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# Exploring Determinants of Consumer Energy Conservation Decision-Making as a Foundation for Residential Energy Conservation Programs

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## Abstract

A relatively small number of recent relevant studies on consumer energy use reduction behavior or energy conservation education initiatives exist despite the fact that ecological models of consumer energy use attribute 85 percent of all energy use to consumer lifestyle decisions. According to the Consumer Lifestyle Approach (CLA), the direct and indirect consumption of energy by consumers is the most significant factor impacting energy use in the United States. The Consumer Lifestyle Approach postulates that external environment, individual characteristics, household demographics, and consumer choice impact consumer energy use behaviors and consequences. Identifying factors that contribute to consumer energy conservation practices and using these factors to tailor energy conservation education programs to change consumer energy use attitudes and behaviors is one essential step to reduce overall energy use and expenditures. This paper brings together literature on the ecological context in which consumers use energy, determinants of consumer energy conservation attitudes and behaviors, and models of consumer energy use decision making toward a discussion of elements necessary to create impactful consumer energy conservation education programs.

## Keywords

energy conservation, consumer energy use, energy use context, energy conservation education

## Residential energy conservation and consumers

The United States has renewed its interest in energy conservation and efficiency. The cost of heating and cooling homes, coupled with the negative economic effects of the recession, has forced homeowners to focus on energy use and expenditures.

United States consumers, like people throughout the rest of the world, have faced rapidly escalating energy prices during the past decade ... U.S. consumers have reacted to these higher energy costs in a variety of ways. Some consumers have cut their purchase of automobile

gasoline by driving less or buying more fuel efficient cars. Others have cut the purchase of home heating fuel by lowering heating temperatures, raising cooling temperatures or improving the energy efficiency of their homes. Still other consumers have taken cutbacks in their lifestyle, ranging from fewer meals away from home and less expensive vacations to limiting the purchase of clothing and groceries to less than they otherwise would have purchased (Dillman, Rosa, and Dillman 1983, 299-300).

Written in 1983, this passage is compellingly true today. Residential energy use accounts for 21 percent of energy consumption in the United States (Joint Center for Housing Studies of Harvard University 2013). A number of new programs and efforts focus on increasing the efficiency of new housing stock. While it is essential that new homes be built to energy efficient criteria, it is also crucial to address the energy efficiency of existing homes. There are 110.7 million occupied housing units in the United States, 64 percent of which are 30 years old or older (U.S. Census Bureau 2008). Many of these older homes have significant energy efficiency concerns such as aging heating and cooling systems, air leakage, inefficient ductwork, wasteful appliances, and little or no insulation.

A search for empirically based research and strategies that focuses on U.S. energy consumers yields a relatively small number of relevant studies on consumer energy use reduction behavior or energy conservation education initiatives. The *Recovery Through Retrofit* report, written by the Middle Class Task Force and described as "a major initiative targeted at raising the living standards of middle-class, working families in America" (The White House, n.d.), explores challenges that the home energy retrofit market faces and recommends using funds from the American Recovery and Reinvestment Act of 2009 to help overcome them. Among the barriers to improving the efficiency of the nation's housing stock are the lack of available financing and of a skilled retrofit workforce and a dearth of "access to straightforward and reliable information on home energy retrofits" (Middle Class Task Force 2009, 1). A range of approaches have proven effective at reaching and teaching consumers about energy conservation and efficiency, including engaging peer-to-peer sharing, targeting messages for specific audiences, performing energy audits, and distributing energy kits (Zimring, Borgeson, Hoffman, Goldman, Stuart, Todd, and Billingsley 2012; Kirby, Chilcote, and Guin 2009, Laquatra, Pierce, and Helmholdt 2009). Utility companies, non-profits, and Cooperative Extension are beginning to engage in energy outreach, however, given the enormity of the existing housing stock and the amount of retrofits and improvements needed to make homes efficient, there is much work to do in the area of residential energy education and the effectiveness of these educational efforts.

Cooperative Extension is particularly well suited to provide energy conservation education as the goal of Cooperative Extension is to leverage research-based information from land-grant universities in a way that delivers this information to the public. As a recognized source of research- and evidence-based information, Cooperative Extension is in a position to add

credibility to energy conservation programs, making it more likely for multiple publics to embrace and use this knowledge.

The purposes of this paper are to bring together literature on energy conservation behavior by providing an overview of an ecological approach for understanding consumer energy use in context and to discuss the known determinants of consumer decisions to participate in energy conservation behaviors. Together, these will provide a foundation from which to construct a discussion of gaps in U.S. energy conservation and behavior efforts and to develop future directions for research to develop consumer energy conservation initiatives.

**Framing the imperative: Why consumer energy conservation is essential**

Energy consumption per person in the United States is declining and the increase in energy use is due largely to population growth (EIA 2012). In addition, while the intensity of energy use per household has decreased due to the improved efficiency of appliances, equipment, and state building codes, the increase in the size of homes and the number of households has increased overall energy usage in the residential sector (EIA 2009). New home construction in the United States over the past 30 years increased in square footage by nearly fifty percent (Ewing and Rong 2008). Average household size has increase from 1,800 square feet in the 1980s to more than 2,460 square feet in the 2000s (EIA 2009). Further, the size of the family (i.e., the number of individuals) living in a single-family dwelling has steadily decreased worldwide (Liu et al. 2003). While reductions have occurred in overall energy use per household, how the energy is actually used within the home has changed. Heating and cooling once made up over half of household energy use. That number is now just over 40 percent of actual use. The greatest increase in overall household energy use is in appliances, lighting, and electronics.

Bin and Dowlatabadi (2005) looked at lifestyle decisions and overall impact on energy use and found that 85 percent of all energy use can be attributed to consumer lifestyle decisions. These decisions include both direct and indirect energy usage, and they encompass consumer activities such as home energy use, personal travel, and indirect influences related to food and beverage choices, apparel, entertainment, and operation of housing and transportation. The reliance of the United States on advances in technology to address the growing problem of increasing energy demands on the decreasing energy supply is insufficient to address the energy conservation needs of the expanding U.S. population (Ewing and Rong 2008). Between 30 percent and 50 percent of energy in the residential market can be saved by changing consumer-based energy conservation behaviors using cost-effective energy conservation measures (Magat et al. 1986). Even small changes to policies or behaviors that save energy and reduce emissions, in aggregate, can have a profound effect on energy use, national energy economics, and the global climate (Pearce and Hanlon 2007; Pearce and Harris 2007, 6514).

**The Consumer Lifestyle Approach to understanding consumer energy use**

With two-thirds of all energy use in the United States stemming from individual household use, half of which is direct consumption, addressing homeowner energy conservation behaviors rather than focusing on price mechanisms or new construction technology to curtail energy use is an essential part of the success or failure of the energy future of the United States (Ewing and Rong 2008). Further, use of new technologies relies on acceptance of those technologies by the end user, the consumer. An interesting way to view the consumer is to place consumer energy use behaviors in an ecological context.

Traditional models of measuring the impact of energy use in the United States divide energy use activities four sectors: industrial, transportation, commercial, and residential. This sector approach is misleading and limited in linking energy use to consumer-related behaviors (Bin and Dowlatabadi 2005) because it treats these four sectors as distinct entities, ignoring the systemic relationships between the sectors. A more complex model accounting for these systemic relationships is needed to understand the overall impact that consumers have on energy use. For this purpose, Bin and Dowlatabadi (2005) introduced the Consumer Lifestyle Approach (CLA).

The CLA postulates that five interlocking factors determine consumer energy use behaviors and consequences. First, external environmental factors (e.g., culture) form the context in which consumer decision processes happen. Next, individual determinants (e.g., attitudes) enter into the equations. Household demographics are then accounted for in this decision-making process followed by consumer choice or action. Ultimately, environmental impacts are seen. These environmental impacts then become part of the context for decision making as culture, attitudes, and demographics change. This model further postulates that consumer energy use functions through both direct and indirect pathways. Direct influences include activities that lead to immediate energy use (e.g., driving a car, turning on a light) whereas indirect influences include activities related to production and delivery of products and services (e.g., manufacturing cars and light bulbs) (Bin and Dowlatabadi 2005). Direct influences are subdivided into home energy use and personal travel, and indirect influences are subdivided into housing operation, transportation operation, food, clothing, health care, and entertainment among other factors. Taken together, indirect and direct consumer activities account for 85 percent of all energy use in the United States (Bin and Dowlatabadi 2005). This contrasts strongly with the traditional sector approach that limits consumer energy use calculations to the direct home energy use that equates to 11 percent of U.S. energy usage.

The traditional sector method removes much of the responsibility for the energy future of the United States from the consumer and places that responsibility with the industrial, transportation, and commercial sectors. However, the industrial, commercial, and transportation sectors function in response to and in relationship with consumer demand behaviors, forming part of the external

culture in which consumer behaviors occur. New cars are made for consumers to purchase, new roads are created for consumer travel, and fueling stations are built to sell gasoline to power the new cars. The common link for all of these sectors is the end user: the consumer. The Consumer Lifestyle Approach therefore places more responsibility for energy use and carbon dioxide emission on the shoulders of the consumer.

With arguably more responsibility for energy use and energy conservation falling to U.S. consumers, two questions arise: (1) What are the individual factors that affect whether consumers decide to conserve energy? (2) How might educators use the knowledge of these individual factors to impact energy conservation decision-making processes to convince consumers to adopt energy conservation behaviors?

**Who are the energy consumers?**

A recent survey of adults in the United States (Leiserowitz and Slovic 2005, as in Maibach et al. 2008) identified five target subgroups based upon individuals' reported perceptions of the environmental, moral, and technological security of the United States, including the impact of climate change, terrorism, and moral issues such as gun control and abortion, among other factors. The first of these target groups, the "liberal left," tended to have higher education and incomes and were more likely to be white, female, and have low religiosity. These individuals were more threatened by environmental and technological issues in the United States than they were by moral issues. The second identified group, "alarmists," tended to possess strong religious values, to come from lower income and education levels, and to be more likely women of color. This group perceived all risks to the United States as high-risk situations, whether environmental, moral, or technological. Group three, "mainstream Americans," tended to be moderate in political views, and to have a high school education. "Mainstream Americans" tended to have moderate views about most risks. However, this group saw environmental risks, war, and terrorism as high-risk situations. Members of the fourth group, termed "optimists," were higher income and education, low religion, geographically urban, conservative white men with non-egalitarian individualistic beliefs. All risks were perceived as low for this group. The final group, the "religious right," also tended to be non-egalitarian individualist men. These men were geographically rural and tended to perceive moral issues as highly risky for the United States. However, this final group was less concerned with issues such as environmental security, war, and technology.

Because each of these identified groups differs in values, belief systems, and perceptions on environmental risk, each of these groups may require special attention when developing marketing campaigns, educational programs, and interventions to promote energy conservation. For example, targeting groups with low concern about environmental security might include marketing campaigns that raise awareness about the consequences of human actions, provide

education about the science behind the need for increasing conservation activities, and, especially for the "religious right," appeal to the target group through faith-based organizations. The next section of this review focuses on how decision-making process theories may help in the adaptation of methods and programs for each of these groups.

**Deciding to conserve energy**

Entire disciplines are founded on the study of human behavior and the decision processes that lead to human behavior. (Psychology, sociology, and behavioral economics are just a few of these disciplines.) It is therefore not feasible nor realistic to expound on the decision-making theories that abound in each of these disciplines. For the purposes of this review, discussion of decision-making theories will be limited to those theories which are directly identified in energy conservation behavioral research.

Utility-based decision models are premised on individuals forming rational decisions on complete information about the impact and usefulness of a particular action (Wilson and Dowlatabadi 2007). By definition, this model of decision-making presupposes that individuals will always make informed, logical choices. With respect to energy conservation behavior, individuals would be expected to weigh the cost and benefits of energy conservation actions. Because this theory does not account for the diversity of individual contexts and experiences it often is an inadequate model of decision making.

Decision making is often not an optimal exhaustive process of weighing benefits and consequences of actions (Wilson and Dowlatabadi 2007). Individuals are unable to weigh and process all information available for every potential for action. Therefore, heuristics for decision making are used in this cost-benefit process. These heuristics include satisficing, recognition, elimination, and availability (Gigrenzer and Todd 1999). "Satisficing" is the act of limiting the amount of information reviewed until just enough information is gathered to make a somewhat informed decision. The "recognition heuristic" relies on familiarity with alternatives. The "elimination heuristic" involves the immediate rejection of actions or products that do not meet a predetermined threshold of acceptability. Finally, the "availability heuristic" is based on the use of information that is easily recalled, recently encountered, or is identified as personally salient. In the decision-making process, an individual may either use all of these heuristics or pick and choose between them.

If individuals relied on utility-based decision models without employing the identified cognitive heuristics, then conservation action would likely be the logical choice for consumers. Energy conservation activities are economically and environmentally beneficial actions. Logically, the benefits of energy conservation actions provide individuals with economic and physical gains whereas the environmental and economic actions of not conserving energy are detrimental to

both the individual and to society. However, this cost-benefit mode of decision making falls short of predicting human behavior because it fails to account for individual differences in context and experience as well as the amount of cognitive work required by individuals to fully weigh the costs and benefits of their actions.

Attitude-based decision models, including Diffusion of Innovation (DoI) theory, have in common stages of change that are proposed to occur in a linear fashion (Rogers 2003). These theories differ from utility-based theories because prior conditions, individual context, and individual characteristics are included dimensions of these models.

DoI theory is based on the assumptions that (1) decision makers progress through a series of predetermined stages of change including awareness, attitude change, decision making, behavioral action, and reinforcement of the chosen action by internal and external feedback; (2) this linear process is prompted by prior conditions such as a personal need or a desire to conform to normative social behavior; (3) attitudes about behavior adoption are formed based on individual characteristics and utility of the behavior or technological innovation; and (4) reinforcement for the chosen behavior will occur (Rogers 2003). DoI theory falls short in predicting energy conservation behaviors because it does not account for barriers that the individual encounters in adopting energy conservation behaviors and technology such as a lack of financial resources (Wilson and Dowlatabadi 2007).

The sociotechnical perspective on the energy conservation decision process moves beyond the individual focus of the previously identified utility- and attitude-based models to include more complex relationships between individual decision making and the ecological contexts that impact those individual decisions (Shove 1998; Summerton 1992). The sociotechnical perspective takes into consideration the evolution processes in recent energy culture that produce social norms and expectations for energy availability. There are four identified characteristics that form the basis for the sociotechnical perspective (Wilson and Dowlatabadi 2007). First, energy use is embedded in the daily lives of individuals. Life in the United States is reliant on the use of energy for food preparation, travel, and entertainment, among other factors. Consumers in the United States therefore expect ongoing energy availability. Second, individual choices to conserve are constrained by individual factors including technological availability, financial resources, and individual knowledge and abilities. Third, media influences views of conservation and consumption by sending mixed or contradictory messages about social expectations. On one hand, media campaigns for adoption of energy saving practices are more wide spread than in previous historic periods (e.g., Energy Star and Change a Light campaigns). On the other hand, commercials and advertisements bombard U.S. consumers with messages to spend for the latest and greatest new product without clarifying the impact of the new product on energy use or environmental security. The fourth and final element of the sociotechnical perspective is the provision of a need to change. According to the sociotechnical perspective, as prices for energy

decline, the driving force for consumers to reduce energy use behavior is no longer present because there is less economical cost for energy use. Consumers in the United States need salient, personally relevant reasons to change indulgent energy use behaviors.

Ultimately, decisions to conserve energy and subsequent energy conservation behaviors are driven by a combination of individual and contextual factors. The next section of this review brings together the information known about the types of energy consumers and the decision-making process theories and proposes how the convergence of these literatures may be used to create and promote energy conservation behavior programs.

**Future directions for a successful energy future**

A successful energy future for the nation includes a number of significant targets. Among those are a reduction in carbon emissions and other green house gases; the conservation of energy used across all sectors, including the residential sector; and the more efficient use of energy sources across those sectors. Reducing energy use and carbon emissions in the United States, given the diverse composition of energy consumers, will require a multi-faceted approach to educate these various publics and to change energy use behavior in order to be impactful. For example, the "liberal left" may be more likely to respond to messages on preventative actions and policies to reduce their carbon footprint whereas "optimists" may be more likely to respond to messages about reducing dependence on foreign energy sources or the financial benefits of energy conservation, and the "religious right" may respond more favorably to messages about moral responsibility (Maibach et al. 2008; Snyder and Hamilton 2002). Differences in perceptions of personal impact on the environment, differences in chosen media outlets, and differences in views on individual responsibility must be taken into account when designing media campaigns and energy education programs (Wilson and Dowlatabadi 2007).

In addition to differing values and environmental risk perspectives, each of the five identified U.S. consumer target groups has different social, educational, and financial realities that affect a group member's ability to participate in certain conservation behaviors. The cognitive processes each target group employs are likely to differ. For example, the "liberal left" may be more likely to seek out technical reports on new energy technologies than would any other target group members. Target groups with more limited financial resources may be less able than other target groups to consider adoption of more high-end conservation practices unless programs provide financial assistance. In addition to contemplating the educational and financial realities of individuals, educators need to consider the previously identified cognitive heuristics and provide education to assist individuals in each target group in effectively and efficiently sifting through the relevant energy conservation information.

The critical factor in the creation of comprehensive energy conservation education programs is the recognition that the consumer's culture, attitudes, and household demographics are driving forces behind consumer actions. It is, for example, unrealistic to expect limited-resource consumers to spend thousands of dollars on energy efficient retrofits. However, it is reasonable to provide educational programs for those limited-resource consumers with low- and no-cost ways to reduce energy costs, thereby increasing the likelihood of future investments in energy conserving retrofits. A practical example of a program that might address the needs of consumers from all educational, income, social realities could include (1) an energy education component that focuses on low-cost (e.g., caulking) and no-cost behaviors (e.g., turning off lights and ceiling fans when leaving a room) for those consumers with limited resources, (2) subsidized home energy audits to identify potential low-cost improvements for consumers who could not otherwise afford comprehensive home energy audits, and (3) funding for higher cost retrofits to offset consumer costs. Several of these program elements currently exist as part of separate energy conservation initiatives (e.g., the North Carolina Energy Conservation Program, the Consumer Education Program for Residential Energy Efficiency, and Zimring et al.'s program for Delivering Energy Efficiency to Middle Income Single Family Households).

The energy future of the United States is dependent upon the ability of researchers, educators, and policy makers to develop energy conservation promotion policies and energy programs that address the various perceptions of consumer target groups. In the United States, empirical work in the area of energy conservation behavior has been largely theoretical. A strong need for practical and applied work to promote energy conservation behavior exists. Creating consumer energy education programs that focus on impacting behavior; providing information to residents on no-, low-, and higher cost home retrofits; and leveraging funds to make those retrofits financially feasible for all consumers is one step in addressing this need. This work must also address complex factors influencing energy use including individual characteristics and opinions, perceptions of environmental risk, educational and financial realities, the energy use consumption culture, social norms for energy use and conservation, media influences on energy conservation and consumption, and the availability of technology.

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