To the Graduate Council:

I am submitting herewith a dissertation written by Karen C. Miller entitled "Decision-making on the Implementation of Energy Conservation Measures as Influenced by the Utility Company Energy Audit." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Home Economics.

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The Graduate School

DECISION-MAKING ON THE IMPLEMENTATION OF ENERGY CONSERVATION MEASURES AS INFLUENCED BY THE UTILITY COMPANY ENERGY AUDIT

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Karen C. Miller

June 1984

ACKNOWLEDGMENTS

I would like to express my sincere thanks to the people at the utility company who provided audit participants and support in mailing the questionnaire for this study. Their time and effort contributed greatly to the quality and size of the sample used in this project. I would also like to thank each of the respondents in this study for their answers to the questionnaire.

The co-chairs of this doctoral committee, Dr. Duncan Case and Dr. Cheryl Beuhler, have been extremely helpful in all phases of this project. I have learned a great deal from them and for this I am indebted. Dean Nancy Belck, Dr. Jacquelyn DeJonge, and Dr. Darrell Holt, the members of my committee, have offered both encouragement and helpful suggestions. I also would like to thank Robert Muenchen, for computer support, Dr. Finn-Aage Esbensen, for his expertise in survey research, and the six technical experts who reviewed the questionnaire as part of the pre-test procedure.

I recognize the Electrical Women Roundtable's Julie Kiene Fellowship and the North Carolina Home Economics Association for financial support. A personal support system during a dissertation is essential; my friend, Geraldine Eaton, and my husband have provided that much needed support.

This dissertation is dedicated to two very special little boys, Ryan and Ryle Miller, who will never know what early childhood is like without a dissertation in the family. I hope they didn't miss too much.

ABSTRACT

The conceptual model developed for this study examines types of energy audits, variables related to differences in consumer acceptance of types of energy audits, the utilization of evaluative criteria in implementation of audit suggestions, and the effect of demographics in implementation of audit suggestions. Data were collected through a mail survey of audit recipients in a large southeastern utility company.

Based on a sample size of 593 consumers, the rate of implementation of audit suggestions differed significantly between those who had an energy auditor present in the home and those who had an unassisted audit, with auditor-assisted participants implementing 15% of the suggestions made in the audit and the unassisted participants implementing 10% of the suggestions. Type of audit, the variables examining consumer acceptance of the audit, and demographics explained 8% of the variance between the implementation rates of auditor-assisted and unassisted audits.

Significant differences between the two audit types emerged on the variables of audit type, satisfaction with the audit, perceived credibility in the audit and the utility, additional information, uncertainty, income, size of the house, value of the house, and age of the house.

The use of evaluative criteria in conservation decisions is decision specific. In decision-making on specific conservation measures, it was found that general attitudes about criteria people use in deliberating the conservation decision correlated at low levels with the use of that same criteria in a specific decision. This general attitude, usually used in conservation research, is not as useful in the use of criteria applied to specific decisions. Within the four specific conservation decisions studied, ceiling insulation, storm windows, caulking windows and doors, and water heater insulation, there was little pattern in use of evaluative criteria in decision-making. Those criteria important in the deliberation of one conservation decision were not necessarily important in another.

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CHAPTER I

INTRODUCTION

In residential energy conservation, no single conservation measure magically produces great energy savings. Sinden (1978) of Princeton's Twin Rivers Energy Project characterizes the situation as a series of small technological fixes. He says:

> Among the ways of conserving household energy, there are no spectacular fixes. There is only a catalogue of small fixes, many of them drab and unimpressive in isolation. . . . But the catalogue is fat, and many of its entries are cheap. With patience, groups of small and even tiny fixes can be put together into large assemblies that overall can produce impressive results. (pp. 63-64)

But before adoption of energy conservation measures occurs, Harris and Keith (1980) suggest, three factors must be present: (a) the family must know about conservation measures which they can adopt; (b) they must be motivated to adopt those suggestions; and, (c) they must have the resources which enable them to adopt conservation measures.

Residential energy audits performed by utility companies present a number of these small fixes to the homeowner. The audit serves to both increase the knowledge of the homeowner by making him or her aware of the various fixes available for his or her home as well as motivating him or her by informing the homeowner of the potential benefit each conservation action has for the home. While this approach has tremendous potential, it has been found that only 20 percent of the suggestions the homeowner receives through the energy audit are implemented (Gorzelnik, 1980).

Statement of Problem

Once consumers receive an energy audit most find themselves facing an area of decision-making that is new to them. Because the consumer usually only implements energy conservation measures once on a dwelling, the decision is unfamiliar. Because of the novelty of the decision, the consumer is faced with formulating an energy-related set of criteria to evaluate various conservation measures. The consumer then uses these evaluative criteria to assess both the current energy situation of the home and the necessity of adding the conservation measures suggested by the audit.

This study will investigate consumer decision-making as influenced by the energy audit. Specifically, the research objective is to compare the differences in the number of audit suggestions implemented by consumers with three different types of energy audits. Included in this comparison is the examination of aspects of audit-acceptance as the first step in the decision-making process in the implementation of conservation measures. The following dimensions of the audit-acceptance were examined: information seeking, credibility, uncertainty felt in making the decision, and satisfaction with the audit. As part of the information processing aspect of the decision, this study will explore the evaluative criteria used in the decision and the importance of those criteria in decision deliberation. The evaluative criteria to be examined in the decision, as identified through the

literature, are capital costs, payback, relative advantage, mobility, financing, effort or skill involved in installation, social responsibility, and comfort.

Rationale

This project worked toward reduction of energy consumption within the residential sector through an understanding of how the consumer makes decisions on energy conservation measures. Sinden (1978) has concluded it is technically possible to reduce energy for heating and cooling a house by over 50 percent through a variety of economically feasible energy conservation measures.

The purpose of this research is to work toward an effective information environment for consumers by studying the consumer's energy conservation decisions. The information the consumer considers necessary to make decisions about energy audit suggestions can be identified, thus irrelevant information can be sorted out to simplify the information processing stage of decision-making for the consumer.

Theoretical Orientation

This study was developed from several bodies of literature: decision theory, energy behavior research, adoption of innovation theory, and information processing theory of consumer choice. Each of these theories contributes to the understanding of the implementation of audit suggestions. Energy adjustment theory (Gladhart & Roosa, 1978) provides the basic framework to examine

the family's perceived deficit between their energy use and their environment. In this study, the family has taken a step to narrow this deficit through the request for an energy audit. Through decision theory, the decision-making process as used in reducing the perceived energy deficit between the family and its environment is explored. Adoption of innovation theory helps explore the reaction of the decision maker to the energy audit suggestions. Information processing theory of consumer choice provides the theoretical framework for the evaluative criteria formulated by the consumer in the actual choice process of whether or not to implement audit suggestions.

Dimensions of the Energy Decision

This study focuses on one part of the Family Energy Adaptation Model developed by Gladhart and Roosa (1978) as part of the Michigan State Family Energy project. This is an ecosystems model of family decision-making based on a "norm deficit" concept which details specific family actions with respect to identification and resolution of household energy problems.

The model advances the idea that there are two sources from which families develop their criteria to judge their energy usage: cultural energy norms and family energy norms. In the model, cultural energy norms are the rules or standards for the conduct and life conditions of members of a particular sector of society. Family energy norms are defined as the energy standards or evaluations the family makes for its energy usage level. Family members

use these norms to judge energy use. For example, in the case of thermal comfort within the home, it is proposed that a given level of consumption is influenced by family norms about thermal comfort level, energy usage level, and financial budgeting. Adjustments or adaptions in energy behavior result from perceived deficits between family standards with an actual environmental situation. For example, a rapidly rising utility bill may be perceived as violating the family's budget norms. Several actions might possibly follow. The family could reduce space heating cost by lowering the thermostat. However, this may violate norms about thermal comfort. An alternative course of action could be the addition of conservation measures such as weatherstripping or insulation. Yet, capital costs must be considered. Another alternative may be to accept a new norm for the energy budget and make adjustments in other areas of household budgeting to compensate.

In this study, the energy audit is viewed as a first step a family takes in making a determination of how to close a perceived energy deficit. Each family that has requested an energy audit has recognized the existence of an energy deficit as explained within the Gladhart and Roosa (1978) model.

Decision-Making

An economic, normative model of decision-making is used in this study. It is viewed as the process of reducing dissonance between the family and its environment as well as between and among family members (Paolucci, Hall, & Axinn, 1977). It begins

with a desire for change, feelings of discomfort, doubt, unpleasantness, or uncertainty.

Optimal, linear decision-making essentially involves four steps: (1) the recognition of need for decision, (2) identifying and weighing acceptable alternatives, (3) selecting or mediating an alternative, and (4) facilitating its action. The request for an energy audit signifies recognition of a problem after internal information search and the need for more external information to make a decision on that problem. This study focuses on the second, third, and fourth steps of the decision-making process. In the second step of decision-making, the energy audit identifies alternatives to improve energy satisfaction through the audit's energy conservation suggestions and provides information for the consumer to weigh in the decision based on his or her personal managerial situation. In the third and fourth steps of the decision-making process, the selection and mediation of suggestions and the facilitation of implementation of the audit suggestions is explored.

This study is concerned with non-programmed decisions which Simon (1960) characterizes as novel, unstructured, and consequential. Decisions about audit suggestions are novel in that it is usually the first time a family has dealt with this type of information, unless they were involved in retrofitting a former residence.

In a novel situation a decision maker may perceive greater risk because many of the consequences of the decision are neither known nor understood. Some audits may reduce risk and uncertainty

better than others through the types of information provided for the consumer (i.e., initial investment required, payback, contractors who could do the work, etc.).

Adoption of Innovation

This study views suggestions made by an energy audit as innovations in terms of the Rogers and Shoemaker (1971) adoption theory. They define an innovation as an idea, practice, or object perceived as new by an individual. An objective measure of newness as measured by the time since its first use or discovery is not of concern. It is how "newness" is perceived by the individual. If an idea seems new, it is an innovation. The assumption is made for this study, that as a non-programmed decision, the decision-maker perceives audit suggestions as unfamiliar and a "new" area of decision-making on "new" types of additions to his or her dwelling.

Rogers and Shoemaker (1971) have suggested that an innovation can be classified along five perceptual dimensions, and that a potential innovator's perceptions of an innovation on these dimensions determines the rate and likelihood he or she will adopt the new innovation. These dimensions are: (a) the relative advantage of the innovation over the system it supersedes; (b) value compatibility with the experience and needs of the decision maker; (c) complexity, or the degree to which the innovation is perceived as difficult to understand and use; (d) trialability, or the degree to which an innovation can be tested for effectiveness on a cost

or scope-limited basis; and (e) observability of outcome of the innovation, which determines the likelihood that others will adopt the innovation (Rogers & Shoemaker, 1971).

Ostlund (1974) studied the utility of Rogers' set of five dimensions for predicting an individual's innovation adoption decision with the additional dimension of perceived risk. These perceptual factors were better predictors of innovation adoption than were personal characteristics of respondents usually employed in this type of research.

Darley and Beniger (1981) modified the work of Rogers and Shoemaker and Ostlund to present a theory of adoption and diffusion of energy conserving innovations. Various aspects of this approach have been used in energy conservation research (Burby & Marsden, 1980; McCray & Weber, 1981; Tienda & Aborampah, 1981) and will be further examined in the literature review.

Information Processing

While deciding whether to implement audit suggestions, the consumer must construct evaluative criteria on which to base his or her choice. Bettman's (1979) information processing theory of consumer choice provides a useful theoretical reference for this process. The information processing approach to choice views the consumer as a processor of information, characterized as interacting with his or her choice environment, seeking and taking information from various sources, processing this information, and then using the information to select an alternative. The basic

components of the choice process utilized for this study are motivation, attention, and information acquisition and evaluation.

People are characterized as having a limited capacity for processing information (Simon, 1969). This implies that in making choices people may not be able to make complicated computations or engage in extensive processing of information without a great deal of effort. People are limited in the numbers of processing activities that can go on simultaneously. This notion of effort or processing capacity impacts the various stages in the choice process. Since this limited processing capacity must be allocated to the various activities of the consumer, seldom will one problem get all the consumer's processing capacity. Therefore, energy audit suggestions will be decided in an environment of conflicts and distractions.

Moving from some initial state toward some desired state characterizes the choice process (Newell & Simon, 1958). That is, at the beginning of some choice process, the consumer has some information relevant to the choice, and certain resources to devote to changing the state. Motivation is the mechanism governing the movement from one state to another (Simon, 1967). Motivation affects both the direction and intensity of behavior. This study sets motivation as a control. Each of the families in the audit groups has indicated motivation in energy decisions when they initially requested the audit.

Choices are often made in environments in which enormous amounts of information are potentially available for processing.

Energy information sources abound and before a decision can be made, the consumer chooses which sources of information are attended to and which of those stimuli are processed (Bettman, 1979). Once a consumer makes a choice to have an energy audit then the audit report becomes the focus of attention. How the audit report is perceived and interpreted likely determines how the consumer will proceed with the choice process. This attention to some stimulus is defined as the allocation of processing capacity to that stimulus.

Perceptual encoding is the process of interpreting a stimulus to which one paid attention. The individual then developes some meaning for this stimulus. The interpretation of a stimulus requires an analysis utilizing information stored in memory. Often the perceptual interpretation of the information will influence the direction of the attention. Context of the information becomes extremely important to this interpretation. Credibility of the energy audit is therefore essential to the encoding of the information it provides the consumer.

As consumers pursue particular goals, they attend to, perceive, and process information. For some choices, the information currently known to the consumer may not be enough and additional information must be sought. This phase of information search may be internal, i.e., stored memory, or external, i.e., information available from television, brochures, newspapers, friends, and so forth. When making novel decisions, consumers face choices about information gathering: which pieces of information should be

acquired and from where, what sources should be used, how much information is needed, and what should the response be to conflicting sources of information or lack of information.

As information is acquired, it is also processed. Evaluation of information refers to the consumer's process of relating information into his or her own value and belief system. The consumer's response to the incoming information can influence the ultimate impact of the information. The incoming information may be integrated, ignored, distorted, and so on (Bettman, 1979). What a consumer chooses to do with information presented in the audit will affect the decision to implement the audit suggestions. The actual choice of whether or not to implement an audit suggestion depends on how particular pieces of information are combined, what evaluative criteria are used by the consumer, and what factors influence the consumer's utilization of specific evaluative criteria.

The Conceptual Model

The conceptual model developed for this study examines types of energy audits, variables related to differences in types of energy audits, consumer acceptance of the types of energy audits, the utilization of evaluative criteria in implementation of audit suggestions, and the effect of demographics in the implementation of audit suggestions (see Figure 1).

In the model, the type of audit is related to variables describing the acceptability of the audit to the audit participant and

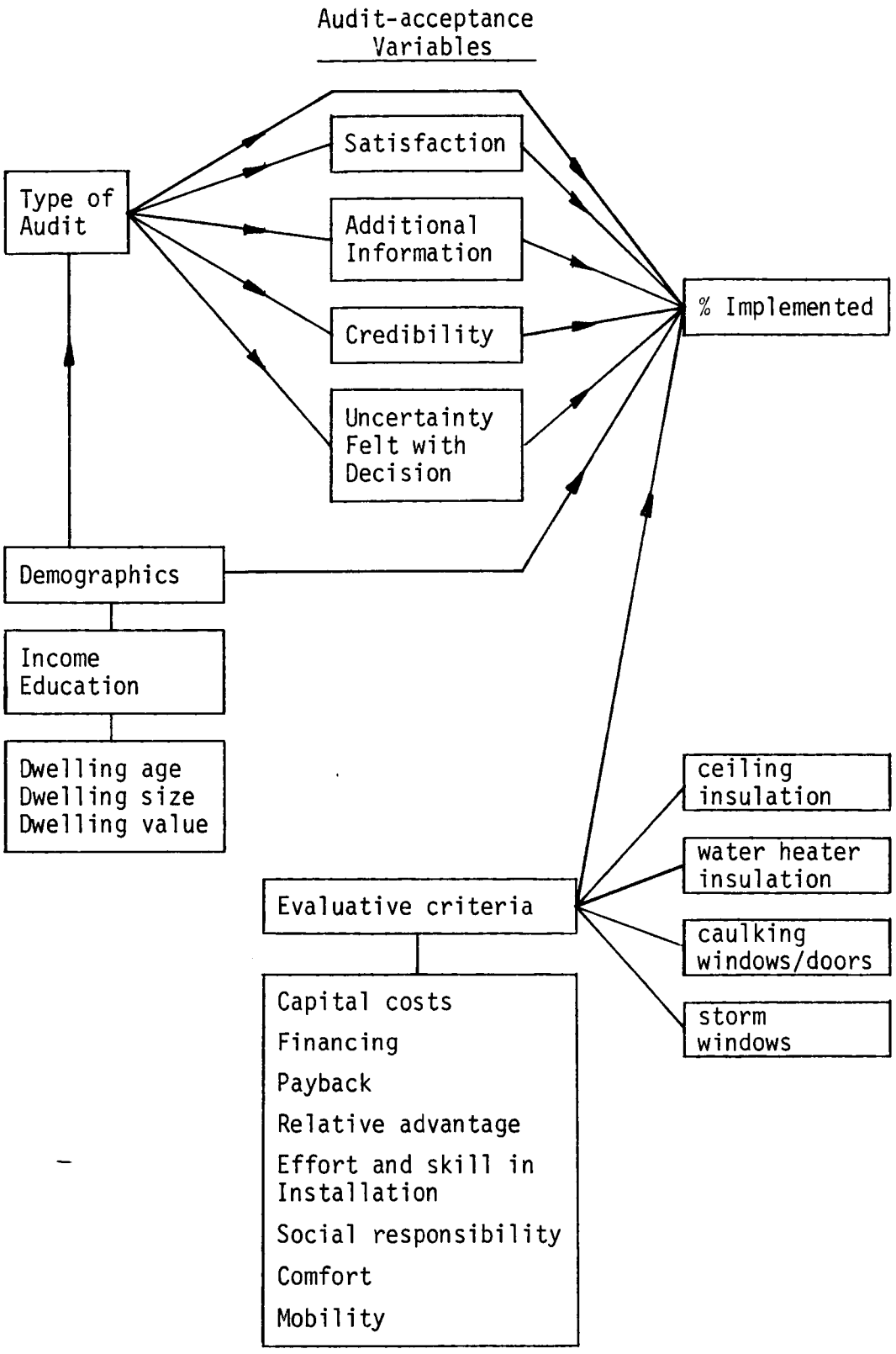


Figure 1. Energy decision-making model.

this acceptability is related to implementation of audit suggestions. This acceptability is measured in terms of credibility of the audit and of the utility, satisfaction, additional information sought after the audit and before decision closure, and uncertainty felt with conservation decisions after the audit. Demographics are examined in relation to type of audit selected by the audit participant and to the implementation of audit suggestions. General attitudes on evaluative criteria (capital costs, financing, payback, relative advantage, effort and skill in installation, social responsibility, comfort, and mobility) associated with the implementation of audit suggestions are examined in terms of their effect on the percent of audit suggestions implemented. This general attitude on evaluative criteria is also related to the use of the criteria in four specific conservation decisions, ceiling insulation, water heater insulation, caulking around windows and doors, and storm windows. The thrust of this model is an explanation of factors related to audit suggestion implementation.

The differences between types of audits will be explored through variables reflecting the consumer acceptance of the audit as a piece of information on which to base a decision. The following factors will be examined: satisfaction with the audit, information seeking, the perceived credibility of the information, and the perceived risk felt with the decision made about the audit suggestions.

The evaluative criteria used in making energy decisions have been defined through the literature as capital costs, financing,

payback, relative advantage, mobility, effort and skill in installation, comfort, and social responsibility. This study explored the importance of each of these in the choice process. The evaluative criteria will be examined for audit suggestions in general and for four specific energy conservation measures.

Demographic variables, income, education, and characteristics of the dwelling, have been identified through the energy conservation and audit-acceptance literature for the model. These will be examined to determine their impact on implementation of audit suggestions as well as their influence on the audit-acceptance variables.

Conceptual Definitions--General Terms

Type of audit--the energy audit received by a family for a specific dwelling. These differ in amount of information conveyed to the consumer and method of data collection.

Audit suggestion--each individual recommendation made by the energy audit for a specific dwelling.

Implementation--the act of carrying out or putting into effect a suggestion from the energy audit.

Conceptual Definitions--Audit-acceptance Variables

Satisfaction with the audit--the degree to which the decision maker feels the audit process fulfills his or her expectations and need for information.

Additional sources of information--when search for more knowledge or facts about audit suggestions is opened after receiving the audit and before closure is reached on the decision.

Credibility of the audit--the degree to which the consumer views the audit as a believable, accurate source of information.

Uncertainty--the lack of confidence associated with implementation decisions for audit suggestions.

Conceptual Definitions--Energy-related Evaluative Criteria

Evaluative criteria--the factors formulated by families for use in assessing the decision to implement audit suggestions, derived from an evaluation based on cultural and family norms for energy use.

Capital costs--the willingness of the consumer to make the investment required to implement an audit suggestion.

Relative advantage--the degree to which the implementation of an audit suggestion is perceived as being better than continuation of household operation without it.

Payback--the cost of implementing an audit suggestion expressed in terms of the number of years before savings achieved by the implementation would pay off.

Social responsibility--convictions held by the family about avoiding waste, stabilizing the U.S. energy situation, and preserving energy for future generations.

Effort and skill involved in installing audit suggestions--the energy and skill necessary to get an audit suggestion

implemented. May be in the form of personal labor or arranging, monitoring, and checking the work of others.

Comfort--the temperature, humidity, and draftiness of a space.

Mobility--history of relocation and the expectation of remaining in the same residence in the future.

Financing--the availability of money resources or willingness to obtain money to implement audit suggestions.

Conceptual Definitions--Demographic

Income--the total family income after taxes.

Education level--the respondent's years of formal education.

Size of dwelling--the heated square footage of the dwelling.

Value of dwelling--the market value of the residence.

Age of dwelling--the number of years since the dwelling was built.

Summary

Several theoretical perspectives are used to construct the framework for this study. Each provides useful theoretical information on the decision whether or not to implement an energy audit suggestion. This study adopts the Adoption of Energy Conservation portion of the Family Energy Adaptation Model (Gladhart & Roosa, 1978). The individual who requested the audit is seeking to reduce the dissonance between the individual and his or her environment through the possible adoption of "new" or unfamiliar ideas (energy conservation measures). The information received

from the audit is processed by the individual to make a choice about whether or not to implement "new" ideas. These decisions on audit suggestions are viewed as economic decisions being carried out by a decision specialist rather than made as joint family decisions. The choice process at the implement or not implement stage is examined through an economic, normative model.

In chapter two the literature is reviewed and developed to expand and explain the Energy Decision-making Model presented in this chapter. In chapter three, the methodology for the project is specified and the results are presented. The results are then discussed in chapter four and interpretation of the results with implications for further research is discussed in chapter five.

CHAPTER II

REVIEW OF LITERATURE

The literature review identified relevant factors and variables in the decision-making process and established the relationship between decision-making and the implementation of energy conservation measures. First, the dimensions of utility company audit programs were examined. Types of audits, penetration of audit programs, demographic characteristics of the audit population, and the effectiveness of various programs were reviewed.

Second, acceptance of the audit as a prerequisite to the processing of information from the audit was considered. The dimensions of audit-acceptance were defined through literature from the areas of information processing, adoption of innovation, and energy conservation. Four dimensions of audit-acceptance were established: satisfaction with the audit, credibility seen in both the audit and the utility company, the need to seek additional information, and uncertainty felt with the decision.

Third, the specifics of the deliberation portion of the implementation decision were reviewed. Evaluative criteria used by the decision maker in his or her deliberation of the conservation decision were identified through the literature. Capital costs, payback, financing, relative advantage, mobility, effort and skill involved in installing conservation measures, social

responsibility, and comfort were described as the evaluative criteria used in the conservation decision.

Fourth, the relevant demographics were identified for those who conserve energy. These are examined in relation to the implementation of conservation measures.

Energy Audit Programs

The Residential Conservation Service, created as part of the 1978 National Energy Act, required major gas and electric utilities to offer a variety of conservation services to their residential customers. These included informing customers of their options to save energy; on-site energy audits; and lists of contractors, financial institutions, and suppliers for implementing conservation measures.

Utility companies have implemented this mandate to various degrees. Home insulation programs, for example, vary greatly in degree of utility involvement. Berry, Soderstrom, Hirst, Newman, and Weaver (1981) reported programs such as Seattle City Light and Salt River Project Agricultural Improvement and Power District offered comprehensive retrofit services including information dissemination, sales and installation of materials, financing, and reinspection. Others covered all phases of the insulation process except installation. Some utilities offered only information dissemination.

Berry et al. (1981) reported utility budgets for the home energy audit programs they surveyed averaged under $500,000 per

year. To put the figures in perspective they noted total conservation budgets were generally less than two percent of total operating expenses. They reported the cost to the utility per audit varied from $25 to $125. Eighty percent of utilities surveyed offered the audits at no cost and of the utilities charging for audits, the cost was from $10 to $25. The utilities that charged found the price of the audit was unrelated to the number of requests for audits.

The 1980 Residential Energy Consumption Survey by the Department of Energy surveyed 6,000 households. It was reported that five percent of those households had an energy audit within the past year and these were concentrated in the upper income groups. These households were evenly divided between rural and urban locations. By region, it was found that households in the western region of the United States reported twice as many audits as those in any other region (United States Department of Energy, 1982).

Energy audits are reaching a specific segment of the population. Studies have shown that participants in audit programs had a higher educational level than one would expect from a sample of the general population (Berry et al., 1981; Fehr, Turner, & Herman, 1978; Johnson, 1979, 1981). Participants in audit programs also had a greater interest/awareness/concern with energy conservation than was found in the general population (Berry et al., 1981).

Berry et al. (1981) found no utility home energy audit programs which successfully attracted a large number of low income

participants. From a 1980 United States Department of Energy report, they noted Memphis Light, Gas, and Water Division conducted a direct mail campaign offering energy audits targeted to specific income residential sectors. One and one half percent of the low income sector responded while five percent of those in higher income sectors responsed. In the same report, Sacramento Municipal Utility District had a response rate in a direct mail campaign of two percent for low income households and eight percent in middle income households.

The type of audit is related to level of consumer response. Pacific Gas and Electric (1979) offered customers either a do-it-yourself audit or an in-home audit; both were free. The response rate for the do-it-yourself audit was almost four times higher (44%) than for the in-home audit (12%). A similar 4 to 1 request ratio was reported by South Carolina Electric and Gas, but it was noted only 10% of those do-it-yourself audits are turned in for computer analysis (R. Eggleston, personal communication, March 23, 1983).

Participants in utility audit programs showed a tendency to minimize initial investment in retrofits and to select measures which paid for themselves with lower fuel bills in a few years. In this respect, the most frequently taken actions were those that could be purchased and installed inexpensively without a contractor's assistance (Berry et al., 1981).

Most utility surveys indicated that a majority of people receiving audits installed some conservation measures. The

reported percentages of program participants taking some action ranged from 30% to 77% with an average of 40% to 50% (Berry et al., 1981). Seldom were these percentages reported with a no-audit control group. However, this was done in the Seattle City Light program and it was found participants took slightly more actions than non-participants for three categories: insulate and/or reduce temperature of water heater (30% versus 20%), install wall and/or floor insulation (9% versus 6%), install storm windows and/or doors (20% versus 14%). For weatherstripping and attic insulation, no differences were reported between groups (Olsen & Cluett, 1979). The Kentucky Extension computer audit program's greatest impact was not on the decision whether or not to implement ceiling insulation, but on the amount to add. The audit encouraged adding greater amounts of insulation (Holland & Fehr, 1981). Few audit program evaluations included information on energy saved due to audit programs through actual consumption records. The Tennessee Valley Authority evaluated the impact of their attic insulation program. After insulation was added, average electric consumption decreased 21% for heating and 17% for cooling (Ozenne & Reisner, 1980). Seattle City Light's analysis of energy savings in 30 audited, all-electric homes redueed consumption by 8.6% while a control group increased consumption by 0.5% (Olsen & Cluett, 1979). In Class B, computer audits, Project Conserve in Michigan investigated actual change in energy consumption following the audits. Whereas energy consumption was increased in both the control group and those who

participated in the audit, those who participated in the audit increased their consumption by 1.1% less than the control group (Harris & Keith, 1980).

Audit-acceptance

As a prerequisite to information processing, a decision maker must attend to a piece of information. As Bettman (1979) suggested, the decision maker will only attend to those pieces of information he or she chooses. The consumer is more likely to attend to and process information from a source of information he or she found credible. Related to this credibility was the idea that the decision maker must be satisfied with a piece of information. Bettman (1979) also suggested that before choice could be made, the decision maker must have adequate information. Adequate information and confidence in the information sources then reduce uncertainty felt with the final decision. This section reviews the literature associated with perceived credibility of energy information sources, satisfaction with energy audits, information used in decision-making on energy conservation measures, and the uncertainty felt by the decision maker regarding decisions on energy conservation measures.

Credibility

Complex or unfamiliar situations, such as energy decisions, may contain discrepant facts and opinions. Based on Rogers and Shoemaker's (1971) work, perceived credibility in the source of

information is related positively to the success in adoption of an audit suggestion.

Farhar, Weis, Unseld, and Burns (1979) reported that few data exist concerning information sources and perceived credibility of those sources on residential energy conservation. The results of these few studies were mixed and possibly noncomparable. Some research has found television was considered the first or second most credible information source (Gottlieb & Matre, 1976; Marsden & McKinney, 1980). Utility company information (not specific to audits) was viewed as a very credible source in two studies (Arcury, Cole, Colliver, & Holland, 1981; Marsden & McKinney, 1980) and as the least credible source in another study (Gottlieb & Matre, 1976). Arcury et al. (1981) found credibility varied with the respondents' attitude toward the energy problem. Those who felt the energy problem to be currently serious tended to feel that all sources of information were more credible than those who did not feel the energy problem was serious. But, they found no significant variations on credibility of information sources based on respondents' community type, dwelling type, or dwelling ownership.

On the credibility of computer evaluated, do-it-yourself audits, two surveys of acceptance of the audit offered through the Kentucky Agriculture Extension Service found that a large majority of people felt the information they received through the audit service was more accurate or about the same as other

information on energy they had used (Fehr et al., 1978; Holland & Fehr, 1981).

Satisfaction with the Audit

Before an individual implements any suggestions received from the energy audit, he or she must feel some degree of satisfaction with the audit process and output. Berry et al. (1981) reported that the audit programs they reviewed showed more than 80% of audited customers were completely satisfied with their home energy audits. They found that, for the most part, people were satisfied with the auditor's manner and knowledge and felt the auditor's information was understandable and helpful. In a post-audit study, Baltimore Gas and Electric (1979) noted that 60% of the respondents to their survey reported a higher opinion of their utility due to receiving an audit whereas only three percent had a lower opinion.

A South Carolina Electric and Gas study (1981) examined satisfaction to see if those who were satisfied with the audit went on to implement audit suggestions. They found 98% of the people were satisfied with their audit and 52% of these went on to install at least one conservation measure. Because there was so little variance in the satisfaction report, it is difficult to determine the effect of satisfaction with the audit on the implementation of a suggestion.

Additional Information Sought

Additional information sought is concerned with the external search phase of information acquisition. Bettman (1979) defined external search as the acquisition of information from sources other than memory. The decision maker, in general, uses different amounts of information in different choice situations. Internal search, or search for information in memory, is generally carried out before external search. Information acquired during external search may lead to further internal search in the process of interpreting the information (Bettman, 1979).

Several studies have looked at the number of sources of information consulted in consumer-related decisions. In their study, Katona and Mueller (1955) found that one-third of the buyers of major appliances received information from only one source. Newman and Staelin (1973) reported 15% of those buying major appliances and automobiles consulted no external information, 30% consulted one source, 26% two sources, 18% three sources, and 12% four sources. Source refers to a category such as books, pamphlets and articles, advertising, retail outlets, and friends. The number of pieces of information consulted within categories was not collected.

-Several studies have examined the source of consumers' energy information. Newspapers and television were viewed as the most important or very important sources of information on energy by consumers (Cunningham & Lopreato, 1977; Marsden & McKinney, 1980; Morrison, Gladhart, Zuiches, Keith, Keefe, & Long, 1978).

Radio and friends were the least important sources (Cunningham & Lopreato, 1977; Marsden & McKinney, 1980). Other sources of information that were considered important in these studies were books, magazine articles, and utility information.

Uncertainty

Uncertainty or incomplete knowledge creates problems in making optimal decisions. In most cases, specific consequences of any particular decision were not certain but rather risky or uncertain (Bonoma & Johnson, 1978). The uncertainty of energy decisions at the household level was compounded by their novelty and their (often) significant initial investment. The novelty of the situation was accompanied by the lack of clear and reliable information about the value of energy conservation technologies and the skepticism about the existence of an energy "crisis." Penz and Yasky (1979) felt this skepticism and the confusion about energy conservation may encourage risk avoidance in decision-making and that as long as the benefits of energy conservation technologies are not well understood, a decision maker will discount them. However, if the outcomes of not changing are perceived as uncertain but quite severe, households would change. In adoption of innovation theory, this is known as relative advantage or the idea that the adoption of a conservation measure will be better than going on without it.

Bauer (1960) believed that differences in buying behavior could be understood in terms of risk perceived by the buyer.

He proposed consumers develop strategies for reducing risk that enable them to act with relative confidence and ease in situations where their information is inadequate and the consequences of their action incalcuable. Ostlund (1974) found the less perceived risk, the more likely the adoption of an innovation.

Darley and Beniger (1981) suggested that perceived risk is associated with certainty of savings in energy conservation. As an example, they cited the use of clock thermostats which can produce highly predictible savings, and savings with insulation which are highly dependent on how well the insulation job is performed. Unfortunately, even when a homeowner receives predicted savings information with the audit he or she has no way of knowing which savings are highly probable and which are dependent on other factors, such as how well the insulation is installed.

Labay and Kinnear (1981) examined the perceived risk involved in adopting solar energy systems. They found both social risks and financial risks affected the adoption of solar energy systems.

Evaluative Criteria Considered in Making Energy Decisions

Families formulate their own evaluative criteria in the process of examining suggestions made by their energy audit. The evaluative criteria reported in the literature are: capital costs, payback, mobility, financing, relative advantage, effort and skill in installation, social responsibility, and comfort. Whereas the relevant aspects in decisions on conservation measures

can be identified, the interrelationships of these have not been examined.

Darley and Beniger (1981) suggested criteria used by decision makers in deliberating conservation decisions. The criteria Darley and Beniger (1981) developed are based on Rogers and Shoemaker's perceptual dimensions. The criteria developed by Darley and Beniger (1981) are incorporated and expanded in this study and serve as the framework for the following decisions of evaluative criteria.

Capital Costs

The initial investment required for some energy conservation measures can be quite high. To add wall insulation can cost several thousand dollars. Other conservation measures, such as weatherstripping or caulking, are inexpensive, especially when labor is provided by the consumer. Clearly, capital costs will be considered in decisions on the adoption of energy conservation measures (Darley & Beniger, 1981). The view the consumer takes of this initial investment will be determined by the availability of money for the initial investment as well as the willingness to devote the money to that purpose rather than other competing family needs (consumer demand).

Using microeconomic theory, Combs (1981) examined the opportunity costs of obtaining energy efficient housing. The opportunity cost was the cost of a decision made defined in terms of the value of opportunities foregone because of spent resources.

Among the opportunity costs in her study, the monetary costs of implementing energy conservation measures were the most verbalized as affecting homeowners' decisions. These costs were broken down into cost of materials, paid help, and money needed for other things.

Payback

Another evaluative criterion involves the amount of time acceptable to consumers for the recovery of energy-related investments. The consumer's incentive in making the cash outlays for energy conservation measures is often the hope that the conservation measures will produce returns in excess of bank interest payments on that amount of money (Dalley, 1982). Examination of this question helps understand how consumers feel about dollar outlays relative to life cycle savings from energy improvements.

For some energy conservation suggestions, the savings can be large but the savings depend on a variety of circumstances. Darley and Beniger (1981) suggested people calculate--however informally--some joint function of capital costs and savings dimensions to determine the economics of a conservation measure.

Payback period analysis of conservation measures has been encouraged by the Department of Energy. The payback period expresses the cost of a conservation measure in terms of the number of years the savings achieved by the innovation would equal its cost.

Compounding the perceived savings aspect of the energy decision is the difficulty in determining the payback period. The initial determination of payback will be affected by climate, home orientation, house design, house age and condition, and household behavior (Penz & Yasky, 1979). Further, the initial payback period information the consumer uses in making a decision can undergo fluctuations with inflation and changing fuel prices.

Cunningham and Lopreato (1977) asked consumers hypothetical questions on payback. They found very clear patterns of responses concerning recovery time for costs of energy-saving investments when examined by income group. The two lowest income groups were distinctly split from the others. The low-income consumers did not seem as likely to make investments that require long payback periods. The middle-income and upper-income groups were more willing to wait longer to recover their investment. However, even for large investments, as solar energy equipment, for example, consumers generally expected a recovery time of less than six years.

Combs (1981) reported that many homeowners in her study felt the perceived costs of energy efficient housing were greater than any anticipated benefits. The reason for this may be found in another study. Craig and Keith (1980) reported that less than one-half of the households identified home heating as an increased cost affecting the family budget. Until energy costs are

recognized as a salient gap, payback will likely be an ineffective argument for conservation.

Financing

Typically a small percentage of audited customers finance retrofit measures. The New York State Residential Insulation Survey found that only 7.4% of audited customers used financing for retrofits while 81% of those who implemented audit suggestions paid cash. Those most likely to finance were less affluent homeowners, renters, landlords, and those investing in expensive conservation measures (Baumann, Cianciulli, Izzo, Rizzulo, Anderson, & Schultz, 1977).

A Seattle City Light Survey indicated 50% of the respondents said availability of loans would have no influence on their decision to invest in home insulation and 33% said they would never consider a loan. The remainder of the respondents would pay over $500 before obtaining a loan for retrofit (Olsen & Cluett, 1979). However, the Tennessee Valley Authority's (1982) evaluation of their audit program found for 7 reported conservation measures from 59% to 88% of the homeowners who implemented those suggestions used TVA low-cost financing programs. They also reported that 76% of the respondents felt this an important factor in implementing audit suggestions.

Relative Advantage

People are motivated to implement conservation measures as a function of their current dissatisfaction with their energy

situation. This dissatisfaction is related to Rogers and Shoemaker's notion of relative advantage in which an innovation is perceived as being better than the idea it replaces. Dissatisfaction causes people to be on the lookout for energy conservation measures and to adopt them if they become available.

Darley and Beniger (1981) attributed consumer dissatisfaction with energy use to macroeconomic forces, not only the current cost of energy but also the rapid rise in cost following an era of cheap energy. Frequently, the argument is used in energy conservation that a sudden price rise shocks consumers into dissatisfaction and they seek innovations. This means that implementation of conservation measures exhibits an advantage to the consumer over the high prices that have brought the dissatisfaction.

Farhar et al. (1979) reported the empirical evidence on perceived relative advantage of domestic energy conservation is sketchy at best. In the studies they examined, relative advantage was associated with cost savings showing the majority conserved primarily to save money, whereas some did it both to ease the energy shortage and save money, and only a few conserved because of any concern for an energy shortage. In the Labay and Kinnear (1981) study of solar energy adoption, relative advantage was significant in the examination of adopters versus non-adopters but it was ranked fifth out of seven factors.

Mobility

Compounding both payback perceptions and the uncertainty involved in decision-making on implementation of conservation measures is the mobility of the homeowner. Leonard-Barton and Rogers (1979) measured mobility by expectations of moving and history of mobility and found those who were highly mobile were less likely to adopt energy conservation measures. People were uncertain they would get a return on their investment if they occupied a house only a short time. However, in the Tennessee Valley Authority's evaluation of audit programs, mobility was considered an important factor in making decisions to implement audit suggestions by only 7% of the participants (Chamberlain, 1983). This is most likely due to the existence of TVA's low-interest loan and the option of transferring payment on those loans to a new owner in the event of sale of the home.

Effort and Skill Involved in Installing the Audit Suggestion

Because many audit suggestions require some effort or skill to implement, Gladhart and Roosa (1978) proposed that the greater the level of home repair skills the more conservation measures involving dwelling system modifications will be implemented. This was supported by Leonard-Barton and Rogers (1979). They found the presence of somebody in the house who was able to make repairs was one of the best predictors of the adoption of a set of energy-conserving modifications in the home. This mechanical ability was felt to impact in three ways. First, those with it could

better understand the energy innovations and judge which made sense for their circumstances. Second, it allowed the homeowner to avoid labor costs by doing the required labor. Third, it increased the potential savings through reduced monetary investment.

Combs (1981) suggested that particular attention be focused on the opportunity costs of getting audit suggestions done. Households which lack the ability to check and/or do maintenance and improvement activities must undergo costs to overcome that constraint. The labor associated opportunity costs she examined were: time available to skilled members of the household to make repairs and improvements, difficulty in obtaining labor, and reliability of repairmen. Harris and Keith (1980) found that respondents over 60, those with incomes less than $10,000, and respondents who were unemployed were less likely to be able to afford an energy saving device or to possess the ability to hire someone to do home repairs.

Social Responsibility

The concept of social responsibility in energy usage is used by various researchers but given a variety of names. Basically, the concept refers to convictions held by the family about the desirability of avoiding waste and preserving energy for future generations.

Gladhart and Roosa (1978) defined social responsibility within their concept of energy usage norms. They defined these norms as the ethical convictions about the proper amount of energy

for a family in some given set of circumstances to consume. Included in this definition is the conviction that one has the right to consume all the energy he or she can afford.

Darley and Beniger's (1981) approach was somewhat different in what they called value, attitude, and style compatibility. They referred to studies of adoption of solar technology that were economically a marginal proposition but because it did not deplete non-renewable resources the technology was adopted, signalling a way of life. Darley and Beniger (1981) expect these people to be in the forefront of adopting various energy conserving innovations.

Attitude, as discussed in the energy literature, refers to the social responsibility dimension of conservation. Two of the attitudes discussed in the literature are important to the social responsibility aspect of this study: the belief that the U.S. energy problem is real and that individual effort at conservation can make a difference.

After the first Arab oil embargo of 1973-74, the question of whether there was a problem and the impact of that belief was examined. Studies done in the mid-to-late seventies supported that approximately half of the population believed that this country was involved in a long-term, serious energy problem (Burby & Marsden, 1980; Gottlieb & Matre, 1976; Perlman & Warren, 1975). Behind the research on the belief in the reality of the energy problem was the assumption that this belief was a precondition for conservation. Morrison (1975) found that belief in the reality of the energy problem had no effect on change in energy consumption

patterns. In an evaluation of Michigan's computerized home energy audit program, no difference was found in belief of the energy problem as a global issue between participants and non-participants in an audit program (Harris & Keith, 1980).

Becker, Seligman, Fazio, and Darley (1981) correlated attitudes and opinions people had about energy-related matters with actual energy consumption. They found people's perception of the reality of the crisis was not correlated significantly with their use of energy. They attribute this to the idea that these same people had another belief that is inconsistent with conservation, for example, a belief that a technological breakthrough will soon solve the problem.

Seligman, Kriss, Darley, Fazio, Becker, and Pryor (1979) examined the role of the individual in energy conservation and the legitimacy of the energy crisis related to actual energy consumption. They found the role of the individual was a significant predictor of consumption in their first study, but not in their follow-up study. When the legitimacy of the energy crisis was examined it did not appear to affect actual consumption. Whether or not the energy crisis was perceived as a legitimate crisis did not appear to affect actual energy consumption.

Comfort

Gladhart and Roosa (1978) indicated norms for thermal comfort refer to the temperature, humidity, and draftiness of the spaces people occupy. Climate control as practiced in housing is an

example of this. The little research that has been done in this area has been related to thermal comfort which is more related to behavioral change to affect conservation, rather than comfort as affected by the installation of conservation measures.

Becker et al. (1981) found one of the best predictors of residential energy consumption is the attitude about thermal comfort and energy use. They compared summer and winter comfort factors and found those who found it difficult to tolerate warmer inside temperatures in the summer also find it difficult to tolerate cooler winter temperatures. Seligman et al. (1979) demonstrated that for those who perceived health and comfort as being related to the need for being cool in the summer, a disproporationate amount was spent on air-conditioning in the summer. No information existed about the relative importance of this aspect in the individual's decision to conserve.

The Demographic Variables

Throughout the literature, socioeconomic and demographic variables have been identified for those who conserve energy. Variables that were found relevant to conservation were used in this study. They include income, education, and characteristics of the dwelling, viz., age, size, and value.

Income

Within the Family Energy Use Adaptation Model, Gladhart and Roosa (1978) used income as a direct measure of economic resources and presumably of the energy budget of families. They felt energy

consumption will be positively related to income. This idea was well supported in the literature (Cunningham & Lopreato, 1977; Gottlieb & Matre, 1974; Milstein, 1978; Morrison et al., 1979; Newman & Day, 1975). Whereas family income was a predictor of energy usage, there have been different reports on the relationship of income to conservation. Kilkeary (1975) in a New York City study and Morrison et al. (1979) in a Michigan study found those in the middle-income groups are the ones who are most likely to conserve energy. Curtin's (1976) research found neither low nor high income groups were consistently associated with either greater past conservation or expected future difficulty with conservation. He concluded that the greater financial discretion that accompanied higher incomes neither greatly facilitated nor presented a barrier to readjusting energy consumption patterns.

Cunningham and Lopreato (1977) found that low-income families adopted more energy conservation practices (not necessarily requiring capital investment) than higher-income families. But when it came to investments in energy conservation measures, higher-income families were more likely to conserve. Tienda and Abrapah (1981) in a study of Wisconsin families found the propensity of low-income households to invest in thermal efficient materials was 16% below that of the total sample and households with annual income over $20,000 are 13% more likely to undertake retrofit measures. In agreement with this, Marsden and McKinney (1980) found greater conservation efforts were being made by those with higher incomes in their sample.

People requesting energy audits have incomes greater than average for their respective location (Berry et al., 1981). A San Diego Electric and Gas survey (1979) revealed a 25% higher median income for participants in their audit program than their general population. These findings were supported in surveys by Gulf States Utilities (1979).

Education

As with income, there is some dispute as to the effect of education on conservation. Curtin (1976) found the highly educated engaged in energy conservation to a greater extent and viewed further adjustments with less difficulty. Marsden and McKinney (1980) found greater conservation effort made by the better educated in their sample. In the Cunningham and Lopreato (1977) study, those with less education were more likely to be classified as more energy conserving. Kilkeary (1975) found that education was not related to energy conservation.

Dwelling

Energy consumption seems to vary directly with the technical features of the dwelling. Included in this are size, energy efficiency, and exposure of the family home. The Michigan State Family Energy Project found single family homes required much more energy per family than multifamily dwellings or mobile homes, which used from 36% to 54% less energy than single family homes (Gladhart, 1976). Marsden and McKinney (1980) found those in single family

detached homes had higher energy conserving indices thus showing more interest in conservation.

Tienda and Aborampah (1981) found that type of dwelling and home ownership status were significant in eliciting various behavioral responses, particularly those that entailed financial outputs to modify energy use patterns. Homeowners displayed higher propensity to adopt practices that entailed monetary outlays when compared with renters. Buck, Brant, and Badenhop (1981) confirmed the propensity of homeowners to adopt conservation measures. Most likely, families living in single family dwellings had greater means for coping with energy-related cost increases by investing in home retrofitting and switching to more efficient space heating systems.

In examining conservation in relation to dwelling size, Curtin (1976) found that 47% of the respondents who lived in houses with three rooms or less conserved on heat whereas 69% of those with seven or more rooms conserved on heat. His conclusion was that larger homes prompted residents to greater conservation.

Penz and Yasky (1979) suggested a measurement of age of the dwelling to encapsulate variations in condition, style, effectiveness of materials, and mechanical equipment. They recognized that this aggregate measure may be inadequate for some energy consumption studies. Combs (1981) found that owners of older homes felt the opportunity costs were particularly high for retrofits to their dwellings. She suggested that home energy audits may be

useful to owners of older homes to help owners understand the feasibility of retrofits for their homes.

This study will examine the reported value of the dwelling as a variable in implementation. Cunningham and Lopreato (1979) asked this question but it did not appear in the analysis. It is felt that this could be significant to the question of retrofits and how the retrofits may increase the value of the home.

Implications of Review for the Conceptual Model

The range of energy conservation information available to the public through utility companies has been identified through the literature review. Types of conservation programs include trained auditors conducting on-site inspections, do-it-yourself audits, and conservation pamphlets. The cost of these services is usually free to the utility customer with some in-home audit inspections going up to $25. This study used utility company audit participants who either chose trained auditors in the home for a cost of $5 or a free, do-it-yourself computer evaluated audit as a representative sample.

The demographic variables for this study were identified from research on energy conservation attitudes, energy conservation actions, and energy audit participants. People who participate in audit programs have been identified as having higher incomes and educational levels than the general population. The dwelling also has been identified as a contributing factor in conservation. This study includes dwelling size, age, and value. Dwelling age

is used to encapsulate variations in conditions, style, effectiveness of materials, and condition, as suggested by Penz and Yasky (1979). Because both of these variables are so closely related to dwelling value, this study added dwelling value as an additional dwelling factor, supplementing what has been done in previous research.

Variables to measure the acceptance of the audit by the consumer were identified through the literature on information processing theory and research on risk in decision-making. Acceptance of any piece of information is a prerequisite to information processing on the part of the consumer. Bettman (1979) suggests a consumer must have adequate information before making a decision. Seeking additional information before decision closure is used to assess whether the audit provides sufficient information for decision-making. Bettman (1979) also suggests a consumer is more likely to pay attention to a piece of information he or she finds credible. Because a consumer must be satisfied with a piece of information before he or she finds it credible, satisfaction was included as a variable to examine audit-acceptance. Penz and Yasky (1979) suggest the skepticism and confusion about the benefits of energy conservation technologies may encourage risk avoidance in making the decision to implement conservation measures. Uncertainty was included as a variable to determine if energy audits alleviate this uncertainty by decreasing the confusion about energy conservation technologies suggested by Penz and Yasky (1979).

These audit-acceptance variables have been examined by other researchers in limited ways. Most people indicate general satisfaction with the audit, but research has not connected this satisfaction with implementation of the suggestions made in the audit. The need for additional information after receiving an energy audit and before closure on an implementation decision has not been researched. The credibility of energy audits needs further examination to determine the effect belief in the information has on the implementation of the audit suggestions. Uncertainty or incomplete knowledge in energy implementation decisions has been examined only in terms of the risk felt in the adoption of solar energy systems.

The evaluative criteria decision makers formulate in the process of making energy conservation decisions have been identified through the literature. These are: capital costs, payback, mobility, financing, relative advantage, effort and skill in installation, social responsibility, and comfort. These evaluative criteria have been examined primarily as general attitudes. There is need to carry the investigation of these criteria a step further by examining how these general attitudes about conservation measures correlate with how the criteria are used in adopting specific audit suggestions.

The Conceptual Model

Based on considerations developed in the review of literature the following conceptual model is proposed as the basis for this

study. This model has two sections. The first section specified the effect of audit type, audit-acceptance variables, and demographics on the implementation of audit suggestions. In the second section, the use of evaluative criteria in the implementation of specific audit suggestions was explored.

Section I--Effect of Type of Audit, Audit-acceptance Variables, and Demographics on the Implementation of Audit Suggestions

The types of audit, audit-acceptance variables, and demographics were identified through the literature review and were used to develop Section I of the model (see Figure 2). The purpose of the model, presented in Figure 2, was to test the effect of audit type, audit-acceptance, and demographics in differentiating the rates of implementation of energy audit suggestions between auditor-assisted and unassisted energy audits. Four specific questions were examined in this section.

Question 1: Effect of audit type. Is the percent of audit suggestions implemented higher for people who receive more assistance with their audits than for those with unasssited audits? A positive relationship was expected between the percent of audit suggestions implemented and increasing levels of auditor assistance.

Question 2: Effect of audit-acceptance variables. To what extent is the difference in the percent of audit suggestions

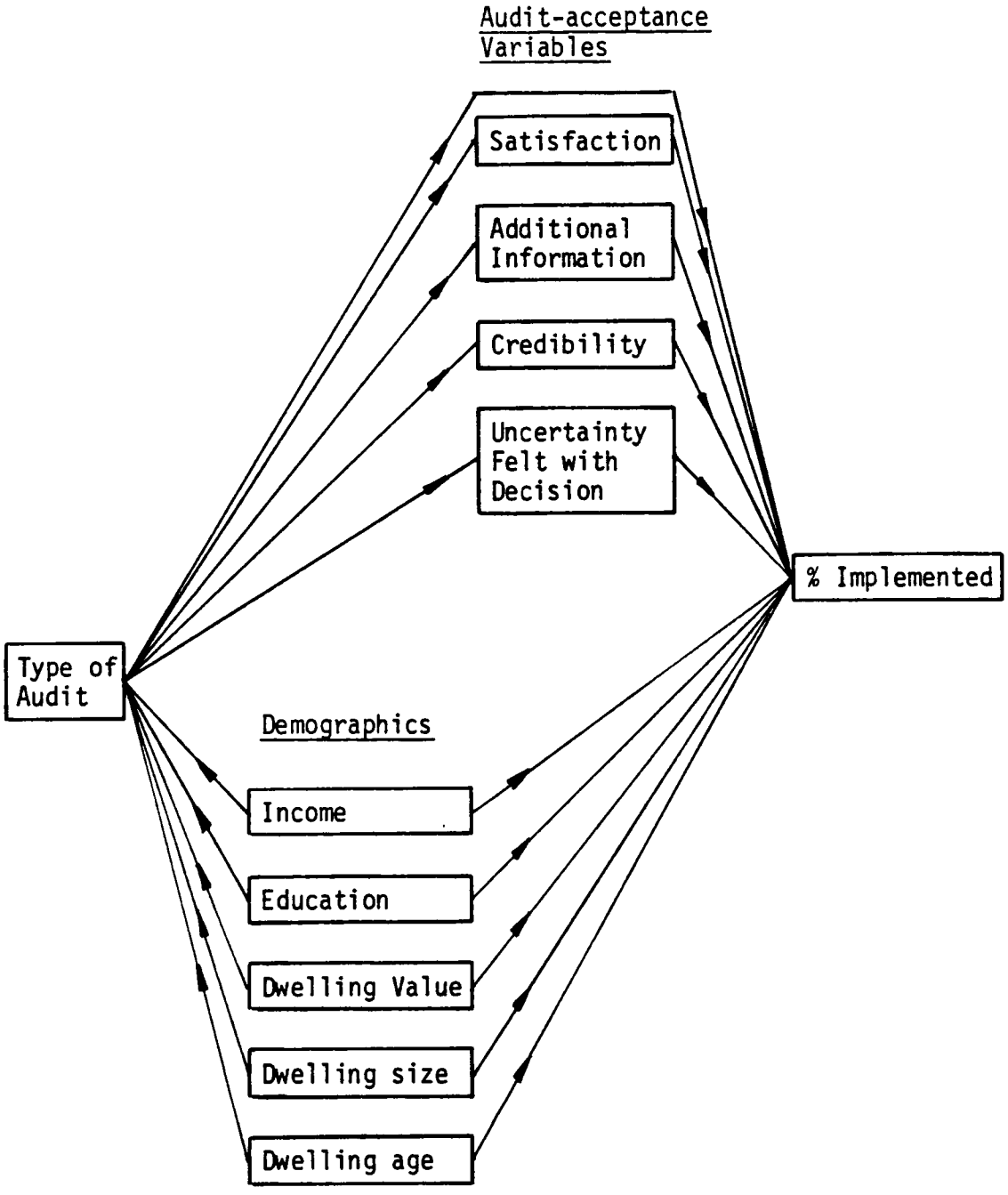


Figure 2. Expected relationship between type of audit, audit-acceptance variables, and demographics, and the percent implemented.

implemented explained by the audit-acceptance variables: satisfaction with the audit, credibility of the audit, the need to seek additional information, and uncertainty with the implementation decision? A positive relationship between satisfaction and the percent implemented was expected for the auditor-assisted audits. A positive relationship between credibility and the percent implemented was expected for the auditor-assisted audits. It also was expected that the need to seek additional information after the audit and before closure on the decision would have a negative association with the percent of audit suggestions implemented. A negative association between uncertainty associated with the implementation decision and the percent implemented for audit-assisted audits was expected.

Question 3: Effect of demographics. To what extent do demographics affect the type of audit chosen and to what extent do demographics affect the percent of audit suggestions implemented? Greater income and educational levels were expected to encourage participation in the auditor-assisted audit as well as increasing the percent of audit suggestions implemented. Greater dwelling size, age, and value were expected to encourage increased participation in the auditor-assisted audit and these also were expected to increase the percent of audit suggestions implemented.

Question 4: Effect of audit type, audit-acceptance, and demographic variables. How much variance in the percent of audit

suggestions implemented can be explained by audit type, audit-acceptance, and demographic variables? It was expected each of the variables would contribute to differences in the rate of implementation in the two groups. The audit, greater satisfaction with the audit, less additional information sought, greater perceived credibility with the audit, less uncertainty felt with the decision, and demographic variables, greater levels of income and education, and greater dwelling value, size, and age should all contribute to greater implementation of audit suggestions in the auditor-assisted group.

The formal hypotheses developed to test this model are stated in Table 1.

Section II--Use of Evaluative Criteria in the Implementation of Audit Suggestions.

When consumers make decisions, they use a set of criteria to evaluate those decisions. For the decision about the implementation of energy conservation measures, several criteria were recurrent through the literature and appear important to include in the model for this section. These criteria were: capital costs, financing, payback, relative advantage, effort and skill in installation, social responsibility, comfort, and mobility.

The literature indicates these criteria were ideas people hold generally about conservation decisions and were not examined in relation to specific implementation decisions, such as putting in storm windows or adding water heater insulation. The question

Table 1. Formal hypotheses for the effect of audit type on the implementation of audit suggestions.

Concept	Hypotheses
Audit Type (Question 1)	1. Respondents with auditor-assisted audits will implement more audit suggestions than those with unassisted audits.
Effect of Audit-acceptance Variable (Question 2)	2a. Respondents with auditor-assisted audits will report higher levels of satisfaction with their audits than respondents with unassisted audits.
	2b. There is a positive relationship between satisfaction with the audit and the percent implemented.
	3a. Respondents with auditor-assisted audits will seek less additional information after their audits and before closure than respondents with unassisted audits.
	3b. There is a negative relationship between seeking information and the percent implemented.
	4a. Respondents with auditor-assisted audits will report higher levels of credibility in their audits than respondents with unassisted audits.
	5a. Respondents with auditor-assisted audits will feel less uncertainty in their implementation decisions than those with unassisted audits.
	5b. There is a negative relationship between uncertainty and the percent implemented.

Table 1 (continued).

Concept	Hypotheses
Effect of Demographic Variables (Question 3)	6a. Respondents with greater income and education levels will choose more auditor-assisted audits than respondents with less income and education.
	6b. There is a positive relationship between income and education levels and the percent implemented.
	7a. Respondents with greater dwelling size, value, and age will choose more auditor-assisted audits than respondents with smaller dwellings, less expensive dwellings, and newer dwellings.
	7b. There is a positive relationship between greater dwelling size, value, and age and the percent implemented.
Effect of Audit Type, Audit-acceptance, and Demographics (Question 4)	8. Factors of auditor assistance, greater satisfaction with the audit, seeking less information, greater credibility seen in the audit, less uncertainty felt with the implementation decision, as well as higher income levels and education and higher levels of dwelling value, size, and age will explain the difference in the rate of implementation among the groups.

that evolved was: are the general attitudes people express about conservation related to the specific conservation decisions?

Question 1: Relationship between general attitudes and specific use of evaluative criteria. Is the general attitude about an evaluative criteria related to the use of that same evaluative criterion in the decisions about specific energy conservation measures? Four specific conservation measures were examined: ceiling insulation, storm windows, caulking around windows and doors, and water heater insulation. A positive relationship was expected between the general attitude on each evaluative criterion and that same criterion as it was used in the implementation decision for ceiling insulation, strom windows, caulking around windows and doors, and water heater insulation (see Figure 3).

Question 2: Relationship between cost and the use of specific criteria. Is the use of a specific evaluative criterion related to the cost of the conservation measure? For example, do people think of comfort differently when evaluating storm windows (a high cost item) than they do when making a decision on caulking (a low cost item)? Two high cost items are examined, ceiling insulation and storm windows, and two low cost items are examined, caulking windows and doors and water heater insulation. For each evaluative criterion, higher correlations were expected between the two high cost conservation measures and between the two low cost conservation measures than between any low cost and high cost conservation measures (see Figure 4).

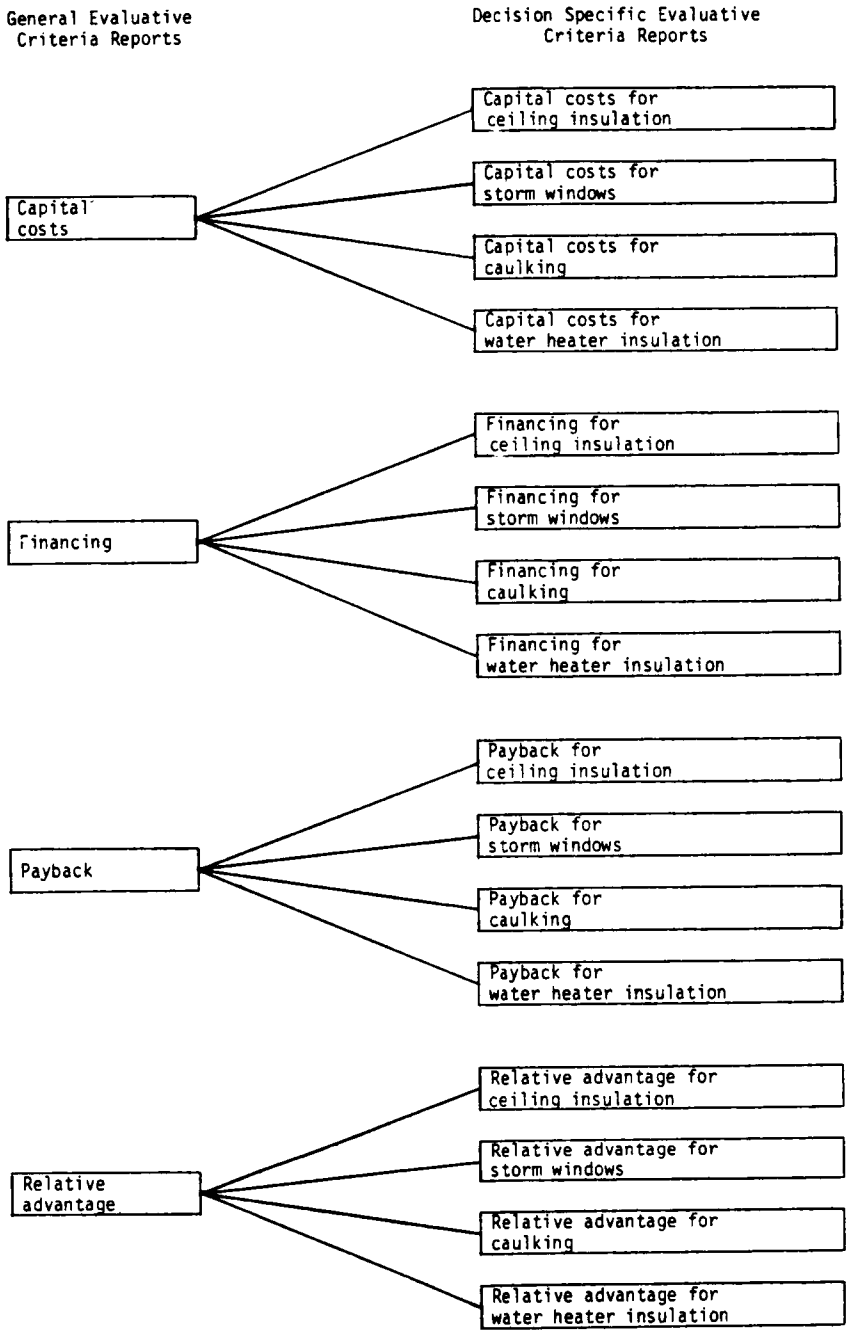


Figure 3. Association of the general reports of evaluative criteria with that same criteria within a specific conservation measure.

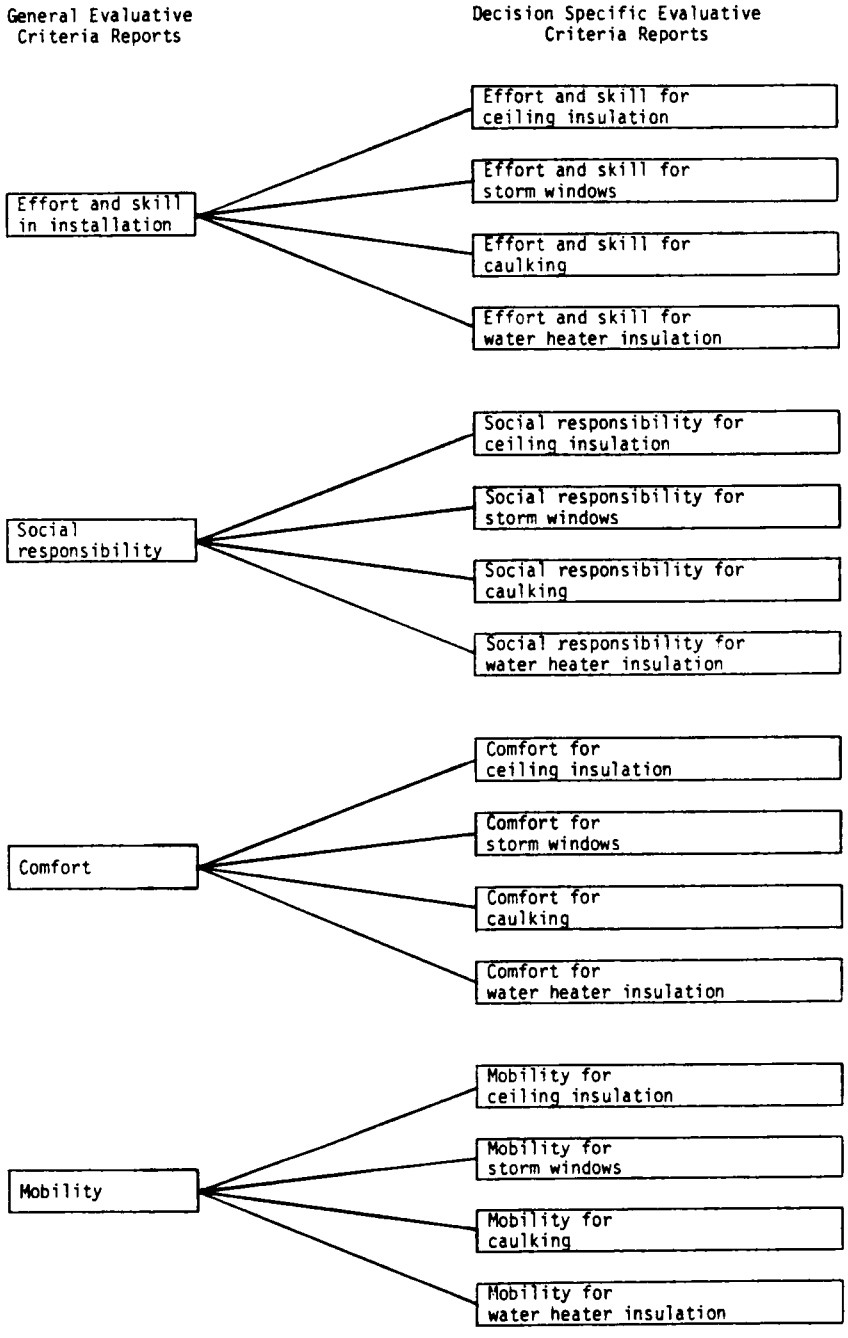


Figure 3 (continued).

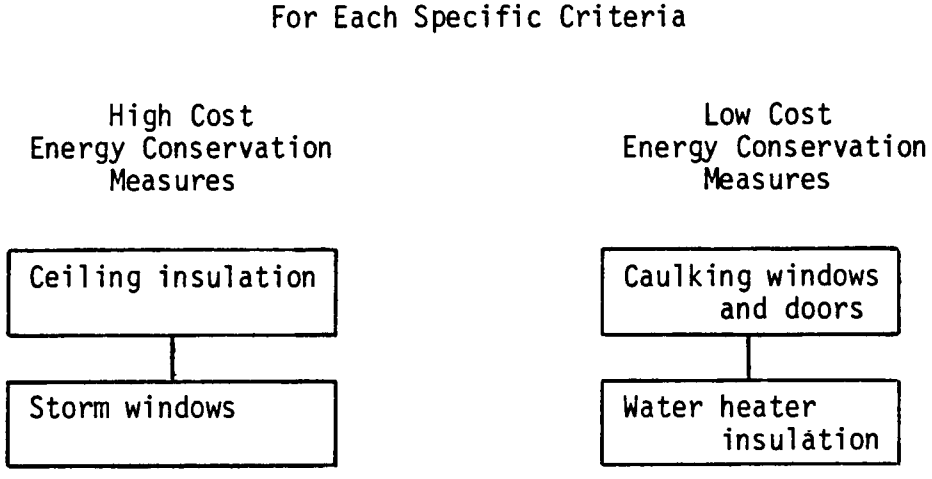


Figure 4. The association of a specific evaluative criteria with the use of that same criteria within four conservation decisions.

Question 3: Relationship of general attitudes on evaluative criteria and the percent implemented. Are general attitudes on evaluative criteria related to the percent implemented? A positive relationship was expected between the importance of the general evaluative criteria and the percent implemented (see Figure 5).

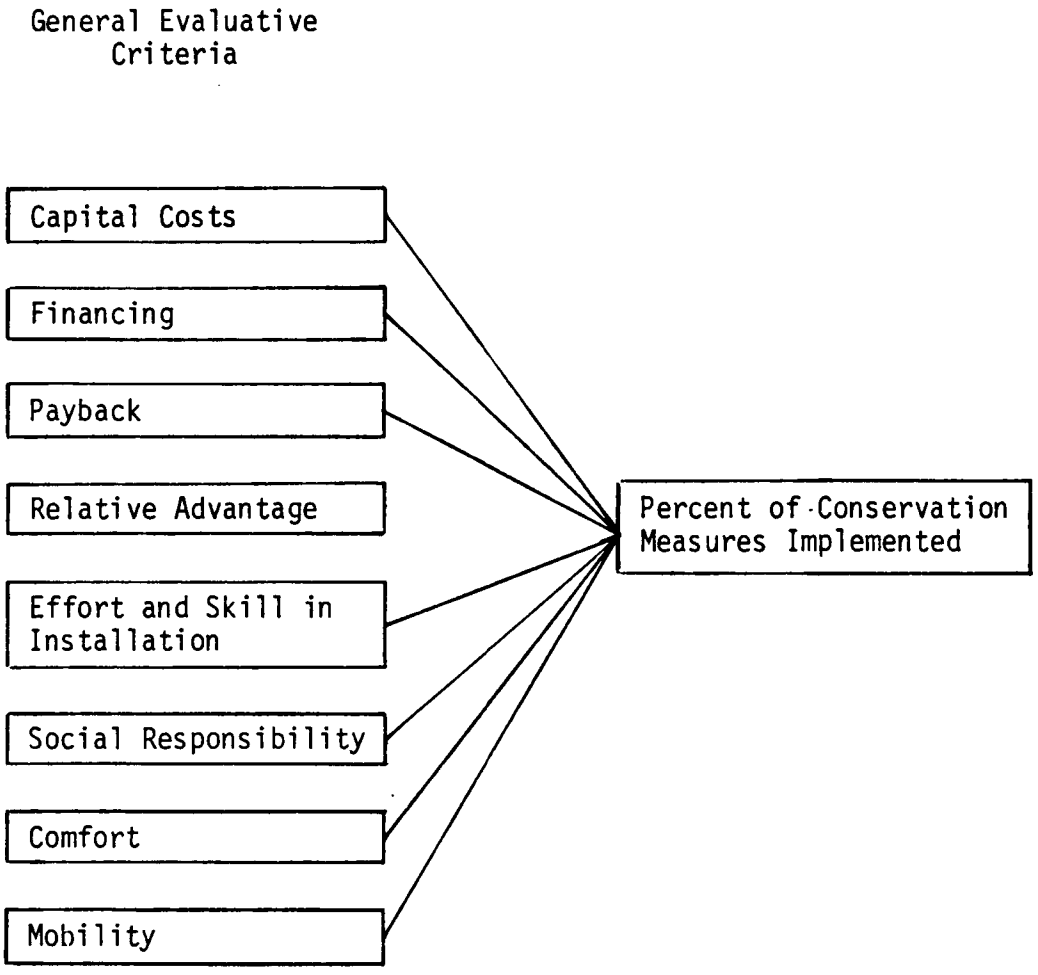


Figure 5. The use of general evaluative criteria in implementation of energy conservation measures.

CHAPTER III

METHODS

The purpose of this study is twofold. First, two types of energy audits and the implementation of conservation measures suggested in those energy audits are investigated. The model developed for this investigation tests the possibility that different audits may be perceived as differing in essential attributes which may in term influence the decision to implement the suggested conservation measures. Second, the evaluative criteria used in decision-making on conservation measures in general and on four specific conservation measures suggested in the audits are examined.

This study is developed as a programmatic evaluation that assesses the influence of the energy audit on the decision to implement conservation measures. A mail survey is used as both an economical and practical means of collecting data.

Sample Setting

To test the models developed for this study, an established audit program is needed. Because of the nature of the suggestions made after an energy audit, time is required for the consumer to make decisions on those suggestions. Therefore, subjects are needed who have had the audits several months to assure enough time for some decision -making to have occurred before studying decision-making criteria. This study also required an audit program that

offered at least two levels of technical assistance with the audit program.

The requirements for this study were met in the audit program of a large southeastern utility. They were able to meet the sampling and design requirements and provide a sufficient sample size.

Research Design

A control group and three audit groups participate in this study. The three audit groups were selected from the customers who chose to participate in the audit programs of the cooperating utility. The audit participants had their choice of either a Class A, auditor-assisted audit or a Class B, unassisted audit. The control group also is selected from the same utility company's files.

In the Class A, auditor-assisted audit, a trained auditor went through the house, examined existing conditions, and took measurements. Then, a telephone hook up to the Enercom computer network was used to process data and give immediate feedback to the auditor. The auditor then explained the types and amounts of conservation measures recommended for the dwelling and left a summary report with the homeowner. The utility charged the participant $5 for this service.

An important part of a Class A audit is the request made by the auditor that the homeowner accompany him or her through the dwelling so the homeowner can be given explanations about conservation measures. However, all homeowners do not follow the

auditor. When the auditor was not followed, the educational function of the audit is assumed to be reduced. Because people who have not accompanied the auditor received a reduced amount of information during the audit process, they are grouped separately from those who followed the auditor more than half the time the auditor was present. This created two groups of participants from the Class A audits.

The third audit group was made up of the people who chose a Class B audit. In the Class B, unassisted audit, the homeowner must go through his or her home and report the type of data the trained auditor collects. The form on which the data is collected is rather complex. This form is then mailed to the utility office where it is computer analyzed and returned to the customer by mail in the same format as the summary report that is left with the Class A participant. There was no charge to the participant for this service. This study viewed the lack of a trained auditor to collect the data as the major variation between the Class A and Class B audits. According to utility company records, only 10% of those who requested the Class B audit completed the complex form and returned it to the utility.

The control group consisted of randomly selected utility customers who had not participated in an audit program. This group was selected from the same neighborhoods as the audit groups to match demographic characteristics. The control group provided the opportunity to compare the demographics of the audit groups to a non-audit group to assess the representativeness of the sample.

The three audit groups provided discrimination between trained versus untrained data collectors and between people who had followed the auditor and those who did not.

Sampling Procedure

The sampling was carried out by the cooperating utility according to procedures set by the researcher. The procedures closely followed the guidelines given by Dillman (1978).

Two samples were selected randomly from the utility company's computer files of the Class A audits and the Class B energy audits, with the Class A audits to be divided later on whether or not the participant followed the auditor. A no-audit control group also was selected randomly. For the Class A group, 500 households were selected from customers who had participated in the Class A audits. For the Class B group, 250 households were selected from the customers who had participated in the Class B audits. Twice as many audit participants were sampled from the Class A audits because of the need to classify respondents into two groups, those who followed the auditor and those who did not follow the auditor.

The 250 households for the control group were selected randomly by using the geographical sections which the utility uses to segment its service area. Based on population density, each section varied in size with a radius from 10 to 15 miles. The number of names selected from each section was based on the number of audits requested from that section. This procedure was used to attempt to provide similar demographic characteristics

between the groups. While procedures were followed to insure optimum response rates, a goal of 50% response was set for the audit groups and a 40% rate for the control group. This goal was set based on questionnaire length and other problems associated with mail surveys (Dillman, 1978).

Measure Development

As a first step in measure development, existing measures for the constructs in the model were examined. Standardized measures for most of the variables in this model did not exist. Three types of questionnaires from related surveys were examined. First, general surveys on energy consumption and conservation were reviewed. These included surveys conducted by the Department of Energy (1980), Newman and Day (1975), Cunningham and Lopreato (1977), and Combs (1981). Second, surveys on the effect of energy audits on implementation of the conservation measures were examined from the Kentucky Agricultural Extension Service (Holland & Fehr, 1980), the Tennessee Valley Authority (Chamberlain, 1983), Michigan State University (Harris & Keith, 1980), and South Carolina Electric and Gas (1981). Third, questions from adoption diffusion studies of energy technology from Leonard-Barton (1979), Seligman et al. (1979), and Tienda and Aborampah (1981) were examined. Each was reviewed for content, dimensions of the measures for specific variables, phrasing, and format.

Instrument Construction

The construction of the instrument began with the development of questions to operationalize the variables identified within the conceptual model. Variables were constructed with items from other questionnaires, rewritten items from other questionnaires, and new items written for this project. For the audit group, the questionnaire assessed (a) reaction to the energy audit, (b) implementation of energy audit suggestions, (c) general evaluative criteria in the decision-making process associated with conservation measures, (d) use of evaluative criteria in specific conservation decisions, and (e) selected demographic variables. The no-audit control group was sent a modified version of the questionnaire which did not assess reaction to the energy audit or the use of evaluative criteria in specific conservation decisions. However, the questionnaire for the no-audit control group did assess (a) implementation of the same conservation measures examined in the audit group, (b) general evaluative criteria in the decision-making process associated with the implementation of conservation measures, and (c) selected demographic variables.

Pretesting the Instrument

The pretest procedures closely followed the total design method for mail surveys (Dillman, 1978). The procedures were developed considering both time and money costs of conducting pretests. This pretest procedure was used to examine several issues. Questions were examined to see if each: measured what

it was intended to measure, was worded properly, was interpreted similarly by all respondents, and provided an applicable response category for all respondents.

In following the total design method, the questionnaire was examined successively by three types of people: colleagues, users of the data, and people from the survey population. This panel was responsible for issues of face validity and reliability. The colleague group included individuals with training similar to the researcher, who understood the study's purpose and the hypotheses being tested. The co-chairs of the committee provided this input along with a sociologist with expertise in survey research.

The second group to examine the questionnaire was the "users of the data." These were the people with substantive knowledge of the survey topic. Two experts were used who had been involved in evaluating the effect of energy audit programs, two who had technical knowledge of installation and effectiveness of conservation measures, and two technical experts who had been involved with energy audits from private sources.

Once the questionnaire was in the final format, it was given to a third group, those representing the population. Because it was not possible to use people who had audits from the cooperating utility at this point, 30 extension homemakers were given the questionnaire. The group was told they were a pretest group and their purpose was to help isolate problems people may have in understanding the cover letter or the items in the questionnaire. Some of the homemakers had had energy audits and some had not.

As the respondents worked on the questionnaire they were observed for non-verbal feedback, as hesitation before answering, erasures, and skipped questions. As each individual completed the questionnaire they were asked for feedback. Revisions were then made for the final version of the questionnaire.

Data Collection Procedures

Data collection procedures were guided by the total design method for mail surveys (Dillman, 1978). The 1,250 households selected for inclusion in this project were sent a questionnaire with a cover letter inviting them to participate and assuring confidentiality. Each cover letter was addressed to the household member who was expected to fill out the questionnaire. For the audit group, the letter was addressed to the person who had originally requested the energy audit. For the control group, the letter was addressed with the name held by the utility in their records on that residence.

A follow-up post card was mailed one week from the mail date of the survey. Subsequent follow-up post cards and letters were not sent because the target response of 50% for the audit groups and 40% for the control groups was surpassed after the first reminder.

Operational Definitions

Each of the variables examined were operationalized through scores assigned to items and indices within the questionnaire.

Many of the concepts examined in this project were somewhat complex. An attempt was made to develop indices for several of the complex variables but not all indices proved to have internal reliability (results reported in the following section). The parenthetical numbers after the following operational definitions refer to the questions in the questionnaire that were used in analysis. The questionnaire for the audit groups is in Appendix A. Items originally intended to be used in an index measurement of the variable were not included in this definition if the index later proved to be unreliable.

Operational Definition--General Term

Percent implemented--The number of conservation measures reported implemented by the respondent divided by the number of conservation measures suggested by the utility company in the energy audit, as taken from the utility company copy of the audit summary report given to the audit participant.

Operational Definition--Audit-acceptance Variables

Satisfaction--An index of satisfaction was constructed with the following items: general satisfaction, how informative was the audit, how well the audit was understood, expectation met, and worthwhileness of the audit program (see Appendix A, questions 6, 7, 9, 11, 12).

Additonal information sought--A trichotomous measure was constructed of no additional information, only one additional

source, and more than one additional source (see Appendix A, question 13).

Credibility--An index of credibility was constructed with the following items: credibility compared to other information, accuracy for this home, believability of the audit, and believability of utility information (see Appendix A, questions 8, 10, 21, 24).

Uncertainty--Uncertainty was measured with a single item on the uncertainty with decisions made on conservation measures (see Appendix A, question 39).

Operational Definitions--Energy-related Evaluative Criteria

Capital costs--The general attitude about capital cost was measured with a single item on the willingness to pay the total investment for conservation measures (see Appendix A, question 41).

Financing--The general attitude about financing was measured with a single item on the availability of money for the audit suggestion (see Appendix A, question 42).

Payback--The general attitude about payback was measured with a single item on the necessity of achieving payback (see Appendix A, question 43).

Relative advantage--The general attitude about relative advantage was measured with a single item on perceived advantage in installing some of the conservation measures (see Appendix A, question 29).

Effort and skill of installation--The general attitude about effort and skill in installation was measured by an index constructed with the following items: skill and time of household members, condition of the home, availability of reliable contractors, and ability of a household member to facilitate installation of the measure (see Appendix A, questions 31, 32, 33, 36).

Social responsibility--The general attitude on social responsibility was measured with a single item on the concern for energy availability for future generations (see Appendix A, question 60).

Comfort--The general attitude on comfort was measured with a single item on conservation measures as increasing comfort (see Appendix A, question 57).

Mobility--Three questions were used to assess the likelihood that the homeowner will stay in the current dwelling based on current tenure, history of past moves, and probability of moving in the next three years (see Appendix A, questions 26, 27, 28).

Operational Definitions--Demographics

Income--The total family income after taxes (see Appendix A, question 130).

Education level--The respondent's years of formal education (see Appendix A, question 114).

Size of dwelling--The heated square feet of the dwelling (see Appendix A, question 125).

Value of dwelling--The market value of the residence (see Appendix A, question 126).

Age of the dwelling--The number of years since the dwelling was built (see Appendix A, question 124).

Index Construction

To avoid some of the reliability and validity problems of single-item variables, an attempt was made to create composite indices to measures satisfaction, credibility, uncertainty, capital costs, payback, financing, relative advantage, effort and skill in installation, social responsibility, and comfort. The use of these indices assumed interval measurement.

Each item in the index used a five point scale ranging from strongly disagree to strongly agree. The individual responses were scored and those independent scores summed. The summed total was then divided by the number of items in the index giving each subject an assigned average for each variable. The underlying assumption here was that this score, based on the responses to the set of items chosen for the index, provides a reasonably good measure of the construct.

Index Reliability

The internal reliability of each index was assessed using Cronbach's alpha. A Cronbach's alpha of .70 or above was considered acceptable because of the exploratory nature of this research (see Table 2). The indices for satisfaction with the audit, credibility, capital costs, effort and skill, and mobility were considered acceptable.

Table 2. Cronbach's alpha of acceptable indices

Concept	Items Making Up Index	Item Number	Cronbach's Alpha
Satisfaction with Audit	Audit report was informative	6	.89
	Could understand the audit report	7	
	Audit program is worthwhile	9	
	Audit met expectations	11	
	Satisfaction with audit from request to report	12	
Credibility	Audit report seemed accurate	8	.76
	Audit report seemed accurate for this house	10	
	Credibility of utility company information	21	
	Credibility of energy audits	24	
Capital Costs	Total cost for conservation measures more than willing to pay	41	.72
	Cost of materials for conservation more than willing to pay	49	
	Cost of labor for conservation measures more than willing to pay	50	
Effort	Someone in household to do minor repairs	31	.75
	Someone in household to do major repairs	32	
	Skilled members of household have time for energy repairs	33	
	Someone in household could facilitate installation of energy conservation measures	36	
Mobility	Tenure at this residence	26	.73
	Number of times moved in last 5 years	27	
	Probability of moving	28	

Indices for uncertainty, finance, payback, relative advantage, social responsibility, and comfort did not have internal consistency. The Cronbach's alphas for these indices were not acceptable (see Table 3). In order to use the concept these indices represented in testing the model, the item which most directly addressed the concept was selected for use in the analyses. For example, on the concept of relative advantage, three items originally made up an index. When these items did not have acceptable internal consistency, the item "I can see advantages in installing at least some energy conservation measures" was selected as addressing the concept of relative advantage most directly. For each unacceptable index, a single item was selected for use in the analyses.

Data Analysis

The analyses for the effect of type of audit, audit-acceptance variables, and demographic variables on the percent of audit suggestions implemented consists of several types of statistical tests. A t-test is used to test the difference in the means of the percent implemented in the two types of audit. T-tests also test the difference in the means of the index for the audit-acceptance variables of satisfaction, credibility, and uncertainty. Chi-squares will be used with the categorical audit-acceptance variable, additional information sought, to determine if information seeking is related to type of audit. Chi-squares also will be used with the categorical demographic variables of income,

Table 3. Cronbach's alpha for unacceptable indices and items chosen for use in analysis.

Concept	Conceptual Items	Item Number	Inter-item Correlations	Chosen Item
Uncertainty	Decisions to implement conservation measures are more difficult than other household decisions.	30	.30	
	Unsure of the future cost of energy.	37	.14	
	It is difficult to tell if conservation measures will work.	38	.43	
	Uncertain with decisions made about conservation measures.	39	.44	*
Finance	Money is available to install conservation measures.	42	.13	*
	Willingness to borrow to install conservation measures.	45	.28	
	Interest for money to install conservation measures more than willing to pay.	47	.04	
	Would use low interest government loan if available.	48	.13	
Payback	Must achieve payback	43	.13	*
	Measures are more than their cost.	46	.12	
	Energy costs rise faster than inflation	61	.13	

Table 3 (continued).

Concept	Conceptual Items	Item Number	Inter-item Correlations	Chosen Item
Relative Advantage	Some advantage in installing some of the measures.	29	.05	*
	Benefits greater than costs.	44	.09	
	Household spends too much on energy.	52	.03	
Social Responsibility	Feel personal satisfaction from conservation.	56	.19	
	Household uses too much energy.	58	.04	
	Impact of individuals in total conservation.	59	.26	
	Energy available for future generations.	60	.16	*
Comfort	Need for cool temperatures in summer.	53	.40	
	Willingness for extra clothes in winter.	54	.33	
	Conservation measures can increase comfort.	57	.60	*

education, size of house, and value of house to determine if each is related to the type of audit originally selected by the respondent. Hierarchical regression will test the amount of explanation type of audit, satisfaction with the audit, seeking additional information, credibility seen in the audit, uncertainty in the decision, income, education, size of house, value of house, and age of house contribute to the percent of audit suggestions implemented.

Pearson's correlation coefficients will be used in examining the use of evaluative criteria specified in the model in the decision-making on the implementation of audit suggestions. The evaluative criteria that will be examined include capital costs, financing, payback, relative advantage, effort and skill in installation, social responsibility, comfort, and mobility. Relationships between general attitudes on the specified evaluative criteria and the use of that same evaluative criterion in specific decisions will be tested using Pearson's correlation coefficients. Pearson's correlation coefficients also will be used to show the strength of association between the use of evaluative criteria in each specific decision and each criterion's use in another specific decision. Stepwise regression will be used to explain the relationship between the general evaluative criteria and the implementation of audit suggestions.

CHAPTER IV

RESULTS

This chapter first examines the response to the questionnaire and the sample characteristics. Then, the hypotheses and research questions are examined.

The Sample

For the audit groups, 750 questionnaires were mailed and 427 returned, for a 57% response rate. For the control group, 500 questionnaires were mailed and 228 were returned for a 47% response rate. Of these, the audit group had 413 usable questionnaires for 55% usable from the original mailout. The audit questionnaires that were dropped from the sample had less than half of the questionnaire filled out or were sent back with notes as to why they were not completed. The control group questionnaires that were dropped were returned past the return deadline.

The audit groups were compared with the control group using Chi-squares to assess the representativenesss of the audit groups. The respondents' sex, age, and education differed significantly, with more males in the unassisted group, the under 30 group being poorly represented, and education levels higher in the auditor-assisted audit group (see Tables 4-10). While there were some differences between the audit and control group, these were typical of other studies and were considered in the evaluation of the findings.

Table 4. Chi-square for sex of the respondent.

Sex	Group: Auditor-Assisted	Group: Unassisted	Group: Control	Chi-square
Male	62%	86%	63%	28.8*
Female	38%	14%	37%	
	100%	100%	100%	
	(n=242)	(n=153)	(n=197)	

*$p < .01$. (df = 2)

Table 5. Chi-square for age of respondent.

	Group			
Age	Auditor-Assisted	Unassisted	Control	Chi-square
Under 30	6%	16%	9%	18.8*
30 to 39	32%	28%	27%	
40 to 49	23%	15%	20%	
50 to 59	14%	22%	20%	
Over 60	25%	19%	24%	
	100%	100%	100%	
	(n=242)	(n=154)	(n=195)	

*$p < .01$. (df = 8)

Table 6. Chi-square for employment of the respondent.

	Group			
Employment	Auditor-Assisted	Unassisted	Control	Chi-square
Full-time	61%	70%	60%	7.9 (n.s.)
Part-time	10%	5%	13%	
Not employed	29%	25%	27%	
	100%	100%	100%	
	(n=241)	(n=152)	(n=195)	

*$p < .01$. (df = 4)

Table 7. Chi-square for education of the respondent.

Education	Group: Auditor-Assisted	Group: Unassisted	Group: Control	Chi-square
Less than high school	0%	1%	3%	19.9*
High school	9%	13%	17%	
Some college	24%	28%	29%	
Graduated college	31%	29%	27%	
Post-graduate study	36%	29%	24%	
	100%	100%	100%	
	(n=242)	(n=153)	(n=197)	

*$p < .01$. (df = 8)

Table 8. Chi-square for marital status of respondent.

Marital Status	Group: Auditor-Assisted	Group: Unassisted	Group: Control	Chi-square
Never married	6%	7%	3%	17.93 (n.s.)
Married	82%	89%	83%	
Divorced	8%	2%	6%	
Separated	0%	1%	2%	
Widowed	4%	1%	6%	
	100%	100%	100%	
	(n=242)	(n=154)	(n=197)	

*$p < .01$. (df = 8)

Table 9. Chi-square for size of the dwelling.

Square Feet	Group: Auditor-Assisted	Group: Unassisted	Group: Control	Chi-square
Less than 500	0%	1%	1%	29.8*
500 to 999	3%	7%	4%	
1000 to 1499	17%	29%	16%	
1500 to 1999	41%	33%	31%	
2000 to 2499	22%	15%	26%	
2500 to 2999	9%	11%	12%	
3000 to 3499	5%	3%	6%	
More than 3500	3%	1%	4%	
	100%	100%	100%	
	(n=234)	(n=151)	(n=193)	

*$p < .01$. (df = 14)

Table 10. Chi-square for value of the dwelling.

Value in Dollars	Group: Auditor-Assisted	Group: Unassisted	Group: Control	Chi-square
Under 25,000	1%	6%	2%	27.0*
25,000 to 49,999	15%	24%	13%	
50,000 to 74,999	46%	30%	38%	
75,000 to 99,999	23%	25%	26%	
Over 100,000	15%	15%	21%	
	100%	100%	100%	
	(n=242)	(n=153)	(n=195)	

*$p < .01$. (df = 8)

The sample is characterized by married, male respondents, with a bimodel age distribution clustering in the 30's and the over 60's group with uncharacteristically high educational attainment and family income levels. About 53% of these families had children present in the household. The dwellings in the sample had a median age of 18 years, between 1,500 and 1,700 square feet, and were valued between $50,000 and $74,999.

Section I--Effect of Type of Audit, Audit-acceptance Variables, and Demographics on Implementation of Audit Suggestions

The analyses for this section tested the first model developed for this study (see Figure 2, page 46) using only families who received energy audits. In this model, four major questions were examined: (a) Is the percent of audit suggestions implemented higher for people who receive more assistance with their audits? (b) To what extent is the difference in the percent implemented, attributed to audit type, explained by the identified audit-acceptance variables? (c) To what extent do demographics affect the type of audit chosen and to what extent are those demographics affecting the percent of audit suggestions implemented? and (d) How much of the difference in the percent implemented between the groups can be explained by audit type, audit-acceptance, and demographic variables?

Question 1: Effect of Audit Type

Is the percent of audit suggestions implemented higher for people who received more assistance with their audit? The analyses involved in the examination of this question determined the definition of the audit groups for the remainder of the study. Three audit groups were originally defined for the study. However, there was no difference in the percent of variance explained between the originally defined groups within the auditor-assisted group, those who followed the auditor, and those who did not (see Table 11). Based on these results, the audit-assisted groups were combined. This combined auditor-assisted group was used for the remainder of the analyses.

Hypothesis 1 (see Table 1, page 49) that respondents with auditor-assisted audits would implement more audit suggestions than those with unassisted audits was supported (see Table 12). The hypothesis was tested using a t-test to examine the difference between the audit group means. The auditor-assisted audit group implemented 15% of the suggestions whereas the unassisted audit group implemented 10% of the suggestions. This was significant at the .01 level.

The effect of the type of audit on the variance in the percent implemented was then tested with regression. This was done to allow for later comparisons. The type of audit accounted for 2% of the variance in the percent of suggestions implemented. This was significant at the .05 level (see Table 13).

Table 11. T-test on difference in the percent implemented between the auditor-assisted group who followed the auditor and the auditor-assisted group who did not follow the auditor.

Group	Number of Cases	Mean Percent Implemented	T-value
Followed the auditor	189	.16	1.22 (n.s.)
Did not follow the auditor	48	.12	

*$p < .01$. (df = 1, 235)

Table 12. T-test on difference in percent implemented between the auditor-assisted and the unassisted audits.

Group	Number of Cases	Mean Percent Implemented	T-value
Auditor-assisted	244	.15	2.44*
Unassisted	159	.10	

*$p < .01$. (df = 1, 401)

Table 13. Regression explaining variance in percent implemented between audit types.

Variable	R^2	R^2 change	Beta	F
Audit type	.02	.02	.12	4.85*

*$p < .05$. (df = 1, 306)

Question 2: Effect of Audit-acceptance Variables

To what extent is the difference in the percent of audit suggestions implemented explained by the identified audit-acceptance variables? This group of analyses examined the relationship between type of audit and the four variables that represent acceptance of the audit by the respondent: (a) satisfaction with the audit, (b) the credibility felt with the audit and the utility company, (c) uncertainty felt with the implementation decision, and (d) additional information sought after the audit was received and before closure. To examine differences between the two audit groups, t-tests were used for the three scales. The Chi-square test of significance was used to examine group differences for additional information sought (recoded to a dichotomous variable).

The auditor-assisted audits, where a trained auditor conducted the audit, produced higher levels of satisfaction with the audit as shown in the mean satisfaction index score of 20.98 in the auditor-assisted group and 18.92 in the unassisted group. These differences were significant (see Table 14). The credibility felt in the audit and in the utility company was significantly greater for the auditor-assisted group with a mean credibility index of 15.87 versus 15.06 for the unassisted group (see Table 14). Seeking additional information did not differ significantly between the groups, with 17% of those with the auditor-assisted audits and 19% of those with unassisted audits seeking additional information (see Table 15).

Table 14. T-tests on effect of audit type on audit-acceptance scales.

Audit-acceptance Scales	Audit Type: Auditor-assisted n	Auditor-assisted $\bar{x}$	Unassisted n	Unassisted $\bar{x}$	df	T-value
Satisfaction	221	20.98	149	18.92	368	4.39*
Credibility	210	15.87	147	15.06	355	2.47*
Uncertainty	239	2.62	158	2.27	395	2.82*

*$p < .01$.

Table 15. Chi-square on the effect of type of audit on additional information sought after receiving the audit and before decision closure.

	Audit Types				
	Auditor-assisted		Unassisted		
	n	% of sample	n	% of sample	Chi-square
Sought additional information	221	17%	154	19%	2.64 (n.s.)

(df = 2)

Two of the variables in this group were affected by the type of audit as hypothesized (see Table 1, page 49). Both satisfaction with the audit and credibility seen in the audit were increased with auditor-assistance (see hypotheses 2a and 4a, Table 1). An unexpected result was that the presence of an auditor did not reduce uncertainty felt after making conservation decision more than not having the auditor present (see hypothesis 5a, Table 1). Additional information was expected to be sought in fewer cases with an auditor present, but there was no difference between the groups in this variable (see hypothesis 3a, Table 1).

The effect of the audit-acceptance variables and the type of audit on the variance in the percent implemented was tested with hierarchical regression. Dummy variables were used for both of the dichotomous variables, type of audit and additional information sought. For the variable type of audit, auditor-assisted audits were coded 1 and for the additional information variable, no additional information sought was coded 1. The audit-acceptance variables were entered as the first block of variable. These variables, additional information, satisfaction, credibility, and uncertainty, explained 4% of the variance in the percent implemented. Although, as a block, these variables were significant at the .01 level (see Table 16), additional information was the only significant individual variable with a Beta of -.12. Of the hypotheses concerning the relationship of the audit-acceptance

Table 16. Hierarchical regression explaining variance in percent implemented based on audit-acceptance variables and type of audit.

Block	Variable	R^2	R^2 change	Beta	df	F
Audit-acceptance		.04			4,303	3.58*
	Additional information	.01	.01	-.12		4.9*
	Satisfaction	.03	.02	.08		.9
	Credibility	.04	.002	.09		1.0
	Uncertainty	.04	.007	.07		1.3
Audit type		.05			5,302	3.34*
	Audit type	.05	.007	.09		2.34

*$p < .01$.

variables to the percent implemented (see hypotheses 2b, 3b, 4b, 5b, Table 1, page 49), the use of additional information was the only significant variable and it was not in the direction expected. The negative Beta indicates that when the respondent sought additional information implementation was more likely to occur. There is evidence the audit did not provide enough information for the decision to implement. When type of audit was entered after the audit-acceptance variable, the R^2 only increased 1% (see Table 16), reduced a percent from when audit type was entered alone (see Table 13). This indicates a slight partial correlation between audit type and the audit-acceptance variables. Although the partial correlation was in the direction expected, it was much less than expected.

Question 3: Effect of Demographics

To what extent do demographics affect the type of audit chosen and to what extent are those demographics affecting the percent of audit suggestions implemented? The effect of demographics on the type of audit initially chosen by the respondent was examined with the Chi-square statistic. Some variables did not have the five cases per cell that is one of the heuristics of the Chi-square test, but with a large number of cases this requirement can be violated (Hayes, 1981). Significant Chi-squares were found for sex of the respondent, age of the respondent, size of the house, and value of the home (see Table 17). The low Lambda's for these significant Chi-squares indicate that sex of the respondent

Table 17. Chi-squares for significant demographic variables between audit types.

Variable	Category	Type of Audit: Auditor-Assisted n	Auditor-Assisted % of sample	Unassisted n	Unassisted % of sample	df	Chi-square
Sex of Respondent	M	149	62.	131	85.	1	25.12*
	F	93	38.	22	14.		
Age of Respondent	Under 30	15	6.2	24	15.6	4	17.54*
	30 to 39	77	31.8	43	27.9		
	40 to 49	55	22.7	23	14.9		
	50 to 59	34	14.	35	22.7		
	Over 60	61	25.2	29	18.8		
Square feet of House	Less than 500	0	0	1	.7	7	19.35*
	500 to 999	6	2.6	1	.7		
	1000 to 1499	40	17.1	45	29.4		
	1500 to 1999	95	40.6	50	32.7		
	2000 to 2499	52	22.2	23	15.0		
	2500 to 2999	22	9.4	17	11.1		
	3000 to 3499	11	4.7	4	2.6		
	More than 3500	8	3.4	2	1.3		
Value of House	Under 25,000	2	.8	9	5.9	4	19.3*
	25,000 to 49,999	36	14.9	37	24.2		
	50,000 to 74,999	111	45.9	46	30.1		
	75,000 to 99,999	55	22.7	39	25.5		
	Over 100,000	38	15.7	22	14.4		

*$p < .01$

(Lambda .01), age of the respondent (Lambda .06), size of the house (Lambda .07), and value of the home (Lambda .05) are all low correlates with the type of audit. The number of responses in each cell for the significant Chi-squares indicated more males answered the survey questionnaire in the auditor-assisted group and the auditor-assisted respondents were older than the unassisted respondents. The auditor-assisted respondents also lived in larger and more expensive homes (see Table 17). Chi-squares for non-significant demographics, employment of respondent, education of respondent, marital status, income, are reported in Appendix C.

The age of the house was a continuous variable and was tested with a t-test. The auditor-assisted group did live in houses that were, on the average, six years older than those houses in the unassisted group (see Table 18). This difference was significant at the .01 level.

Higher levels of the demographic factors of income and education were expected to affect the type of audit chosen (see hypothesis 6a, Table 1, page 49). They did not have an effect. The dwelling factors of value, size, and age of the house all affected the audit choice (see hypothesis 7a, Table 1). Higher levels of each of these variables were found in the auditor-assisted group.

The effect of the demographic variables and type of audit on the variance in the percent implemented was tested with hierarchical regression. The demographic variables, income, education, age of dwelling, size of dwelling, and value of dwelling, were

Table 18. T-test on the difference in age of house between auditor-assisted and unassisted audits.

Audit Type	Number of Cases	Mean Age of House	T-value
Auditor-assisted	244	22	4.28*
Unassisted audits	155	15	

*$p < .01$. (df = 1, 397)

non-significant as a block, explaining only 2% of the variance in the percent implemented (see Table 19). Of these variables, the only significant one at the .01 level was income with a Beta of .14. Thus only one hypothesis on the effect of demographics on the percent implemented was supported (see hypotheses 6b, 7b, Table 1, page 49): there was a positive relationship between income and implementation. When type of audit was entered after the demographic variables, the R^2 increased 2% (see Table 19). This was the same as when type of audit was entered alone (see Table 13). This indicates there was little correlation between demographics and type of audit.

Question 4: Effect of Audit Type, Audit-acceptance, and Demographic Variables

How much of percent implemented can be explained by audit type, audit-acceptance, and demographic variables? Hierarchical regression was used to determine the contribution of audit type, audit-acceptance, and demographic variables on the percent of audit suggestions implemented. Again, dummy variables were used for both of the dichotomous variables, type of audit and additional information sought. For the variable type of audit, auditor-assisted audits were coded 1 and for the additional information variable, no additional information sought was coded 1. The demographic variables, income, education, dwelling size, dwelling age, and dwelling value, were entered in the first step to control for the effect of demographics on the other variables.

Table 19. Hierarchical regression explaining variance in percent implemented based on demographics and type of audit.

Block	Variables	R^2	R^2 change	Beta	df	F
Demographics		.02			5,302	1.62
	Income	.01	.01	.14		4.45*
	Education	.02	.01	-.10		2.97
	Age of dwelling	.02	.00	.02		.15
	Size of dwelling	.02	.00	-.08		.79
	Value of dwelling	.02	.005	.07		.50
Audit Type		.04			6,301	2.22
	Audit	.04	.02	.14		5.15*

*$p < .01$.

Overall, the demographic variables only explained 2% of the variation in the percent implemented and it was non-significant at the .01 level (see Table 20).

In the second step the audit-acceptance variables were entered. With this addition, 7% of the variance between the percent implemented in the two audit groups was explained and it was significant at the .01 level. When type of audit was added in the final step, a total of 8% of the variance was explained and it was significant at the .01 level.

The hypothesis concerning the effect of audit type, audit-acceptance, and demographics on the percent implemented (see hypothesis 8, Table 1, page 49) was partially supported. Demographics, in general, explained little, but income did explain some variation. Audit-acceptance variables were significant with additional information being the strongest contributor to the explanation provided by the audit-acceptance variables, but this relationship was opposite of what was expected. The type of audit also supported the hypothesis significantly contributing to the explanation of the percent implemented.

All of the variables examined were able to explain very little about the percent of audit suggestions implemented, but certain relationships were revealed. Demographics, while contributing to the selection of audit, had little effect on the implementation of suggestions made in that audit. Audit-acceptance variables contributed the most to the variance in the percent implemented between the groups and because the audit-acceptance variables were embedded

Table 20. Hierarchical regression explaining variance in percent implemented based on audit-acceptance, demographics, and type of audit variables.

Block	Variables	R^2	R^2 change	Beta	df	F
Demographics		.02			5,302	1.62
	Income	.01	.01	.15		3.70*
	Education	.02	.01	-.12		2.57
	Age of dwelling	.02	.00	.03		.90
	Size of dwelling	.02	.00	-.06		.22
	Value of dwelling	.02	.005	.06		.44
Audit-acceptance		.07			9,298	2.73*
	Additional information	.04	.01	-.13		5.39*
	Satisfaction	.06	.02	.09		1.73
	Credibility	.06	.00	.08		1.01
	Uncertainty	.07	.01	.08		3.13*
Audit Type		.08			10,297	2.7*
	Audit	.08	.01	.09		2.34

*$p < .01$.

in type of audit, type of audit added very little additional explanation in variance.

Section II--Use of Evaluative Criteria in the Implementation of Audit Suggestions

The analyses for this section examined the use of evaluative criteria in the energy conservation implementation decision. The criteria examined were: capital costs, financing, payback, relative advantage, effort and skill in installation, social responsibility, comfort, and mobility. The models developed for these analyses examined the association between (a) the general use of evaluative criteria and the specific use of evaluative criteria in the following four specific conservation decisions, ceiling insulation, storm windows, caulking windows and doors, and adding water heater insulation; (b) the cost of a conservation measure and the use of the evaluative criteria in two high cost (ceiling insulation and storm windows) and two low cost (caulking and water heater insulation) conservation measures, and (c) the effect of the general evaluative criteria on the percent implemented. The analyses for this section were exploratory in nature and guided by the three research questions.

Question 1: Relationship between the general attitude and specific use of evaluative criteria.

Is the general attitude about an evaluative criteria related to the use of that same evaluative criteria in the decisions about

specific energy conservation measures? The measure of the general attitude on an evaluative criterion was correlated with that same criterion as used with one of four specific conservation measures using Pearson's correlation coefficient. When an evaluative criterion within a specific conservation decision was reported as not considered, it was treated as a missing value. Pairwise deletion was used for missing data. The specific measures for financing, effort and skill, and mobility were recoded to make them conceptually compatible with the general measures.

Many of the general attitudes on evaluative criteria are significantly related to the use of the same criterion in a specific decision situation, although the relationships are not strong. Most correlations between the general attitude and the criterion in the specific were significant at the .01 level, but few correlations were greater than .4 (see Table 21). The exception was mobility which had a strong association with each of the decisions on the four conservation measures. Thus, the conclusion is that the criteria are situation specific. The positive relationship expected here was partially supported. Correlations of .4 and above are graphically represented in Figure 6. This begins to sort out the relationships of importance. The general measures of mobility correlated with the use of mobility as a criterion in specific decision-making on ceiling insulation, storm windows, and water heater insulation and general attitude on financing correlated with specific use in the decision on storm windows.

Table 21. Correlation between general attitudes on evaluative criteria and each criterion as used in four specific conservation decisions.

General Attitude on Evaluative Criteria Report	Specific Conservation Measures Evaluative Criteria Reports			
	Ceiling Insulation	Storm Windows	Caulking	Water Heater
Capital Costs	.11	.16	.07	.08
Financing	.46*	.38*	.26*	.20*
Payback	.34*	.44*	.25*	.31*
Relative Advantage	.15	.12	.08	.13
Effort and Skill	.23*	.15	.21*	.20*
Social Responsibility	.30*	.33*	.30*	.30*
Comfort	.34*	.23*	.27*	.20*
Mobility	.67*	.54*	.39*	.46*

*$p < .01$.

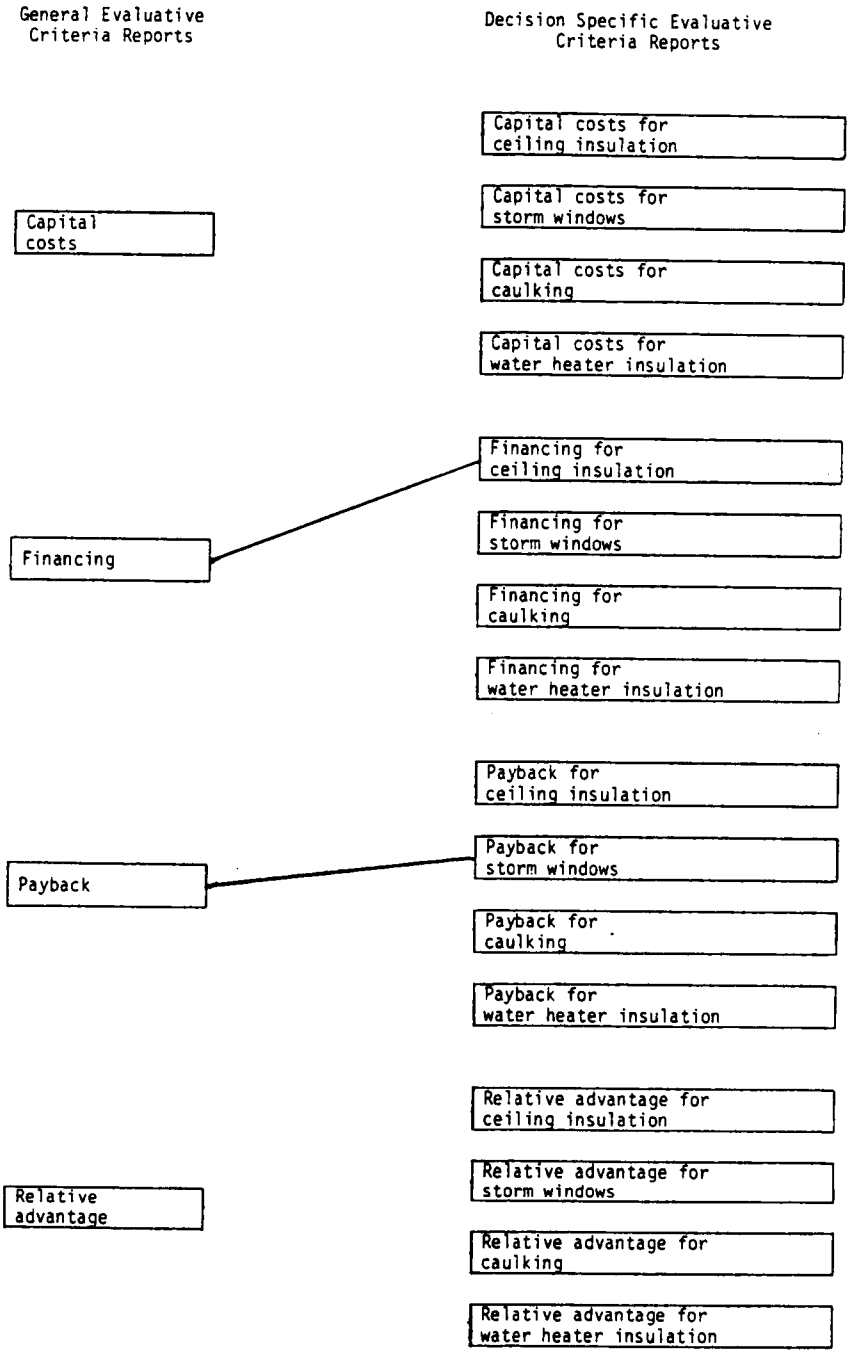


Figure 6. Graphic representation of the association of the general reports of evaluative criteria with that same criteria used in a specific conservation measure.

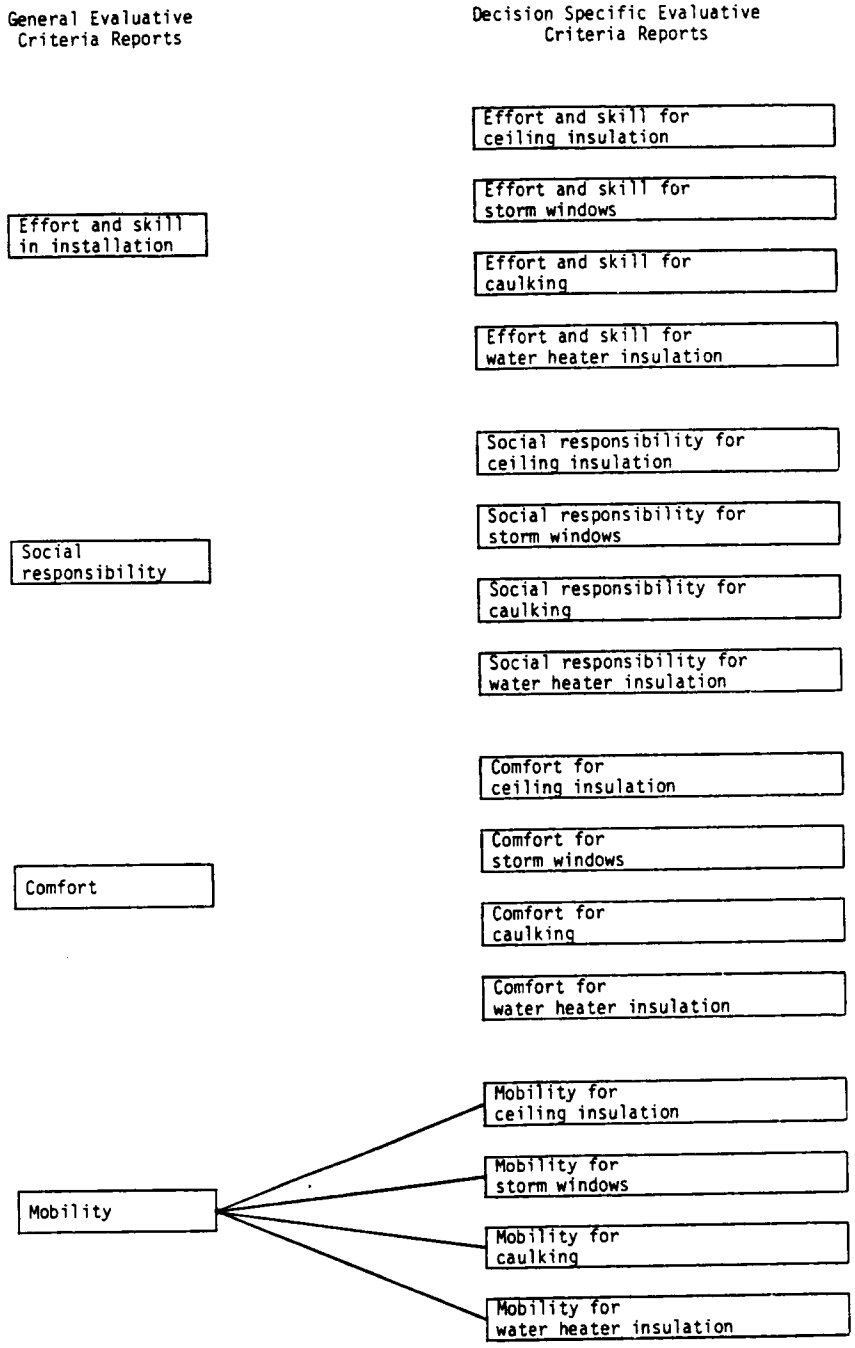


Figure 6 (continued).

Question 2: Relationship between cost and the use of specific criteria.

Is the use of specific evaluative criteria related to the cost of the conservation measure? This question also was addressed using Pearson's correlations to show the strength of association between the use of evaluative criteria in each specific decision and each criterion's use in another specific decision. Each evaluative criterion in each of the four conservaiton measures, ceiling insulation, storm windows, caulking, and water heater insulation, was examined.

The cost of the conservation measure was not a factor in the use of evaluative criteria within a specific decision. For each evaluative criterion used in the implementation decision, higher correlations were expected between the two high cost conservation measures and between the two low cost conservation measures than between any high cost and any low cost conservation measure. This was unsupported in that the correlations were as strong between low cost and high cost conservation measures as between the two high cost measures and the two low cost measures (see Table 22). Graphic representations (see Figure 7) allow closer examination of the strengths of those relationships. Very high correlations (over .6) exist between the conservation measures on the criteria of social responsibility and mobility. These criteria were equally strong between each of the four conservation measures.

Table 22. Correlation matrices for the importance of the evaulative criteria in decision-making on four energy conservation measures.

Conservation Measure	Conservation Measure			
	Ceiling Insulation	Storm Windows	Caulking	Water Heater Insulation
Criteria				
Capital Costs				
Ceiling Insulation	1.000			
Storm Windows	.48* (100)	1.000		
Caulking	.48* (107)	.33* (100)	1.000	
Water Heater Insulation	.38* (116)	.40* (118)	.52* (99)	1.000
Payback				
Ceiling Insulation	1.000			
Storm Windows	.55* (106)	1.000		
Caulking	.48* (109)	.45* (99)	1.000	
Water Heater Insulation	.41* (121)	.59* (120)	.44* (98)	1.000
Financial Consideration				
Ceiling Insulation	1.000			
Storm Windows	.79* (90)	1.000		
Caulking	.56* (94)	.62* (91)	1.000	
Water Heater Insulation	.47* (104)	.48* (107)	.66* (87)	1.000

Note: The number in ( ) is the number of cases.
*$p < .01$.

Table 22 (continued).

Conservation Measure	Conservation Measure: Ceiling Insulation	Storm Windows	Caulking	Water Heater Insulation
Criteria				
Effort and Skill				
Ceiling Insulation	1.000			
Storm Windows	.50* (101)	1.000		
Caulking	.56* (107)	.56* (104)	1.000	
Water Heater Insulation	.57* (116)	.52* (121)	.63* (104)	1.000
Relative Advantage				
Ceiling Insulation	1.000			
Storm Windows	.61* (99)	1.000		
Caulking	.62* (104)	.59* (99)	1.000	
Water Heater Insulation	.47* (116)	.38* (118)	.51* (99)	1.000
Comfort				
Ceiling Insulation	1.000			
Storm Windows	.53* (106)	1.000		
Caulking	.68* (109)	.56* (107)	1.000	
Water Heater Insulation	.41* (105)	.42* (112)	.30* (94)	1.000

Note: The number in ( ) is the number of cases.
*$p < .01$.

Table 22 (continued).

Conservation Measure	Conservation Measure: Ceiling Insulation	Storm Windows	Caulking	Water Heater Insulation
Criteria				
Social Responsibility				
Ceiling Insulation	1.000			
Storm Windows	.77* (82)	1.000		
Caulking	.80* (82)	.77* (85)	1.000	
Water Heater Insulation	.84* (98)	.78* (102)	.72* (86)	1.000
Mobility				
Ceiling Insulation	1.000			
Storm Windows	.93* (64)	1.000		
Caulking	.86* (62)	.89* (64)	1.000	
Water Heater Insulation	.84* (68)	.88* (68)	.87* (63)	1.000

Note: The number in ( ) is the number of cases.
*$p < .01$.

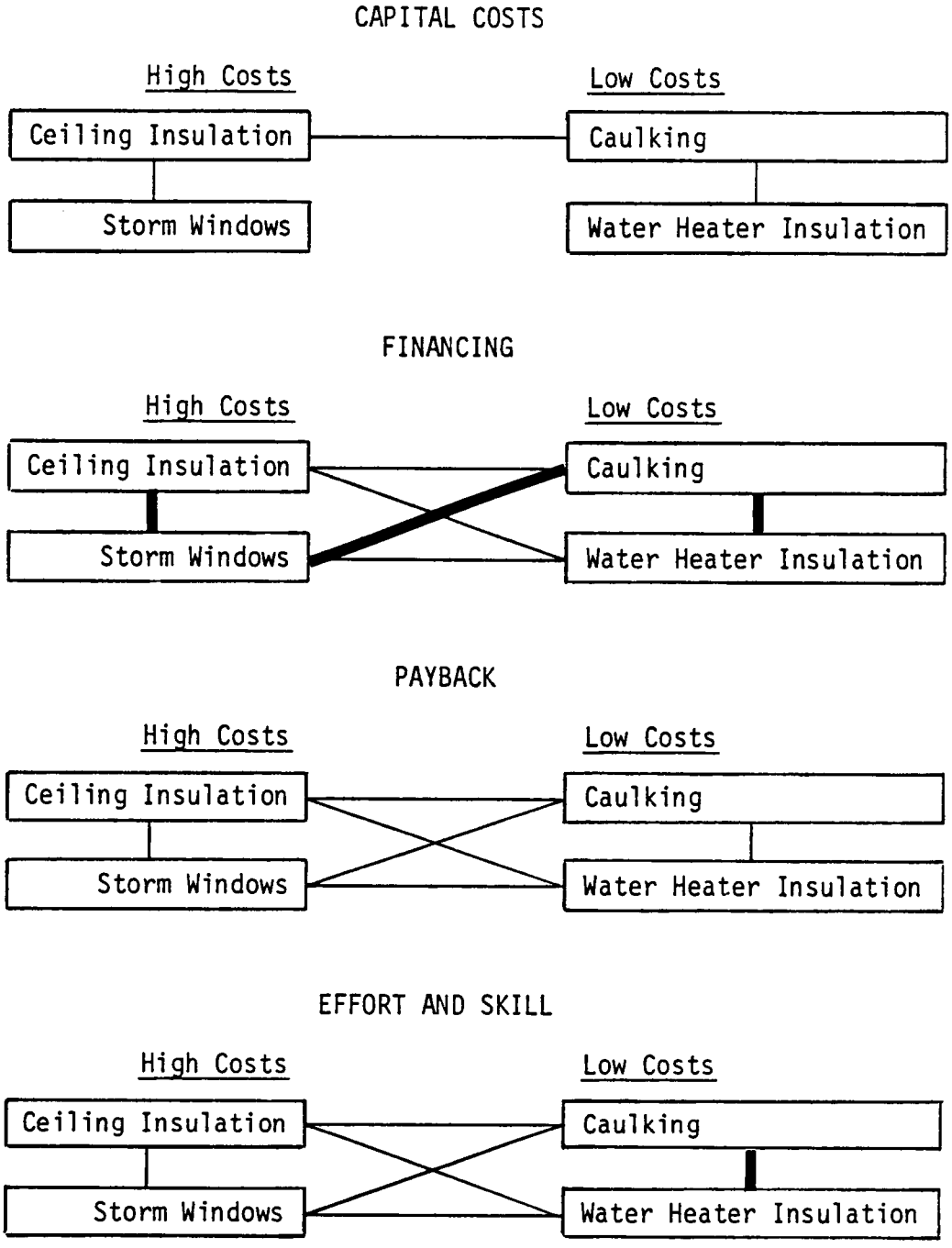
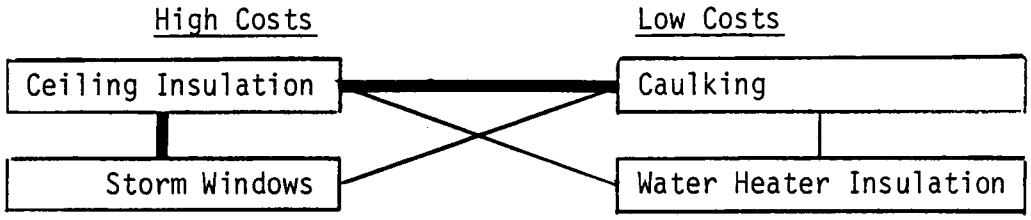


Figure 7. Graphic indication of association of a specific evaluative criteria with the use of that same criteria within four conservation measures.

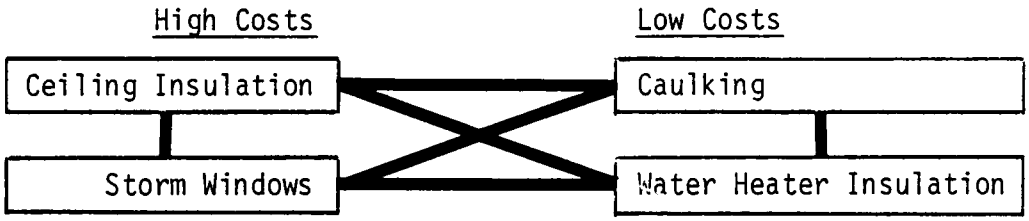
.4 ——————————

.6 ▬▬▬▬▬▬▬▬▬▬

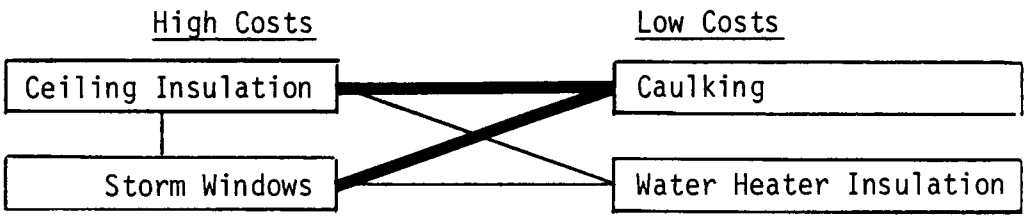
RELATIVE ADVANTAGE



SOCIAL RESPONSIBILITY



COMFORT



MOBILITY

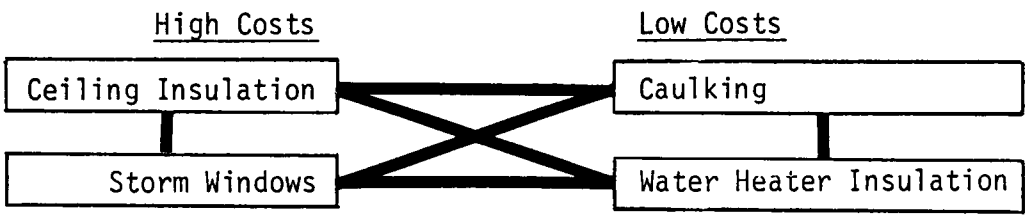


Figure 7 (continued).

Question 3: Relationship of general evaluative criteria and the percent implemented.

Are general evaluative criteria related to the percent implemented? A stepwise regression procedure was used to examine this research question. The variables used for the computation were the general measures for capital costs, financing, payback, relative advantage, effort and skill in installation, social responsibility, comfort, and mobility. These variables were significant in explaining 4% of the variance in the percent implemented between the two audit groups (see Table 23). Of these evaluative criteria, the availability of money offered the best single explanation of variance in the percent implemented by the audit groups with a significant Beta of .15.

Summary

The data gathered in this investigation support the hypothesis that different types of energy audits differentially affect implementation of energy conservation measures. Those with auditor-assisted audits implemented 15% of the audit suggestions and those with unassisted audits implemented 10% of the suggestions made in them. Further, the investigation offered limited support that this difference may be attributable to the difference in the way people perceived the audits, viewed as acceptance of the information offered in the audit. People with auditor-assistance perceived their audit as being more credible and reported greater satisfaction with the audit. While these relationships were

Table 23. Stepwise regression for the effect of evaluative criteria on the percent implemented.

Variable	R^2	R^2 change	Beta	F
	.04			2.60*
Availability of Money	.02	.02	.15	12.03*
Comfort	.03	.01	.07	2.49
Social Responsibility	.03	.00	.06	1.82
Payback	.03	.00	.06	1.80
Effort and Skill in Installation	.04	.00	.02	.27
Relative Advantage	.04	.00	.02	.32
Total Cost	.04	.00	.02	.22
Mobility	.04	.00	.01	.13

*$p < .01$. (df = 8, 534)

significant in the direction expected the model offered far lower levels of explanation than expected.

Another variable expected to be related to the type of audit was uncertainty. Uncertainty with conservation decisions made after the audit was expected to be less with auditor-assisted audits. This was not the case. The people with the unassisted audits were less uncertain with their decisions.

The need to seek additional information after the audit and before decision closure was unrelated to the type of audit. Information seeking was similar for both audit groups with about 1 person in 5 seeking additional information before decision closure.

The demographics of income, education, dwelling size, and dwelling age did not influence the type of audit chosen by the respondent, but dwelling age was a factor in the type of audit chosen. The older the home, the more likely the respondent to choose an auditor-assisted audit. This supports Combs' (1981) idea that home energy audits may be particularly useful to the owners of older homes in that the owners of older homes felt the opportunity costs of retrofits high for their dwellings.

Overall, audit type, the perceived effects of audit type, and demographics explained only 8% of the variance in implementation rates in the two groups. While there are differences in the rates of implementation of suggestions made in the two different energy audit groups, these differences are only partially attributable to the type of audit, acceptance of the audit, or demographics.

There was limited association between the general attitude about evaluative criteria and how that same criterion was used with a specific decision.

When the use of the evaluative criteria was examined within specific decisions, capital costs were found to be the only criterion associated with cost of the conservation measure. The evaluative criteria, social responsibility and mobility, were not associated with cost but were strongly associated with one another no matter what the cost of the conservation measure. This means if a consumer viewed one of these criteria as important in a decision on a specific conservation measure, that consumer also viewed that same criterion as important in another conservation decision.

General attitudes on conservation decision-making criteria, capital costs, financing, payback, relative advantage, effort and skill in installation, social responsibility, comfort, and mobility explained little about the implementation of audit suggestions.

CHAPTER V

DISCUSSION AND CONCLUSIONS

Two areas were examined in this project. First, the rate of implementation of audit suggestions was examined for two types of home energy audits, the auditor-assisted and unassisted audit, testing the possibility that different audits may be perceived as differing in essential attributes which may influence the decision to implement conservation measures. The impact of demographics on the selection of type of audit and on the implementation of audit suggestions also was investigated. The major finding was that consumers with auditor-assisted audits implemented more audit suggestions than those with unassisted audits. Variables measuring the acceptability of the audit to the consumer were significant in explaining some of the differences in implementation rates. Demographics were found not significant.

The second area of the study examined the general attitudes about evaluative criteria used in decision-making on conservation and how these same criteria were used in four specific energy conservation decisions. Although it was found that the general evaluative criteria correlated with the use of the criteria in a specific decision, this correlation was only low to moderate.

Discussion

In this study, the rate of implementation of audit suggestions differed based on the type of audit. However, the rate of audit suggestion implementation was even less than the 20% reported by Gorzelnik (1980).

Acceptance of the audit, as measured by perceived credibility of the audit and the utility, satisfaction with the audit, additional information sought, and uncertainty with the conservation decision, offered limited support that some of the variance in implementation of audit suggestions between audit types may be attributed to the acceptance of the audit to the audit participant.

The credibility of the utility company and the audit were high in comparison to other sources of energy information in this study. Of the five sources of information, information from the audit and information from the utility company ranked first and second in believability. This agreed with Arcury, Cole, Colliver, and Holland (1981) and Marsden and McKinney (1980). While the two audit groups viewed the credibility of the utility company similarly, the credibility of the audit differed significantly between the two audit groups with the auditor-assisted group perceiving the audit as more credible than the unassisted group.

Berry et al. (1981) reported audit programs they reviewed showed more than 80% of the audit participants were satisfied with their energy audits. In this study, satisfaction was associated with type of audit. Of the auditor-assisted participants, 83% were satisfied with their audit but only 62% of the

unassisted participants were satisfied. The lower levels of reported satisfaction for the unassisted audit group is even more meaningful when it is realized only 10% of those who requested the do-it-yourself, unassisted audit found it satisfactory enough to fill it out and return to the utility. The Baltimore Gas and Electric Company (1979) reported the image of the utility was enhanced by audits. This question arises: How is corporate image affected by the lower satisfaction and credibility rates of the unassisted audit?

Only 1 in 5 of the participants in this study sought additional information after their audit and before decision closure. Little has been reported in the literature relating information seeking to energy conservation decisions. But, in decisions on major appliances Katona and Mueller (1955) found one-third of their participants consulted only one source of information. By comparison, four-fifths of this sample reached decision closure after receiving the audit. This study did not measure pre-audit external information search nor did it measure information search related specifically to those conservation measures actually installed.

Regardless of audit type, people were still uncertain about the decisions they made on energy conservation measures. Penz and Yasky (1979) hypothesized that the skepticism and confusion about energy conservation technologies may encourage risk avoidance in decision-making (hence, no decision). This hypothesis was certainly not refuted by this data. An unexpected finding in this

study was that the people with unassisted audits were less uncertain with their decisions on conservation measures. An alternative hypothesis may be those with a do-it-yourself or unassisted audit were confident enough going into the audit to perform the audit and this confidence was reflected in their conservation decision-making after the audit. Confidence in one's ability to perform the unassisted audit was a self selected characteristic of the sample because only 10% of those who requested the unassisted, do-it-yourself audit actually filled it in and returned it to the utility. The sample for unassisted audits was drawn only from those who returned the audit form.

Previous studies have not related these audit-acceptance variables to the implementation of energy audit suggestions. In this study, there were differences in these audit-acceptance variables between the types of audit and these variables did contribute significantly to the explanation of the difference in the percent implemented between the two audit groups. While the relationship was, for the most part, in the direction expected the level of explanation was lower than that expected.

Demographics define both those who conserve energy and those who participate in energy audits throughout the literature. The respondents in this project fit these demographic descriptors. Like other studies of audit participants, income was higher for audit participants and there were few low income families. Even though the control group was matched for demographics with the audit groups, 13% of the control group participants reported

incomes under $15,000 and 7% of the audit groups reported incomes under $15,000. This finding agrees with Berry et al. (1981) that few low income families participate in energy audits. Education was significantly higher in the audit groups than in the control group as found in studies by Fehr, Turner, and Herman (1978) and Johnson, 1979, 1981).

Few audit surveys included information on dwelling characteristics but this study found the audit groups had both bigger and more expensive dwellings.

When demographics were examined in terms of the types of audits people chose, income and education did not differ with audit choice but the dwelling characteristics did differ with the choice of audit. Participants in the auditor-assisted audits had larger, more expensive, and older homes than the unassisted audit participants.

The effect of demographics on conservation in the literature is closely tied with conservation practices rather than the implementation of conservation measures. In this study, the demographics chosen for examination were those that defined energy conservers. These demographics, income, education, and dwelling characteristics did little in explaining the difference in the rate of implementation of audit suggestions between the two types of audits.

In the literature, the criteria a decision maker considers in making a conservation decision, referred to as evaluative criteria in this study, have been examined as a general attitude

about the particular criteria rather than the use of that criteria within a specific decision context such as in the decision on ceiling insulation, storm windows, and so forth (Combs, 1981; Cunningham & Lopreato, 1977; Darley & Beniger, 1981; Gladhart & Roosa, 1978; Leonard-Barton & Rogers, 1979). Criteria from previous research were identified as criteria people use in making decisions on energy conservation measures. Then, the following criteria were selected for the study: capital costs, payback, financing, relative advantage, mobility, effort and skill in installation, social responsibility, and comfort. Rather than evaluate individual impact of each of these as the literature has done, this study concentrated on three research questions. The first assessed whether the traditional general attitude measure of these criteria was associated with the criteria as used in specific conservation decisions. The second question examined whether the criteria used within a specific decision was used in the same way in other specific decisions. The third question examined how the traditional attitude measures of the criteria were related to the implementation of audit suggestions.

When the general attitude on each of the various evaluative criteria were considered in the deliberation of four specific conservation decisions, most of the correlations were significant but many were weak. However, the general measure of mobility was strongly associated with how mobility was considered in each of the four specific decisions, ceiling insulation, storm windows, caulking around doors and windows, and water heater insulation.

The criteria as used within a specific decision were examined to see if they were used in similar ways for high cost conservation measures and low cost conservation measures. This idea was unsupported. An alternative hypothesis that the criteria were used in similar ways in each of the four specific conservation decisions regardless of cost of the measure was upheld for the criteria of social responsibility and mobility. The correlations on each of these two criteria were very strong across all four of the conservation measures. This indicated that social responsibility and mobility are used in the same manner in each of the four specific conservation decisions. This hypothesis was not supported for capital costs, payback, financing, relative advantage, effort and skill in installation, and comfort.

The general attitude on the evaluative criteria, as traditionally measured, were analyzed to determine their effect on the percent of audit suggestions implemented. When the eight evaluative criteria were used in a stepwise regression procedure, overall it was significant in explaining the percent implemented but at a very low level. Of the criteria considered, capital costs was the single criteria that was significant within the regression. This means that as traditionally measured this criteria had the only significant impact on the implementation of conservation measures.

Limitations

The conclusions must be considered within the limitations of this project. Among the methodological limitations was the difficulty respondents had in remembering what conservation measures were suggested in their audits. A copy of the actual audit report given to the consumer was used for the analyses. But the discrepancies between the respondents' reports and the actual report cast doubt on the other responses that required respondent memory. Part of this discrepancy was undoubtedly due to the time that passed between the audit and the questionnaire. However, time between the audit and the questionnaire was necessary to allow the consumer to go through the decision-making process.

The validity and reliability of this instrument were difficult to assess. Precautions were taken to insure both validity and reliability, but tested scales or instruments had not been previously developed for the concepts studied here.

Characteristics of the quesionnaire may provide some explanation for the low R^2 in this study. It was quite lengthy because of the number of variables in the model and the effort to develop new measures. In analysis, many of these questions did not prove reliable and in the end only burdened the respondent with extra questions to answer. Even though pretesting steps were followed, some questions were difficult for respondents to interpret and follow through. The length and the

interpretation of questions may have led to some inconsistencies in the data.

The generalizability of the data presented may be geographically limited. Weather as a consequence of geography may be an important factor in the implementation decision. It is unknown how climate affects one's perceived need for conservation measures. This evaluative criteria could not be included in this study because of the limited nature of the sample.

Another limitation of the study may be the self-selection aspects of the sample. It is not known what effect those who did not respond to the questionnaire might have had on the results. Further, no attempt was made to contact any members of the original sample who did not respond to the questionnaire to establish a comparison of those who responded and those who did not respond.

Further Research

This project, although grounded in theory, was exploratory in many respects. The surface just has been scratched in explaining the differences between the two types of audits. The percent of conservation measures implemented differed by 5% between the two groups. Because of the difference in energy saving impact of different audit suggestions, it is important to explore the 5% difference to see what the difference in energy savings might be.

The differences in implementation rates for each conservation measure need to be studied. If both types of audits are encouraging the implementation of measures which produce equal energy savings, then the case for unassisted audits might well be supported. But, if the auditor-assisted audit produces implementation of measures with significantly higher energy savings, then the effort and cost may be well justified.

The factors identified in this study to differentiate between the audits, both audit-acceptance and demographics, offered little explanation about the difference between two audits. Further work needs to be done to identify the differences between the audits that result in different implementation rates.

Work also needs to be done in the area of implementation of energy conservation measures in the general population so comparisons can be made between audit and control groups. The next step is to work on calculating a percent implemented measure that controls for people having different need or demand levels. The energy audit defines the need and simplifies the measurement of whether the need has been met. To measure within the general population without an investigator going into the house to assess the situation is difficult. Self-report measures seem to be unreliable in this area because of the complicated nature of making the technical assessments.

Conclusion

Different types of energy audits do encourage different rates of implementation of the suggestions made in the energy audits. Respondents who received auditor-assisted audits did report having greater satisfaction with the audit and seeing greater credibility in both the audit and the utility than those who received unassisted audits. While it was also the auditor-assisted group who implemented more audit suggestions it did not follow that this was a result of either satisfaction or credibility.

The need to seek additional information after the audit and before decision closure was unrelated to type of audit. Information seeking was similar for both groups with about 1 person in 5 seeking additional information before decision closure. But for 80% of both audit group samples, information search was concluded with the audit.

It is concluded that consumer uncertainty in energy conservation decisions is not eliminated with energy audits. In other words, the audit is not totally convincing to the consumer with the mix of information and personnel presented to the consumer.

It may be concluded that when the various evaluative criteria considered in the deliberation of a conservation decision were measured with the traditional general attitude, respondents' answers did not highly correlate with how the respondent reported using that criterion in the decision on a specific conservation

measure, except on the criterion of mobility. Nor was the use of the criteria used consistent between conservation measures. Therefore, this indicated that acceptance of consumers' reports on general attitudes on conservation may be only that, general attitudes, and those attitudes might well change when applied within the consumer's own specific conservation decisions.

Perhaps one of the explanations of the low R^2 in the study is the choice of the decision-making model. This study assumed a normative, economic decision-making model. This model presumes household decision makers (family members) share common goals and make decisions by sorting out and examining all evaluative criteria one by one. The normative, economic decision-making model is a traditional, multiple goal, resource allocation model. Many other decision-making models exist which do not rest on this premise.

Energy conservation could be examined through Diesing's (1962) social decision model which assumes differences in goals held by decision-makers and examines the process of resolving these differences. Although Americans are aware of the recent dramatic increase in energy costs, they have yet to restructure values about energy and family roles in living with those new values. Maybe the focus in energy conservation research should be the process of resolving this change. The implication for future research would be to include variables to define the process of the conservation decision such as couple interaction, decision process, and the power structure of the family.

Another possible model to study energy conservation implementation, also by Diesing (1962), is the technical model. The model views families focusing on a single goal within resource limits. Within this model, the one goal is conservation and the audit presents the alternatives for allocation of resources.

Implications for Utility Companies

The findings from this study suggest two main implications for utility companies. The first is the use of the unassisted audit. Based on only a 5% difference in implementation rates, the utility may question whether to offer the auditor-assisted audits as these are far most costly to the utility because they involve a personal visit to the house. To test the value of the audit, the participation rate of consumers in one program versus another must be examined. For every two participants who asked for an auditor-assisted audit, eight asked for an unassisted audit, but only one of those eight returned the audit and that one implemented 10% of the conservation measures suggested. However, the two participants requesting the auditor-assisted audit, each implemented 15% of the conservation measures suggested. This means the difference in implementation rates between the two groups is greater than the 15% versus the 10% reflected in the analyses.

The second implication from this study is the type of information presented in the audit report. Payback statistics for each suggested conservation measure were the only information

provided in the audit report. Payback orients the decision-maker toward a future time orientation in making a decision on conservation measures. In a small study of families in high and low socio-economic groups, it was found that consumers in neither group used a future orientation in decision-making (Hogan, 1977). Rather, decisions by these consumers were based on past experience, not future consequences.

Information on any of the other evaluative criteria used in this study was not provided in the audit report. By using a singular argument, payback, for installing conservation measures, this utility and all others who present audit reports in this way are presenting information to the homeowner with only one argument for the installation of conservation measures. This study showed that people consider more than payback in the energy conservation decision. Also, many respondents had a great deal of uncertainty associated with conservation measures as a good investment. Information about payback alone may not alleviate this uncertainty. These data suggest utility companies need to be looking at additional kinds of information to provide the consumer with additional dimensions on which to base the conservation decision.

A further issue to consider is whether audits are the most effective or desirable strategies for achieving energy conservation. While energy audits have potential, the utility company may wish to reinforce it with other strategies. Not all energy

problems can be addressed through retrofits suggested in an audit. For example, utility companies are also concerned with load control and peak usage. Differential pricing of rates around peak loads may provoke necessary behavioral changes more effectively than audits.

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APPENDIXES

APPENDIX A

INSTRUCTIONS

This questionnaire should only take 20 minutes or less to fill out. PLEASE MARK YOUR ANSWERS BY MAKING A CIRCLE AROUND THE NUMBER CORRESPONDING TO THE RESPONSE YOU SELECT. DO NOT PUT YOUR NAME ON THIS FORM. If you have additional comments to make about this survey, a space is provided on the back cover.

Have you had an audit on this residence other than your [redacted] audit in 1982? [1]*

1. NO
2. YES, BY [redacted] IN_____(YEAR)
3. YES, BY ANOTHER ORGANIZATION OR PERSON

WHO _____

YEAR _____

In 1982, which [redacted] audit did you have:(circle number) [2]

1. I HAD THE ENERGY AUDITOR FROM [redacted] COME TO MY HOME.
2. I HAD THE DO-IT-YOURSELF AUDIT.

(If you had the energy auditor)

While the [redacted] auditor was at your home did you: [3]

1. ACCOMPANY AUDITOR THROUGH HOUSE OVER HALF THE TIME AND LISTENED TO THE EXPLANATIONS.
2. STAYED WITH AUDITOR LESS THAN HALF THE TIME.
3. DID NOT ACCOMPANY AUDITOR AT ALL

How helpful was the auditor to your understanding of your audit? [4]

1. VERY HELPFUL
2. SOMEWHAT HELPFUL
3. NOT AT ALL HELPFUL
4. I WOULD HAVE RATHER DONE THE DO-IT-YOURSELF AUDIT

(If you had the do-it-yourself audit)

How did you feel about the "Residential Energy Analysis Input Form"? [5]

1. VERY DIFFICULT TO FILL OUT
2. DIFFICULT TO FILL OUT
3. IT WAS O.K.
4. EASY TO FILL OUT
5. VERY EASY TO FILL OUT

*Numbers did not appear on original questionnaires as per Dillman's (1978) Total Design Method.

The following statements express opinions people may have about their energy audit. Do you agree or disagree with these statements. (circle number for each statement)	STRONGLY DISAGREE		NEITHER AGREE OR DISAGREE		STRONGLY AGREE	
The audit report was informative.	1	2	3	4	5	[6]
I could understand the audit report.	1	2	3	4	5	[7]
The information I received on my audit report seemed accurate compared with other information I have seen on energy conservation.	1	2	3	4	5	[8]
The audit program is worthwhile.	1	2	3	4	5	[9]
The audit report I received provides an accurate source of information on what needs to be done to make my home more energy efficient.	1	2	3	4	5	[10]
The audit met my expectations.	1	2	3	4	5	[11]
Overall, I was satisfied with the audit (from request for the audit through the report received).	1	2	3	4	5	[12]

Once you received your energy audit report, did you consult any additional sources of energy conservation information before you decided whether or not to install any of the suggestions? (circle the number) [13]

1. NO
2. YES, ONLY ONE
3. YES, MORE THAN ONE

If yes, how helpful was that information in making your decision? [14]

1. VERY HELPFUL
2. HELPFUL
3. NOT AT ALL HELPFUL

What was the primary reason you requested your energy audit (circle one) [15]

1. CURIOUS ABOUT THE "ENERGY CONDITION" OF MY HOME
2. NEEDED INFORMATION ABOUT HOW TO CONSERVE ENERGY IN THIS HOUSE
3. LOOKING FOR SOME WAY TO LOWER MONTHLY UTILITY BILL
4. WANTED TO SEE WHAT THE AUDIT WAS ABOUT
5. OTHER, PLEASE SPECIFY _____

Audit suggestions vary in cost. What do you think is a fair amount of time to get your money back, through lower utility bills, for the following investments. (circle number)

	LESS THAN 1 YEAR	1 TO 2 YEARS	3 TO 5 YEARS	6 TO 10 YEARS	OVER 10 YEARS	
A $100 investment	1	2	3	4	5	[16]
A $300 investment	1	2	3	4	5	[17]
A $1000 investment	1	2	3	4	5	[18]

Overall, how do you rate the following sources of information on energy conservation techniques.

	VERY BELIEVABLE		SOMEWHAT BELIEVABLE		NOT AT ALL BELIEVABLE	
Federal Government	1	2	3	4	5	[19]
Newspapers, magazines	1	2	3	4	5	[20]
Utility company	1	2	3	4	5	[21]
Manufacturers' Literature	1	2	3	4	5	[22]
Radio, TV	1	2	3	4	5	[23]
Energy Audits	1	2	3	4	5	[24]

Do you own or rent where you live? [25]

1. Rent
2. OWN

How long have you lived at this address? [26]

1. LESS THAN 1 YEAR
2. 1 YEAR TO 23 MONTHS
3. 2 TO 4 YEARS
4. 5 YEARS OR MORE

If you have lived here less than 5 years, how many times have you moved your household since 1979. [27]

1. FOUR OR MORE TIMES
2. THREE TIMES
3. TWICE
4. ONCE

How probable is it that you will move in the next 3 years? [28]

1. VERY PROBABLE
2. PROBABLE
3. POSSIBLE
4. NOT AT ALL LIKELY

Below are listed some opinions that people have had about implementing energy conservation measures. Indicate whether you agree or disagree with each statement. (circle number for each statement.

	STRONGLY DISAGREE		NEITHER AGREE OR DISAGREE		STRONGLY AGREE	
I can see advantages in installing at least some energy conservation measures.	1	2	3	4	5	[29]
Decisions to implement or not implement energy conservation measures are more difficult to make than other household decisions.	1	2	3	4	5	[30]
Someone in this household is able to do the work involved in installing minor energy conservation measures.	1	2	3	4	5	[31]
Someone in this household is able to do the work involved in installing major energy conservation measures.	1	2	3	4	5	[32]
Skilled members of the household have the time to make repairs and improvements.	1	2	3	4	5	[33]
The structure of my home would make it difficult to change to make it more energy efficient.	1	2	3	4	5	[34]
Available contractors can be counted on to do a good job in installing conservation measures.	1	2	3	4	5	[35]
A person in this household could arrange, monitor, and check contractors installing energy conservation measures.	1	2	3	4	5	[36]
I am unsure about what the cost of energy will be in the next few years.	1	2	3	4	5	[37]
It is hard to tell whether energy conservation measures will really work even after they are implemented.	1	2	3	4	5	[38]
In general, I feel uncertain with the decisions I make concerning conservation measures.	1	2	3	4	5	[39]
Energy conservation improvements increase the value of a home.	1	2	3	4	5	[40]

A major concern about implementing energy conservation measures is their cost. Do you agree or disagree with the statements below on the cost of implementing energy conservation measures. (circle number for each statement)	STRONGLY DISAGREE		NEITHER AGREE OR DISAGREE		STRONGLY AGREE	
The total cost of implementing energy conservation measures is more than I am willing to pay.	1	2	3	4	5	[41]
I have the money available (without borrowing) to install energy conservation measures if I choose to do so.	1	2	3	4	5	[42]
I must get back all the money I put into installing conservation measures through reduced utility bills.	1	2	3	4	5	[43]
The benefits of inplementing energy conservation measures are greater than what they cost.	1	2	3	4	5	[44]
I am willing to obtain a loan for installing energy conservation measures if I choose to install them.	1	2	3	4	5	[45]
In general, energy-related home improvements will save more money in the long run than they will cost to make.	1	2	3	4	5	[46]
Interest rates for energy conservation measures are higher than I care to pay.	1	2	3	4	5	[47]
If a low or no interest loan for installing conservation measures was available from a government agency, I would be willing to apply for it.	1	2	3	4	5	[48]
The cost of materials for energy conservation measures is more than I am willing to pay.	1	2	3	4	5	[49]
The cost of a contractor to install conservation measures is more than I am willing to pay.	1	2	3	4	5	[50]
The energy tax credit is an important consideration for me in installing conservation measures.	1	2	3	4	5	[51]

The statements on this page are about energy usage. How closely do they reflect your family's energy use. (circle number)

	STRONGLY DISAGREE		NEITHER AGREE OR DISAGREE		STRONGLY AGREE	
Our household spends too much for energy.	1	2	3	4	5	[52]
While others might tolerate turning off the air conditioner in the summer, my own need for being cool is high.	1	2	3	4	5	[53]
Our family is willing to put on extra clothing to avoid turning up the heat in the winter.	1	2	3	4	5	[54]
Having the house a comfortable temperature comes before the cost of energy in this household.	1	2	3	4	5	[55]
I feel personal satisfaction when I conserve energy in my home.	1	2	3	4	5	[56]
Implementation of energy conservation measures can make a home more comfortable.	1	2	3	4	5	[57]
Our household uses too much energy.	1	2	3	4	5	[58]
If everyone in the country tried to conserve energy at home, there would be a real impact upon the nation's overall energy consumption.	1	2	3	4	5	[59]
I am concerned that energy will not be available for future generations.	1	2	3	4	5	[60]
Energy costs for heating a home will rise faster than the rate of inflation in the years to come.	1	2	3	4	5	[61]
Do you feel you could do more to save energy in your home.	1	2	3	4	5	[62]

For each of these conservation measures:		Answer here first (circle number)				Answer here second (For audit suggested items only)				
		HERE WHEN I MOVED IN	I DID THIS BEFORE AUDIT	SUGGESTED IN MY AUDIT		I HAVE DONE THIS	I PLAN TO DO THIS	WILL NOT DO THIS	NOT YET DECIDED	
[63]	Ceiling insulation	1	2	3	[79]	1	2	3	4	[95]
[64]	Attic ventilation	1	2	3	[80]	1	2	3	4	[96]
[65]	Wall insulation	1	2	3	[81]	1	2	3	4	[97]
[66]	Floor insulation	1	2	3	[82]	1	2	3	4	[98]
[67]	Storm/insulated windows	1	2	3	[83]	1	2	3	4	[99]
[68]	Shading sun exposed glass	1	2	3	[84]	1	2	3	4	[100]
[69]	Caulking doors/windows	1	2	3	[85]	1	2	3	4	[101]
[70]	Weatherstripping doors/ windows	1	2	3	[86]	1	2	3	4	[102]
[71]	Water heater insulation wrap	1	2	3	[87]	1	2	3	4	[103]
[72]	Clock thermostat	1	2	3	[88]	1	2	3	4	[104]
[73]	Duct insulation	1	2	3	[89]	1	2	3	4	[105]
[74]	Pipe insulation	1	2	3	[90]	1	2	3	4	[106]
[75]	Flue opening modification	1	2	3	[91]	1	2	3	4	[107]
[76]	Electrical or mechanical ignition systems	1	2	3	[92]	1	2	3	4	[108]
[77]	Furnace repalcement	1	2	3	[93]	1	2	3	4	[109]
[78]	Air conditioner replacement	1	2	3	[94]	1	2	3	4	[110]

We would like to ask some questions about your household.

Your sex (circle number) [111]

1. MALE
2. FEMALE

Your age [112]

1. UNDER 30
2. 30 TO 39
3. 40 TO 49
4. 50 TO 59
5. OVER 60

Are you employed outside the home? [113]

1. FULL TIME
2. PART TIME
3. NOT EMPLOYED OR RETIRED

What is the highest level of education that you have completed? [114]

1. LESS THAN HIGH SCHOOL
2. HIGH SCHOOL OR GED
3. SOME COLLEGE OR POST HIGH SCHOOL TRAINING
4. GRADUATED FROM COLLEGE
5. POST GRADUATE STUDY

What is your present maritial status? [115]

1. NEVER MARRIED
2. MARRIED
3. DIVORCED
4. SEPARATED
5. WIDOWED

If you are married, please answer the following questions about your spouse:

If married, what is your spouse's age? [116]

1. UNDER 30
2. 30 TO 39
3. 40 TO 49
4. 50 TO 59
5. OVER 60

If married, is your spouse employed outside the home? [117]

1. FULL TIME
2. PART TIME
3. NOT EMPLOYED OR RETIRED

If married, what is the highest level of education completed by your spouse? [118]

1. LESS THAN HIGH SCHOOL
2. HIGH SCHOOL OR GED
3. SOME COLLEGE OR POST HIGH SCHOOL TRAINING
4. GRADUATED FROM COLLEGE
5. POST GRADUATE STUDY

Are there children in the household? [119]

1. NO
2. YES

If yes, give the number in each of the following age catagories.(write number in each space, if none write 0)

____ UNDER 5 YEARS [120]

____ 5 TO 13 YEARS [121]

____ 14 TO 18 YEARS [122]

____ 19 TO 24 YEARS [123]

Approximately how many years old is your house? (write in number) [124]

_____ years old

Approximately how many heated square feet are in your home? (circle number) [125]

1. LESS THAN 500
2. 500 TO 999
3. 1000 TO 1499
4. 1500 TO 1999
5. 2000 TO 2499
6. 2500 TO 2999
7. 3000 to 3499
8. MORE THAN 3500

Please indicate what you believe the value of your home is: (circle number) [126]

1. UNDER $25,000
2. 25,000 TO 49,999
3. 50,000 TO 74,999
4. 75,000 TO 99,999
5. OVER 100,000

Approximately how much have you invested in energy conservation measures in the past 3 years. [127]

1. 0 TO $99
2. 100 TO 499
3. 500 TO 999
4. 1000 TO 1999
5. OVER 2000

Approximately how much are you willing to invest in energy conservation measures in the next 3 years. [128]

1. 0 TO $99
2. 100 TO 499
3. 500 TO 999
4. 1000 TO 1999
5. OVER 2000

Have you installed energy conservation measures in a previous residence? [129]

1. YES
2. NO

What was your approximate family income from all sources last year--before taxes? (circle number) [130]

1. UNDER $5,000
2. 5000 TO 9,999
3. 10,000 TO 14,999
4. 15,000 TO 19,999
5. 20,000 TO 24,999
6. 25,000 TO 29,999
7. 30,000 TO 34,999
8. 35,000 TO 39,999
9. OVER 40,000

INSTRUCTIONS

On the next 4 pages are listed 4 of the most common audit suggestions. If your audit suggested any of these items please answer the questions listed beneath.

CEILING INSULATION

Did your audit make this suggestion?

1. NO, go to next page → [131]
2. YES, answer these questions

How important were these considerations in deciding whether or not to install ceiling insulation (circle one number for each consideration listed).

	NOT IMPORTANT		SOMEWHAT IMPORTANT		VERY IMPORTANT	DID NOT CONSIDER THIS	
A. Effort and skill required for the job or getting a qualified person to do the job	1	2	3	4	5	0	[132]
B. Getting my money back on my investment in a resaonable time	1	2	3	4	5	0	[133]
C. Cost to do this	1	2	3	4	5	0	[134]
D. Providing energy for future generations	1	2	3	4	5	0	[135]
E. Improving the comfort of my home	1	2	3	4	5	0	[136]
F. Doing this seems to be of greater benefit than not doing this.	1	2	3	4	5	0	[137]
G. Having money or getting a loan	1	2	3	4	5	0	[138]
H. I may be moving soon	1	2	3	4	5	0	[139]

IF YOU HAVE DONE THIS SUGGESTION:

How difficult was it to decide to install ceiling insulation? [140]

1. VERY DIFFICULT
2. DIFFICULT
3. NEITHER DIFFICULT OR EASY
4. EASY
5. VERY EASY

Who did the work: (circle one that applies) [141]

1. OUR HOUSEHOLD DID THE WORK
2. OUR HOUSEHOLD HIRED SOMEONE TO DO THE WORK

Our approximate cost for this suggestion was: (write in amount) [142]

$ _____

CAULKING WINDOWS AND DOORS

Did your audit make this suggestion?

1. NO, go to next page → [143]
2. YES, answer these questions

How important were these considerations in deciding whether or not to install caulking around windows and doors (circle one number for each consideration).

	NOT IMPORTANT		SOMEWHAT IMPORTANT		VERY IMPORTANT	DID NOT CONSIDER THIS	
A. Effort and skill required for the job or getting a qualified person to do the job	1	2	3	4	5	0	[144]
B. Getting my money back on my investment in a resaonable time	1	2	3	4	5	0	[145]
C. Cost to do this	1	2	3	4	5	0	[146]
D. Providing energy for future generations	1	2	3	4	5	0	[147]
E. Improving the comfort of my home	1	2	3	4	5	0	[148]
F. Doing this seems to be of greater benefit than not doing this.	1	2	3	4	5	0	[149]
G. Having money or getting a loan	1	2	3	4	5	0	[150]
H. I may be moving soon	1	2	3	4	5	0	[151]

IF YOU HAVE DONE THIS SUGGESTION:

How difficult was it to decide to install caulking around windows and doors? [152]

1. VERY DIFFICULT
2. DIFFICULT
3. NEITHER DIFFICULT OR EASY
4. EASY
5. VERY EASY

Who did the work: (circle one that applies) [153]

1. OUR HOUSEHOLD DID THE WORK
2. OUR HOUSEHOLD HIRED SOMEONE TO DO THE WORK

Our approximate cost for this suggestion was: (write in amount) [154]

$ _____

STORM OR INSULATED WINDOWS

Did your audit make this suggestion?

1. NO, go to next page → [155]
2. YES, answer these questions

How important were these considerations in deciding whether or not to install storm or insulated windows (circle one number for each consideration listed).

	NOT IMPORTANT		SOMEWHAT IMPORTANT		VERY IMPORTANT	DID NOT CONSIDER THIS	
A. Effort and skill required for the job or getting a qualified person to do the job	1	2	3	4	5	0	[156]
B. Getting my money back on my investment in a resaonable time	1	2	3	4	5	0	[157]
C. Cost to do this	1	2	3	4	5	0	[158]
D. Providing energy for future generations	1	2	3	4	5	0	[159]
E. Improving the comfort of my home	1	2	3	4	5	0	[160]
F. Doing this seems to be of greater benefit than not doing this.	1	2	3	4	5	0	[161]
G. Having money or getting a loan	1	2	3	4	5	0	[162]
H. I may be moving soon	1	2	3	4	5	0	[163]

IF YOU HAVE DONE THIS SUGGESTION:

How difficult was it to decide to install storm or insulated windows? [164]

1. VERY DIFFICULT
2. DIFFICULT
3. NEITHER DIFFICULT OR EASY
4. EASY
5. VERY EASY

Who did the work: (circle one that applies) [165]

1. OUR HOUSEHOLD DID THE WORK
2. OUR HOUSEHOLD HIRED SOMEONE TO DO THE WORK

Our approximate cost for this suggestion was: (write in amount) [166]

$ _____

WATER HEATER INSULATION

Did your audit make this suggestion?

1. NO, go to next page → [167]
2. YES, answer these questions

How important were these considerations in deciding whether or not to install water heater insulation (circle one number for each consideration listed).

	NOT IMPORTANT		SOMEWHAT IMPORTANT		VERY IMPORTANT	DID NOT CONSIDER THIS	
A. Effort and skill required for the job or getting a qualified person to do the job	1	2	3	4	5	0	[168]
B. Getting my money back on my investment in a resaonable time	1	2	3	4	5	0	[169]
C. Cost to do this	1	2	3	4	5	0	[170]
D. Providing energy for future generations	1	2	3	4	5	0	[171]
E. Improving the comfort of my home	1	2	3	4	5	0	[172]
F. Doing this seems to be of greater benefit than not doing this.	1	2	3	4	5	0	[173]
G. Having money or getting a loan	1	2	3	4	5	0	[174]
H. I may be moving soon	1	2	3	4	5	0	[175]

IF YOU HAVE DONE THIS SUGGESTION:

How difficult was it to decide to install water heater insulation? [176]

1. VERY DIFFICULT
2. DIFFICULT
3. NEITHER DIFFICULT OR EASY
4. EASY
5. VERY EASY

Who did the work: (circle one that applies) [177]

1. OUR HOUSEHOLD DID THE WORK
2. OUR HOUSEHOLD HIRED SOMEONE TO DO THE WORK

Our approximate cost for this suggestion was: (write in amount) [178]

$ _____

Does anyone share this household with you? [179]

1. NO
2. YES, answer the next two questoins

Did this person participate in making decisions about the audit suggestions? [180]

1. YES, MORE THAN I
2. YES, WE PARTICIPATED EQUALLY
3. YES, LESS THAN I
4. NO, NOT AT ALL

If one person participated more than the other for this decision, what was the reason (circle one number) [181]

1. ONE PERSON WOULD NOT PARTICIPATE MORE
2. ONE PERSON KNEW MORE ABOUT ENERGY MATTERS
3. ONE PERSON SHOULD MAKE THE DECISIONS ABOUT ENERGY MATTERS
4. ONE PERSON KNEW MORE ABOUT FAMILY FINANCES FOR MAJOR PURCHASES
5. ONE PERSON IS IN CHARGE OF INSTALLING CONSERVATION MEASURES
6. OTHER, PLEASE SPECIFY _____

Is there anything else you would like to tell us about your energy audit or your decision whether or not to implement the suggestions made in your energy audit? If so, please use this space for that purpose.

Also, any comments you wish to make that you think may help us provide families with more helpful energy audit information will be appreciated.

Your contribution to this effort is very much appreciated.

APPENDIX B

INSTRUCTIONS:

This 9 page questionnaire should only take 15 minutes or less to fill out. PLEASE MARK YOUR ANSWERS BY MAKING A CIRCLE AROUND THE NUMBER CORRESPONDING TO THE RESPONSE YOU SELECT. DO NOT PUT YOUR NAME ON THIS FORM. If you have additional comments about this survey, a space is provided on the back cover.

Do you own or rent where you live? [1]*

1. RENT
2. OWN

How long have you lived at this address? [2]

1. LESS THAN 1 YEAR
2. 1 YEAR TO 23 MONTHS
3. 2 TO 4 YEARS
4. 5 YEARS OR MORE

If you have lived here less than 5 years, how many times have you moved your household since 1979? [3]

1. FOUR OR MORE TIMES
2. THREE TIMES
3. TWICE
4. ONCE

How probable is it that you will move in the next 3 years? [4]

1. VERY PROBABLE
2. PROBABLE
3. POSSIBLE
4. NOT AT ALL LIKELY

*Numbers did not appear on original questionnaires as per Dillman's (1978) Total Design Method.

Below are listed some opinions that people have had about implementing energy conservation measures. Indicate whether you agree or disagree with each statement. (circle number for each statement.

	STRONGLY DISAGREE		NEITHER AGREE OR DISAGREE		STRONGLY AGREE	
I can see advantages in installing at least some energy conservation measures.	1	2	3	4	5	[5]
Decisions to implement or not implement energy conservation measures are more difficult to make than other household decisions.	1	2	3	4	5	[6]
Someone in this household is able to do the work involved in installing minor energy conservation measures.	1	2	3	4	5	[7]
Someone in this household is able to do the work involved in installing major energy conservation measures.	1	2	3	4	5	[8]
Skilled members of the household have the time to make repairs and improvements.	1	2	3	4	5	[9]
The structure of my home would make it difficult to change to make it more energy efficient.	1	2	3	4	5	[10]
Available contractors can be counted on to do a good job in installing conservation measures.	1	2	3	4	5	[11]
A person in this household could arrange, monitor, and check contractors installing energy conservation measures.	1	2	3	4	5	[12]
I am unsure about what the cost of energy will be in the next few years.	1	2	3	4	5	[13]
It is hard to tell whether energy conservation measures will really work even after they are implemented.	1	2	3	4	5	[14]
In general, I feel uncertain with the decisions I make concerning conservation measures.	1	2	3	4	5	[15]
Energy conservation improvements increase the value of a home.	1	2	3	4	5	[16]

A major concern about implementing energy conservation measures is their cost. Do you agree or disagree with the statements below on the cost of implementing energy conservation measures. (circle number for each statement)	STRONGLY DISAGREE		NEITHER AGREE OR DISAGREE		STRONGLY AGREE	
The total cost of implementing energy conservation measures is more than I am willing to pay.	1	2	3	4	5	[17]
I have the money available (without borrowing) to install energy conservation measures if I choose to do so.	1	2	3	4	5	[18]
I must get back all the money I put into installing conservation measures through reduced utility bills.	1	2	3	4	5	[19]
The benefits of inplementing energy conservation measures are greater than what they cost.	1	2	3	4	5	[20]
I am willing to obtain a loan for installing energy conservation measures if I choose to install them.	1	2	3	4	5	[21]
In general, energy-related home improvements will save more money in the long run than they will cost to make.	1	2	3	4	5	[22]
Interest rates for energy conservation measures are higher than I care to pay.	1	2	3	4	5	[23]
If a low or no interest loan for installing conservation measures was available from a government agency, I would be willing to apply for it.	1	2	3	4	5	[24]
The cost of materials for energy conservation measures is more than I am willing to pay.	1	2	3	4	5	[25]
The cost of a contractor to install conservation measures is more than I am willing to pay.	1	2	3	4	5	[26]
The energy tax credit is an important consideration for me in installing conservation measures.	1	2	3	4	5	[27]

The statements on this page are about energy usage. How closely do they reflect your family's energy use. (circle number)

	STRONGLY DISAGREE		NEITHER AGREE OR DISAGREE		STRONGLY AGREE	
Our household spends too much for energy.	1	2	3	4	5	[28]
While others might tolerate turning off the air conditioner in the summer, my own need for being cool is high.	1	2	3	4	5	[29]
Our family is willing to put on extra clothing to avoid turning up the heat in the winter.	1	2	3	4	5	[30]
Having the house a comfortable temperature comes before the cost of energy in this household.	1	2	3	4	5	[31]
I feel personal satisfaction when I conserve energy in my home.	1	2	3	4	5	[32]
Implementation of energy conservation measures can make a home more comfortable.	1	2	3	4	5	[33]
Our household uses too much energy.	1	2	3	4	5	[34]
If everyone in the country tried to conserve energy at home, there would be a real impact upon the nation's overall energy consumption.	1	2	3	4	5	[35]
I am concerned that energy will <u>not</u> be available for future generations.	1	2	3	4	5	[36]
Energy costs for heating a home will rise faster than the rate of inflation in the years to come.	1	2	3	4	5	[37]
Do you feel <u>you</u> could do more to save energy in your home.	1	2	3	4	5	[38]

We would like to ask some questions about your household.

Your sex (circle number) [39]

1. MALE
2. FEMALE

Your age [40]

1. UNDER 30
2. 30 TO 39
3. 40 TO 49
4. 50 TO 59
5. OVER 60

Are you employed outside the home? [41]

1. FULL TIME
2. PART TIME
3. NOT EMPLOYED OR RETIRED

What is the highest level of education that you have completed? [42]

1. LESS THAN HIGH SCHOOL
2. HIGH SCHOOL OR GED
3. SOME COLLEGE OR POST HIGH SCHOOL TRAINING
4. GRADUATED FROM COLLEGE
5. POST GRADUATE STUDY

What is your present maritial status? [43]

1. NEVER MARRIED
2. MARRIED
3. DIVORCED
4. SEPARATED
5. WIDOWED

If you are married, please answer the following questions about your spouse:

If married, what is your spouse's age? [44]

1. UNDER 30
2. 30 TO 39
3. 40 TO 49
4. 50 TO 59
5. OVER 60

If married, is your spouse employed outside the home? [45]

1. FULL TIME
2. PART TIME
3. NOT EMPLOYED OR RETIRED

If married, what is the highest level of education completed by your spouse? [46]

1. LESS THAN HIGH SCHOOL
2. HIGH SCHOOL OR GED
3. SOME COLLEGE OR POST HIGH SCHOOL TRAINING
4. GRADUATED FROM COLLEGE
5. POST GRADUATE STUDY

Are there children in the household? [47]

1. NO
2. YES

If yes, give the number in each of the following age catagories.(write number in each space, if none write 0)

_____ UNDER 5 YEARS [48]

_____ 5 TO 13 YEARS [49]

_____ 14 TO 18 YEARS [50]

_____ 19 TO 24 YEARS [51]

Approximately how many years old is your house? (write in number) [52]

_____ years old

Approximately how many heated square feet are in your home? (circle number) [53]

1. LESS THAN 500
2. 500 TO 999
3. 1000 TO 1499
4. 1500 TO 1999
5. 2000 TO 2499
6. 2500 TO 2999
7. 3000 to 3499
8. MORE THAN 3500

Please indicate what you believe the value of your home is: (circle number) [54]

1. UNDER $25,000
2. 25,000 TO 49,999
3. 50,000 TO 74,999
4. 75,000 TO 99,999
5. OVER 100,000

Approximately how much have you invested in energy conservation measures in the past 3 years. [55]

1. 0 TO $99
2. 100 TO 499
3. 500 TO 999
4. 1000 TO 1999
5. OVER 2000

Approximately how much are you willing to invest in energy conservation measures in the next 3 years. [56]

1. 0 TO $99
2. 100 TO 499
3. 500 TO 999
4. 1000 TO 1999
5. OVER 2000

Have you installed energy conservation measures in a previous residence? [57]

1. YES
2. NO

What was your approximate family income from all sources last year--before taxes? (circle number) [58]

1. UNDER $5,000
2. 5000 TO 9,999
3. 10,000 TO 14,999
4. 15,000 TO 19,999
5. 20,000 TO 24,999
6. 25,000 TO 29,999
7. 30,000 TO 34,999
8. 35,000 TO 39,999
9. OVER 40,000

INSTRUCTIONS

On the next 4 pages are listed 4 of the most common audit suggestions. If your audit suggested any of these items please answer the questions listed beneath.

For each of the conservation measures listed below, indicate which were in your home when you moved in, which you have done, which you plan to do, and which you will not do (circle number)

	WAS HERE WHEN I MOVED IN	I HAVE DONE THIS	I PLAN TO DO THIS	WILL NOT DO THIS	NOT YET DECIDED	
Ceiling insulation	1	2	3	4	5	[59]
Attic ventilation	1	2	3	4	5	[60]
Wall insulation	1	2	3	4	5	[61]
Floor insulation	1	2	3	4	5	[62]
Storm/insulated windows	1	2	3	4	5	[63]
Shading sun exposed glass	1	2	3	4	5	[64]
Caulking doors/windows	1	2	3	4	5	[65]
Weatherstripping doors/ windows	1	2	3	4	5	[66]
Water heater insulation wrap	1	2	3	4	5	[67]
Clock thermostat	1	2	3	4	5	[68]
Duct insulation	1	2	3	4	5	[69]
Pipe insulation	1	2	3	4	5	[70]
Flue opening modification	1	2	3	4	5	[71]
Electrical or mechanical ignition systems	1	2	3	4	5	[72]
Furnace replacement	1	2	3	4	5	[73]
Air conditioner replacement	1	2	3	4	5	[74]

Does anyone share this household with you? [75]

1. NO
2. YES, answer the next two questions.

Did this person participate in making decisions about conservation measures [76]

1. YES, MORE THAN I
2. YES, WE PARTICIPATED EQUALLY
3. YES, LESS THAN I
4. NO, NOT AT ALL

If one person participated more than the other for this decision, what was the reason (circle one number) [77]

1. ONE PERSON WOULD NOT PARTICIPATE MORE
2. ONE PERSON KNEW MORE ABOUT ENERGY MATTERS
3. ONE PERSON SHOULD MAKE THE DECISIONS ABOUT ENERGY MATTERS
4. ONE PERSON KNEW MORE ABOUT FAMILY FINANCES FOR MAJOR PURCHASES
5. ONE PERSON IS IN CHARGE OF INSTALLING CONSERVATION MEASURES
6. OTHER, PLEASE SPECIFY _____

Energy conservation measures vary in cost. What do you think is a fair amount of time to get your money back, through lower utility bills, for the following investments. (circle number)

	LESS THAN 1 YEAR	1 TO 2 YEARS	3 TO 5 YEARS	6 TO 10 YEARS	OVER 10 YEARS	
A $100 investment	1	2	3	4	5	[78]
A $300 investment	1	2	3	4	5	[79]
A $1000 investment	1	2	3	4	5	[80]

Overall, how do you rate the following sources of information on energy conservation techniques.

	VERY BELIEVABLE		SOMEWHAT BELIEVABLE		NOT AT ALL BELIEVABLE	
Federal Government	1	2	3	4	5	[81]
Newspapers, magazines	1	2	3	4	5	[82]
Utility company	1	2	3	4	5	[83]
Manufacturers' Literature	1	2	3	4	5	[84]
Radio, TV	1	2	3	4	5	[85]
Energy audits	1	2	3	4	5	[86]

[redacted] has been offering home energy audits for several years. We would like you to answer the following questions about audit programs.

Have you had an energy audit of this residence? [87]

1. NO
2. YES

If yes:

1. Who gave the audit? _____ [88]
2. What year did you have the audit? _____

If no, have you ever considered requesting our energy audit? [89]

1. NO
2. YES

If yes, why have you not gotten our energy audit? [90]

1. HAVEN'T GOTTEN AROUND TO IT YET
2. THE COST OF THE AUDIT
3. TIME TO BE THERE WITH THE AUDITOR
4. OTHER, PLEASE SPECIFY _____

If no, why not? [91]

1. NEVER HEARD OF THE AUDIT PROGRAM
2. I LIVE IN A HOUSE WHICH DOESN'T NEED ENERGY IMPROVEMENTS
3. I DON'T CARE TO MAKE ENERGY IMPROVEMENTS
4. I DON'T WANT ANYONE LOOKING AROUND MY HOUSE
5. OTHER, PLEASE SPECIFY _____

Is there anything else you would like to tell us about your decision to implement energy conservation measures? If so, please use this space for that purpose.

Also, any comments you wish to make that you think may help us provide families with more helpful energy conservation information will be appreciated.

Your contribution to this effort is very much appreciated.

APPENDIX C

Table C-1. Chi-square for non-significant demographic variables.

Variable	Category	Type of Audit: Class A n	Class A % of sample	Class B n	Class B % of sample	Chi-square
Employment of Respondent	Full-time	147	61.0	106	69.7	5.21
	Part-time	24	10.4	7	4.6	
	Retired or not employed	69	28.6	39	25.7	
Education of Respondent	Less than high school	0	0	2	1.3	6.71
	High school	22	9.1	20	13.1	
	Some college	57	23.6	42	27.5	
	Graduated college	76	31.4	45	29.4	
	Post graduate study	81	36.0	44	28.8	
Marital Status	Never married	14	5.8	11	7.1	11.20
	Married	199	82.2	137	89.0	
	Divorced	18	7.4	3	1.9	
	Separated	1	.4	2	1.3	
	Widowed	10	4.1	1	.6	
Income	Under $5,000	1	.4	1	.7	6.0
	5,000 to 9,999	1	.4	1	.7	
	10,000 to 14,999	17	7.2	6	4.1	
	15,000 to 19,999	11	4.7	11	7.5	
	20,000 to 24,999	33	14.0	17	11.6	
	25,000 to 29,999	27	11.5	23	15.6	
	30,000 to 34,999	38	16.2	23	15.6	
	35,000 to 39,999	30	12.8	13	8.8	
	Over 40,000	77	32.8	52	35.4	

VITA

Karen Childress Miller was born in Dayton, Ohio on December 5, 1947. She attended elementary schools in that city and was graduated from Fairmont West High School in June, 1966. The following September she entered Bowling Green State University in Bowling Green, Ohio, and in March 1970 she received a Bachelor of Science degree in Home Economics. In the fall of 1970 she accepted a teaching assistantship at Purdue University and began study toward a Master's degree in Home Economics. This degree was awarded in June, 1972.

She taught three years at Miami University in Oxford, Ohio and then began a consulting business which she pursued until 1980. In the fall of 1981 she entered the Graduate School of The University of Tennessee, Knoxville. She received the Doctor of Philosophy degree with a major in Home Economics in June, 1984.

The author is a member of the American Home Economics Association, the American Association of Housing Educators, the Alliance to Save Energy, Phi Upsilon Omicron, Omicron Nu, and Kappa Delta Pi. Ms. Miller will be employed by the Clemson Cooperative Extensive Service after graduation.