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The Consumer Education Program for Residential Energy Efficiency

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Abstract: Rising energy prices resulting from global increases in energy demand highlight the importance of energy efficiency. The Consumer Education Program for Residential Energy Efficiency is an educational effort conducted in partnership with Cornell Cooperative Extension and the New York State Energy Research and Development Authority. This article describes program strategies and impacts and features efforts county Extension educators have implemented to engage adults and youth in learning practical aspects of energy efficiency. Extension's historical role in developing effective educational programs at critical periods in U.S. history is discussed, and a national approach for education on residential energy efficiency is recommended.

Introduction

The U.S. residential sector is responsible for 21% of total energy consumption in the country (EIA, 2008). The potential for substantial decreases in this figure is not realized for various reasons, including a lack of knowledge about improving home energy efficiency among Americans (Tonn & Peretz, 2007) and the fact that Energy Star homes comprise just over 12% of new homes built in the United States (EPA, 2007). First-cost sensitivity among consumers and risk-averse behaviors of builders contribute to market failures that keep the residential sector at suboptimal levels of energy efficiency (Prindle, Dietsch, Elliott, Kushler, Langer, & Nadel, 2003).

This article highlights a successful partnership between Cornell Cooperative Extension (CCE) and the New York State Energy Research and Development Authority (NYSERDA) in an ongoing statewide effort to transform markets for residential energy efficiency. The partnership demonstrates the ability of the Cooperative Extension Service to educate various market segments in local communities about residential energy efficiency. Because the success of such transformation efforts depends on recognizing the importance of reaching both

supply and demand sides in a given market, targeted efforts have focused on homeowners, renters, builders, landlords, real estate brokers, retailers, and other professionals. The Cooperative Extension Service is a valuable resource in the United States that can overcome conditions that contribute to informationally imperfect markets and resulting suboptimal levels of residential energy efficiency.

The Program

In recent years, linkages among energy, the economy, the environment, and national security have gained renewed importance. The role of conservation is once again gaining national attention as a means of reducing dependence on oil imports. For residential consumers, the purchase of homes, appliances, and electronic equipment with high levels of energy efficiency is typically resisted because of higher first costs. This tendency can be countered with strong educational messages from credible sources. The Cooperative Extension Service throughout the United States is recognized as a credible, unbiased source of consumer information. With linkages to resources of the land-grant universities, Extension is able to draw on timely research to develop effective educational programs. The system's purpose is education—practical education for individuals, families, and communities to use in dealing with critical economic, societal, and environmental issues affecting their daily lives.

Extension programs throughout the country are addressing the issue of residential energy efficiency (USDA, 2007; Atiles, Wysocki, & Tremblay, 2003). Upgrading a home's thermal performance, putting efficient appliances in homes, and changing resident behaviors are essential parts of a current trend toward market transformation strategies.

In 2004, New York State residents spent an estimated $14.9 billion on energy. That amount purchased 47,379 million kWh of electricity, over 42 million barrels of heating oil, and 393 billion cubic feet of natural gas (Energy Information Administration, 2008). Because New York imports 90% of the energy consumed within its borders (NYSERDA, 2007), these expenditures represent money leaving the state's economy. One economic outcome of improving energy efficiency in homes is to minimize these losses at the state level.

The CCE-NYSERDA partnership has demonstrated that a coordinated statewide effort targeted to individuals, families, businesses, and communities can overcome market barriers through creative educational efforts. This partnership, known as the Consumer Education Program for Residential Energy Efficiency (CEPREE), has been ongoing since 2003. During this time the program has been implemented in 44 counties in New York State, including the boroughs of New York City. To date, 73,893 New Yorkers have attended workshops on energy efficiency; 66.6 million potential media impressions have been made on the topic; 9.3 million potential impressions have been made through public exhibits; and Extension educators have implemented creative and effective community-based programs. An analysis of program results for 2006 demonstrated that those who attended presentations on residential energy efficiency reduced their home energy bills by an average of $400 and reduced their annual carbon dioxide (CO_2) emissions by an average of 2.53 metric tons.

Theory and Principles

The overall goal of market transformation is to increase the share of energy-efficient products and services within targeted markets. Market transformation programs seek to achieve this goal through fundamental, enduring changes in those targeted markets (Energy Center of Wisconsin, 1999).

Market transformation for energy efficiency has been necessitated by federal and state energy market deregulation. In the post public-utility marketplace, states are addressing consumer needs for energy-related education and services. New York implemented a Systems Benefit Charge (SBC), a fee paid by customers of

investor-owned utilities, that provides funding to NYSERDA for its research, education, and financial incentive programs. NYSERDA is primarily responsible for improving energy efficiency in all sectors of the electricity and heating fuel markets in service areas of investor-owned utilities. The agency uses principles of market transformation to guide educational efforts it undertakes through funded partnerships. Cooperative Extension is in a unique position to provide education in those sectors. Its statewide network of educators can communicate energy efficiency techniques and behaviors to various audiences in every county of the state.

Program Activities

CEPREE is a program that focuses on teaching elements of residential energy efficiency to homeowners, renters, builders, and other housing professionals. Through a variety of program elements and a statewide network of educators, energy efficiency information has reached people throughout New York State. County Extension educators have promoted residential energy efficiency issues through a number of channels including events at county fairs, workshops, meetings, and mass media campaigns. In addition, many Extension educators have incorporated residential energy information into their seminars on household finance. These methods are encouraged and supported by Cornell faculty.

At the beginning of each program year, educators willing to participate in the program submit a short plan of work. These plans are reviewed by a NYSERDA project officer and Cornell faculty. When they are approved, Extension educators receive mini-grants to support their program efforts. Grant amounts have varied between $2,500 and $3,000 per year. Educators are given wide latitude in use of these funds; creativity is encouraged and supported. In 2005, the CCE Director allocated $15,000 of Cornell funds to the project to allow for the participation of more CCE county offices.

At the beginning of each program year, educators participate in an inservice education program that covers new developments in energy efficiency and NYSERDA programs that offer financial incentives for consumers to improve levels of energy efficiency in their homes. Breakout sessions include one in which Educators meet in small groups and share their programming strategies.

Table 1 summarizes outreach efforts of extension educators over the first 4 years of the partnership. Because of differences in grant amounts to Cornell each year, the number of participating counties has varied.

Table 1.
CEPREE Outreach Efforts

	Year					
Event/Impact	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Participating counties	24	30	34	30	32	34
Presentations	261	485	402	393	304	315
# reached via presentations	5,174	14,780	11,312	17,289	11,307	14,031
Public education events	42	220	287	161	349	235
		128,372	109,197	400,000	364,360	177,000

Potential impressions from public education events	1.3 million*					
County fair exhibits	7	26	30	24	30	33
Potential impressions from Fair Exhibits	*	2.1 million	2 million	1.2 million	2.2 million	1.8 million
Press Releases	145	159	241	93	144	98
Potential impressions from press releases	19 million**	14.9 million	14 million	3.8 million	7.8 million	7.1 million
Newsletter articles	**	141	68	117	164	142
Households receiving a copy of the newsletter article	**	176,384	56,059	133,700	614,193	103,075

* In 2003 the number of potential impressions from public education exhibits included the county fair exhibits. They were not reported separately, as is currently the case.

** Newsletter and press releases were not reported separately during the 2003 program year.

Behavioral Change

Although workshop attendance figures and numbers of people contacted through press releases and newsletter articles can provide insights into a program's reach, behavioral changes are specific measures of program success. Unfortunately, funding to track such changes is not included in the CEPREE contract. In its annual report of 2006, however, CCE presented survey data collected from a system-wide evaluation (Cornell University, 2007). Included in the data are the number of people who participated in programs related to acquiring energy efficient homes or adapting homes for energy efficiency and the number of those participants who implemented recommended practices. The survey found that of 8,991 people who participated in these programs, 6,207 (69%) implemented recommended practices.

A core recommendation made during CEPREE workshops is that homeowners and renters participate in the Home Performance With Energy Star® program. This program features a thorough energy audit, which is conducted by a trained technician, and improvements to energy efficiency based on audit findings. Plympton (2008) reported the following impacts from Home Performance With Energy Star® in a cold climate: 20 - 30% reduction in energy use per home; average electricity savings of 1,298 kWh (12%); average oil or gas savings of 270 therms (22%); and average cash savings of $400 per year. These figures are used to calculate cash and energy savings, as well as the resulting reduction in CO_2 emissions, realized by 69% of the 17,289 people reached via presentations during the 2006 program year (11,921). Results are shown in Table 2.

Table 2.
Projected CEPREE Impacts from Presentations in 2006

Electricity Savings (kWh)	Oil or Gas Savings (therms)	Cash Savings ($)	Reduction in CO_2 Emissions (lbs.)*	Average CO_2 Reduction Per Participant (lbs.)**
15,473,458	3,218,670	4,768,400	66,415,229	5,571

*Method: Natural gas produces 11 lbs. CO_2/therm; fuel oil produces 22 lbs./therm (Faulkner, 2000); average = 16.5 lbs./therm: 11,921 x 16.5 x 270 = 53,108,055. Add to this electricity production of 0.86 lbs. CO_2 per kWh consumed (U.S. Department of Energy, 2002): 15,473,458 x .86 = 13,307,174.
** 66,415,229/11,921=5,571.

The results in Table 2 represent a reduction in CO_2 emissions of 5,571 pounds per person (or 2.53 metric tons) from participation in one element of CEPREE. In 2006, CO_2 emissions per capita in the U.S. averaged 19.78 metric tons (U.S. Department of Energy, 2006). The 2.53 metric ton figure represents 13% of the average American per capita emission. The assumptions used in this analysis are conservative. Actual reductions are likely to be much higher and could substantially contribute to goals of the Regional Greenhouse Gas Initiative, of which New York is a participating state (Regional Greenhouse Gas Initiative, 2009).

Some Program Highlights

The Energy Bike

In 2005, Cornell funds were used to purchase two Energy Bikes. As shown in Figure 1, an Energy Bike is a stationary bicycle with a generator attached to the rear wheel. Attached to the generator is a panel with incandescent and compact fluorescent light bulbs, a hair dryer, a fan, and a small television. These electric devices are powered by whoever is pedaling the bicycle.

Figure 1.
Energy Bike

Extension educators have noticed that the Energy Bike has been very effective at communicating a few key pieces of their message, especially with the different amounts of energy necessary to power the light bulbs. Bikers and onlookers can easily comprehend how harder pedaling translates into more lit bulbs. The incandescent bulbs take substantially more work to power up than the compact fluorescent bulbs. The Energy Bike has become a popular feature of county fairs held each summer. It was also highlighted at grade schools across New York State and was especially popular at Environmental Awareness Field day events. 3,742 4th through 6th grade students rode the Energy Bike and learned important lessons at such events between August 1, 2006 and July 31, 2007. A thank-you letter from a participant is shown in Figure 2.

Figure 2.
Thank-You Letter

Grid-Tied Photovoltaic Display

A portable, working, grid-tied solar electric array modeled after a system typically installed in a home was built in early 2007. The display includes a photovoltaic (PV) array that is capable of generating 600 watts of electricity. Along with the array, the system also includes an inverter that converts the direct current electricity produced by the solar cells to alternating current electricity that household appliances use. The grid-tied solar electric display also includes educational posters and handouts, in addition to detailed information on incentives available to homeowners who install a grid-tied renewable energy system. The display has been featured at county fairs, Earth Day events and the New York State Fair.

Figure 3.
Grid-Tied Photovoltaic Display

Lighting Change-Out

Fort Drum Military Base is located in Jefferson County, New York. In September 2006, an educator in that county who is a CEPREE participant worked with the manager of residential buildings at the base to change 18,000 75-watt incandescent bulbs to 15-watt compact fluorescent bulbs. Data were collected for 6 months after the change-out. Reductions in electricity consumption and carbon dioxide emissions are shown in Tables 3 and 4. Figure 4 graphically depicts carbon dioxide emissions before and after the lighting change-out.

Table 3.
Reduction in Electricity Consumption

Year	October	November	December	January	February	March	Totals
2006 - kWh Consumption	1,485,607	1,691,928	1,617,589	1,580,479	1,439,291	1,451,180	9,266,074
2007 - kWh Consumption	1,021,185	1,322,318	1,470,543	1,272,946	1,419,913	1,191,904	7,698,809
Total reduction in electricity consumption for six-month period: 1,567,265 kWh.							

At $0.13 per kWh, the reduction in electricity usage is equivalent to savings of $203,744, or over $400,000 per year.

Table 4.
Reduction in CO_2 Emissions*

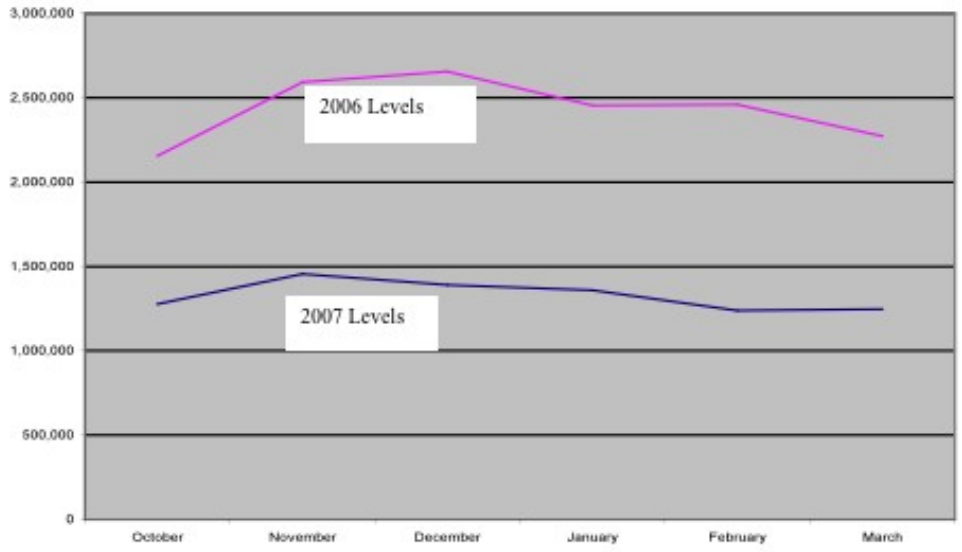
Year	October	November	December	January	February	March	Totals
2006 - CO_2	1,277,622	145,5058	1,391,127	1,359,212	1,237,790	1,248,015	7,968,824

Emissions (lbs.)							
2007 - CO_2 Emissions (lbs.)	878,219	1,137,193	1,264,667	1,094,734	1,221,125	1,025,037	6,620,976
*Assumes an average of 0.86 lbs. CO2 produced per kWh consumed (Source: U.S. Department of Energy, 2002). Total reduction in CO_2 emissions for six-month period: 1,347,848 lbs.							

The change in CO_2 emissions represents a reduction of nearly 17% over the tracked six-month period. As mentioned previously, this result could contribute to goals of the Regional Greenhouse Gas Reduction Initiative.

These results have been communicated to stakeholders of Cornell Cooperative Extension, including state legislators. Future plans include communicating them to other military bases throughout New York State.

Figure 4.
Illustration of CO2 Levels (lbs.) Before and After Change to CFL Lighting



Energy Forums

In February 2005, an educator in Franklin County who is participating in CEPREE used part of his mini-grant to host an all-day program at a local restaurant. This free event was titled "An Energy Forum for Farmers and Rural Landowners" and was attended by 200 people. Two Cornell faculty members were featured speakers. One addressed residential energy efficiency; the other talked about bio-fuels. A NYSERDA regional representative spoke about financial incentives available for improving residential energy efficiency and renewable energy systems. Other speakers were from the area and talked about efficient wood heating and renewable energy systems. A free lunch was provided to attendees.

The local newspaper featured front-page stories on the event the day before and the day after. This event was considered a success because of the large number of attendees, the engaged question-and-answer period, and the good press coverage. The format for this forum has been replicated in four other New York counties over the past 2 years.

Energy Town Meetings

Cornell's wide area network provides an electronic link for face-to-face meetings between the Ithaca campus and county Extension offices. This network has been used for Energy Town Meetings in which the general public is invited to county offices to hear lectures from Cornell faculty, NYSERDA personnel, and others on topics that have included lighting efficiency, photovoltaic systems, wind energy, and improvements to residential energy efficiency. Lectures typically last from 30 minutes to 1 hour and are followed by question-and-answer sessions and follow-up discussions. These meetings have also been Web streamed and posted on Cornell Cooperative Extension's Web site for various periods of time.

Special Audiences

In 2004 Cornell participated in a pilot project with the National Association of State Universities and Land Grant Colleges (NASULGC) and the U.S. Department of Energy (DOE) to teach homebuilders concepts related to DOE's Building America program. Working with the New York State Builders Association (NYSBA) Research Foundation, Cornell faculty delivered educational sessions about high performance housing and Energy Star homes to 133 builders at five locations around New York State. These talks included information about NYSERDA resources available to builders. This information was also included in an article written by faculty for *Empire State Builder,* NYSBA's trade magazine. This project was selected by DOE for representation on a panel at the 2006 International Builders Show, the annual conference of the National Association of Home Builders. Some New York Builders attended this panel presentation and discussed their participation in the program. One observation was that many of the concepts covered in the educational sessions were previously unfamiliar to participants.

Other supply-side activities undertaken through CEPREE include outreach to owners and superintendents of apartment buildings in New York City to increase awareness of NYSERDA resources targeted to those groups. Educators have also reached retailers to encourage the stocking of Energy Star appliances in their stores. Educators have also provided real estate brokers information about residential energy efficiency and NYSERDA programs.

Project Web Site

The CEPREE Web site <http://housing.cce.cornell.edu/nyserda/> provides a description of the program with links to resources for Extension educators and the general public, including press releases and fact sheets on various aspects of residential energy efficiency, links to NYSERDA, the U.S. Department of Energy, and other sites. Web sites for county offices include a link to this page.

Implications for Extension

Depending on the willingness of state energy offices to fund such programs, CEPREE could be replicated in other states and could lead to substantial gains in energy efficiency in the residential sector. Tonn and Peretz (2007) reported that state-level programs to promote energy efficiency can result in a 20% reduction in residential energy use. In light of increasing global demand for energy and rising prices, educating consumers about practical ways to lower energy use is an appropriate role for Extension.

Extension has a track record of effective programming during critical periods of U.S. history. Rasmussen (1989) described the roles Extension, then a young educational agency, played during the First World War and how it had "become an effective instrument for quickly attaining national goals" (Rasmussen, 1989, p. 71). At the time, those goals were to increase production of wheat and other crops and to conserve perishable food through different preservation methods. Extension played a major role in achieving these goals through effective educational campaigns directed toward farmers, homemakers, and youth.

Simons (1960) noted that entrance of the U.S. into both world wars was anticipated sufficiently in advance, so that Extension programs could be adapted as necessary. He noted that this was not the case with natural disasters and presented as an example the Central New York Flood of 1935, which caused extensive damage to an area 25 miles wide and 180 miles long. At the time, county Extension offices employed home demonstration agents, who worked quickly with faculty in Cornell's College of Home Economics to disseminate materials on the renovation of water-soaked clothing, furniture, and bedding. Extension now has the Extension Disaster Education Network (EDEN) <http://www.eden.lsu.edu/>, with educational resources on responding to natural disasters, terrorist events, food supply contamination, and other issues.

With Extension's proven ability to educate the public when a critical need arises, it is time to implement a national effort that applies this ability to residential energy efficiency. This was the case in the mid 1970s, following the Arab oil embargo and resulting high energy prices, when Extension home economists and agricultural specialists cooperated in efforts related to residential, farm, and community energy conservation programs (Rasmussen, 1989).

The development of a national program covering all 50 states is not likely to occur without funding devoted to such an effort. Many state Extension specialists and county educators are currently involved in energy conservation education programs that are funded from a variety of sources. Decisions to include this subject matter in Extension programs are made at the state, regional, and county levels. This is appropriate, given the nature of Extension. However, the importance of this topic should be noted by State Directors of Extension, College Deans, and Executive Directors of county offices when positions are to be filled.

If a state Extension specialist is interested in implementing a program similar to CEPREE, an important first step to take would be to gauge interest and willingness on the part of county educators to participate and to determine how much they would require in financial support. A one-page description of the proposed program should be developed that describes what topics will be covered and the educational methods that will be undertaken. A simplified budget should also be presented.

The appropriate project officer within the state energy office should be identified and then contacted to request a meeting. The purpose of the meeting would be to familiarize the officer with Extension and to gauge the extent of interest on the part of the energy office to develop such a program. The one-page program description should be sent to the officer in advance of the meeting. If the officer is unfamiliar with Extension, the specialist should give a presentation on Extension programming in the state at the meeting and present the officer with impact statements, brochures, and other relevant materials. By the end of this meeting, the specialist should convince the officer that Extension and the energy office have complementary goals and that Extension has the capability to deliver an energy efficiency education program that will substantially reduce energy use across the state.

After Congress passed the National Energy Extension Service Act in 1977, the Federal Energy Research and Development Administration implemented, in a 10-state pilot project, a new energy outreach program, the Energy Extension Service (Riter, 1980). But, as noted by McDowell (1985), political problems were encountered with this program because of existing energy education activities within Extension. Rather than establish a separate organization, it would be more effective to follow the recommendations of Dorf and Hunter

(1977), who developed a useful model for incorporating an Energy Extension Service within the land-grant university system in partnership with state and federal agencies. DOE could encourage state energy agencies to work with Extension in their respective states to implement such a model or require it as a condition for receiving their annual State Energy Program allocations.

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