

## **Sustainable Energy Efficiency: Leveraging Utility Energy Efficiency to Improve Our Communities**

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### **ABSTRACT**

National Grid<sup>1</sup> highlights three specific energy efficiency programs funded by public benefit funds providing lasting improvements to local communities and increasing public support for energy efficiency.

These initiatives were selected because they evolved with input from the community into utility/community partnerships, creating community benefits in addition to energy savings. These benefits include increased energy efficiency skills at local community action agencies, school boards, and vocational schools, local building trades, the creation of affordable housing and more productive schools, and more comprehensive treatment of homes and schools. Evaluations of the programs were performed by several different independent evaluation companies and references are provided.

National Grid's Appliance Management Program (AMP) contracts directly with local Community Action Agencies (CAAs) to provide education and replace inefficient refrigerators, lighting, and other measures, serving over 16,000 low income customers since 1996 and saving over 22,000 MWH. An important additional community benefit is that National Grid has greatly increased the capacity of the CAAs to serve their communities by providing computer and technical training and administrative assistance and supporting new public/private initiatives.

National Grid started a Schools Initiative in 2000 through its large commercial/industrial energy efficiency programs that targets cities and towns engaged in building new schools. The initiative requires the use of the "DesignLights™ Consortium classroom lighting *knowhow*™ guide" developed by the Northeast Energy Efficiency Partnerships and several of its member utilities. National Grid is working to transform the lighting design practices of architects and engineers while providing better classrooms for children.

National Grid is an active member of the national ENERGY STAR® Homes program, signing agreements to build over 6,000 new homes since 1998. These homes typically save 30% of the energy of a standard home built to the Model Energy Code 95.2.<sup>2</sup> The Massachusetts Board of Building Regulations and Standards commissioned a study to evaluate the impact of the residential energy code that took effect in March 1998. The study, conducted by XENERGY, Inc., looked intensively at 186 houses in Massachusetts built in 1999 and 2000, and found that only 46.4% of the sample complied

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<sup>1</sup> National Grid USA consists of four electric utilities including Massachusetts Electric, The Narragansett Electric Company, Granite State Electric and Nantucket Electric.

<sup>2</sup> More information on the EPA's ENERGY STAR Homes program is available at <http://yosemite1.epa.gov/estar/homebuyers.nsf/content/WhatAreESLHS.htm>

with the thermal performance requirements of the code.<sup>3</sup> Because only half the builders are building to code, the impact ENERGY STAR Homes program, which measures building performance on new homes, is even greater. National Grid partners with local vocational school systems, community development groups, CAAs and lending institutions in Woonsocket and Warwick, Rhode Island, and Lowell, Massachusetts to train home construction and/or at risk students to build ENERGY STAR Homes. The homes are then sold as affordable housing through local private/public partnerships. The program increases energy efficiency knowledge in the next generation of builders, encourages at-risk young people, and increases home ownership and community redevelopment.

## **Background**

After fifteen years of aggressive investment in energy efficiency in states such as Massachusetts, Rhode Island, California and Oregon, the debate about the efficacy of efficiency has shifted from whether the energy savings are real to how the demonstrated benefits of efficiency can help specific segments of the residential sector. Two segments that have gained increasing attention include low-income customers and public schools. National Grid has acquired extensive experience dealing with these segments through a number of programs it has offered over the past four years. This experience has provided valuable insight into the most effective ways to overcome market barriers and to capture efficiency in low-income housing and new and existing public schools. The success of these programs and the lessons learned from them adds to the wealth of experience gained in other parts of the country and can serve as the stimulus to encourage other states to follow suit.

## **Appliance Management Program**

The Appliance Management Program (AMP) targets low-income customers who are at or below 200% of poverty or served by the Company's low-income rates. National Grid delivers the program in partnership with Community Action Agencies (CAA) across Massachusetts, Rhode Island and New Hampshire. At no cost to customers, these agencies conduct energy audits of customers' homes, install a variety of energy efficient measures, and provide customer education on steps customers can take to conserve energy. Measures installed in customers' homes include compact fluorescent lights, hot water measures, air conditioner filters and replacement refrigerators and freezers (see Table #1). The Program Manager provides the CAAs with equipment to perform the audits and diagnostics as well as diagnostic software.

AMP serves approximately 3,700 customers annually and since its inception in 1996 has served over 16,000 customers. On average, participating customers save 982 kWh or roughly \$100 per year on their electric bills<sup>4</sup>. The frequency of measures

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<sup>3</sup> "Impact Analysis of the Massachusetts 1998 Residential Energy code Revisions", Prepared for the Massachusetts Board of Building Regulations and Standards, Boston MA, Prepared by XENERGY, Inc. Portland, Ore, May 14, 2001, available at [www.state.ma.us/bbrs/EXEC\\_SUMM.pdf](http://www.state.ma.us/bbrs/EXEC_SUMM.pdf).

<sup>4</sup> "Process and Impact Evaluation of New England Power Service Company's Appliance Management Program", Jane S. Peters, Ken Seiden (Research Into Action, Inc. 1998).

installed is shown in Table 1 with compact fluorescent lamps and replacement refrigerators being the most commonly installed measures. Existing refrigerators, in existing low-income housing, are frequently highly inefficient and therefore provide a significant opportunity for energy savings. On average existing refrigerators with 19 cubic foot of space use 1,398 kWh per year while new energy efficient refrigerators use 440 kWh per year<sup>5</sup>.

**Table 1. Measure Mix for 2000**

Measure	Frequency
Compact Fluorescents	87%
Replacement Refrigerator	39%
Replacement Freezer	4%
Waterbed Measure	1.5%
DH Water Measure	15%
Appliance Removal	1.3%
Fluorescent Torchiere	1%
AC\ Pool pump Timer	19%

The success of this program in reaching the target audience and creating real energy savings is largely attributable to the close relationships the CAAs have with low-income customers. The agencies provide a variety of services to these customers which have helped them gain the respect and trust of customers. Of the low-income families to whom this program is offered, over 90% participate. Less than one third of the customers are on National Grid's low income rate, so without the assistance of the CAAs, it would be very difficult to identify and market to the target audience .

The Appliance Management Program (AMP) provides multiple benefits to communities including customer education, energy and non-energy related economic benefits as well as health and safety benefits.

AMP is built around an interactive educational approach and offers information designed to address customer questions, and encourage adoption of efficiency actions. Customer education about lighting, cooking, heating, cooling, laundry and other appliances is a central part of the service. Working cooperatively with customers, Energy Managers identify site-specific causes of inefficient electric appliance use and identify and prioritize solutions. The program evaluation found that on average customers implement 3.5 behavioral changes per household<sup>6</sup>.

A specific program goal is to empower customers to “manage their appliances wisely.” The education includes savings calculations for all suggested appliance actions so customers will know which actions will save more money. Because appliance education is an evolving science, the CAA field staff often discover new effective practices from their work with customers. Those practices are then integrated back into the training curriculum and software via the strong relationship between the CAAs and National Grid.

<sup>5</sup> These data are based on metering over 958 kWh per year savings per Peters and Seiden and energy guide label of the 19 cubic foot model used in the program in 2001

<sup>6</sup> “Process and Impact Evaluation of New England Power Service Company’s Appliance Management Program”, Jane S. Peters, Ken Seiden (Research Into Action, Inc. 1998)

This partnership approach has allowed the CAAs to develop strong residential electricity efficiency skills. The CAAs have gained strong technical expertise through years of running state and federal Weatherization programs. National Grid's provision of field equipment, intensive training, and field supervision has created a whole new area of expertise for the CAAs. National Grid's investment in the CAAs have also allowed them to compete to run programs for other utilities and the private sector, again building local jobs and expertise.

New England has a high percentage of customers who heat with oil. For a number of years, the Department of Energy's (DOE) weatherization funds have been supplemented by gas utility energy efficiency programs. Beginning in 2000 National Grid started funding weatherization for income eligible households heating with other fuels not including natural gas. These homes may be heated by oil, propane, wood or other non-utility fuels.

By providing this funding, the Company's aim is to extend the benefits of AMP to more customers and enable the weatherization network to efficiently deliver a total package of energy efficiency services including weatherization to address heating usage and appliance services. As a result CAAs are able to deliver services more cost effectively and have fewer visits to customers' homes per unit of energy saved. More importantly, the CAAs have integrated appliance usage into their "house as a system" approach, allowing for a better understanding of all energy uses in the home, and better services to their clients. CAA field staff now understand the electric use of heating system pumps and blowers, the interaction of refrigeration, lighting, and heating, and are able to solve customer problems as opposed to just dealing with a part of the consumer's overall energy use.

Integration of AMP with weatherization (Wx) services also offers an opportunity to specifically address health and safety issues more effectively. For example, Wx crews have the equipment needed to vent a clothes dryer to the outside to reduce moisture problems thereby protecting the health of the building and the residents. AMP auditors also address safety issues related to appliances such as fire hazards from a faulty light fixture or a severely clogged clothes dryer filter.

The regulatory commissions in Massachusetts, Rhode Island, and New Hampshire have recognized the societal benefits of using system benefit charge funds in order to provide weatherization services to customers who heat with non-regulated fuels. Massachusetts and New Hampshire regulators allow National Grid to quantify the value of these energy savings and to include them in the cost-effectiveness analysis for the program.

Through this partnership, National Grid has also provided training to clients of the CAAS who are in programs to become energy efficiency professionals. The CAAs have identified a lack of trained office and field staff to run their expanding appliance and weatherization programs. The AMP program has allowed the CAAs to hire more local staff and provide new training and jobs in their communities.

## **Vocational Technical Schools and ENERGY STAR Homes**

Starting in 2001 National Grid USA formed partnerships with several Vocational Technical High Schools in Massachusetts and Rhode Island. The mission of these partnerships is to heighten the importance of energy efficient building science in residential new construction. The program criteria are the same as the criteria for the Environmental Protection Agency's (EPA) ENERGY STAR Homes program. Through these partnerships, groups of 50 to 100 students, per school, have to date built five ENERGY STAR Homes, some of which have been made available to low income families. Each school will complete at least one additional ENERGY STAR home during the next school year.

National Grid provides training and support to the vocational school teachers, organizational assistance in finding community development corporations and cities to agree to donate land for affordable housing, tool kits for the students, and some funding for start-up. National Grid invests \$1,800 to \$ 3,000 in each project. Because the proceeds of the first home finance the next home, this project will continue as long as the schools can find donated land.

Vocational students majoring in construction and carpentry are the participants. They receive training to incorporate ENERGY STAR building techniques into their first jobs after they graduate. Without this partnership, the vocational students would not receive this latest training in energy efficiency, and would not have the opportunity to build an ENERGY STAR home. These new builders will bring advanced building skills into the workforce and will have been exposed to the important concept that you can build safer, more efficient homes with minimal additional costs. As technology improves, they may be more open to incorporating updates.

The Vocational schools are often located in lower income communities. Additional owner-occupied low/moderate income housing is a valued contribution, and the fact that the new homes are energy efficient means the affordability of the home is assured far into the future.

These are cooperative projects that require a significant commitment of time and resources by vocational schools and their communities. The project in Woonsocket, Rhode Island happened because a dedicated teacher saw an opportunity and approached National Grid. Once a model was in place, other vocational schools expressed interests and we are now working with five schools. More and more communities are requesting to participate. With a fairly small initial dollar investment from National Grid, coupled with community resources, an ongoing project is developed which will continue to provide vocational training and affordable housing every year.

These partnerships are a win-win arrangement for all participants. Participating schools get the advice and support of energy consultants for classroom presentations and curriculum updates. Students gain hands-on experience and understanding of energy efficient building science. The communities receive much needed affordable housing and an increased inventory of skilled builders. Partnering with ENERGY STAR Homes and the Vocational Technical Schools in National Grid's service territory is an important way for the Company to apply its experience with energy efficiency directly to the communities.

## National Grid's Schools Initiative

In 2000 National Grid began offering a targeted energy efficiency initiative for public schools. This initiative is offered through both its commercial new construction/renovation program called Design 2000 Plus and its commercial retrofit program called Energy Initiative. The program is aimed at overcoming market barriers such as high first costs, the lack of information on the costs, savings and reliability of energy efficient equipment and the dearth of expertise in energy efficient design among architects and builders. These barriers prevent cities and towns from incorporating high quality, energy efficient lighting and other energy efficient technology in renovated and new schools. The Initiative's intent is to help schools minimize the hurdles posed by these market barriers during a time when Massachusetts is seeing an unprecedented level of investment in new and renovated schools. This Initiative helps schools identify and install cost-effective electric efficiency opportunities in retrofitted, renovated and new school buildings. Incentives pay for the full cost of equipment in retrofit cases and the full incremental cost in major renovations or new construction. With these incentives schools do not incur additional costs for the installation of high efficiency equipment. Through these installations, the program broadens the awareness of the benefits of high quality lighting in schools within communities, school districts and among building practitioners. By building this awareness through actual installations, the Company hopes to have high quality lighting become more the norm in school design as opposed to the exception. Clearly, in the long term, paying the full incremental costs for high efficiency lighting is not sustainable; however, the Company views these incentives as the catalyst for changing building practices. Starting in 2002, the Company has reduced the incentives resulting in a copay from the school district.

A primary component of the Schools Initiative is the requirement that all participating schools use lighting guidelines developed in 1999 by the DesignLights™ Consortium<sup>7</sup>. This consortium is a regional collaborative of utilities and other organizations whose purpose is to influence lighting design toward quality and energy efficiency during remodeling, renovation and new construction. The Classroom Lighting knowhow™ guideline establishes specific fixture and fixture-layout (design) criteria focused on achieving high quality lighting as well as energy efficiency. When followed the guidelines result in designs with improved lighting uniformity, control of glare, increased comfort and quality, and lower-than-standard lighting power densities in school classrooms, multi-purpose rooms and corridors. In addition, where appropriate effective daylighting and lighting control strategies are incorporated into the schools' lighting designs. The overarching goal of the guidelines is to provide a visual environment that is supportive of the learning process. This can be achieved only if the occupants can see their visual tasks accurately, quickly, and comfortably. Effective lighting designs can make a school pleasant, attractive and can stimulate learning, and improve student learning. Efficiency opportunities are found in better lighting design. Lower net lighting power densities may result from more efficient overall system designs that do not degrade lighting quality. Essential design variables include variations in fixture layout patterns, high-power ballasts and the use of optically efficient fixtures.

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<sup>7</sup> See website for Northeast Energy Efficiency Partnership at [www.NEEP.org](http://www.NEEP.org).

Through 2001 twenty three new schools have participated in the program and over 40 existing schools have been retrofitted. Budget constraints have limited the number of participating schools. These have all been public/regional schools with a mixture of elementary, middle and high schools as well as special needs and vocational schools. New schools save roughly 15% of their projected electricity consumption while retrofitted schools save over 20% of existing consumption, mostly through lighting<sup>8</sup>. Incentives for new and retrofitted schools have ranged from \$7,000 to over \$140,000 and \$60,000 to over \$750,000 respectively. Incorporating energy efficiency in new schools is considerably more cost-effective than doing so in existing schools. National Grid has found that roughly half the existing schools approached about participation in the program have not been cost-effective to retrofit. Cost-effectiveness is more difficult to achieve in existing schools due to the fact that most schools have already installed an earlier version of an energy efficient lamp and ballast retrofit and are therefore maintaining moderate watts/sq.ft thresholds. Introduction of better fixtures with appropriate fixture spacing does not gain significant energy savings. While the general quality of the lighting environment is improved the energy savings to drive the cost effectiveness is difficult to achieve.

As noted above, the program overcomes first cost barriers incurred by cities and towns in building new or retrofitting existing public schools and influences the design practices of architects and engineers who specialize in new school construction. First cost barriers lead to school designs that essentially meet but don't exceed the state energy code. Many architects and engineers are hesitant to change their "standard" design because of the additional cost and lack of confidence in newer designs and technologies. In the two years the Initiative has been implemented, National Grid has been able to work with the same architects/engineers on a number of projects. Although an evaluation of this initiative has not been conducted, ongoing work with these practitioners suggests that they are gradually shifting their designs to incorporate high quality energy efficient lighting in schools with less intervention by National Grid.

## **Conclusion**

A number of common themes run through the three programs described above. First, the direct installation of energy efficient measures in homes and schools provide quantifiable energy savings while improving comfort and in the case of schools a better learning environment. Second, by combining these initiatives with existing programs such as EPA's ENERGY STAR Homes, DOE's weatherization program or other National Grid efficiency programs, they can significantly increase their benefits to communities. Third, the educational value of such initiatives greatly enhances the permanent integration of energy efficiency into different sectors in communities such as CAAs and school districts and among architects and other building practitioners. The continual evolution of these programs over the past few years has enhanced the sustainability of their impacts and the potential for them to become self-sustaining in the future.

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<sup>8</sup> Energy savings estimates from National Grid technical studies performed by professional engineering firms.

