FACTORS INFLUENCING HOMEOWNERS' DECISIONS TO SEEK RESIDENTIAL ENERGY EFFICIENCY KNOWLEDGE

by

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The undersigned, appointed by the Dean of the Graduate Faculty, have examined the thesis entitled

FACTORS INFLUENCING HOMEOWNERS' DECISIONS TO SEEK RESIDENTIAL ENERGY EFFICIENCY KNOWLEDGE

Presented by Barbara Buffaloe
A candidate for the degree of Master of Science

And hereby certify that, in their opinion, it is worthy of acceptance.

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ABSTRACT

Factors influencing homeowners' decisions to seek residential energy efficiency knowledge

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Knowledge on energy efficiency methods has been available for decades. The question this study is seeking to answer is "what factors influence homeowners to seek out knowledge on energy efficiency?" This research replicates a 1979 survey by Clive Seligman in which homeowners responded to statements about energy consumption. The same questionnaire was administered to homeowners interested in further information about home energy by either attending an Energy Conservation workshop held by MU Extension throughout the central Missouri's counties, or asked for further information on home energy at an Earth Day event or on the workshop's website. The results showed that Seligman's four factors are still important to homeowners in 2007. The data was then analyzed and five different types of individual are defined, according to their attitude towards energy conservation. These patterns are examined in the context of their demographic composition.

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Chapter 1 - Introduction

This report will review the importance of home energy efficiency and the role that education plays in energy efficient practices. Previous research on attitudes towards energy conservation, energy efficiency education, and the role demographics play in energy efficient behaviors are discussed in depth. The results of a recent study conducted in central Missouri with homeowners who were interested in energy efficiency education are presented. Attitudes towards energy conservation are identified, and correlations between those attitudes and demographic traits are investigated. These results illustrate how energy efficiency education programs can be successful across different demographic groups.

History of Problem

Nye (1998) asks the question, "how did the United States become the world's largest consumer of energy?" He answers that Americans adopted different behaviors as more power became available. As these behaviors became common, the dependence on them became a part of the culture. The United States was founded at a time when most energy was expended by human activity, with the majority of it on farms. As late as 1915, most farm work was still performed by human muscle while at the same time only one home in ten had electricity. By the late 1980s, Americans represented five percent of the world's population, but consumed 25 percent of the world's oil and released 22 percent of the world's carbon emissions. In the year 2000, the United States consumed more energy than any other country; consuming 40 percent more energy than Germany, and three times more than Italy and Japan combined.

American homeowners are often unaware of their increasing energy consumption because they assume that it is normal. Americans are born into a society in which abundant, inexpensive energy allows them to participate in activities that rapidly become a part of their daily life. Although promoting savings had been a fundamental part of the early American Protestant work ethic, "Americans began to lose their fundamentalist moorings in the culture of consumption based on abundant power" [Nye, 1998]. Consumption became a part of everyday life for Americans from 1930 to 1970 as energy consumption grew by 350 percent.

The design of the single-family home changed with this culture of consumption. New homes were designed as private retreats that no longer were open to the world. Large, welcoming front porches were replaced by large garage doors. To consumers, the changes seemed natural as long as energy remained inexpensive. Rising home energy use increased the demand for coal and oil production. The oil and natural gas industries were not taxed heavily by the federal government, so alternative energy sources did not become economically attractive. The United States government kept gas prices artificially low. Competition between different forms of energy, such as electricity and natural gas, also kept prices low. Since prices were so low, consumption increased. In 1970, the average home consumed as much energy as an entire colonial town.

The oil industry could no longer keep pace with the demand for energy. The oil industry in the early 1970s was running at 100 percent capacity. Five national trade associations published a statement that said the "energy problem is continuing to worsen" and that "the vast majority of Americans do not realize there is a problem" [Nye 1998]. The

energy problem became a crisis in 1972 when the Organization of Petroleum Exporting Countries (OPEC) stalled the economy with price hikes and boycotts. In 1973, OPEC imposed an embargo on the United States because they helped Israel during the Yom Kippur War. In response, the United States government worked on obtaining more oil rather than limiting demand. Electricity consumption increased by 50 percent with half being used for transportation while the rest was the result of America's preference for detached houses with air conditioning [Nye 1998].

Since the 1970's, a popular incentive for making a home more energy efficient has been the annual operational cost savings. Running a home takes energy, which costs money in the form of utility bills. Taking steps to make a home more energy-efficient costs money, however those steps save money over time by decreasing the amount of energy consumed by the home.

Additionally, energy efficient homes can be worth more on the real estate market. In a report by the consulting and research firm, ICF International, energy consultant Nevin (1998) shows that the real estate market gives an energy-efficient house a higher appraised value reflecting annual energy savings. This added value makes energy efficiency more attractive for homeowners who may not live in the home long enough to fully benefit from lower utility bills or return on their investment in energy efficient repairs, as they benefit from lower utility bills while occupying the home then rewarded with the value added to their home when on the market.

The demands that growing populations place on energy production is not ebbing. Though technology is improving, it is not improving fast enough to keep up with the increasing demands of consumers. Schipper and Meyers (1992) conclude that a large increase in the efficiency of energy's end use is needed to help solve the problems affecting the environment and economy of all nations.

Consumer behavior may be the most important barrier to energy conservation. A lack of reliable information about the financial impact of different energy-efficiency investments, or the difficulty of making those investments, is especially a problem for households. Even if relevant information were abundant and easily available, few energy consumers calculate the costs and benefits of those investments. The perceived risk of energy-efficiency investments is one reason consumers require a higher rate of return than for other types of investments.

In order to overcome these barriers, there is an urgent need to educate homeowners on energy efficiency. Individual homeowners need to be knowledgeable about their home energy consumption in order to have an impact on the nation's total energy consumption. Some citizens believe that they could not achieve their current levels of comfort and convenience if they were to practice efficient energy consumption at home. However, most energy efficient strategies require little or no extra effort on the part of the homeowner, and do not sacrifice comfort. For example, using a programmable thermostat to lower the daytime temperature does not impact on the user, who is usually not at home, and saves over 495 pounds of CO_2 emissions into the atmosphere (see energyguide.com). Barriers to energy efficiency apply to varying degree in different sectors, and within sectors as well.

Energy users differ with respect to their circumstance, perspective, and the criteria that they use in making decisions that affect energy efficiency.

Questions to be answered by this research

This author administered a replication of a 1979 survey to central Missouri homeowners attending a workshop on energy efficiency. The survey primarily addresses attitudes towards energy conservation. Seligman's 1979 study analyzed four key attitudinal factors: (1) effort to conserve and monetary savings, (2) Comfort and health concerns, (3) role of individual, and (4) legitimacy of the energy crisis. This study will answer the following questions:

4. What attitudes about energy conservation are prevalent to homeowners seeking knowledge on energy efficiency?
5. Do the same attitudinal factors identified by Seligman still exist today?
6. Will the correlation of each attitudinal factor be the same as the responses in 1979?
7. Do people with similar attitudes towards energy conservation have similar demographic traits?

Assumptions and Limitations

The questionnaire developed adequately measures the influencing factors that are central to this study. Because the population used in this study is a "case study", a limitation exists within this study concerning the relationships found between influencing factors and demographics and cannot be generalized over larger populations. The population consists of homeowners interested in energy efficiency. It should not be

assumed that the results of this study can be applied to homeowners who are not interested in seeking out information on energy efficiency education.

Organization of the Remainder of the Study

The remainder of the study is organized within four chapters. Chapter 2 reviews the literature appropriate to the topic of energy efficiency and its education. In Chapter 3, the research method selected to respond to the problem is described and discussed. Chapter 4 presents and analyzes the data collected from the study using the method described in Chapter 3. The study concludes with Chapter 5, which is a summary of conclusions drawn from the data presented in Chapter 4.

Chapter 2 - Literature Review

Chapter 2 reviews literature that is related to energy efficiency and the teaching of energy conservation practices. This chapter first looks at research on attitudes towards energy conservation. The focus then shifts to review prior research on energy conservation education. Next, it reviews prior research on energy use by different demographic groups.

Factors Associated with Residential Energy Conservation

A popular area of interest in energy conservation concerns consumer attitudes and perceptions towards energy conservation. Black (1978), Hummel (1978), Seligman (1979), Samuelson (1990), Berger (1992), Lutzenheiser (1993), all conducted research on homeowners and homeowners' attitudes towards energy conservation.

Energy efficiency and human activity: past trends, future prospect (Schipper, 1992) examines energy efficiency attitudes from the 1970s to the early 1990s in an attempt to understand energy use. The authors examine energy use records and the activity for which the energy was used. Schipper describes the dramatic increase in oil prices in the late 1960s and early 1970's, which was accompanied by a transition in popular perceptions of the environmental and sociopolitical costs of energy consumption. The result of this transition was an increase in research on energy conservation. One study from this period was *Man's impact on the global environment*, written by the MIT-sponsored Study of Critical Environmental Problems (SCEP). This study identified that energy consumption contributed to more than a dozen environmental problems of global scale, including

greenhouse gas emissions, acid precipitation, oil spills, radioactive waste production, and particulate pollution.

A balance is desired between energy benefits and energy costs (Schipper, 1992). Energy benefits are perceived to contribute positively to the well-being of humans. Having a home heated in the winter and well-lit in the evening are two examples of energy benefits. Energy costs are the losses attributed to the obtaining and exploiting energy. The emission of carbon dioxide during the burning of fossil fuels is an example of an energy cost. These environmental costs can be divided into two groups: Internal and external. Internal environmental costs affect those who directly benefit from energy consumption, such as owners of automobiles. External environmental costs affect members of society that are not gaining from the production of the energy. For example, the income lost by a farmer as a result of crop damage due to pollution is an example of an external energy cost. Internal and external costs include both damage to the environment as well as the monetary cost of reducing the environmental damage.

Hummel, Levitt, and Loomis (1978), who surveyed two representative samples of residents living in a Colorado community during the 1973 gasoline shortage, found that the best predictors of consumers' attitudes toward energy use and environmental issues were perceived blame variables, which indicate who the respondent thinks is responsible for an existing crisis. For example, an energy shortage that is attributed to environmental factors, such as an ice storm, is more likely to produce cooperative energy conservation than an energy shortage attributed to others' overconsumption. Three types of pro-energy actions were measured: (1) Voluntary actions that benefit the environment at the expense of

lifestyle, (2) mandatory actions that benefit the environment at the expense of lifestyle, and (3) actions that increase energy consumption at the expense of the environment. Hummel's analysis indicates decreasing support in voluntary actions when overconsumption was blamed for the energy shortage.

Kinnear, Taylor, and Ahmed (1974) argue that a consumer's level of concern for the environment is noticeably affected by perceived consumer effectiveness, or the degree to which consumers believe that their actions have an effect on the crisis in question. Kinnear *et. al.* collected data through a mall questionnaire administered to 500 members of a consumer panel. The goal of their study was to empirically explore the relationship between the socioeconomic and personality characteristics of consumers and the amount of ecological concern they indicate. Their study suggests that it may be possible to change patterns energy use by educating consumers about the impact of their energy use on the environment. Their study is discussed in greater depth later in this chapter.

In contrast, Seligman's study (1979) observed that consumer attitudes towards comfort and health are the strongest predictors of actual energy use by homeowners. In the study, a questionnaire was administered to help understand the factors effecting homeowners' decisions to conserve energy in their home. At the time, the study was looking for relationships between what homeowners' reported that their attitudes towards energy conservation were, and what their actual energy consumption was. The questionnaires were administered to 56 couples in a New Jersey suburb.

From the responses, four attitude factors were revealed through factor analysis: (1) effort to conserve and monetary savings, (2) comfort and health concerns, (3) role of individual, and (4) legitimacy of the energy crisis. The factors were entered into a multiple regression analysis to predict actual energy consumption. The predicted attitudes were responsible for 55 percent of the variance in energy consumption

It was determined that comfort and health concerns were responsible for the majority of the energy consumption in a house. In an attempt to see whether comfort and health could be separated into different factors, and to attempt a more accurate prediction of energy consumption, a second survey was administered. An effort was also put towards separating effort and savings into two factors. The respondents in survey two consisted of 69 couples from an area similar to that used in survey one. Survey two repeated 19 variables from survey one, removed ambiguous questions, and added more attitudinal variables to help clarify the factors. Survey two's regression analysis predicted over 60 percent of the variance in energy consumption.

The results of both studies suggested that comfort and health were the greatest influencing factor for predicting energy consumption. The comfort and health factor was the only significant predictor in survey two. The effort-savings factor was unable to be fully separated in survey two and might underscore efforts for rewarding conservation behavior. Seligman points out that as the cost of energy increases, homeowners might increase the effort to conserve in order to retain savings. The factor of the energy crisis emerged during this study because of the late 1970s media coverage of the topic.

Samuelson (1990) analyzed the problem of energy conservation from a social dilemma approach. Social dilemmas are situations in which voluntary acts by individuals are needed to benefit the common good, while there is also an incentive for individuals not to act. The article reviewed empirical research from both laboratory experiments on social dilemmas and field research on the topic of energy conservation. The goal was to identify a number of psychological variables that influence cooperation in social dilemmas. These variables were then compared to the conceptual variables tested in the energy conservation field research.

Samuelson sorts consumer responses to social dilemmas into three different classes: (1) Unrestrained consumption (2) curtailment, and (3) device adoption. The classes were defined by Messick and Brewer (1983), who investigated numerous responses to social dilemmas. The classifications are widely used throughout Samuelson's social dilemma approach research. The first response classification, unrestrained consummatory behavior, refers to homeowners who turn the thermostat to its lowest setting in the summertime for personal comfort, regardless of the environmental and monetary costs of energy consumption. The second classification, curtailment behavior, are changes in homeowners' daily energy use habits, such as turning the thermostat up when gone during a summer day. The third class of responses is device-adoption behavior, which is the use of new technologies by homeowners to reduce energy consumption while maintaining personal comfort. An example would be the purchase of an alternative energy producer, such as solar panels, for the home. A cost-effective device adoption is one for which the value of

future energy savings over the life of the technology is greater than the costs incurred to achieve those energy savings.

The first response, unrestrained consumption, can be represented as a collective trap. A collective trap is a form of social dilemma in which individuals in a group are motivated to take an action that benefits them but imposes costs on other group members. In unrestrained consummatory behavior, the homeowners are benefiting from improved comfort in their home while the community as a whole runs the risks of higher utility rates and brownouts. Another classification of a social dilemma is the collective fence. A collective fence is a situation in which individuals perform an unpleasant task that requires personal sacrifice but benefits all group members. Curtailment behavior and device-adoption are examples of collective fence. Curtailment behavior requires a sacrifice of comfort for the individual but maintains more energy for the community. Device-adoption requires an initial cost to the homeowner while the benefits will be shared by both the individual and the community in the form of more available energy.

Samuelson summarized that there are obvious connections between the types of encouragement used in energy conservation campaigns and the variables investigated in social dilemma research. Samuelson concludes that group workshops hold the most potential for changing consumer behaviors. Group workshops, which require individuals to meet face-to-face and to see each other after the meetings, assign individuals greater responsibility for their community's energy use and overall welfare.

Energy Efficiency Education

Identifying the factors that influence consumers to practice energy conservation behaviors is an important aspect of designing any conservation education program, because it allows educators to know how to market the programs with the most success. This is illustrated by Henion and Wilson (1976), who predicted that as the environmental movement of the late 1970's continued, the uniformity of the group would dissolve. The authors suggested that educational programs designed for energy conservation would have to identify attitudinal traits associated with conservation behavior and market educational campaigns towards those attitudes.

Kinnear, Taylor, and Ahmed (1974) suggested that educational programs should have two targets and associated objectives. The first target of educational programs focuses on methods to get consumers already interested in conservation to practice conservation behaviors. The second target focuses on consumers not interested in conservation. The objective of an educational program geared towards the second target involves consumers concerned about energy consumption and helping them practice conservation behaviors. The most important objective described by Kinnear, *et. al*, related to perceived consumer effectiveness, is to make consumers believe their actions do make a difference with an energy crisis. The study is discussed in greater depth in the next section.

A study by Ellen *et al* (1991) elaborated on Kinnear, Taylor, and Ahmed's research on perceived consumer effectiveness by illustrating that consumers often do not practice energy conservation because they do not know if their actions make a difference even if

practiced by everyone. Ellen *et al*. emphasize that regular, positive feedback is needed to make individuals feel that they are making a difference.

In *The Logic of Collective Action*, Mancur Olson (1965) also discusses perceived consumer effectiveness. Olson notes that as group size increases, the perceived effectiveness of individual efforts decreases. The lower the perceived effect of a single person's behavior, the less likely a homeowner is to believe that individual conservation behavior has an effect on the community's overall energy use.

Kinnear, Taylor, and Ahmed (1974) also explain the correlation between campaigns using fear appeal and consumers ignoring the energy problem. Kinnear, Taylor, and Ahmed find that conservation efforts that attempt to frighten consumers into reducing their energy usage are often less persuasive than are minimal appeals because the fear appeals create too much tension.

Similarly, Fine (1990) suggests that when marketing educational energy campaigns, a "well-baby" approach should be practiced. The "well baby" approach emphasizes the steps that can be taken to solve a problem. This is the opposite of the "sick baby" approach, which emphasizes the bad behaviors known to be causing the problem. This approach not only describes what the proper consumption behavior is, but it also describes how the difference is made by just one person.

Samuelson (1990), whose study is mentioned earlier in this section, analyzes residential energy use from a social dilemma perspective in an attempt to encourage energy conservation. Samuelson points out that voluntary conservation efforts will be less likely to

occur when the benefits of overconsumption, such as personal comfort and convenience, are given to the individual, while the negative costs, such as pollution, are shared by the community. In addition, the personal benefits are accrued immediately while the costs to the community are delayed. Messick and Brewer (1983) also note that both collective fences and traps that are delayed are the most difficult to solve.

According to Samuelson, the concept of the social dilemma can be applied to energy conservation education. Samuelson argues that group workshops hold the most potential for changing consumer behaviors. Group workshops, which require individuals to meet face-to-face, assign individuals greater responsibility for their community's energy use and overall welfare, and help them to place selfish individual motives below the interests of the group.

Looking at energy efficiency education programs, Samuelson (1990) also found that these campaigns have historically based their methods on two different psychological models of behavior: The attitude model and the rational-economic model. The attitude model assumes that attitudes guide behavior, and that positive attitudes towards energy conservation are required for conservation to take place. The rational-economic model theorizes that consumers can rationalize energy conservation if their economic self-interest is served. For example, financial incentives such as tax credits and low-rate loans for the purchase and use of energy-efficient appliances address the rational-economic model.

Energy Use by Different Demographics

Schipper and Meyers (1992) compared residential energy use in 18 different countries. The countries were divided into three types: (1) Industrialized countries, (2) countries of the former East Bloc (the Soviet Union and Eastern Europe), and (3) developing countries. Because household occupancy and sizes change over time, the authors used population as a measure of residential activity. The source of energy and how it was consumed were the main focus of the study.

High energy prices and conservation programs had a small effect on changing household energy use in industrialized countries. Energy use increased as the amount of equipment ownership, such as automobiles and heating equipment, and home size increased over time. Although the efficiency of appliances improved over time in industrialized countries, this was offset by changes in the sizes and features of many appliances. Alternatively, there was little efficiency improvement found in the former East Bloc, especially in space and water heating. Schipper and Meyers found the cause was a lack of information on energy pricing. Developing countries have very different energy usage between the rural and urban areas. Affluent members of cities use Western-style electricity for appliances, cooking, and water heating. Even the lower classes use electricity for televisions and refrigerators. Biomass is the dominant fuel for the rural areas of the same countries. In developing countries, appliances are still very inefficient when compared to similar appliances in the industrialized countries.

Schipper and Meyers (1992) argue that barriers to energy efficiency apply to different sectors. Homeowners and small companies usually face greater barriers to

improved energy efficiency because they do not have the resources to evaluate and implement energy saving methods in contrast to large companies and governments. Programs that encourage energy efficiency need to address the different circumstances, perspectives, and criteria that groups make in improving energy efficiency. Gilg (2006) argues that defining the characteristics of individuals who conserve is important, given the need for policy makers to define groups who are both active and less enthusiastic with regard to energy conservation. Gilg's research is discussed in greater detail below.

Kinnear, Taylor, and Ahmed (1974) explored the relationship between ecological concern and a combination of personality characteristics and socioeconomic factors. Kinnear *et. al.* created an ecological concern index and examined 20 independent variables. Variables, such as family income, level of education, age and the presence of children were some of the socio-economic factors tested. The independent variables were predictors for possible scores on the ecological concern index. Using analysis of variance (ANOVA), the study's top 10 predictors were income, perceived consumer effectiveness, depression, sentience, understanding, desirability, dominance, rebelliousness, tolerance, and harm avoidance.

Multiple classification analysis (MCA) measured the importance of the top predictors. The predictors explained 28 percent of the variance in scores on the ecological concern index. This variance helped to profile ecologically concerned adults. The profile suggested that personality characteristics were better predictors than socioeconomic factors of ecologically concerned consumers. The profile also showed a slight tendency that these

consumers were in an over-$15,000 income category. The 2006 equivalent of $15,000 in 1974 dollars is over $65,000 [see Westegg.com].

Samuelson (1990) points out that consumers interested in energy efficiency education come from different areas of the United States and from different backgrounds. The environmental factors affecting conservation behavior must be considered when analyzing residential energy use and how to market energy efficiency campaigns to different groups. Family variables, including family size, number of children, and who makes the decisions regarding energy use must also be considered, to have an effect on how and why energy is consumed in a home. Energy use can also be affected by the climatic conditions of the home location. Geographic locations that experience extreme differences in temperature are more likely to have energy shortages caused by increased demand for energy.

Borden and Francis (1978) conducted a study to answer the question: "Who cares about ecology?" Their research examined personality factors influencing concern about the environment, and found that men and women become involved with the environmental movement for different reasons. In the study, females that demonstrated ecologically concerned personality traits had the tendency to also be leaders in the movement. A possible explanation for this factor is that the environmental awareness movement was taking place at the same time as the women's movement. While interesting, this study is not sufficiently current to provide adequate analysis of male and female roles in the contemporary environment awareness movement.

The majority of the research on energy conservation was undertaken in the 1970s and 1980s, and since that time changes have occurred in the knowledge, behavior, and attitudes towards the environment. Diamantopoulos *et al* (2003) attempted to update research on how demographic factors influence energy conservation behaviors. In this study, the authors hypothesized on the links between five measures of environmental concern and demographic factors such as gender, marital status, age, education, number of children, and social class. The hypothesis was then tested on a nationwide sample of British consumers through interviews and surveys.

The results showed that associations between demographic traits and environmental consciousness are complex; and that no accurate profile of a green consumer can be created that includes all aspects of environmental concern. An interesting finding was that environmental consciousness is often a factor of situational characteristics, rather than socio-demographic ones. Consumers are more often knowledgeable about an environmental concern if it is happening in their community.

Gilg (2006) analyzed the environmental attitudes and actions of households in terms of water and energy conservation. These were examined in the context of each household's demographic composition. Surveys were administered to a sample of 1600 households with a response rate of 59 percent. Factor analysis showed three factors relating to environmental behavior. The first behavior involved purchase decisions, such as buying compact fluorescent bulbs. The second set of behaviors were habits, such as turning off the faucet when brushing teeth. Factor three involved recycling behaviors.

Frequencies of certain behaviors pertaining to water conservation were calculated. The behaviors were then broken down in to three categories: Most frequent behavior by the sample, less frequent behavior by the sample, and the least frequent behaviors by the sample. Gilg (2006) suggests that policy makers could target certain individuals by their level of behavioral commitment. Cluster analysis was used to examine individuals who answered similarly. Four patterns emerged. The most likely to engage in water and energy saving activities were "Committed environmentalists" and "Mainstream environmentalists". Only 18 percent of the "Occasional environmentalists" committed to the behaviors. "Non-environmentalists" did not practice any water saving behaviors. A demographic profile was then attempted. "Committed environmentalists" are older, tend to own their own home, lived in a terraced property, voted Green/Liberal Democratic and were members of community groups. "Non-environmentalists" were young, male, low income, had received less formal education, were less involved in the community and were more likely to be politically apathetic.

Chapter 3 – Research Methods

This chapter describes the design, sample and procedures involved in this research. This descriptive study replicates Seligman's 1979 survey that examines energy conservation attitudes. The current research study attempts to determine if Seligman's four energy conservation factors remain valid in 2007. In addition, relationships between demographic traits and attitudes towards energy conservation are identified.

Research Methods Description

This action research aims at a comprehensive understanding of the factors influencing energy efficiency knowledge in the central region of Missouri. Because a case study is being used, this research is not generalizable to other populations or settings. Surveys were administered to all attendants at the Home Energy Conservation workshops given by University of Missouri Extension between February and May of 2007. University of Missouri Extension is a partnership of the University of Missouri campuses; Lincoln University; the people of Missouri through county extension councils; and the Cooperative State Research, Education and Extension Service of the U.S. Department of Agriculture. Seven workshops were held during that time period yielding multiple case studies. The survey was also administered online to homeowners who requested more information regarding home energy use at a booth sponsored by University of Missouri Extension, as part of Earth Day festivities in Columbia, Missouri. The two groups are of the same population, i.e., homeowners interested in furthering their energy efficiency education.

Instrumentation

Pencil and paper surveys were the main instruments used in this study. The physical questionnaire was highly reliable. There was little possibility for error in collecting the responses from the survey. Maximum "white space" was left on the survey and no questions regarding any item arose during the administration of the survey.

An electronic online survey was also employed. The electronic host site, surveymonkey.com, is a highly regarded survey host and has had few complaints. No complaints were registered regarding this survey.

Data Collection

Surveys were administered to home energy efficiency workshop participants and to participants who visited a website on home energy efficiency. The goal of the surveys was to provide a numerical description of how one or more variables were distributed among a sample of homeowners. Seven workshops were given throughout the central region of Missouri between February and May of 2007. Attendance for each workshop varied from fewer than 10 to more than 20. Online responses were collected over a two-month period between April and May of 2007.

At the beginning of the workshop, participants were asked if they would be willing to participate in a survey on homeowners' attitudes towards energy conservation. Once affirmed, the participants were administered a three page survey. Page one was a consent form. Page two (Appendix B) was a survey involving demographic items. Page three (Appendix C) presented a list of Likert-scaled statements that varied from Strongly Disagree (1), Disagree (2), Agree (3), and Strongly Agree (4). The items on page three of

this survey are duplicates of Seligman's 1979 study. The demographic items are approximately the same -- Seligman no longer has a record of the actual demographic questions.

All surveys were numbered according to their response time. A codebook was created for all possible responses to the survey questions. The survey responses were entered into an Excel spreadsheet using the established coding system. The paper surveys were retained as a record of responses as a backup data source in the event the electronic data are lost or destroyed.

Data Analysis

Data analyses are employed to permit descriptive and inferential statistical investigations. The analysis strategy seeks to identify and measure causal relationships between selected variables. The Statistical Package for the Social Sciences (SPSS) is used to examine the relationships between variables. Factor Analysis is conducted across all attitudinal variables. Factor loadings are compared to the factor loadings found in Seligman's study. For those factors of highest loadings – the distinguishing factors -- a sample mean is calculated. If a respondent's loading is greater than or equal to the sample mean, a new variable is constructed in which the respondent will be assigned a score of one. If the response is less than the sample mean, a zero is assigned. This variable transformation yields a binary code for each of the highest loading factors. A high/low pattern among all of the factors, then, can be identified as a four-digit, binary coded number, where pattern 1 = 0000, pattern 2 = 0001, pattern 3=0010, and so on. The

frequency of occurrence of each pattern in the sample is identified. Subsequently, each so identified pattern is compared to each of the demographic variables.

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Chapter 4 – Data Presentation and Analysis

This chapter describes the design, sample and procedures involved in this research. This descriptive study replicates Seligman's 1979 survey that examines energy conservation attitudes. The current research study attempts to determine if Seligman's four energy conservation factors remain valid in 2007. In addition, relationships between demographic traits and attitudes towards energy conservation are identified.

Data Collected

A total of 85 questionnaires were completed for this study. Seven workshops provided a total of 62 completed questionnaires and 23 valid online responses were collected. The demographics of this study vary in an attempt to profile the attitudes of particular demographics.

Collected Data Analysis

Data analyses were employed in four steps. First, factor analysis was conducted across all attitudinal variables and compared to factor loadings found in Seligman's study. Second, variable transformation into binary coding was conducted on responses related to the highest factor loadings. Third, patterns of the binary coded numbers were established along with their frequencies. Finally, each identified pattern was investigated in light of the demographic variables.

The surveys yielded 40 variables. The 28 attitudinal items were subjected to a principal components analysis, with squared multiple correlations used as common estimates. Eight factors were extracted with eigenvalues greater than 1 employing the

varimax rotation method. Table 1 illustrates the factor loadings for the first four rotated factors. Because the first four factors accounted for 52 percent of the total variance of the attitudinal variables, only these four were retained for further analysis. An examination of those variables that have loadings of .50 or greater on a rotated factor suggests the following interpretation of the factors:

Factor 1. The six variables (Guilty, Impact, One-hundred, Sweat, Pennies, Savings) having loadings greater than .50 indicates a belief that conserving energy in the home requires a great deal of effort for too little dollar savings and that homeowners deserve to use as much as they want. This factor will be labeled **Savings**.

Factor 2. Variables (Hoax, Outside, Seventy-five, Turned up) reflect the homeowners' concern with personal comfort and belief in an energy crisis. This factor will be labeled **Comfort**.

Factor 3. Believing in the individual's role in having an impact on the energy crisis are factor 3 variables (Right, Forty, Immoral, Individual). This factor will be labeled **Individual**.

Factor 4. The four variables (Moon, Shortages, Technology, Federal) loading greater than .50 signal a belief that technology and governmental regulation will solve the energy crisis. This factor will be labeled **Regulation**

Table 1: Rotated Factor Loadings: Buffaloe Survey

Variable	Savings	Comfort	Individual	Regulation
1. Consumers have the right to use as much energy as they want and can afford.	.414	-.054	(-.595)	.190
2. I find it very difficult to fall asleep without an air conditioner on at night.	.252	.064	.225	.197
3. Nuclear power will eventually provide us with most of our energy needs.	.357	-.324	-.092	.34
4. Science will soon provide society with a long lasting source of energy.	.069	.094	-.093	.231
5. It's essential to my health and well-being for the house to be air-conditioned in the summer.	.343	.016	.166	.274
6. It is not worth the trouble to turn off the air conditioner and open the windows every time it gets a little cooler outside.	.365	-.047	.019	-.005
7. If we were able to put a man on the moon, we could certainly solve the energy crisis within a short period of time.	.082	.057	.107	(.708)
8. The energy crisis is a hoax.	.084	(.630)	-.411	-.148
9. I never feel guilty about having my air conditioner on.	(.614)	-.223	.040	.113
10. It is immoral for America to consume 40% of the world's energy resources.	.009	-.026	(.721)	.075
11. If everyone in the country tried to conserve energy at home, there would probably be little or no real impact on the nation's overall energy consumption.	(.694)	.151	-.105	.123
12. The energy crisis is largely due to real worldwide shortages of fuels needed to produce energy.	-.035	.429	.002	(-.607)
13. I almost never think about the energy needs of Americans 100 years from now.	(.626)	.189	-.103	-.226
14. It is immoral to consume any more energy than I absolutely need.	.020	-.182	(.764)	.296
15. American technology in the past has come to grips with all major crises and it will no doubt soon discover a solution to the energy problem.	.366	-.302	-.014	(.526)

Table 1: Rotated Factor Loadings: Buffaloe Survey (cont'd)

Variable	Savings	Comfort	Individual	Regulation
16. While others might tolerate turning off the air conditioner in the summer, my own need for being cool is higher.	-.014	.436	-.190	.109
17. I would only conserve energy if I could not afford to pay my energy bills.	.063	.268	-.124	.052
18. It's not worth it at all to sweat a little to try and save a little energy.	(.662)	.044	-.200	.481
19. The energy crisis is largely due to the federal government's lack of an adequate energy policy.	.168	-.028	.252	(.617)
20. The energy crisis is largely due to supply and price manipulation by the major oil companies.	.214	-.295	.460	.199
21. Trying to save pennies a day conserving energy is just not worth it.	(.838)	-.051	-.142	.080
22. It's essential to my family's health and well-being for the house to be air conditioned in the summer.	.311	-.251	.158	.277
23. It's just not worth the trouble to turn the thermostat temperature up every time it gets a little cooler outside.	.013	(.643)	-.122	-.258
24. To what degree would more conservation of energy on the part of the individual alleviate the energy problem?	-.159	-.401	(.614)	-.074
25. To what degree has overconsumption by individuals contributed to this country's energy problem?	-.156	-.43	(.642)	-.009
26. How difficult would it be for you to adjust to an indoor temperature of not less than 75° in the summer months?	-.041	(.816)	-.078	-.016
27. How much savings per month on your summer electricity bill would it take to induce you to turn up your thermostat setting up 3 degrees from its usual setting?	(.558)	.215	.297	.355
28. How uncomfortable would you be if you turned up the thermostat setting 3 degrees from its usual setting?	.035	(.852)	-.151	.031

( ) indicates loading > .50

____ indicates the name of this variable

Table 2 identifies the factor loadings from this study in comparison to the factor loadings from Seligman's 1979 study. Seligman's four attitude factors were (1) effort to conserve and monetary **savings**, (2) **comfort** and health concerns, (3) role of the **individual**, and (4) legitimacy of the energy crisis. This study's **Regulation** factor 4 was eliminated from this table because it does not correspond with any of Seligman's factors.

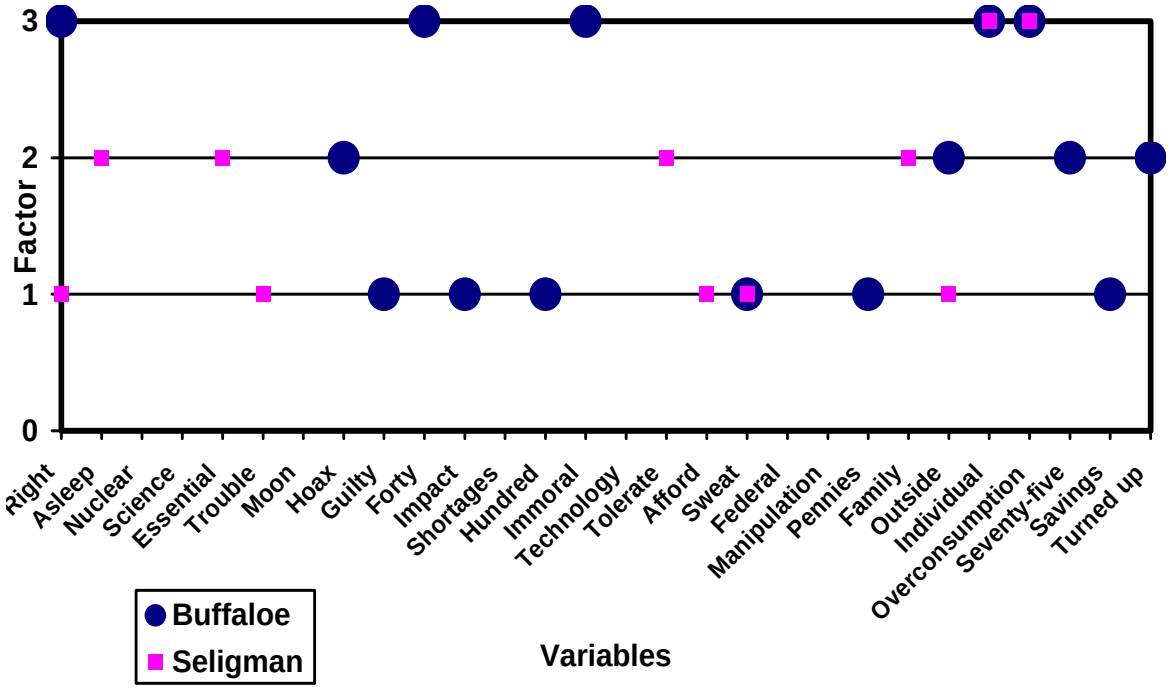
Table 2: Rotated Factor Loadings: Buffaloe and Seligman Surveys

Variable	Savings Buffaloe	Savings Seligman	Comfort Buffaloe	Comfort Seligman	Individual Buffaloe	Individual Seligman
1. Right	.414	(.53)	-.054	.19	(-.595)	.29
2. Asleep	.252	.28	.064	(.61)	.225	.38
3. Nuclear	.357	-.11	-.324	.06	-.092	.02
4. Science	.069	.1	.094	.26	-.093	-.06
5. Essential	.343	.28	.016	(.76)	.166	.16
6. Trouble	.365	(.62)	-.047	.27	.019	.19
7. Moon	.082	.14	.057	.16	.107	.13
8. Hoax	.084	.21	(.630)	.23	-.411	.13
9. Guilty	(.614)	.17	-.223	.3	.040	.25
10. Forty	.009	-.25	-.026	-.02	(.721)	-.28
11. Impact	(.694)	.03	.151	.22	-.105	.33
12. Shortages	-.035	-.02	.429	-.02	.002	-.09
13. Hundred	(.626)	.18	.189	.07	-.103	-.06
14. Immoral	.020	-.39	-.182	-.02	(.764)	-.03
15. Technology	.366	-.09	-.302	.19	-.014	-.07
16. Tolerate	-.014	.3	.436	(.74)	-.190	.00
17. Afford	.063	(.76)	.268	.25	-.124	.00

Table 2: Rotated Factor Loadings: Buffaloe and Seligman Surveys (cont'd)

Variable	Savings Buffaloe	Savings Seligman	Comfort Buffaloe	Comfort Seligman	Individual Buffaloe	Individual Seligman
18. Sweat	(.662)	.58	.044	.21	-.200	.11
19. Federal	.168	.16	-.028	-.13	.252	.08
20. Manipulation	.214	.01	-.295	.17	.460	.00
21. Pennies	(.838)	.48	-.051	.41	-.142	.33
22. Family	.311	.19	-.251	(.74)	.158	.13
23. Outside	.013	(.59)	(.643)	.08	-.122	.11
24. Individual	-.159	-.21	-.401	-.04	(.614)	(-.79)
25. Overconsumption	-.156	-.22	-.43	-.23	(.642)	(-.65)
26. Seventy-Five	-.041	.49	(.816)	.4	-.078	.13
27. Savings	(.558)	.23	.215	.25	.297	.05
28. Turned Up	.035	0	(.852)	.55	-.151	.11

Figure 1: Factor Loading by Statement Variable: Both Surveys



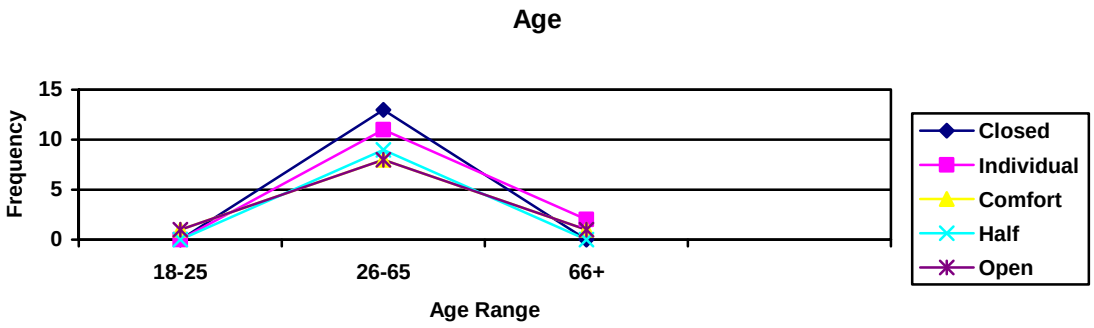
Next, a sample mean was calculated for each of factors of highest loadings. A new variable was constructed in which the respondent was assigned a score of one if the response was equal or greater than the sample mean. If the response was less than the sample mean, a zero was assigned. This variable transformation yields a binary coding for each of the highest factor loadings.

Patterns evolved from respondents binary code results. A total of 16 patterns were possible for the data. Five of those patterns had distinguishing frequencies of 9, 10, and 13. Pattern one [0000] contained 13 respondents. The pattern will be labeled **Closed** because there are no factor loadings. Pattern two [0010] contained 13 respondents and will be labeled **Individual** because respondents scored equal to or above the mean on the factor,

individual. Pattern three [0100] contained 10 respondents, and will be labeled **Comfort** because it weighed on the *comfort* factor. Pattern four [0011] contained nine respondents that weighed on *individual* and *regulation* factors. This pattern will be labeled **Half**. The final pattern with distinguishing frequencies will be labeled the **Open** pattern [1111], because 10 respondents weighed on all four factors. See Appendix D for all the patterns and their frequencies.

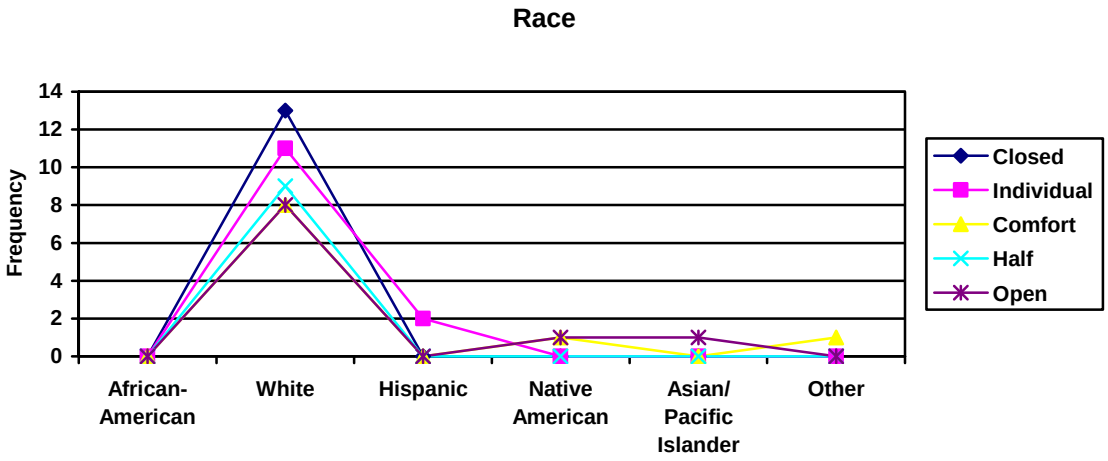
Each identified pattern was compared to each of the demographics. Figures 2-10 present the profile of the patterns for all 10 variables.

Figure 2: Patterns' Demographic - Age



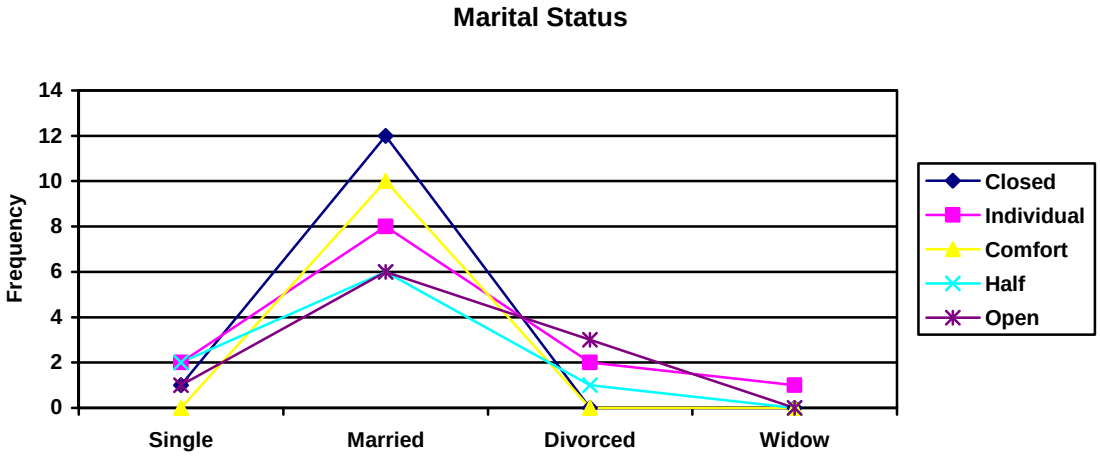
The mean age for the sample is between 26 and 65 years old, with the **Closed** pattern having the most frequencies.

Figure 3: Patterns' Demographic - Race



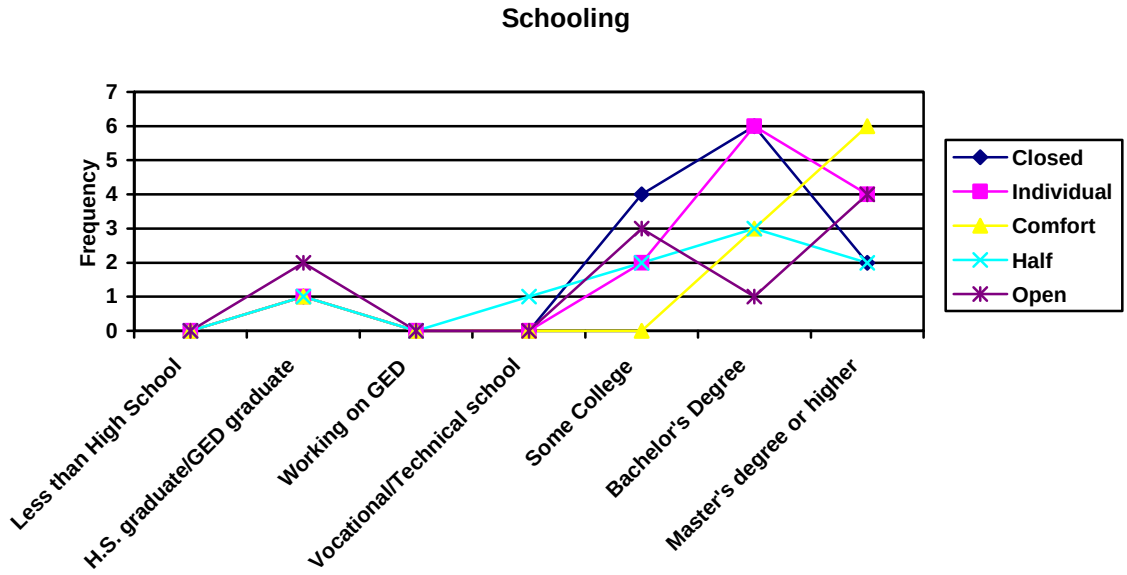
The majority of the sample is white.

Figure 4: Patterns' Demographic – Marital Status



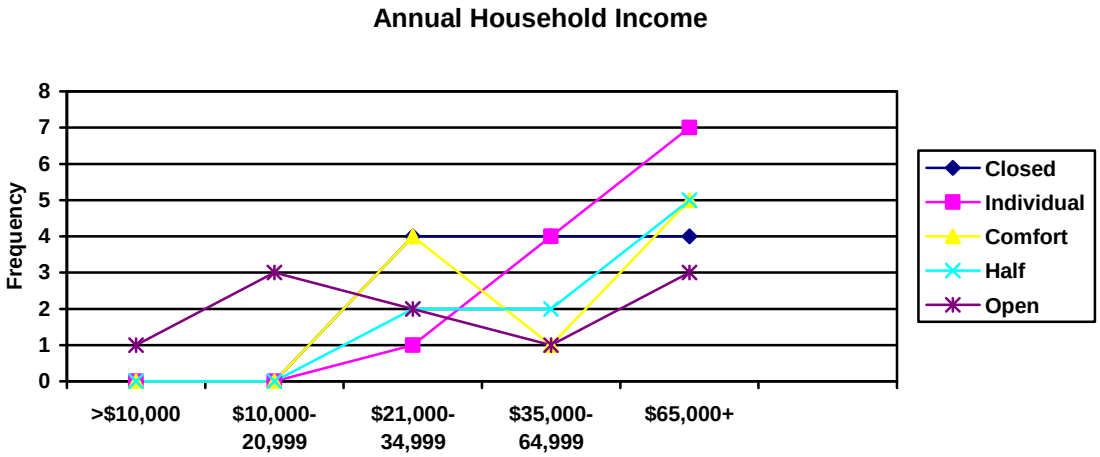
The majority of the sample is married, with the **Closed** and **Comfort** patterns having the most frequencies of marriage.

Figure 5: Patterns' Demographic - Schooling



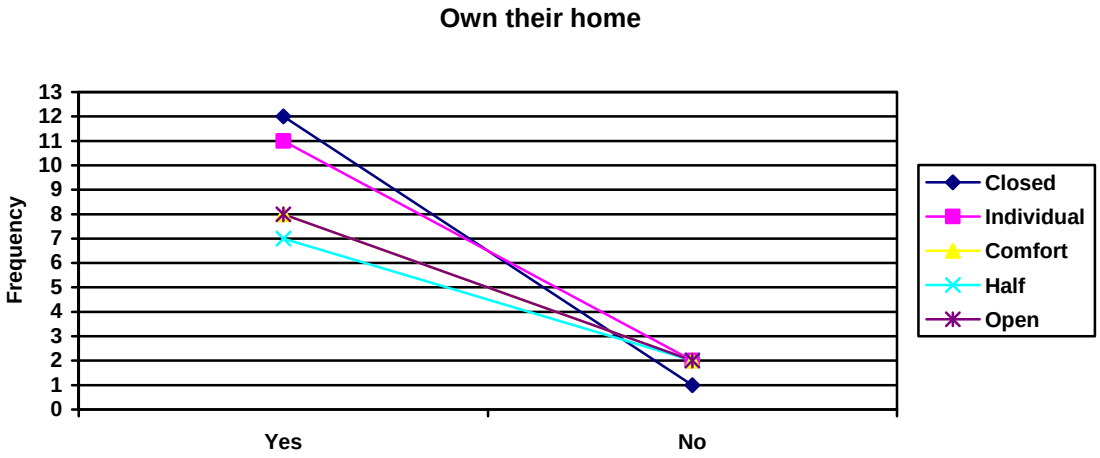
The greatest differences occur on the sample's demographic response for amount of schooling. A majority of the sample went to at least college. The most frequencies are in the "Bachelor's Degree" and "Master's Degree of Higher" categories. The majority of the Bachelor's Degree frequencies are part of the **Closed** and **Individual** patterns. The greatest number of frequencies under Master Degree or Higher is the **Comfort** pattern.

Figure 6: Patterns' Demographics - Income



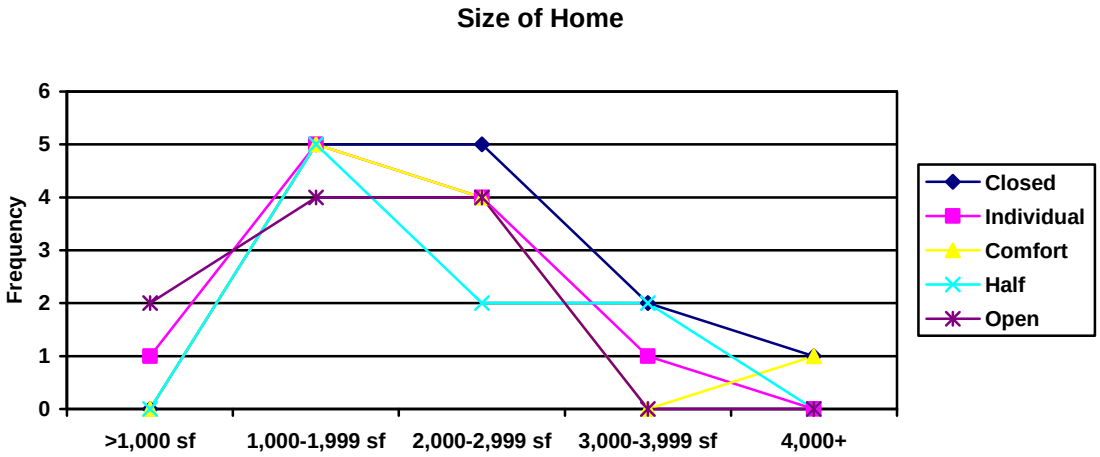
Annual household income varied over the different patterns. The **Individual** pattern reported significantly more household income than any other pattern.

Figure 7: Patterns' Demographics – Home Ownership



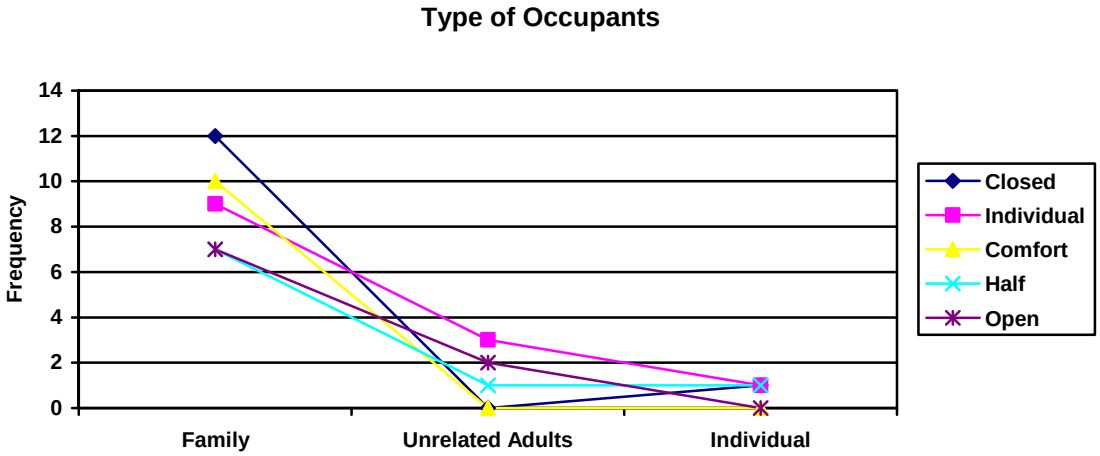
The majority of the sample owns their own home.

Figure 8: Pattern's Demographics – Home Size



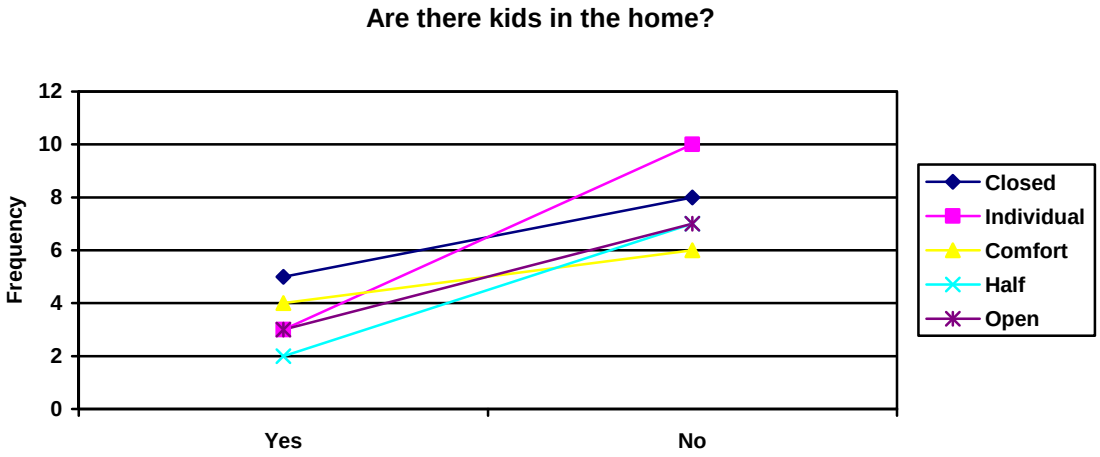
The majority of the sample has a home between 1,000 -3,000 square feet.

Figure 9: Patterns' Demographics – Occupant Type



The majority of the sample is families.

Figure 10: Patterns' Demographics – Kids in Household



A majority of the sample do not have children living in the house.

Chapter 5 - Findings and Discussion

This chapter discusses the research findings and proposes possible answers to the questions posed in chapter one. Limitations of this study and the future direction of the research will also be discussed. The questions posed in chapter one are: What attitudes about energy conservation are relevant to homeowners seeking energy efficiency knowledge? Do the same attitudinal factors identified by Seligman still exist today? Will the correlation of each attitudinal factor be the same as the responses cited in 1979? Do people with similar attitudes towards energy conservation have similar demographic traits?

Energy Conservation Attitudes

What attitudes about energy conservation are relevant to homeowners seeking energy efficiency knowledge? The attitudes most frequently reported in this study's findings are *monetary **Savings** for one's conservation efforts, effects of conservation on **Comfort**, the impact of the **Individual** on conservation*, and *the impact of technology and government **Regulation** on conservation*. The first three factors are the same as Seligman's 1979 study; albeit in a different level of significance order. Instead of existing as its own factor, Seligman's fourth factor, the ***Legitimacy** of the energy crisis*, tied itself in to this study's ***Comfort*** factor.

Table 3: Most frequently reported attitudes of each study

Buffaloe	**Seligman**
1. ***Savings***	1. ***Comfort***
2. ***Comfort***	2. ***Savings***
3. ***Individual***	3. ***Individual***
4. ***Regulation***	4. ***Legitimacy***

The attitudinal factor that accounted for the greatest variance in this study was ***Savings***. The ***Savings*** factor indicates a belief that conserving energy in the home requires a great deal of effort for too little dollar savings and that homeowners deserve to use as much as they want. "Trying to save pennies a day conserving energy is just not worth it" was the most significant variable in this factor. Another significant variable statement is respondents not seeing "sweating a little" as worth the effort to save energy. The ***Savings*** factor accounted for the second greatest variance in Seligman's 1979 study.

The factor that accounted for the greatest variance in Seligman's study was the ***Comfort*** factor. Seligman believes the importance of this factor in his findings demonstrated the importance of personal comfort. Different than this study's ***Comfort*** factor is the existence of a health concern within this factor for Seligman. The variables that indicated a health concern did not have significant factor loadings on this study. This study's ***Comfort*** factor reflects the homeowners' concern with personal comfort and belief in an energy crisis. Statement variables that had the greatest factor loadings asked the respondents how uncomfortable they would be to before raising their thermostat setting in the summertime.

The third factor in both this study and Seligman's study is the impact of the individual on conservation. The factor, ***Individual***, shares characteristics with the concept "perceived consumer effectiveness" (Kinnear, Taylor, and Ahmed, 1974) discussed in chapter two. Perceived consumer effectiveness is the degree to which consumers believe that their actions have an effect on the crisis. The attitude variables loading on this factor reflect the belief that it is immoral to consume too much energy. The attitudinal variable

"consumers have the right to use as much energy as they want and can pay for" result in a high negative correlation for this study's ***Individual*** factor.

The variables of factor four, ***Regulation***, signals a belief that science and government are needed to improve energy conservation. The variables for the ***Regulation*** factor did not have significant loading in Seligman's 1979 study. Examples of the variables having positive correlation on this factor are "American technologies…will no doubt soon discover a solution to the energy problem" and "The energy crisis is largely due to the federal government's lack of an adequate energy policy."

Similar Attitude Patterns

The patterns that developed from the binary coding resulted in factor profiles among the sample. Analyzing the demographic frequency distributions of each pattern allows energy education campaigns to be specifically tailored for people based on their profile. The population in this case study were homeowners interested in further home energy conservation. On average, most of the respondents were white, married, and between the ages of 26-65. The majority of the sample completed some college and owned their own home. In this study, five patterns with distinguishable frequencies emerged during the pattern analysis procedure. The patterns are labeled: **Closed**, **Individual**, **Comfort**, **Half**, and **Open**.

All respondents within **Closed** did not load on any of the four factors' variables. These respondents indicate that they do not care about energy conservation for any of the same reasons the respondents in the top four factors care. A respondent in **Closed** is white,

married, and owns his/her own home that is occupied by a family. Almost half of the homes have children living there. Most respondents of **Closed** have a Bachelor's Degree but few have a Master's degree or higher. **Closed** respondents are on lower annual incomes than respondents in the **Individual**, **Comfort**, and **Half** patterns.

The **Individual** pattern contains respondents who only ranked above the mean score for factor three, ***Individual***. Responses indicate that these individuals believe individuals make a difference in energy conservation. **Individual** respondents tended to have smaller houses than **Closed** respondents. Respondents of **Individual** had the highest annual income of any other pattern; seven out of 12 respondents are in the $65,000+ bracket. Both the **Closed** and **Individual** patterns have the greatest frequencies of respondents having a Bachelor's Degree, however the **Individual** pattern is more likely to have a Master's Degree than the **Closed** pattern is.

The **Comfort** pattern accounts for responses loading on factor two, concern for ***Comfort***. With only one respondent answering they did not; the **Comfort** pattern had the highest percentage of respondents possessing degrees in higher education. **Comfort** respondents have an annual income above the **Closed** and **Open** patterns. Similar throughout most of the patterns are that the respondents are white, married, and between the ages of 26-65.

The fourth pattern, **Half**, shows respondents weighing on factors 3 and 4. This response indicates and interest in both the individual's role in conserving energy that is facilitated by science and the government. **Half** has the fewest frequencies of the five

patterns. Years of education are almost evenly distributed over **Half**'s respondents; with the highest frequency being three out of nine respondents holding a Bachelor's degree.

Pattern five, **Open**, does not have distinguishing demographic traits and significantly loads on all factors. As to be expected, the demographic traits of this pattern evenly distribute themselves throughout the categories. Because the population from which the sample is derived is, on average, white, married, 26-65 years old, and resides in their own home with their family, the frequency counts of these traits do not present characteristic frequencies for any of the patterns. The implication is that the **Open** respondents did not take the survey seriously.

Summary

This study examines the residential energy conservation attitudes among homeowners. A comparison between current energy attitudes and energy attitudes found in a 1979 study by Clive Seligman was completed. The final goal of this study was to answer the question: Do people with similar attitudes towards energy conservation have similar demographic traits? In addressing these objectives, three energy conservation research topics were reviewed: Studies investigating factors associated with residential energy conservation, energy efficiency education, and energy use by different demographics.

As stated in previous chapters, homeowners' energy conservation attitudes is a popular area of research interest in energy conservation. Black (1978), Hummel (1978), Seligman (1979), Samuelson (1990), Berger (1992), Lutzenheiser (1993), all conducted research on homeowners and their attitudes towards energy conservation. Analysis of

previous research indicates the four major attitudes that may be of significance when evaluating homeowners' decisions regarding energy conservation:

(1) monetary return for one's conservation efforts,

(2) effects of conservation on comfort,

(3) the impact of the individual on conservation, and

(4) the impact of technology and government regulation on conservation [Seligman, 1979].

The immediate goal of this study was to determine if these same four factors are still prevalent in 2007. These attitudes were measured in this survey among participants in energy conservation workshops in mid-Missouri. The variables were factor analyzed so as to prove a range of empirically linked variables with which to undertake further analysis. Seligman's 1979 factors were found to be still important to homeowners in 2007.

To determine if people with similar attitudes towards energy conservation also have similar demographic traits pattern analysis, five binary patterns emerged based on factor loadings. These patterns allowed profiles of people interested in energy efficiency knowledge to be made.

Limitations

This research focused on the energy conservation attitudes of homeowners already seeking knowledge on energy efficiency. Several limitations were placed on this project. First, because this study is a case study, the data obtained are not generalizable to a larger

population. Second, limitations are likely in a replication study done 30 years after the original because of information lost over the years.

Three such limitations arose in this study: no demographic data for the 1979 study, ambiguousness of some survey questions, and no additional data was available on less-significant factors that evolved. Not being able to obtain the original demographics questionnaire and raw data used in the 1979 study limits inter-study comparisons. Comparing patterns between the two samples is also difficult because no pattern analysis was applied to the original study.

When comparing the survey administered in this research with that of Seligman's 1979 study, the ambiguity that was removed by his survey two would have been useful here. One statement reads "It's just not worth the trouble to turn the thermostat up every time it gets a little cooler outside". Seligman's survey two rephrased the statement to truly reflect either effort or savings by saying "It is too much effort to get up and change the thermostat setting every time it gets a little cooler outside."

When comparing 2007 factors to 1979 factors, there is an opportunity that a new factor or pattern will develop. Using only the top four factors limited this study in its ability to explain the existence of pattern one, **Closed**. The existence of pattern one leads the researcher to ask: Why were those respondents at a workshop for home energy conservation? The respondents may weigh on factors that did not account for the majority of the variance, and were thus excluded. This is likely because the demographic features of **Closed** were not averaged across the field, as would be expected. A more detailed profile

of each pattern might have developed had the possible responses to demographic questions been more detailed.

Future Direction

There are two areas which this study informs the design of another experiment. First, there needs to be more demographic variables. More detailed ages, gender, political preferences, and organization participation, would all help filter similar profiles of homeowners. Knowing who makes the decisions in the house regarding energy conservation would help determine to the most appropriate education program market [Samuelson, 1990].

Second, this study could be replicated with a larger random sample. At no time did face-to-face interaction play an important role in collecting data. An area cluster sample could provide an accurate description of homeowners in central Missouri. The same seven counties (Audrain, Boone, Callaway, Cole, Howard, Pettis, and Saline) could comprise the population. Data collection could use telephone surveys administered to a list of telephone numbers created randomly, proportionally sampled from among telephone prefixes. Data analysis would be similar to that employed in this study. Generalizable conclusions could then be presented. With the addition of the increased demographic variables, energy efficiency education programs could be more accurately designed for residents in mid-Missouri. The entire study could be replicated throughout all regions of the state, and beyond, to increase energy conservation knowledge to all homeowners.

B i b l i o g r a p h y

Borden, R.J., Francis, J.L. "Who cares about ecology? Personality and sex differences in environmental concern." *Journal of Personality.* 46:1. (1978): p190-203.

Diamantopoulos, A., Schlegelmilch, B., Sinkovics, R., Bohlen, G. "Can socio-demographics still play a role in profiling green consumers? *Journal of Business Research* 56 (2003): p465-480.

Ellen, P.S., Wiener, J.L., Cobb-Walgren, C. "The role of perceived consumer effectiveness in motivating environmentally conscious behaviors." *Journal of Public Policy and Marketing.* 10:2. (1991): p102-117.

Gilg, A., Barr, S. "Behavioural attitudes towards water saving? Evidence from a study of environmental actions." *Ecological Economics* 57 (2006): p400-414.

Henion, K. and Wilson, W. "The ecologically concerned consumer and locus of control." In Ellen, P. *et al*. "The role of perceived consumer effectiveness in motivating environmentally conscious behaviors." *Journal of Public Policy and Marketing.* 10:2 (1991).

Hummel, C.F., Levitt, L., and Loomis, R.J. "Perceptions of the energy crisis: who is blamed and how do citizens react to environmental-lifestyle trade-offs?" *Environment and Behavior* 10 (1978): p37-88.

Kinnear, T.C., Taylor, J.R., and Ahmed, S.A. "Ecologically concerned consumers: Who are they?" *Journal of Marketing* 38 (1974): p20-24.

Messick, D.M. and Brewer, M.B. "Solving social dilemmas: a review." In Samuelson, C. "Energy Conservation: A Social Dilemma Approach." *Social Behaviour* 5 (1990).

Nevin, R. "Evidence of rational market valuations for home energy efficiency," *The Appraisal Journal* (1998): p401-409.

Nye, D. E. Consuming Power: A Social History of American Energies. Cambridge: The MIT Press, 1998.

Olson, M. *The Logic of Collective Action*. Cambridge: Harvard University Press, 1965.

Samuelson, C. "Energy conservation: a social dilemma approach." *Social Behaviour* 5 (1990): p207-230.

Schipper, L. and Meyers, S. Energy Efficiency and Human Activity: Past Trends, Future Prospects. Cambridge: University Press, 1992

Seligman, C. "Predicting summer energy consumption from homeowners' attitudes." *Journal of Applied Social Psychology* 9.1 (1979): p70-90.

Appendix A– Definition of Terms

When discussing energy efficiency in terms of residential use, some terms may be used that are unfamiliar: All definitions are in accordance with the Department of Energy.

Energy Audit – A survey that shows how much energy you use in your house or apartment. It will help you find ways to use less energy.

Fossil Fuels – Fuels formed in the ground from the remains of dead plants and animals. It takes millions of years to form fossil fuels. Oil, natural gas, and coal are fossil fuels.

Global Warming – A popular term used to describe the increase in average global temperatures due to the greenhouse effect.

Greenhouse Effect - A popular term used to describe the heating effect due to the trapping of long wave radiation by greenhouse gases produced from natural and human sources.

Green Power – A popular term for energy produced from clean, renewable energy sources.

Nonrenewable Fuels – Fuels that cannot be easily made, such as oil, natural gas, or coal.

Payback Period – The amount of time required before the savings resulting from your heating, ventilation, and air conditioning (HVAC) system equals the system cost.

Renewable Energy – Energy derived from resources that are regenerative or for all practical purposes can not be depleted. Types of renewable energy resources include moving water (hydro, tidal and wave power), thermal gradients in ocean water, biomass, geothermal energy, solar energy, and wind energy. Municipal solid waste (MSW) is also considered to be a renewable energy resource.

R-Value – A measure of the capacity of a material to resist heat transfer. The R-Value is the reciprocal of the conductivity of the material (U-Value); the larger the R-Value, the greater the insulating properties.

Solar Collector - A device used to collect, absorb, and transfer solar energy to a working fluid. Flat plate collectors are the most common type of collectors used for solar water or pool heating systems. In the case of a photovoltaic system, the solar collector could be crystalline silicon panels or thin-film roof shingles, for example.

Solar Energy – Electromagnetic energy transmitted from the sun (solar radiation).

Weatherization – Caulking and weather-stripping to reduce air infiltration and exfiltration.

Wind Energy - Energy available from the movement of the wind across a landscape caused by the heating of the atmosphere, earth, and oceans by the sun.

Appendix B - Demographics Questionnaire

1. **Please select your age range:**

   □ 18-25 □ 26-65 □ 65+ □ No response

2. **What is your race/ ethnic group:**

   □ African-American □ White □ Hispanic □ Native American

   □ Asian/ Pacific Islander □ Other □ No response

3. **What is your Marital Status?**

   □ Single □ Married □ Divorced □ hmmm

4. **What is the highest level of schooling you have received?**

   □ Less than High School □ High School Graduate/ GED Graduate

   □ Working on GED □ Vocational/ Technical School

   □ Some College _____ (how many years?)

   □ Bachelor's Degree □ High Master's Degree or Higher

   □ No response

5. **What is your annual household income range?**

   □ Under 10,000 □ 10,000 – 20,999 □ 21,000 – 34,999

   □ 35,000 – 64,999 □ 65,000+ □ No response

6. **Do you own your own home?**

   □ Yes □ No

7. **If "Yes", how many years have you owned a home? _____**

8. **What is the total area range of your home? (Square footage)**

   □ Under 1,000 □ 1,000 – 1,999 □ 2,000 – 2,999

   □ 3,000 – 3,999 □ 4,000 + □ No response

9. **What is the composition of occupants in your home?**

   □ Family □ Unrelated adults □ Individual

   □ No response

10. **How many occupants are the in the following age ranges?**

    □ 65+ _____ □19-64 _____ □ 18 and under ____

    □ No response

Appendix C - Statements Questionnaire

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. Consumers have the right to use as much energy as they want and can pay for.	☐	☐	☐	☐
2. I find it very difficult to fall asleep without an air conditioner on at night.	☐	☐	☐	☐
3. Nuclear power will eventually provide us with most of our energy needs.	☐	☐	☐	☐
4. Science will soon provide society with a long lasting source of energy.	☐	☐	☐	☐
5. It's essential to my health and well-being for the house to be air-conditioned in the summer.	☐	☐	☐	☐
6. It is not worth the trouble to turn off the air conditioner and open the windows every time it gets a little cooler outside.	☐	☐	☐	☐
7. If we were able to put a man on the moon, we could certainly solve the energy crisis within a short period of time.	☐	☐	☐	☐
8. The energy crisis is a hoax.	☐	☐	☐	☐
9. I never feel guilty about having my air conditioner on.	☐	☐	☐	☐
10. It is immoral for America to consume 40% of the world's energy resources.	☐	☐	☐	☐
11. If everyone in the country tried to conserve energy at home, there would probably be little or no real impact on the nation's overall energy consumption.	☐	☐	☐	☐
12. The energy crisis is largely due to real worldwide shortages of fuels needed to produce energy.	☐	☐	☐	☐
13. I almost never think about the energy needs of Americans 100 years from now.	☐	☐	☐	☐
14. It is immoral to consume any more energy than I absolutely need.	☐	☐	☐	☐
15. American technology in the past has come to grips with all major crises and it will no doubt soon discover a solution to the energy problem.	☐	☐	☐	☐
16. While others might tolerate turning off the air conditioner in the summer, my own need for being cool is higher.	☐	☐	☐	☐
17. I would only conserve energy if I could not afford to pay for my energy bills.	☐	☐	☐	☐
18. It's not worth it at all to sweat a little to try and save a little energy.	☐	☐	☐	☐

Statement	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
19. The energy crisis is largely due to the federal government's lack of an adequate energy policy.	☐	☐	☐	☐
20. The energy crisis is largely due to supply and price manipulation by the major oil companies.	☐	☐	☐	☐
21. Trying to save pennies a day conserving energy is just not worth it.	☐	☐	☐	☐
22. It's essential to my family's health and well-being for the house to be air conditioned in the summer.	☐	☐	☐	☐
23. It's just not worth the trouble to turn the thermostat temperature up every time it gets a little cooler outside.	☐	☐	☐	☐
Statement	Very Low	Low	High	Very High
24. To what degree would more conservation of energy on the part of the individual alleviate the energy problem?	☐	☐	☐	☐
25. To what degree has overconsumption by individuals contributed to this country's energy problem?	☐	☐	☐	☐
26. How difficult would it be for you to adjust to an indoor temperature of not less than 75° in the summer months?	☐	☐	☐	☐
27. How much savings per month on your summer electricity bill would it take to induce you to turn up your thermostat setting up 3 degrees from its usual setting?	☐	☐	☐	☐
28. How uncomfortable would you be if you turned the thermostat setting up 3 degrees from its usual setting?	☐	☐	☐	☐

Appendix D – Consent Form

Energy Conservation Behavior Survey 2007
Conducted by Barbara Buffaloe, graduate student at the University of Missouri-Columbia

Thank you for choosing to participate in this survey. I am conducting research to learn more about homeowners' attitudes about home energy conservation. Your answers are very important because they will be used to develop energy conservation education programs that will help homeowners' increase their home's efficiency.

Your participation in this survey is strictly voluntary and you may refuse to participate at any time. Your decision to participate or not participate will not affect your relationship with MU Extension. All of your survey responses will be kept strictly confidential. Your responses will be seen only by authorized researchers working on the project; only the results of my analysis will be shared with researchers and organizations interested in developing education curriculum on energy conservation for homeowners. At no time will your identity be linked to your survey. Your survey will be assigned a number that only I will know. At the conclusion of the data collection, I will destroy this numerical reference.

By completing this survey, you acknowledge that you are 18 years or older. The survey will take about 10-15 minutes to complete. Thank you for your participation.

_____
Signature

_____
Name Printed

Questions or concerns about the survey may be directed to Barbara Buffaloe (bal3db@mizzou.edu) or her advisor, Ronald Phillips (PhillipsR@missouri.edu). For information about your rights as a research subject, please contact MU IRB (573.882.9585; www.research.missouri.edu/cirb/index.htm)

Appendix E – Frequency of Binary Codes Pattern

ID	F1	F2	F3	F4	Pattern
12	0	0	0	0	**1**
13	0	0	0	0	**1**
21	0	0	0	0	**1**
25	0	0	0	0	**1**
102	0	0	0	0	**1**
108	0	0	0	0	**1**
120	0	0	0	0	**1**
121	0	0	0	0	**1**
311	0	0	0	0	**1**
35	0	0	0	0	**1**
37	0	0	0	0	**1**
56	0	0	0	0	**1**
72	0	0	0	0	**1**
08	0	0	0	1	**2**
58	0	0	0	1	**2**
75	0	0	0	1	**2**
719	0	0	0	1	**2**
01	0	0	1	0	**3**
05	0	0	1	0	**3**
06	0	0	1	0	**3**
313	0	0	1	0	**3**
32	0	0	1	0	**3**
33	0	0	1	0	**3**
39	0	0	1	0	**3**
53	0	0	1	0	**3**
77	0	0	1	0	**3**
713	0	0	1	0	**3**
714	0	0	1	0	**3**
716	0	0	1	0	**3**
717	0	0	1	0	**3**
104	0	1	0	0	**4**
105	0	1	0	0	**4**
109	0	1	0	0	**4**
113	0	1	0	0	**4**
114	0	1	0	0	**4**
115	0	1	0	0	**4**
116	0	1	0	0	**4**
117	0	1	0	0	**4**
118	0	1	0	0	**4**
119	0	1	0	0	**4**
09	1	0	0	0	**5**
34	1	0	0	0	**5**
76	1	0	0	0	**5**
79	1	0	0	0	**5**
718	1	0	0	0	**5**
03	0	0	1	1	**6**
07	0	0	1	1	**6**
23	0	0	1	1	**6**
312	0	0	1	1	**6**
36	0	0	1	1	**6**
51	0	0	1	1	**6**
59	0	0	1	1	**6**
74	0	0	1	1	**6**
720	0	0	1	1	**6**
24	0	1	0	1	**7**
123	0	1	0	1	**7**
71	1	0	0	1	**8**
78	1	0	0	1	**8**
107	0	1	1	1	**9**
310	0	1	1	1	**9**
122	1	0	1	1	**10**
38	1	0	1	1	**10**
11	1	1	1	1	**11**
14	1	1	1	1	**11**
22	1	1	1	1	**11**
26	1	1	1	1	**11**
101	1	1	1	1	**11**
106	1	1	1	1	**11**
112	1	1	1	1	**11**
54	1	1	1	1	**11**
711	1	1	1	1	**11**
721	1	1	1	1	**11**
52	1	1	1	0	**12**
55	1	1	1	0	**12**
73	1	1	1	0	**12**
103	1	1	0	0	**13**
110	1	1	0	0	**13**
02	0	1	1	0	**14**
04	1	0	1	0	**15**
31	1	0	1	0	**15**
710	1	0	1	0	**15**
712	1	0	1	0	**15**
111	1	1	0	1	**16**
57	1	1	0	1	**16**
715	1	1	0	1	**16**