are equivalent to avoiding the burning of 55,000 tons of bituminous coal, the primary type of coal burned for electricity generation. The 145,000 tons of reduced CO_2 emissions are equivalent to the annual emissions of 29,000 cars and light vehicles.

Future DOER reports will expand this analysis by considering the long-term impacts of energy efficiency on air emissions. The factors to be reviewed include: uncertainty about long-term fuel prices; stricter state and federal standards for electricity generation; changes in the portfolio of New England power plants; and the effect that energy efficiency has on the dispatch of power plants.

Figure 3: Energy Efficiency Programs Reduce Annual Emissions

SO_2	NOx	CO_2
770 tons	453 tons	145,000 tons

Source: Division of Energy Resources

Energy Efficiency Program Targets Economic Development Area

Description: Harvest Coop, Cambridge grocery store located in economic development area
Provider: Cambridge Electric Company
Program: Small C&I retrofit program
Efficiency Activities: Installed cooler economizers and controls to control thermostat zones for walk-in cooler, evaporator fans, electric door heaters and compressor run times
Annual Savings: 49,070 kWh or $3,925
Lifetime Savings: 736,035 kWh or $58,880
Total Project Costs: $11,628
Customer Rebate: $11,628

Increasing Jobs in the Commonwealth

One of the several benefits of energy efficiency activities is that they help to encourage local energy efficiency industries to grow in Massachusetts. For example, the Division's economic model estimates that 1999 ratepayer-funded investments in energy efficiency will provide 1,060 new jobs in Massachusetts, contributing $72 million to the gross regional product. In addition, $40 million in disposable income will be gained over the next decade from these jobs, most of which will be realized in the short-term. These jobs are concentrated in the services, retail trade and manufacturing sectors. In addition to creating jobs, 1999 energy efficiency programs targeted economic development projects throughout the state, in which participating customers received 100% rebate on projects to improve the efficiency of their facilities or operations.

Pittsfield Plastics Stays in Massachusetts

Description: Pittsfield Plastics, Pittsfield Manufacturing plant for plastic injected molded products, considered leaving Massachusetts
Provider: Western Massachusetts Electric Company
Program: Custom Services Program
Efficiency Activities: Evaluated energy use; analyzed and installed variable frequency drive on existing plastic injection molding machine; company committed to stay in Massachusetts and expand its operations.
Annual Savings: 82,700 kWh or $3,270
Lifetime Savings: 1,240,500 kWh or $49,050
Total Projects Costs: $16,600
Customer Rebate: $8,300

Energy Efficiency Programs were Cost-Effective in 1999

According to the methodology approved by the Department of Telecommunications and Energy (the Department), 1999 ratepayer-funded programs were cost-effective where benefits exceeded costs by a factor of 1.6. Under the methodology, benefits are defined as wholesale electricity and distribution and transmission costs avoided by distribution companies due to program savings over the lifetime of 1999 installations. Costs are those expended on program activities in 1999.

1999 developments included the Department's issuance of new Cost-Effectiveness Guidelines (Docket 98-100). These guidelines set out a more comprehensive methodology for quantifying other energy and non-energy benefits of programs. As a result, the cost-effectiveness of most programs will likely increase in the future. These additional benefits include increased worker productivity and property improvement for homeowners and businesses due to the installation of higher efficiency equipment. In addition, energy efficiency investments save distribution companies money by reducing costs related to bad debt expenses, and termination and connection charges-costs that would otherwise be passed on to all customers. Further, customers accrue resource savings in reduced natural gas and water bills. For example, the investment in an energy efficient clothes washer will not only reduce electricity costs to wash the clothes, but will also reduce water use and if applicable, the gas used to heat the water.

Other benefits are more difficult to quantify but are significant. These include creation of employment in the state, increased economic activity stimulated by energy cost savings, and improved health as a result of reduced air pollution.

Fitchburg Housing Authority Participates in Low-Income Program

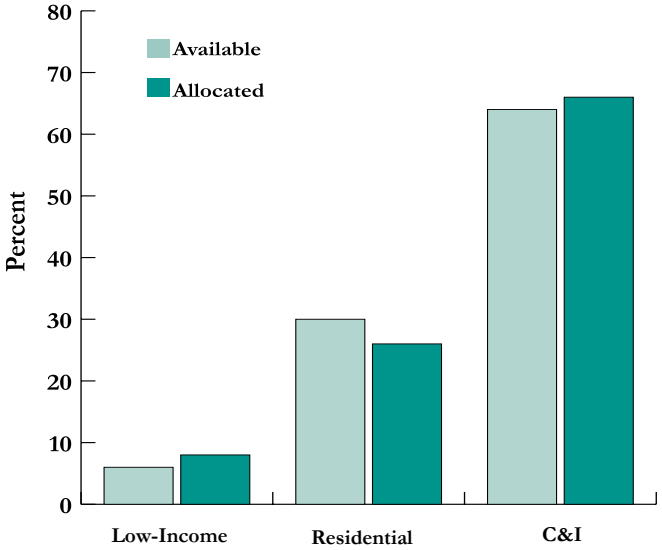
Description: Fitchburg Housing Authority, Fitchburg, 12-unit low-income apartment complex
Provider: Fitchburg Gas & Electric Company
Program: Low-Income Program
Efficiency Activities: Installed energy efficiency fluorescent bulbs and fixtures, automatic set back thermostats, and Energy Star rated refrigerators
Annual savings: 20,007 kWh or $1,677
Lifetime Savings: 300,105 kWh or $25,150
Total Project Costs: $10,435
Customer Rebate: $10,435

Allocation of Funds to Different Customer Sectors Needs Improvement

The Act directs the Division to ensure that ratepayer funding for energy efficiency is equitably allocated among customer sectors. Equitable allocation is influenced by a specific requirement of the Act with respect to low-income customers (defined as 175% of the Federal Poverty Line). The Act directs that low-income program funding levels be at least 20% of the amount expended for residential programs, and no less than $0.00025 per kWh (based upon total kWh sold to all customers).

On a percentage basis, 1999 available funds for customer sectors were: Low-Income (6%), Residential (30%), and C&I (64%). Funds were allocated 8%, 26%, and 66% respectively. The Residential sector fully subsidized the Low-Income sector, and slightly subsidized the C&I sector as well. The Division is working with Program Administrators to ensure that, in the future, both the residential and C&I sectors proportionately subsidize the low-income sector, given the mandated funding levels for this customer sector.

Figure 4: 1999 Available vs. Allocated Funds



Source: Division of Energy Resources

Note: "Available funds" refers to 1999 collections from customer sectors and carry over funds from 1998. "Allocated Funds" refers to 1999 expenditures plus year end balances.

Program Activities are Balancing Short and Long Term Savings

Ratepayer-funded energy efficiency programs served two fundamental purposes in 1999: they provided immediate savings for participating customers, while also laying the foundation for future savings for all customers by transforming energy efficiency markets.

The greatest portion of 1999 energy efficiency expenditures ($64.5 million) was invested in Retrofit programs (referred to as In-home Services for residential customers). These programs encourage the replacement of outdated and inefficient electrical or mechanical equipment, such as for lighting, heating and cooling systems, motors, energy management systems, and process redesign/improvement. Financial rebates are employed to persuade customers to upgrade to higher efficiency equipment.

Shaw's Supermarket Increases Efficiency in Seven Stores

Description: Shaw's Supermarkets Seven Boston area stores
Provider: Boston Edison
Program: Commercial and Industrial Program
Efficiency Activities: Retrofited stores using "Smart Station" energy monitoring and reporting system; Re-commissioned store refrigeration, HVAC, and lighting systems.
Annual Savings: 598,400 kWh or $48,650
Lifetime Savings: 9,000,000 kWh or $729,750
Total Project Costs: $144,235
Customer Rebate: $47,000

The next largest portion of funding ($25.6 million) was spent on Lost Opportunity/New Construction programs. These programs focus on encouraging investment in higher energy efficiency at the time of a naturally-occurring market event, such as construction of a new home or building, major expansion, renovation or remodeling, or replacement of failed equipment. These programs not only provided immediate and long-term savings to participants through rebates, but also targeted key market players (e.g., architects, designers, and builders) in order to change standard building practice and to upgrade building codes and standards, thus benefiting all customers over the long-term.

The balance of total 1999 expenditures ($15.5 million) was largely spent on Regional Market Transformation programs. While these programs provided some immediate savings to participating customers, more importantly, they targeted non-customer actors higher up in the market chain, seeking to change the production, purchasing, design, and stocking practices of manufacturers, builders, engineers, architects, and retailers over the long-term. By changing the fundamental behavior of these market players, there is the potential for much greater long-term energy efficiency than what can be accomplished through other types of programs. In the long run, this benefits all customers.

ENERGY STAR Lighting Program

Provider: All Massachusetts distribution companies, in coordination with other regional electric utilities and the Northeast Energy Efficiency Partnership.
Program: Regional market transformation program
Efficiency Activities: Goal of program is to transform the market to one that sustains availability of and demand for quality, energy efficient lighting products. Program has two components; point-of-purchase retail lighting component, and mail order catalog.
Customer Rebates: Program provided over 300,000 and 130,000 rebates for bulbs and fixtures, respectively, in 1999, totaling $5.3 million in rebates to MA residential customers.
Progress to Date: Over the past two years, the program has helped to lower marketing costs and increase manufacturer and retailer participation in the ENERGY STAR Lighting Program.

Summary of Funds Collected and Expended

A total of $136.5 million was collected from ratepayers during 1999 to support energy efficiency activities. This represents 3.5% of distribution companies' 1999 revenues (note: these do not include competitive supplier revenues). In addition, $10 million of unspent funds in 1998 were carried forward to 1999 program budgets, providing a total of $146.5 million in Total Available Funds for 1999. Total expenditures for the year were $125.0 million, leaving a year-end fund balance of $21.5 million. This year-end balance resulted from: higher actual sales than forecasted sales (which were used to develop program budgets), thus producing a

surplus of funds; a portion of 1999 funds was *committed* to energy efficiency projects but not yet expended as of year-end; and some programs were not fully implemented since their introduction in 1998. Unexpended funds in 1999, plus interest, were carried forward to 2000. The Division anticipates that the 1999 fund balance and year-end balances for 2000 and 2001 will be committed to specific energy efficiency projects by year-end 2002.

Low-Income Customer Benefits from Improved Appliance Efficiency

Description: Mr. Roger Hills of West Newbury, single family home
Provider: Massachusetts Electric Company in cooperation with Community Weatherization Assistance Agencies
Program: Appliance Management Program
Efficiency Activities: Provided Mr. Hills with personalized information on electricity usage and installation of various energy savings measures, including replacement of refrigerator with a higher efficiency (ENERGY STAR) model, compact fluorescent light bulbs, and refrigerator coil brush
Annual Savings: 1,760 kWh or $144
Lifetime Savings: 28,000 kWh or $2,300
Total Project Costs: $965
Customer Rebate: $965

Changes in the Competitive Market for Energy Efficiency Services

The Division observed a decline in energy efficiency services offered by competitive retail suppliers. While most suppliers offered energy efficiency related services in 1998, fewer did in 1999. This may be due partly to limited activity in the electricity market in general, but also to certain barriers customers face (e.g., paying for up front costs of energy audits). Greater emphasis on other energy cost savings strategies, such as load management services, may also be a factor.

Another measure of competition in the energy efficiency market is the extent to which ratepayer-funded program services (e.g., program implementation) were competitively procured. The Act requires that competitive procurement processes be used to the greatest extent practicable when delivering programs to Massachusetts' customers. These procurement processes benefit customers by providing lower, competitively set program costs, as well as by introducing innovative elements to program designs and/or implementation. In 1999, 76% or $94.5 million, of all energy efficiency services were competitively procured outside of the administering distribution company.

Table 3: Massachusetts Energy Efficiency Goals

OVERALL STATEWIDE ENERGY EFFICIENCY GOAL:
Strengthen the economy and protect the environment by increasing the efficiency of energy use.
ENERGY EFFICIENCY OPERATIONAL GOALS:
1) Reduce the use of electricity cost-effectively.
2) Ensure that energy efficiency funds are allocated to low-income customers consistent with the requirements of the Act, and allocated equitably to other customer classes.
ENERGY EFFICIENCY PROGRAMMATIC GOALS:
3) Reduce customer energy costs by balancing short-run and long-run savings from energy efficiency programs.
4) Support the development of competitive markets for energy efficiency products and services.

Conclusions and Future Outlook

The Division concludes that 1999 energy efficiency program activities continue to meet or make progress toward the statewide energy efficiency goals. Program activities provided direct benefits to participating customers as well as indirect benefits to the Commonwealth as a whole.

The impact of 1999 program activities as well as experience from other years, will serve as the basis for the Division's recommendation to the Legislature during 2001 concerning the future of electric ratepayer-funded energy efficiency activities beyond 2002. In addition, the Division is currently undertaking extensive research that will inform its recommendation to the Legislature, including addressing the following key questions:

1) What energy efficiency opportunities remain in the Commonwealth for each customer sector?
2) To what extent can the remaining opportunities be achieved during the period 2003-2007, with and without ratepayer-funded support?
3) What barriers do customers currently face to investing in energy efficiency?
4) To what extent are competitive markets providing energy efficiency products and services?

This Executive Summary and the full 1999 Energy Efficiency Report are available at DOER's web site.

http://www.state.ma.us/doer/

Suggestions and comments can be mailed to

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The DOER report is a publication of the Commonwealth of Massachusetts
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