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Energy Education Incentives: Evaluating the Impact of Consumer Energy Kits

Abstract

Measuring the energy and environmental impact of residential energy education efforts is difficult. The E-Conservation residential energy management program uses consumer energy kits to document the impact of energy-efficient improvements. The consumer energy kit provides an incentive for individuals attending energy education workshop, helps consumers identify simple energy-saving technologies, and provides consumers with accessible energy-saving actions. As a result of consumers installing the compact fluorescent light bulbs and low flow showerheads in the energy kits, measureable savings in terms of annual energy savings, kilowatt hours, gallons of water used, and CO^2 reduction are achieved.

Sarah D. Kirby
Associate Professor and Housing Specialist
sarah_kirby@ncsu.edu

Autumn Guin
Extension Associate
autumn_guin@ncsu.edu

Laura Langham
Extension Associate
laura_langham@ncsu.edu

North Carolina State University
Raleigh, North Carolina

Introduction

Residential energy education programs are an important area of focus for Extension. In the late 1970's, Extension programs grew out of concern for energy prices, dependence on non-domestic energy sources, and the depletion of nonrenewable resources (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Atiles, Wysocki, & Tremblay, 2003). In recent years, concern about global warming as a result of green house gas emissions and the role that consumers play in energy consumption have given new emphasis to energy conservation and efficiency educational efforts (Laquatra, Pierce, & Helmholdt, 2009). The Obama Administration has placed significant emphasis on increasing energy efficiency for the positive effects it has for the environment as well as the economy in terms of job creation and consumer spending (Middle Class Task Force and Council on Environmental Quality, 2009).

There are two important steps in reducing energy consumption. The first step is creating the desire for change among consumers, and the second step is changing consumer behavior. Once desire is created and behavioral change is made, a third issue is determining the result or ultimate impact of that change. Both encouraging change and measuring the economic and environmental impact of energy efficiency or conservation changes can be difficult.

Educational intervention is one strategy for effecting behavioral change. Evidence indicates that reduction in energy consumption behaviors can be achieved through educational interventions (Weihl,

1987; Abrahamse et al., 2005; Carrico & Riemer, 2011). Combining interventions with incentives can work together to produce substantial reductions in energy use (Geller, 1981). Fuller et. al (2010) reviewed a number of components related to energy efficiency programs and developed a list of best practices for future programs. Among their recommendations, researchers suggested that it is essential to enlist trusted community members to help deliver and support the educational messages and to make the process easy for participants to incorporate energy-efficient solutions.

The E-Conservation Program

The E-Conservation residential energy education program, funded by the State Energy Office and operated by Extension, educates homeowners and renters about ways to reduce their energy use and increase their homes' energy efficiency through behaviors, retrofits, and energy-saving technologies (Kirby & Chilcote, 2005; Chilcote, Guin, & Kirby, 2007; Kirby, Chilcote, & Guin, 2009). The program uses both intervention and incentive strategies in order to influence energy consumption behavior and create positive energy savings. E-Conservation uses educational intervention strategies, including educational workshops, fact sheets, social media, demonstrations, and websites to provide consumers with information on particular aspects of home energy efficiency. These strategies have been shown to be successful in changing knowledge and attitudes of consumers, but do not provide valuable quantifiable data regarding energy savings or environmental impact.

Consumer Energy Kits

To address the need for data regarding environmental impact and energy savings, the E-Conservation program developed a consumer energy kit. These kits are funded through the contract with the State Energy Office and are free to those individuals who attend an E-Conservation residential energy workshop. The purpose of the kit is threefold: 1) to provide an incentive for individuals to attend an E-Conservation energy education workshop; 2) to allow consumers to see, firsthand, what simple energy-saving technologies look like; and 3) to provide participants with an immediately accessible energy-saving action they could do without delay after attending a workshop.

The E-Conservation program has been in effect since 2004, and during that time, the kit has gone through a number of revisions. The original kit included a compact fluorescent light bulb, a faucet aerator, a hot water temperature card, a refrigerator thermometer, and an LED light bulb. Based on participant feed back and installation practices, the consumer kit was changed in 2009. The new kit includes fewer items. However, the items in the kit are easier for consumers to install, and they also have a measurable impact on home energy use. The current consumer energy kit includes five items: two Energy Star compact fluorescent lamps (CLF), a low-flow showerhead, an energy conservation information wheel, and a water conservation information wheel. Consumers also receive a corresponding information sheet with the kit to explain what items are in the kit and what energy savings they might achieve through the installation of those items.

In addition to the ease of installation of CFLs and a low-flow showerhead, there was another reason for selecting these two items. Energy-savings calculators for installing CLFs exist. These calculators help predict the amount of kilowatt hour (kWh) savings, electrical cost savings, and carbon dioxide (CO^2) that can be achieved through installation of these bulbs. Carbon dioxide is a green house gas that is

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created during the burning of fossil fuels, and it is believed to contribute to global warming (Aresta, Dibenedetto, & Angelini, 2013). Calculators also exist for water and energy savings associated with the use of a low-flow showerhead.

Consumer Kit Survey

Extension field faculty collected email addresses and mailing addresses of workshop participants who received consumer energy kits. Approximately 2-4 weeks after attending a workshop and receiving a consumer kit, each participant was sent a survey to determine if they had installed the energy-saving devices. The study received IRB approval through North Carolina State University, IRB #120-07-4. For those participants who provided an email address, an on-line survey was used. For those with physical mailing addresses, a mailed postcard was used. The survey reminded participants that they had attended a workshop focused on saving energy hosted by their county Extension office and that as a part of the training they had received a consumer energy kit. The survey then asked three yes or no questions:

- Have you installed the compact fluorescent light bulbs?
- Have you installed the low-flow showerhead?
- Did you read the information on the water and energy wheels?

The survey also asked one open-ended question.

- Have you made any other changes in your home to conserve energy or water since attending the workshop? If so, please tell us about them.

Consumer Kit Results

Over 2,100 kits were distributed across the state, and follow up surveys were sent to all individuals receiving kits. The purpose of the survey was to ascertain if individuals installed the items in the kit and not to make any generalizations about the population using the kit. No demographic information was collected. The results of the survey revealed that participants are using the energy- and water-saving items in the consumer energy kit.

Of the 2,103 participants who received the consumer energy kit with two compact fluorescent light bulbs, 94% installed their fluorescent light bulbs, 66% had installed their low-flow showerhead, and 90% used their water and energy wheel.

To determine CFL savings, the Energy Star savings calculator was used (Energy Star, n.d.). This calculator estimates that bulbs are used an average of 3 hours per day and at a cost of $0.108, the average electrical cost of kWh for North Carolina utilities (Energy Star, n.d.). The CFL calculator can be found at <http://www.energystar.gov/?c=cfls.pr_cfls_savings>. Replacing 3,954 incandescent bulbs with CFL bulbs will annually save approximately 268,437kWh in energy use, $27,434 in energy costs, and 413,393 pounds of carbon dioxide (CO_2). Additionally, the savings calculator estimates that over the life of the bulbs, $170,878 will be saved in energy costs, and 1,961,184 kWh of electricity will

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be saved.

Water savings were calculated using calculation data provided by the showerhead manufacturer (Niagara Conservation, 2013). The calculation was based on reductions of 1 gallon of water per minute created by replacing a standard showerhead that uses the federal standard of 2.5 gallons per minute with the low-flow showerhead in the energy kit that uses 1.5 gallons per minute. The U.S. Census data reports the average number of residents per household is 2.6 people. The calculation provided by Niagara Conservation uses an average of 3 persons per household. Using this number for family size, households taking a 10-minute daily shower can expect to save 13,688 gallons of water each year per household. Homeowners installing the low-flow showerhead also save approximately 2007 kWh per year in electric water heating, resulting in total electricity savings of approximately $217 per year, per household. The potential result of 1,388 households installing low flow showerheads is $300,857 per year in electrical costs, 2,785,716 in kWh savings, and 3,593,574 in CO_2 reductions.

Table 1.

Impacts of Consumer Kit Installation on Energy Use, Energy Savings and CO_2 Reduction

Installation of	Number Installed	kWh Saved	Energy Costs Saved	Pounds of CO_2 Reduced*
Light Bulbs	3954	268,437	$29,018	413,393
Low flow Showerhead	1388	2,785,716	$300,857	3,593,574
*Based on a fuel mix of 1.29 pounds of CO_2 per kWh				

In addition to the installation information, participants shared additional energy saving behaviors, retrofits, or technologies used as a result of what was learned in the workshops. These included weather stripping, caulking, adding insulation, and replacing appliances.

Implications

Determining impact, especially economic and environmental impact, from education programs can be difficult. The use of consumer energy kits by the E-Conservation program has proved to be a good investment of funds as evidenced by the installation of the CFLs and low flow showerheads. While the distribution and use of these items may not initially appear to have a sizeable influence on overall energy use, savings, or CO_2 reduction, calculations prove that they do indeed have significant impact. The provision of incentives along with education can assist in reducing overall energy use and environmental impact among constituents.

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