ENERGY CONSERVATION DECISIONS OF ELDERLY HOMEOWNERS

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1980

Submitted to the Faculty of the
Graduate college of the
Oklahoma State Unversity
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 1987

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OF ELDERLY HOMEOWNERS

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ACKNOWLEDGEMENTS

My sincere appreciation is extended to my committee members whose expertise in various areas laid the groundwork for this research project. They include Dr. Althea Wright, Dr. Sue Williams and Dr. Margaret Weber, my advisor, who instilled in me an appreciation for research and its usefulness in my profession.

Credit must also go the those who assisted with sampling, typing and statistical analysis. Your technical skills made this research project much easier.

Appreciation also goes to my Extension co-workers and clientele. I have enjoyed your assistance and encouragement in my academic endeavors.

A heart-felt thanks is extended to my parents. You instilled in me a belief that I can accomplish anything I truly want to. And to my sister, I say thanks for helping me to see the humor in every day living.

In addition to these people, I must also acknowledge appreciation to the respondents in this study. Their willingness to be a part of this project is greatly appreciated.

Lastly, I say thanks to my family. To my husband Myron I owe a great deal for his patience during my graduate work. You were always there to support me. Appreciation is also

extended to my daughters, Lindsey and Allison, who were both still babies during this project. I hope that you too will have the opportunity to accomplish educational goals and to experience the joys that knowledge affords you.

Throughout this project I have learned a great deal about the elderly population, their attitudes and beliefs, questions and concerns. I have also learned more about research methods, statistics, and computer analysis. Most of all, however, I have learned about myself.

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INTRODUCTION

Statement of Problem

The Arab oil embargo of 1973 had a dramatic effect on the lifestyle of the American energy consumer. The shortage of oil created havoc in both the residential and transportation sectors. Oil prices escalated as never before. As a result, energy conservation strategies were initiated.

When oil prices dropped in 1986, the public developed a false sense of security over the future supply. But as oil prices again begin to rise in 1987, energy conservation is an issue to be addressed.

The American energy situation continues to be affected by the Middle Eastern OPEC nations. Our dependency on this volatile area of the world makes the United States politically vulnerable to another energy crisis.

The realization of today's energy situation is also evidenced by the fact that most of our energy sources - oil, gas, and coal - are nonrenewable. Unicef (1982) reports these figures estimating the year in which global supplies of fossil fuels, at our present consumption rate, will become exhausted: coal (2029), oil (2001), natural gas (1991). In addition, over a 20 year period, the Consumer

Price Index of housefold fuel oil has risen to 503.2 and piped gas and electricity to 428.9 (USDA, 1987).

Many households in the United States are facing economic and social stress as a result of the energy situation. The consequences are particularly severe for the elderly who must manage on a fixed or reduced income while other expenses continue to rise.

The burden of rising energy prices is greater for the elderly in all income groups than for any other age groups. The Consumer Federation of America Study on Energy (U. S. OTA, Vol. II, 1979) indicated an increase in this trend as they compared 1974 data with 1985 projections, shown in TABLE I.

TABLE I

PERCENT OF DISPOSABLE INCOME SPENT ON HOME FUELS ACCORDING TO AGE

Percent of Poverty Line	Age	1974	1985
Less than 100	Less than 60	11.4	18.5
	60 or older	16.2	27.0
Less than 125	Less than 60	9.3	15.9
	60 or older	13.7	22.7
125 to 199	Less than 60	5.3	8.4
	60 or older	7.4	12.6
200 to 299	Less than 60	4.1	6.3
	60 or older	5.0	8.3
300 or Greater	Less than 60	2.7	4.7
	60 or older	2.8	4.8
All Households	Less than 60	3.7	5.9
	60 or older	4.7	7.4

Another factor amplifying the impact of the energy price increases on the elderly is the structures in which they live. Elderly Americans are far more likely to live in high energy consuming single family dwellings. The elderly also tend to live in older homes built without energy efficient details when fuel was cheap and readily available (Brotman and Allan, 1981).

Another concern of the elderly is the health problems associated with exposure to extreme temperatures. The threat of hypothermia and heat stress is potentially dangerous to the older citizens who live in poor quality

structures and are likely to spend much of their time at home.

Rising inflation and the dependence on non-renewable energy sources put any energy consumer at a disadvantage. However, the situation is even more important to the elderly as they have a greater sensitivity to temperature extremes and tend to spend more time at home, in older, larger, less energy efficient structures.

According to Stobaugh and Yergin (1979), energy usage could be reduced by as much as 30 percent to 40 percent through conservation efforts. Conservation can take one of two forms: behavioral or structural. Behavior changes are the least costly, but are also less effective. Structural modifications in existing houses can require large investments, but homeowners can realize substantial savings when proper changes are made. The most expensive energy conservation strategy, but also the most energy saving option, is new construction with energy efficiency in mind. Choices include such innovative designs as passive solar, active solar, and earth sheltered.

Additional information is needed about the energy decisions of the elderly. Few studies have focused on this area of research. The studies that have been conducted have had contradictory findings. Negative relationships between energy conservation and age were found by Bailey (1980), Henderson (1982), Junk, Jones, and Kessel (1984), and Brandt and Guthrie (1984). On the other hand, Cunningham and

Lopreato (1977) had earlier found a positive relationship. Other studies (Hogan and Paolucci, 1979; Winter, 1980; and Drummond, 1985) found no difference in energy conservation between younger and older respondents. Research in this area would be helpful to those in education, industry, and government. Educational agencies such as Cooperative Extension would benefit from any information that would enable them to meet the energy education needs of their elderly audiences. Manufacturers and marketers of energy saving equipment as well as homebuilders and real estate professionals need to know what motivates the elderly to invest in such housing or equipment. Policy makers would benefit from knowing what energy policies the elderly will accept.

Purpose of the Study

The purpose of this study is to examine how elderly homeowners are coping with the energy situation. Specific objectives of respondents perceptions include:

1. To compare the relationship between energy conservation decisions and socio-demographic characteristics of the respondents.

2. To identify motives and barriers in making conservation decisions.

3. To compare the level of energy knowledge with energy conservation behaviors, structural changes, and attitude toward innovative housing.

4. To compare attitudes toward the energy situation with energy conservation behaviors, structural changes, and attitude toward innovative housing.

5. To compare the level of awareness of innovative housing with the acceptance of innovative housing.

6. To identify sources used for energy information.

7. To identify energy policies acceptable to the elderly.

Assumptions

For this study, it is assumed that:

1. The sample used is representative of elderly homeowners in Payne County, Oklahoma.

2. Questions will be answered truthfully, even though anonymity cannot be granted in a personal interview.

Limitations

One limitation of this study is in using voter registration cards for the sampling frame. However, nationwide surveys indicate that 76.9 percent of the elderly are registered voters (U.S. Department of Commerce, 1985). A further limitation is that self-reporting of behavior may not represent actual practices.

Definition of Terms

It is necessary to define the following terms to assure accuracy in understanding and interpreting this study:

Active solar design--an assemblage of collectors, storage devices, and distribution equipment along with mechanical devices used to transfer heat from the sun in a controlled manner to provide power for a residence.

Earth sheltered design--a housing design that is surrounded partially or completely by soil, thereby utilizing the earth's natural ability to warm in the winter and cool in the summer.

Elderly--anyone age 65 or older.

Energy conservation--process of utilizing energy as efficiently as possible with behavioral efforts or technological changes.

Household--consists of all persons who occupy a dwelling.

Passive solar design--a design that incorporates the use of heat from the sun in a building for purposes of heating and cooling without relying on moving parts.

Retrofit--upgrading a structure which will result in energy saving benefits, such as storm windows, solar panels, and insulation.

Weatherization--process of plugging up air leaks by caulking, weatherstripping, installing storm windows and doors, or other methods that control drafts.

CHAPTER II

REVIEW OF LITERATURE

Introduction

For the field of energy conservation, the years since the 1973 oil embargo have been a time of rapid growth in many directions. These directions include the technical, political and social aspects of conservation. This literature review considers these various aspects as they relate to energy conservation. In addition, demographic information concerning the target population - the elderly - is provided.

Technology of Energy Conservation

The residential environment has a significant effect on our nation's total energy use, accounting for approximately 20 percent. The National Association of Home Builders (1979) breaks down this figure to include:

» 73.5% - space heating and cooling

» 14.0% - water heating

» 3.5% - lighting

» 9.0% - appliances and other uses

Substantial energy savings in each of these categories can be realized through behavioral and structural changes in

existing houses and in the design and construction of new houses.

Behavioral Changes

According to Thompson (n. d.), behavioral changes can result in energy savings such as:

» 15% saved by setting thermostat back in winter by an average of 6° to 68°.

» 7% saved by setting thermostat to 60° at night

» 6-12% saved by setting water heater back to 120° from 145°

» 10-15% saved by maintaining furnace and air conditioner at maximum efficiency by annual checkups.

Modifying behavior to conserve energy is the least expensive way to save energy. However, the behavior must be a conscious effort resulting in a change of lifestyle to make an impact on a household's energy use.

Wasteful behaviors can virtually nullify any structural changes that have been made to improve the energy efficiency of a house. In the Twin Rivers Experiment (Harrje, 1978a), researchers experimenting with alternative housing retrofits found that twice as much energy was consumed in some units, even though their structures were identical.

Structural Changes

Another means of improving the energy efficiency of an existing structure is through retrofitting. According to Newman and Day (1975), the structures in which people live account for a larger proportion of the variance in energy use than does the behavior of its residents. Structural changes tend to be more expensive than behavioral changes, but once the change is made, it usually does not involve a lifestyle change on the part of the household.

An energy conservation study by the U. S. Environmental Protection Agency (1975) indicated that additional insulation in attics, storm windows and weatherstripping could save close to 20 percent in energy consumption in the approximately 18 million older homes without such additions. Harrje (1978b) estimates the projected energy savings to be 30 percent.

The type of heating system is a central factor in determining the energy intensiveness of a structure (Seligman, et al. 1978). According to the Council on Environmental Quality (1979), additional energy savings could be realized if heating systems were replaced with heat pumps.

There has been varying success in persuading households to improve the thermal efficiency of existing dwellings through retrofitting. However, energy conservation programs which involve major capital investments, sophisticated technologies, or the design and orientation of the dwelling

are best targeted at new housing (Division of Solar Energy 1977).

New Construction

In new construction, research by Hittman Associates (1978) suggests that energy savings between 30 and 60 percent can be achieved through modifications in design and construction. Innovative energy efficient designs such as passive solar, active solar, and earth sheltered are among the alternatives.

Earth sheltered housing can be a desirable economic alternative to the standard above ground residence. The concept of using earth as a shelter is not new, having been used by ancestors who had no other protection from the elements.

Williams and Larson (1983) point out these advantages of earth sheltered housing:

1. Reduction in the amount of energy needed for heating and cooling due to constant underground soil temperatures.
2. Protection from wind, tornadoes and lightning.
3. Reduction in outside noise entering the home.
4. Utilization as a fallout and storm shelter.
5. Reduction in exterior maintenance required.
6. Resistant to fire.
7. Less disruption of the natural environment.

With so many advantages, one tends to think of earth sheltered housing as the answer to the energy situation, as well as other housing problems (weather, fire, maintenance). However, earth sheltered housing has not yet been widely accepted. Williams and Larson (1983) list possible reasons:

1. Inexperienced designers and contractors.
2. Difficulty in financing.
3. High humidity for at least the first year or so.
4. Lack of the typical home image.
5. Limitation of where daylight can enter the home.
6. Limitation of cross-ventilation possibilities.
7. High cost of removal and replacement of earth to find and correct any hidden defects or leaks.

Solar energy, using energy produced by the sun, can take one of two forms - passive or active. The systems can be used alone or in combination, and are even compatible with earth sheltered housing.

Passive solar technology uses only the site and building materials to provide heat for space and water. The design and landscaping of the structure helps to maintain cool summer temperatures.

Williams and Larson (1983) list these advantages of passive solar housing:

1. It involves the use of common building materials and conventional building techniques.
2. The components are usually durable and maintenance-free.

3. It is possible to attain 50 to 70 percent of the structure's heating requirement.

4. There are no adverse effects on the environment.

There are, however, a few potential disadvantages:

1. The additional masonry and glass could result in a 5 to 8 percent increase in initial cost as compared to a conventional home.

2. Some passive solar homes are so tight that there is a chance of interior air pollution.

3. The temperature changes in the home may be slow depending on the backup heating system used.

Unlike earth sheltered or passive solar housing, active solar technology uses mechanical parts to convert the sun's energy into space and water heating. But, the active system has greater potential as an "add on" component.

Solar panels attached to the roof can be constructed at little cost by a skilled homeowner, or more costly if manufactured. An important consideration of the active solar system is the selection of a backup system to be used on cloudy days.

Although different analysts will arrive at different estimates of the exact amount of energy that can be saved in the residential sector, it is clear that 1) the amount of energy in housing that can be saved is large, and 2) options vary from behavioral to retrofitting to new construction.

Energy Policies

As less revenue is available to support energy policies, it is important that acceptable policies be directed where the real need exists. This is particularly true with respect to the elderly, who have traditionally had little participation in energy programs. The most acceptable policies are those requiring the least inconvenience, the least personal cost, and the least change in lifestyle (Gottlieb and Matre, 1976).

Healy and Hertzfeld (1975) report four strategies often used in reducing energy consumption in the residential sector. These include: 1) supply restriction policies, 2)regulatory policies, 3) incentive policies, and 4) education/information policies. To a lesser extent, equity and pricing strategies have been employed.

Supply strategies are appropriate in emergency situations. However, they do not serve a purpose in long term reduction of energy use.

Regulatory policies have included:

1) building codes to insure energy efficient features

2) disclosure regulations that enable consumers to make more informed purchase decisions

3) subdivisions which require attention to the energy implications of lot and building orientation and neighborhood design.

Garza (1985) found low income respondents favorable toward increased energy information on appliances. However,

they were opposed to policies regulating the energy efficiency of housing.

Increases in the price of energy will force conservation. However, Cunningham and Lopreato (1977) report that low income individuals are already conserving as much as they can and higher income individuals may not change consumption patterns as a result of increased price. For this reason, pricing strategies reach only middle income individuals. Garza (1985) found low income respondents against increased price as an energy policy.

Equitable utility rates have been offered in some areas to promote energy conservation. Those using less energy, particularly the low income and elderly, receive reduced "lifeline" rates, whereas those consuming more energy are charged more for it. The low income respondents in Garza's study (1985) and elderly subjects interviewed by Long (1983) were in favor of this policy.

Burby and Marsden (1980) found that of five energy policy alternatives, the elderly most favored energy conservation education programs. Over half favored equity, supply, and regulatory policy options. Few favored raising fuel prices to conserve energy.

Energy Conservation Incentives

Incentive-based programs are not mandatory as are regulatory policies, but are designed to induce consumers to move in certain directions. Incentive programs work through the marketplace by making certain goods less expensive. According to the law of consumer demand, more consumers will purchase these goods when offered with an incentive program.

The Department of Energy provides an incentive program through the Weatherization Assistance for Low-Income Persons. The program provides direct weatherization aid in the form of technical assistance and materials. The addition of insulation, storm windows, and storm doors are customary uses of the funds. Eligibility for the program is related to income with priority given to low-income elderly and handicapped (Mayer and Lee, 1981).

The Energy Tax Act of 1978 provided federal tax credit for certain conservation measures including insulation and the application of solar technology for space and water heating. The tax credit was equal to 15 percent of the cost of the improvement, up to a maximum credit of $300 per year. The program expired in 1985 (Iams and Zimmer, 1984). The tax credit program offered by the State of Oklahoma extends until 1989.

Utility companies are offering incentive programs to induce their rate payers to conserve energy. Examples include rebates on energy efficient household equipment, low cost loans for energy saving home improvements, and lower

utility rates for customers whose homes meet specific thermal standards. TABLE II outlines the utility-based incentive programs available in Payne County, Oklahoma.

Cunningham and Lopreato (1977) found the middle-income most responsive to economic incentives, particularly to loans. Participation was found to be higher among those with higher income and more education in Long's study (1983) of retiree homeowners. Few elderly take advantage of incentive programs for energy conservation. This may be because of physical or financial limitations (Iams and Zimmer, 1984) or because of pride and what they perceive to be charity (Cooper, 1981).

Energy Education Programs

A less expensive approach to energy conservation is through education and information programs. This strategy has been used to raise consumers' awareness of the need and techniques for energy conservation using a variety of methods. On the state level, much of this has been the responsibility of the Cooperative Extension Service.

On the national level, the Energy Extension Act of 1977 established a pilot program for an 18 month period to provide personalized services tailored to the needs of small-scale energy users. Reports indicate a high level of success for this program attributable to the individualized attention, narrow focus of the topics, and the association of the programs with a reputable agency on the local level.

TABLE II

UTILITY-SPONSORED CONSERVATION PROGRAMS OFFERED
IN PAYNE COUNTY, OKLAHOMA

Utility Company	Low Interest Loans	Rebate	Reduced Rate For Thermal Quality	Energy Audit
CREC	5% loan for such purchases as heat pump, insulation, storm windows, etc.	$100 - energy saving water heater $200-$300 - heat pump	No	Yes
SEU	No	No	5% Discount	Yes
ONG	No	No	No	Yes
OGE	No	$200 per KW saved	No	Yes
ARKLA	No	No	No	No

CREC - Central Rural Electric Cooperative
SEU - Stillwater Electric Utilites
ONG - Oklahoma Natural Gas
OGE - Oklahoma Gas and Electric
ARKLA - Arkansas Louisiana Gas

Before more effective policies can be devised or pursued, much more information is needed regarding energy conservation decisions. The technology exists to substantially reduce energy consumption, but it must first be determined what the consumer will accept.

Energy Conservation Predictors

Numerous studies related to predictors of energy conservation efforts were conducted in the mid to late 1970's as a result of the increased energy prices created by the Arab oil embargo. Research has continued into the 1980's , although the immediate threat of an energy shortage no longer exists. This section of the Literature Review deals specifically with energy conservation research as it relates to three predictor variables: demographics, attitude toward the energy crisis, and energy knowledge.

Demographics

In an effort to predict who will implement energy conservation strategies, a variety of demographic characteristics have been studied. The findings tend to be contradictory and therefore, confusing. Many of the findings related to the general population are reported here. Specific studies concerning energy conservation and the elderly are included.

The early studies of Perlman and Warren (1975) and Talarzyk and Omura (1975) report more conservation efforts

by upper income groups. This is supported by more recent work done by Beck, Doctors, and Hammond (1980), Dillman, et al. (1983), and Junk, Junk, and Jones (1984). Long (1983) found this to be true of retiree homeowners' investment in energy saving improvements. Kilkeary (1975) argues that middle-income households are more likely to reduce energy use, and Cunningham and Lopreato (1977) found this to be true of low-income households. No relationship was found between income and energy conservation decisions in Hogan and Paolucci's study (1979) of the interaction of husband-wife values. Neither Henderson's study (1982) on retrofitting nor Winter's study (1980) concerning earth-sheltered housing found a relationship with income.

Research by Barnaby and Reizenstein (1975) found energy conscious consumers to be better educated. Combs and Madden (1983) found this to be true with respect to solar heating. Participation in energy audit programs was highest among better educated respondents in a study by Junk, Jones and Kessel (1984). To the contrary, Cunningham and Lopreato (1977) and Beck, Doctors, and Hammond (1980) found a negative relationship between education and energy conservation. Both Hogan and Paolucci (1979) and Drummond's study (1985) with husband-wife pairs and Winter's work (1980) on earth sheltered housing found no relationship.

Burby and Marsden (1980) found owners of older homes more likely to retrofit them. However, owners of newer

homes were more likely to make energy related structural changes in a study by Beck, Doctors, and Hammond (1980).

Negative relationships between energy conservation and age were found in Henderson's study (1982) on retrofitting and Junk, Jones, and Kessel's work (1984) on participation in energy audits, but Cunningham and Lopreato (1977) found those installing energy conserving equipment tended to be older. Hogan and Paolucci (1979), Winter (1980), and Drummond (1985) found no relationship.

Attitude Toward the Energy Situation

Public concern over the energy situation has been addressed by several studies. An early study by Murray, et al. (1974) indicated that consumers believed the energy problem to be contrived by government and large oil companies. Later, Thompson and McTavish (1976) found over 50 percent of their respondents cynical about the energy problem. However, more recent studies have suggested a belief in a serious energy situation (Burby and Marsden, 1980, Garza 1985).

Brunner and Bennet (1976-77) found that efforts to conserve energy were more prevalent among respondents who believed there was an energy crisis. Donnermeyer (1977) found only a moderate link between attitude and behavior. Henderson (1982) and Garza (1985) found no significant relationship.

Energy Knowledge

The level of energy knowledge has not frequently been identified in conservation research, but most studies find the public fairly ignorant of the nature of energy use and conservation techniques. Opinion Research Corporation (1974, 1976) found people unaware of the sources of energy or the amount of energy needed to carry out household functions. Respondents answered correctly only slightly more than half of energy knowledge questions in a study by Gotlieb and Matre (1976). However, fifty-two percent of the subjects in Garza's (1985) study answered at least six of seven questions correctly.

Knowledge of energy conservation techniques is associated with greater likelihood of conservation measures taken, according to Kaiser, Marsden and Burby (1979). They found informed homeowners more likely to reduce heating and air conditioning, use appliances less, and to retrofit homes. Williams' work on energy consrvation (1984) reports a positive change in respondents' energy knowledge as well as their behavioral and structural conservation decisions.

Studies by Henderson (1982) and Garza (1985) indicate that energy knowledge is not a predictor of energy conservation. Boles and Jackson (1982) educational program with elderly apartment dwellers was successful in increasing energy knowledge, but not effective in reducing energy use. However, the study may be biased because renters seldom make

structural changes to conserve energy in their residence (Garza 1985).

There is little agreement on the predictors of energy conservation behavior. TABLE III summarizes the findings listed above.

Energy Conservation and the Elderly

Burby and Marsden (1980) found the elderly most often engage in energy conservation behaviors that involve using less heating and cooling. Brandt and Guthrie (1984), however, found the elderly less likely to adjust thermostats due to health risks associated with becoming too hot or too cold.

The elderly are more likely to retrofit their homes than any other age group (Beck, Doctors, and Hammond, 1980). Changes most often made include the addition of insulation, storm or double pane windows, storm doors, caulking and weatherstripping (Long, 1983; Brandt and Guthrie, 1984).

Economics tends to be an important factor in motivating the elderly to conserve energy. Garza (1985) and Long (1983) report the high cost of energy as a component in persuading energy conservation. Garza (1985) also found comfort an important factor.

Economics also affects the decision not to make changes to conserve energy. Lack of money was listed as a barrier in several studies (Frieden and Baker, 1983; Junk and Jones, 1984; Long, 1983; Garza, 1985). In addition, Long (1983)

TABLE III

SIX PREDICTORS OF ENERGY CONSERVATION
SUMMARY OF RESEARCH

Predictor	Positive	Negative	No Relationship
AGE	Cunnigham & Lopreato (1977)	Henderson (1982) Junk, Jones & Kessel (1984) Brandt & Guthrie (1984)	Hogan & Paolucci (1979) Winter (1980) Drummond (1985)
INCOME	Pearlman & Warren (1975) Talarzyk & Omura (1975) Beck, Doctors & Hammond (1980) Long (1983) Dillman, et al. (1983) Junk, Junk, & Jones (1984)	Cunningham & Lopreato (1977)	Hogan & Paolucci (1979) Winter (1980) Henderson (1982)
EDUCATION	Barnaby & Reizenstein (1975) Combs & Madden (1980) Junk, Jones & Kessel (1984)	Cunningham & Lopreato (1977) Beck, Doctors & Hammond (1980)	Hogan & Paolucci (1979) Winter (1980) Drummond (1985)
HOUSE AGE	Bursby & Marsden (1980)	Beck, Doctors & Hammond (1980)	
ATTITUDE TOWARD ENERGY SITUATION	Brunner & Bennet (1976-77) Donnermeyer (1977)		Henderson (1982) Garza (1985)
ENERGY KNOWLEDGE	Kaiser, Marsden & Burby (1979) Williams (1984)		Boles & Jackson (1982) Henderson (1982) Garza (1985)

found elderly respondents concerned about having too few years of life remaining to justify an energy conservation investment.

Many studies suggest the elderly do not invest in energy conserving equipment because they feel their homes are already energy efficient (Brandt and Guthrie, 1984; Junk, Jones and Kessel, 1984; Garza, 1985). This may or may not be correct, but serves as a barrier to making additional structural changes.

Energy Information Sources

Consumers often receive inaccurate information about energy conservation. As a result, it is important to know where they have acquired such information and who they trust to have reliable energy information.

Cunningham and Lopreato (1977) found respondents' major sources of energy information to be newspaper, television, and news magazines. They placed little importance on government literature. Gottlieb and Matre (1976) and Burby and Marsden (1980) support this finding. Garza (1985) found respondents attributed energy knowledge to personal experience.

Scientists and engineers tend to be the most creditable sources of energy information (Montgomery and Leonard-Baxton 1977). Junk and Jones (1984) found people have a high degree of confidence in County Extension personnel as providers of energy conservation information. Utility

companies and television were also chosen for their credibility (Burby and Marsden 1980).

Adoption and Diffusion of Energy Conserving Innovations

Background of Diffusion Research

The background of research on the adoption and diffusion of innovations dates from the 1920's. It was at this time the Federal Extension Service began evaluating the effectiveness of Extension programs, specifically the adoption of new farming methods. Few studies related to the adoption of innovations for the home. Only recently have researchers begun to look at the adoption and diffusion of energy efficient housing as an innovation.

Previous studies have correlated socio-demographic characteristics with respondents' decisions to adopt an innovation. These studies indicate that housing innovators are often younger with more education and higher incomes (Real Estate Research Corporation, 1980; Labay and Kinnean, 1981), have larger, newer, more expensive homes and higher monthly utility bills (Davis and Rubin, 1983).

Mitchell (1983) found that "achievers" are more willing to try new products. These achievers tend to be college-educated, with an average age of 42 and an average yearly income of $31,400.

On the other hand, research by Tremblay, McCray and Navin (1984) suggests that socio-demographic characteristics

may not always be useful in predicting adoption of energy efficient housing. They found only a weak link between respondents' utility cost and income and their willingness to consider innovative housing. More positive correlations were found with the respondents' belief in the energy crisis.

According to leading researchers in the field of adoption and diffusion of innovations (Rogers, 1963; Rogers and Shoemaker, 1971) and supported by Ostlund (1974), the relationship between an individual's perception of and attitude toward an innovation is a better indicator of its adoption than socio-demographic characteristics. The absence of this framework is a major reason for the high potential/low adoption rate of energy conservation innovations (Shama, 1981; McDougall, Glaxton, Richie, and Anderson, 1981).

Adoption Process

Innovations are not immediately adopted following their invention. Rather, adoption proceeds through a series of stages. These stages are as follows: (Rogers, 1963)

1. Awareness stage - the individual is exposed to the innovation, but lacks complete information about it.

2. Interest stage - the individual becomes interested in the new idea and seeks additional information about it.

3. Evaluation stage - the individual mentally applies

the innovation to his present and anticipated future situation and then decides whether or not to try it.

4. Trial stage - the individual uses the innovation on a small scale in order to determine its utility in his own situation.

5. Adoption stage - the individual decides to continue full use of the innovation.

These stages in the adoption process were used as indices by Weber, McCray, and Claypool (1985) to determine their usefulness in measuring consumers' propensity to adopt innovative housing. Their findings indicate the knowledge indices are valid in predicting consumer acceptance of innovative housing. As a result, by knowing an individual's level of awareness of an idea or product, one can anticipate the individual's adoption of it.

Rate of Adoption

Rogers and Shumaker (1971) have suggested that an innovation can be classified along six dimensions and that perceptions of an innovation on these dimensions determine the rate and likelihood of its adoption. These dimensions are:

1. Relative advantage - the degree to which the innovation is superior to prior innovations.

2. Risk - the degree to which economic, physical, psychological, functional, and social ills are perceived in an innovation.

3. Compatibility - the degree to which an innovation is consistent with the values and experiences of potential adopters.

4. Complexity - the degree to which an innovation is difficult to use and understand.

5. Divisibility - the degree to which an innovation can be tried on a limited basis.

6. Communicability - the degree to which results of an innovation are easily and effectively communicated.

Although Rogers' dimensions are useful in the study of adopting energy innovations, Darley and Beniger (1981) suggest that the dimensions can be made more useful by modifying and extending them. They are as follows:

1. Capital cost of the innovation
2. Perceived savings
3. Certainty of savings
4. Value, attitude, and style compatibility
5. Innovation and life-pattern interaction
6. Trialability of the innovation
7. Dissatisfaction with the existing situation
8. Effort and skill involved in installing or using the innovation.

Adopter Categories

It is obvious that all individuals do not adopt an innovation at the same time. According to Rogers (1963), adopter distributions follow a bell-shaped curve. Only a

few individuals adopt a new idea at first, then many individuals follow the example that has been set. Finally, the rate of adoption slows until no one remains to adopt.

Innovativeness is the degree to which an individual is relatively early in adopting new ideas when compared to others in his social system. Individuals can be classified into five adopter categories on the basis of their innovativeness: innovators, early adopters, early majority, late majority, and laggards. Rogers (1963) provides a composite picture of adopter categories as shown in TABLE IV. Of particular interest is the suggestion that innovators are the youngest and laggards are the oldest.

Communication Channels

An important component of the diffusion process is information transmission, although receiving information does not necessarily mean adoption of an innovation. Information received through mass media can create an awareness of an innovation, but network channels are more likely to influence attitude change or adoption (Solo and Rogers 1972).

The diffusion of innovations is most often through a network of interpersonal communications, not neighborhoods. Rather than neighbors, research by Darley (1978) found that second-stage adopters of energy-conserving devices were friends and co-workers of the initial innovators.

TABLE IV

A COMPOSITE PICTURE OF ADOPTER CATEGORIES

Adopter Category	Salient Values	Personal Characteristics	Communication Behavior	Social Relationships
Innovators	"Venturesome"; willing to accept risks	Youngest age; highest social status; largest and most specialized operations; wealthy	Closest contact with scientific information sources; interaction with other innovators; relatively greatest use of impersonal sources	Some opinion leadership
Early Adopters	"Respect"; regarded by many others in the community as role-model	High social status; large and specialized operations	Greatest contact with local change agents	Greatest opinion leadership of any adopter category in most communities
Early Majority	"Deliberate"; willing to consider new ideas only after peers have	Above-average social status; average-sized operations	Considerable contact with change agents and early adopters	Some opinion leadership
Late Majority	"Skeptical"; overwhelming pressure from peers needed before adoption occurs	Below-average social status; small operations; little specialization; small income	Interaction with peers who are mainly late majority or early majority; less use of mass media	Little opinion leadership
Laggards	"Tradition"; oriented to the past	Little specialization; lowest social status; smallest operations; lowest income; oldest	Neighbors, friends, and relatives with similar values are main information sources; suspicious of change agents	Very little opinion leadship; semi-isolates

* "operations" refers to farming operations.
(Rogers 1963)

In any social system, the top-ranking units, or opinion leaders, will generally try an innovation before lower-ranking units, the followers. Lower-ranking individuals then engage in imitative behavior so that innovations diffuse from the early-adopting elite down the social hierarchy.

At some point in the adoption process, network diffusion is overtaken by the neighborhood effect, so that nearer individuals adopt the innovation. Physical distance becomes more important than does social position. This is the stage at which demonstration homes might play a crucial role in the diffusion of energy-related innovations.

This section of the Literature Review has focused on the process by which new ideas are communicated in a social system and then practiced. The adoption process follows a prescribed series of stages from awareness through adoption. The rate and likelihood of adoption is determined by the individual's perception of the innovation along a set of dimensions. Individuals differ in their degree of innovativeness and interpersonal communication is the most effective means of diffusion.

Demographics of an Aging Population

In an effort to truly understand the elderly population, it is important to highlight some specific characteristics of those age 65 and older. This information is supplied by Allan and Brotman (1981) in the Chartbook on

Aging in America, compiled for the 1981 White House Conference on Aging.

One of the most significant demographic trends of the twentieth century has been the aging of the nation's population. In 1900, only 3.1 million persons were 65 years of age or older, representing four percent of the total population. By 1980, the number had increased eight-fold, reaching 25 million or 11 percent. By the year 2000, it is anticipated that nearly 32 million (12 percent) will exceed age 65. But the major increase in the elderly population will occur between the years 2010 and 2030, as the "baby boom" generation reaches this age group and represents nearly 18 percent of the population.

America's older population is represented on all rungs of the economic ladder, but is heavily concentrated at the lower levels. In 1979, the median income of families headed by persons under 65 was $21,201. One-fourth of the nation's families headed by persons over 65 had incomes below $7,275. Median income of Payne County, Oklahoma households with an elderly head is $11,245 (Oklahoma State Data Center, 1980).

Older people are more likely to be homeowners than younger people. The 1976 National housing survey indicated that more than seven out of 10 households headed by an elderly person own their own homes, 84 percent of which are mortgage-free.

While home ownership is widespread among this age group, total housing costs remain high (for such

expenditures as utilities and property taxes). In absolute monetary terms, the elderly spend less on housing than younger age groups, but because of their lower incomes older homeowners spend a greater percentage of their incomes on housing. Persons age 65 and older who have mortgage-free homes spend 15.2 percent of their income on housing, compared with 8.1 percent for homeowners aged 30-44 and 8.9 percent for those 45-64. For homeowners with a mortgage, the rates are 25.5 percent for those 65 and older, 18.7 percent for those 30-44, and 15.3 percent for the 45-64 age group.

Persons aged 65 and older are more likely to live in older housing structures than are younger persons. Nearly one-half of all homeowners aged 65 and older reside in homes built prior to World War II, compared with less than one-third of all young homeowners. By the same token, only 24 percent of older homeowners, compared with 42 percent of younger homeowners, live in homes built after 1969. While age of housing may not necessarily reflect the condition of the structure, it does bear a relationship to size, functional obsolescence, and ease of maintenance. Various housing studies reveal that many older persons live in homes that are too large for current family size and need.

Since the major reason for a change in residence is a change in one's work location, older persons are less likely to change residence than members of younger age groups. Between 1975 and 1979, only one person in six aged 65 and

older moved from one home to another. For the population as a whole, more than 40 percent changed residence during 1975-1979 period.

Summary

Technically, our dependence on nonrenewable energy resources can be lessened through behavioral and structural conservation strategies. Changes in lifestyle can result in effective conservation at no monetary costs. Structural changes to existing residences are more expensive, but can have dramatic effects. New construction is the most costly, but can take advantage of building site, materials, and design to incorporate renewable energy sources.

Politically, efforts to reach energy independence have fallen short of expectations. Consumers want a "quick fix" to the energy problem, which is difficult to achieve in such a complex situation. Energy education programs offer information that would benefit all consumers, at much lower costs than incentive programs.

It is difficult to predict who will conserve energy. The bulk of the research indicates that energy conscious consumers are younger, better educated, and have higher incomes. The issues of house age, attitude toward the energy situation and energy knowledge are debatable.

Energy conservation practices and products are considered innovations, and as a result, are adopted in stages. It is the perception of the innovation that

determines the rate and likelihood of adoption. Interpersonal communication is the most effective means of diffusion of innovations.

The elderly population is the fastest growing age group. Their incomes tend to be low and their housing costs high. They tend to live in larger, older homes, and have less mobility than other age groups.

From this Review of Literature it is clear that the elderly population is a good target for energy conservation programs. But because their participation in such programs has been low, more research is needed to understand the situation.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this project was to determine how elderly homeowners are responding to the current energy situation as well as their attitude toward innovative energy efficient housing. Data was collected and analyzed to satisfy this purpose.

Pilot Study

The methodology planned for this study was pilot tested in February 1987. Cold temperatures and increased heating costs during this period created increased awareness of the need for energy conservation.

In an effort to determine the validity of the sampling frame (voter registration records), the names of five registered voters and five nonregistrants fitting the qualifications were obtained. Registered voters were randomly chosen from voter registration records. To obtain a sample of nonregistrants, membership lists of Payne County Extension Homemakers and Senior Citizen Centers were compared with voter registration records. The first five

names not listed with the Election Board were used in the pilot study.

Personal letters were sent to prospective participants, indicating the need for their cooperation with the study. The letters indicated that prospective participants would be contacted by telephone to set up a personal interview which would last less than one hour. As an incentive for participating, subjects were offered energy education material at the conclusion of the interview and the results of the study upon completion.

Telephone contacts were made with the prospective participants within one week of sending the personal letter. The conversation began with a reminder of the letter received and a determination of whether the individual fit the desired qualifications - homeowner, head-of-household, age 65 or older, residing in Payne County.

Of the 10 contacts made, eight agreed to be interviewed as part of the study (four registered voters and four nonregistrants). Appointments were scheduled with these for a personal interview. Participants were interviewed in their homes over a three day period in February, 1987.

As a result of the pilot study, the original Interview Schedule was altered to allow for more freedom in responding to the questions. Additional information was added to the questionnaire concerning the respondent's housing, utility provider, and average monthly fuel bill, as these may have a bearing on energy conservation decisions. More information

was also requested about conservation incentives. Retro-fitted Solar was added to the list of innovative housing options.

In comparing the responses of the registered voters to the nonregistrants, there were differences in demographic characteristics. The registered voters tended to be younger, better educated, and more affluent. Their housing tended to be newer and larger than that of nonregistrants. However, there was little difference in their energy knowledge, energy conservation behaviors, structural changes made, or attitude toward innovative housing. For this reason, the decision was made to continue to use voter registration records for the sampling frame.

Sampling

Several options were considered in determining the sampling frame for this study. These methods are discussed below.

Social Security records provide an ideal sampling frame for obtaining a list of elderly people in the county. However, under the current administration, these records are not available for research purposes.

Detailed census data on individuals is unavailable for a period of 75 years after it is taken. Therefore, these records could not be used in obtaining the sample.

County Assessor records, which are public documents, were reviewed for those residents filing double homestead

exemption Form 538H. This form reflects homeowners age 65 or older, but only if annual income is $8500 or less. Information from the Oklahoma State Data Center (1980) indicates that Payne County households with an elderly head have a median income of $11,245. As a result, these documents do not provide an accurate sampling frame.

Following a review of research literature concerning the elderly, several other sampling frames were considered. Many of these studies used senior citizens centers, nursing homes, or retirement housing. Others used personal contacts, newspaper requests or membership lists from churches and other organizations. None of these sampling frames is considered to be representative of the elderly population.

Another avenue investigated as a sampling frame for this study was through utility companies. Because the Oklahoma Corporation Commission prohibits the utility companies from denying service to elderly households based on inability to pay, each utility provider makes note of an elderly customer when service is initially provided. However, lack of computerization would mean a manual search through all customer records. In the interest of time, this method of obtaining the sample was not utilized.

The method chosen for obtaining the sample was voter registration records. These records are available to the public through the Payne County Election Board. Information provided on the individual registration cards includes name,

address, and birthdate, all of which are necessary for the study. Although not every elderly person is a registered voter, research indicates that 76.9 percent are (U.S. Department of Commerce 1985). As a result, voter registration records provide a more representative sampling frame than the other sources investigated.

Voter registration cards are arranged according to location in the county, into 42 precincts. Within each precinct, cards are grouped by political parties. The cards are arranged alphabetically within each party.

To obtain the sample using the voter registration method, the proportion of elderly county residents to the adult (voting age) population of the county must be considered. This is determined to be 12 percent, as 6157 of the 49,759 adult residents are age 65 or older (Oklahoma State Data Center, 1980). In an effort to obtain the names of 100 people with birthdates 1922 or earlier, 833 cards from voter registration records were examined.

The range between voter registration cards examined was determined by the total number of registered voters in the county and the number of cards to be examined. According to Election Board documentation, there are 38,280 registered voters in Payne County. To examine 833 cards, every 46th card was drawn.

This method of obtaining the sample resulted in the names of 145 potential subjects. The exact birthdate was not available on 80 of the 145 voter registration cards as a

result of the registrant transferring from another county where birthdates were not recorded on cards before 1957. However, it was necessary to consider these potential respondents in the study so as not to overlook anyone fitting the age requirement.

The names of the 145 potential respondents were cross-referenced with local telephone directories to obtain current addresses and telephone numbers. In some cases, the last name and address of a potential female respondent was listed under a man's first name. When this occurred, it was assumed the man was her spouse and head-of-household, and therefore became the one chosen for the study. Likewise, when the last name and address of a potential male respondent was listed under a woman's first name, it was assumed that she was the surviving female head-of-household, thus becoming the potential respondent. The list of 145 potential respondents was narrowed to 106 as 39 could not be located in local telephone directories and were therefore presumed to have moved or died, or did not subscribe to telephone service.

Personal letters were sent to prospective participants, outlining the situation that exists between the energy situation and the elderly and indicating the need for their cooperation with the study. Letters noted that prospective participants would be contacted by telephone to set up a personal interview. As an incentive for participating in the study, prospective participants were offered energy

conservation educational material and the results of the study upon its conclusion.

The telephone contact with the prospective participant determined if the individual was a qualified candidate for the study - homeowner, head-of-household, age 65 or older, residing in Payne County. This further narrowed the potential respondents to 100 as 6 rented their homes. Again the sample was narrowed when 17 of those whose voter registration card had no birthdate, were not yet age 65. Of the 83 remaining, 41 were not interested in participating in the study and 12 had other commitments that prevented them from participating. Interviews were scheduled with the 30 remaining from the original sample.

Methodology

This project dealt with nonexperimental variables. The beliefs, attitudes, and conditions surrounding the respondents had already occurred. The respondents were observed in a natural setting, and the variables were not manipulated in any way. According to Best and Kahn (1986), this project focuses on descriptive research, describing the situation as it exists.

The case study approach was employed to focus on one group of people (the elderly) to obtain indepth information about one segment of their lives (energy conservation). This method allows the researcher to probe deeply into the

situation and analyze the factors that contribute to the findings.

Interview techniques were chosen to obtain the data, because opportunities for observation were limited. Observation can also be costly and time-consuming.

Questionnaires were considered inappropriate for this sample. The reading level and vision capabilities of the elderly would result in a low level of response.

Other advantages of the interview are that the researcher can establish rapport with the respondent, explain more fully the information needed, and clarify questions the respondent misunderstands. Also, people who may be unwilling to write a lengthy answer on paper are often willing to respond to an interviewer's questions verbally (Sommer and Sommer, 1980).

Instrumentation

The study instrument, a questionnaire administered through personal interview, was developed by combining and adapting research instruments from a variety of sources. The 48 items address eight areas: 1) demographics, 2) energy knowledge, 3) sources used for energy information, 4) attitude toward the energy situation, 5) preferences for energy policy alternatives, 6) energy conservation behaviors performed, 7) energy conservation structural changes made, and 8) attitudes toward innovative energy efficient housing.

Demographics requested in this study included age, education, housing, and household income. Information was also requested concerning monthly utility bills and the utility service provider. Annual income, a sensitive subject, was addressed at the conclusion of the interview when rapport had been established with the subject. To simplify this question and to give the respondent as much anonymity as possible as to exact income, the respondent was given a card listing 10 income brackets and responded by the number of the bracket.

Level of energy knowledge was assessed through seven questions relating to energy saving behaviors and techniques, drawing on studies by Garza (1985), Weber and Strebe (1983), and Williams, Braun, and Lauener (1981). Subjects were then asked to list sources they use for energy information, and to state which one they consider to be the most reliable. These questions were derived from Cunningham and Loperato (1977).

A Likert-type scale was used to determine the respondent's attitude toward the energy situation. Preferences for energy policy alternatives were determined by asking respondents to prioritize a set of eight cards listing energy policies. Suggestions for these questions came from Burby and Marsden (1980).

Energy conservation behaviors were determined by asking respondents to list those they regularly practice. Following this, subjects were asked to list structural

changes they have made in their house to conserve energy and reasons for these changes, as well as factors influencing the decision not to make additional changes.

Subjects were asked questions related to four innovative energy efficient housing types - passive solar, active solar, solar retrofit, and earth sheltered. Questions covered their awareness of each housing type, whether they would consider buying this type housing, and characteristics they liked and disliked about each housing type. To clarify the definition of each housing type, respondents were shown a notebook of pictures and given verbal explanation. The questions relating to the innovative housing were drawn from the S-141 Regional Housing Project (1981).

Each subject was asked about their awareness of and use of energy conservation incentive programs. Long's study (1983) provided suggestions for these questions.

Data Collection

Data for the study was collected through personal interview during June and July 1987. Awareness of increased temperatures and increased cooling costs was considered to be at a peak during this time.

For the statistical data analysis, frequencies and means were used to identify the subjects according to demographic information. Frequencies were also use to identify the conservation motives and behaviors, sources

used for energy information, and energy policies acceptable to the elderly. Pearson's Product-Moment correlation was used to compare the energy conservation decisions and socio-demographic characteristics of the respondents, as well as the relationship between energy knowledge and energy conservation decisions. Correlation was also used to determine the relationship between attitude toward the energy situation and energy conservation decisions, as well as the relationship between awareness of and attitude toward innovative energy efficient housing. Claypool (1987) indicated that correlation was an appropiate statistical test for the number of subjects (30) because of the diversity of their responses.

CHAPTER IV

RESULTS

Characteristics of Respondents and Their Housing

The age of the 30 respondents ranged from 65 years to 85 years. The mean age was 74.2 years.

Respondents' educational level ranged from seven having less than a high school education to eight having more than a bachelors degree in college. Half of the respondents had at least a college degree.

The income levels of the respondents ranged from one who earned less than $10,000 a year to six whose income was $50,000 or more annually. A mean score of 5.86 in the income category indicates the average income of the sample is in the upper end of the $25,000-$29,999 income bracket. One respondent did not know her income and another refused to answer the question.

Of the four housing types, 24 of the 30 respondents (80 percent) lived in a traditional single family detached dwelling. Two of the respondents lived in mobile homes and one lived in a condominium. Three respondents lived in other types of structures which included an earth sheltered

house, a passive solar house, and a retrofitted active solar house.

House size of the respondents ranged from 672 square feet to 4200 square feet. The mean size was 1868.38 square feet. The age of the respondents' houses ranged from five years to 85 years. The mean age was 29.79 years. One respondent did not know the age of his home.

Respondents had lived in their current residence an average of 21.33 years. The responses ranged from four years to 47 years. The majority of the respondents (93.3 percent) indicated they plan to stay in their own home.

Five major utility companies provide electricity or natural gas to the Payne County area. These include Central Rural Electric Cooperative (CREC), Oklahoma Natural Gas (ONG), Oklahoma Gas and Electric (OG&E), Stillwater Electric Utilities (SEU), and Arkansas Louisiana Gas Company (ARKLA). Others used propane, natural gas from a local well, or a minor utility provider. One respondent did not know who provided utilities for the household. The distribution of service is indicated in TABLE V.

TABLE V

UTILITY PROVIDER

Provider	Number	Percent*
CREC	8	27.6
ONG	17	58.6
OG&E	1	3.4
SEU	14	48.3
ARKLA	5	17.2
OTHER	8	27.6

* Percent does not equal 100 due to multiple responses.

Estimated monthly fuel bills of the respondents ranged from $45 to $250. The average was $100.71 per month.

Energy Knowledge

When asked the best place to put insulation in a home, 23 of the 30 respondents (76.7 percent) answered correctly with "ceiling or attic". Six respondents answered with "walls". One chose "floors" as the best location.

Seven respondents (23.3 percent) answered correctly with "heating and cooling" as the greatest energy user in the home. The majority (53.3 percent) said that either heating or cooling alone took the most energy to operate. Other answers included water heating (6.7 percent), lighting (10 percent), and appliances (6.7 percent).

Over half of the respondents (53.3 percent) answered correctly that windows in a home should face south. Other indicated that windows should face south and east (13.3 percent) or other directions (33.3 percent).

When asked about the major cause of energy loss, 26.7 percent answered correctly with "air leaks". The majority (56.7 percent) answered "lack of insulation". Other answers were given by 16.7 percent of the respondents.

Ninety percent of the respondents knew that the purpose of a fan is to circulate air. Others answered "evaporate water" (3.3 percent) and "cool the air" (6.7 percent).

The location to plant trees to reduce summer cooling costs was correctly answered as "east and west" by 6.7 percent of the respondents. Seventy percent answered "west" to the question. Other locations were listed by 23.3 percent of the respondents.

The location of trees planted to reduce winter heating costs was known to be "north" by 73.3 percent of the respondents. Ten percent answered "north and west" to the question and 16.7 percent answered with other locations.

Energy Information Sources

Newspapers were listed most frequently as a source of energy information with 73.3 percent, followed by television with 70 percent. Other frequently used sources were utility companies (63.3 percent) and friend or relative (50.0 percent). Those sources of energy information less

frequently used were radio (36.7 percent), hardware or lumber stores (30 percent), government (23.3 percent), and cooperative extension (23.3 percent). Other sources were listed by 53.3 percent of the respondents which included personal experience, professional training, college courses, and real estate agent.

Thirty-two percent of the respondents listed "other sources" of energy information as the most reliable. This included such responses as professional training, college courses, and personal experience. Friends and relatives and utility companies were listed as the most reliable source by 28 percent and 24 percent of the respondents, respectively. Cooperative Extension and hardware/lumber stores were each listed by eight percent of the respondents. None of the respondents chose newspaper, radio, television, or government as the most reliable source of energy information. Five respondents said energy information is so confusing, they don't know who to believe. These respondents chose not to answer this question.

TABLE VI reflects the use of various sources of energy information. Also included is the perceived reliability of each source.

Energy Situation

Only one respondent perceived the energy situation to be a crisis. Six (20 percent) felt the situation to be serious. Half of the respondents (50 percent) indicated the

energy situation is somewhat serious. Eight (26.7 percent) felt the situation is not serious. The mean level of response was "somewhat serious".

TABLE VI

ENERGY INFORMATION SOURCES AND RELIABILITY

Source	Use*		Reliability**	
	n	%	n	%
Newspaper	22	73.3	0	0
Radio	11	36.7	0	0
Television	21	70.0	0	0
Government	7	23.3	0	0
Cooperative Extension	7	23.3	2	8
Utility Company	19	63.3	6	24
Hardware/Lumber Company	9	30.0	2	8
Friend/Relative	15	50.0	7	28
Other	16	53.3	8	32

* Percent equals more than 100 due to multiple responses.
** Number equals less than 30 due to five missing responses.

Favored Energy Policies

Respondents ranked eight energy policy options from 1 (most favored) to 8 (least favored). The highest ranked policies were education/information with a mean ranking of 2.37; minimum efficiency standard, 2.59; and economic incentives, 2.92. Other policies received considerably lower rankings, including reduced rates for elderly, 4.18; help pay utility bills for elderly, 4.92; increase use of nuclear energy, 5.40; raise price of energy, 6.62; and ration supply of energy, 6.62. Four respondents felt that the government should stay out of the energy situation, and therefore chose not to rank the policies.

Energy Conservation Behavior

Of 10 energy conserving behaviors, 25 respondents (83.3 percent) use a fan, and 23 (76.7 percent) each reduce their heating and their cooling. Twenty respondents (66.7 percent) wear extra clothing and 15 (50 percent) add moisture to the air to be more comfortable in the winter.

Closing off unused rooms and stopping air leaks was listed by 17 (56.7 percent) and nine (30 percent), respectively. Twelve respondents (40 percent) have lowered their water heater, five (16.7 percent) use less hot water, and nine (30 percent) use less lighting. Other energy conserving behaviors were listed by eight (26.7 percent) respondents, including spending time outside, cleaning air filter, using blankets, and taking cool baths. Two

respondents (6.7 percent) did not perform any behaviors to conserve energy. TABLE VII reflects these answers in graphic form.

Energy Conservation Structural Changes

Respondents were asked to list structural changes they had made in their residence to conserve energy. The majority had added insulation (56.7 percent), storm or double pane windows (50 percent), storm doors (53.3 percent), caulking (50 percent), and heavy drapes (53.3 percent). Fewer had added weatherstripping (43.3 percent), ceiling fan (46.7 percent), or energy efficient appliances (26.7 percent). Only one respondent had added a solar collector, and none had added a heat pump or a sun space. Other changes were listed by 36.7 percent of the respondents, and included enclosing a porch, adding landscaping, adding awnings, applying solar film to windows, and installing a wood stove. One respondent had not made any structural changes to conserve energy. TABLE VIII graphically reflects the respondents' answers.

Energy Conservation Motives and Barriers

When asked why energy efficient structural changes had been made, respondents listed save money (30 percent), save energy (26.7 percent), and comfort/convenience (46.7 percent). Other reasons were listed by 20 percent of the

TABLE VII

ENERGY CONSERVING BEHAVIOR PERFORMED

	Percent 10 20 30 40 50 60 70 80 90	n	%*
Use Fan		25	83.3
Reduce Heat		23	76.7
Reduce Cooling		23	76.7
Extra Clothing		20	66.7
Close Rooms		17	56.7
Add Moisture		15	50.0
Lower Water Heater		12	40.0
Less Lights		9	30.0
Stop Drafts		9	30.0
Other		8	26.7
Less Hot Water		5	16.7

* Percent equals more than 100 due to multiple responses.

TABLE VIII

ENERGY EFFICIENT STRUCTURAL CHANGES MADE

	Percent 0 10 20 30 40 50 60 70 80	n	%*
Insulation		17	56.7
Doors		16	53.3
Drapes		16	53.3
Caulk		15	50.0
Windows		15	50.0
Ceiling Fan		14	46.7
Weatherstrip		13	43.3
Other		11	36.7
Appliances		8	26.7
Solar Collector		1	3.3
Heat Pump		0	0.0
Sun Space		0	0.0

* Percent equals more than 100 due to multiple responses.

respondents and included tax credit, available materials, and improve appearance.

Reasons for not making additional energy conserving changes were "not needed", listed by 60 percent of the respondents and "cost/payback", listed by 36.7 percent. Other reasons were given by 16.7 percent of the respondents, and included lack of time, lack of skills, lack of trust in repairmen.

Innovative Energy Efficient Housing

Respondents were asked to indicate their awareness of four innovative energy efficient housing types on a scale from 1 (never heard of) to 6 (lived in). Mean responses were 2.08 for Passive Solar; 2.46, Active Solar; 2.66, Retrofitted Solar; and 3.8, Earth Sheltered. TABLE IX shows the level of awareness of each of the four housing types.

Respondents were also asked to indicate the level at which they would consider living in each of the innovative housing types on a scale from 1 (definitely would consider) to 5 (definitely would not consider). Mean responses were 3.56, Passive Solar; 3.7, Active Solar; 3.86, Retrofitted Solar; and 3.63, Earth Sheltered. The level of acceptance of the four housing types is shown in TABLE X.

TABLE IX

AWARENESS OF INNOVATIVE HOUSING

	Passive Solar		Active Solar		Retrofitted Solar		Earth Sheltered	
	n	%	n	%	n	%	n	%
Never Heard of	8	26.7	11	36.7	8	26.7	0	0.0
Heard of	7	23.3	7	23.3	9	30.0	4	13.3
Read about	2	6.7	2	6.7	2	6.7	3	10.0
Seen	10	33.3	7	23.3	8	26.7	19	63.3
Considered	1	3.3	3	10.0	2	6.7	3	10.0
Lived in	2	6.7	0	0.0	1	3.3	1	3.3

TABLE X

ACCEPTANCE OF INNOVATIVE HOUSING

	Passive Solar		Active Solar		Retrofitted Solar		Earth Sheltered	
	n	%	n	%	n	%	n	%
Definitely Would	1	3.3	0	0.0	2	6.7	1	3.3
Would	8	26.7	3	10.0	3	10.0	6	20.0
Undecided	1	3.3	8	26.7	2	6.7	4	13.3
Would Not	13	43.3	14	46.7	13	43.3	11	36.7
Definitely Would Not	7	23.3	5	16.7	10	33.3	8	26.7

Characteristics liked about passive solar housing included saves money (20 percent), saves energy (26.7 percent), comfort/convenience (10 percent), and maintenance/upkeep (3.3 percent). Ten respondents (33.3 percent) indicated they lack information to know what they like about passive solar housing.

Listed as characteristics disliked about passive solar housing was cost/payback (30 percent), appearance/design (13.3 percent), and maintenance/upkeep (10 percent). One respondent (3.3 percent) was unsure that passive solar housing saves energy, four (13.3 percent) indicated they were too old to make a housing change, and ten (33.3

percent) lack information to make a judgement. Other characteristics disliked about passive solar housing were listed by 10 percent of the respondents, and included too tight, too much glass, and limited view.

Respondents most liked the money saving (33.3 percent) and energy saving (30 percent) features of active solar housing. Comfort/convenience was listed by 10 percent of the respondents. Eight respondents (26.7 percent) indicated they didn't know enough about active solar housing to know its advantages.

Cost/payback and appearance/design were each listed as characteristics disliked about active solar housing by 20 percent of the respondents. Maintenance/upkeep and other features were each listed by 13.3 percent. These other features included higher insurance costs and potential storm damage. Respondents indicating they were too old to change housing or unsure of active solar technology were 16.7 percent each. Lack of information to make a decision was listed by 23.3 percent of the respondents.

Thirty percent of the respondents liked the characteristic that retrofitted solar housing saves energy. Saving money was listed by 13.3 percent. Comfort/convenience and other characteristics were each listed by 3.3 percent. Respondents indicating they lacked information to make a decision equaled 33.3 percent.

Cost/payback was listed by 26.7 percent of the respondents as a characteristic disliked about retrofitted

solar housing. Appearance/design and maintenance/upkeep were listed by 13.3 percent and 10 percent, respectively. Twenty percent of the respondents indicated they were unsure that solar retrofitting actually works and 26.7 percent lack information to know the disadvantages. Ten percent listed other reasons for disliking this type of housing and 13.3 percent said they were too old to change housing.

Characteristics liked about earth sheltered housing included saves money (13.3 percent), saves energy (26.7 percent), comfort/convenience (40 percent), appearance/design (13.3 percent), maintenance/upkeep (10 percent), and safety (43.3 percent). One respondent lacked information to know what features he liked about earth sheltered housing.

Earth sheltered characteristics disliked by respondents included cost/payback (6.7 percent), appearance/design (43.3 percent), maintenance/upkeep (3.3 percent), psychologically confining (36.7 percent), and damp/musty (10 percent). Two respondents indicated they were too old to change housing, one didn't have enough information to know what he disliked, and two listed other disadvantages of earth sheltered housing.

TABLE XI reflects the advantages of the four housing types as perceived by the respondents. Overall, respondents felt like they knew more about the advantages of earth sheltered housing and listed it as having more safety features and comfort/convenience features than the other

innovative housing types. All four designs were liked for their money-saving and energy-saving features.

Respondents felt like they knew more about the disadvantages of earth sheltered housing than the other innovative housing types, and perceived more disadvantages with its appearance/design and psychological confinement. Cost/payback was listed as a major disadvantage of all solar housing types, but not with earth sheltered housing. TABLE XXII reflects these findings.

Energy Conservation Incentives

Respondents were asked to indicate their level of awareness and use of five incentives for energy conservation. TABLE XIII indicates the results.

TABLE XI

ADVANTAGES OF INNOVATIVE HOUSING

	Passive Solar		Active Solar		Retrofitted Solar		Earth Sheltered	
	n	%*	n	%*	n	%*	n	%*
Save Money	6	20.0	10	33.3	4	13.3	4	13.3
Save Energy	8	26.7	9	30.0	9	30.0	8	26.7
Comfort/ Convenience	3	10.0	3	10.0	1	3.3	12	40.0
Appearance/ Design	-	0.0	-	0.0	2	6.7	4	13.3
Maintenance/ Upkeep	1	3.3	-	0.0	-	0.0	3	10.0
Safety	-	0.0	-	0.0	-	0.0	13	43.3
Other	-	0.0	-	0.0	1	3.3	-	0.0
Lack of Information	10	33.3	8	26.7	10	33.3	1	3.3

* Percent equals more than 100 due to multiple responses.
\- No response

TABLE XII

DISADVANTAGES OF INNOVATIVE HOUSING

	Passive Solar		Active Solar		Retrofitted Solar		Earth Sheltered	
	n	%*	n	%*	n	%*	n	%*
Cost/Payback	9	30.0	6	20.0	8	26.7	2	6.7
Appearance/ Design	4	13.3	6	20.0	4	13.3	13	43.3
Maintenance/ Upkeep	3	10.0	4	13.3	3	10.0	1	3.3
Confining	-	0.0	-	0.0	-	0.0	11	36.7
Musty/Damp	-	0.0	-	0.0	-	0.0	3	10.0
Other	3	10.0	4	13.3	3	10.0	2	6.7
Unsure of Technology	1	3.3	5	16.7	6	20.0	-	0.0
Too old to Change	4	13.3	5	16.7	4	13.3	2	6.7
Lack of Information	10	33.3	7	23.3	8	26.7	1	3.3

* Percent equals more than 100 due to multiple responses.
\- No Response

TABLE XIII

AWARENESS AND USE OF ENERGY CONSERVATION INCENTIVES

	Tax Credit		Loans		Rebates		Reduced Rates		Weatherization		Audit	
	#	%	#	%	#	%	#	%	#	%	#	%
Unaware, Would not use	4	13.3	10	33.3	10	33.3	9	30.0	9	31.0	4	13.3
Unaware, Would use	3	10.0	2	6.7	2	6.7	5	16.7	2	6.9	1	3.3
Aware, Have not used	14	46.7	18	60.0	15	50.0	15	50.0	17	58.6	17	56.7
Aware, Intend to Use	0	0.0	0	0.0	1	3.3	1	3.3	1	3.4	1	3.3
Aware, Have used	9	30.0	0	0.0	2	6.7	0	0.0	0	0.0	7	23.3

Relationships Among Variables

Before statistical analysis could be performed on variable relationships, certain variables were recorded. A "knowledge" score was obtained for each respondent by summing their scores on the seven questions of the energy knowledge quiz. Totaling the number of energy conservation behaviors performed resulted in a "behavior" score for each respondent. Likewise, a "change" score for each respondent was obtained by totaling the number of energy related changes that had been made to their existing residence.

Pearson's Product-Moment Correlation was used to determine the relationships among those variables that were based on numerical scores or ranked categories. The level of significance used for the statistical tests was 0.01.

Demographics

Characteristics of the respondents and their housing were used to determine relationships with energy conservation behavior, energy-related structural changes, and acceptance of innovative energy efficient housing. The results are discussed below and presented in TABLE XIV.

Low negative relationships between respondents' age, education, fuel bill, years lived in current house, and income were found with respondents' energy conservation behavior. The size and age of respondents' housing and their conservation behavior had little correlation.

TABLE XIV

CORRELATION COEFFICIENTS OF DEMOGRAPHIC VARIABLES WITH BEHAVIOR, CHANGE, AND ACCEPTANCE OF INNOVATIVE HOUSING

	Behavior	Change	Passive	Active	Retrofit	Earth Sheltered
Age	-0.25441	-0.32862	0.30932	0.02506	0.21185	-0.05256
Eductaion	-0.33803	0.05998	0.24532	-0.33700	0.03370	0.09795
House size	0.07174	0.24628	-0.23889	0.15792	-0.04235	-0.02318
House age	0.11883	0.56935*	-0.27317	0.15152	0.04236	0.08082
Length of stay	-0.30961	0.43392	-0.02514	-0.02165	0.16635	-0.02130
Fuel bill	-0.20328	0.25032	-0.26437	-0.21492	-0.40078	-0.08343
Income	-0.32339	-0.00143	-0.06956	-0.13316	-0.03542	-0.14583

* Statistically significant (P=0.01)

Little correlation was found between respondents' education or income and their "change" score. Age had a low negative relationship. Both house size and fuel bills had a low positive relationship with respondents' efforts to make energy related changes to their housing. The length of time the respondents had lived in the current home had a moderate positive association. House age had a positive relationship with "change", statistically significant at the 0.01 level.

Respondents' age was found to have a moderate positive relationship with the acceptance of passive solar housing. Education had a low positive relationship. Low negative relationships were found with the size and age of respondents' housing and also with their fuel bill. Income and the length of stay had little association with the acceptance of passive solar housing.

Negligible relationships were found between respondents' age, income, or length of stay, and their acceptance of active solar housing. The size and age of their housing also had little relationship with active solar housing. Low negative relationships were found with education and fuel bill and acceptance.

Respondents' education, income, length of stay, house size and house age had little to do with their acceptance of solar retrofitting their housing. Age had a low positive relationship and fuel bill had a moderate negative relationship.

Demographic characteristics were also correlated with the acceptance of earth sheltered housing. However, there were no associations.

Energy Knowledge

Energy conservation behavior was found to have a moderate positive association with energy knowledge. Changes in existing housing had a low positive relationship with knowledge. The acceptance of passive solar housing was found to have a low positive relationship with energy knowledge. Acceptance of all other types of innovative housing was found to have little association with energy knowledge. TABLE XV summarizes these findings.

Energy Situation

Belief in an energy crisis had a low negative relationship with energy conservation behavior. No relationship was found with structural changes made. Neither the acceptance of passive solar, active solar or earth sheltered housing was found to be correlated with attitude toward the energy situation. The acceptance of retrofitted solar housing was found to have a low negative relationship. The summary of these findings is shown in TABLE XVI.

TABLE XV

CORRELATION COEFFICIENTS OF ENERGY KNOWLEDGE WITH BEHAVIOR, CHANGE, AND ACCEPTANCE OF INNOVATIVE HOUSING

	Behavior	Change	Passive	Active	Retrofit	Earth Sheltered
Energy Knowledge	0.44604	0.22162	0.31115	-0.09422	0.00000	0.04176

TABLE XVI

CORRELATION COEFFICIENTS OF ATTITUDE TOWARD ENERGY SITUATION WITH BEHAVIOR, CHANGE, AND ACCEPTANCE OF INNOVATIVE HOUSING

	Behavior	Change	Passive	Active	Retrofit	Earth Sheltered
Attitude toward Energy situation	-0.23602	-0.00000	0.07158	-0.00000	-0.25622	0.11048

Awareness Versus Acceptance of Innovative Housing

The awareness of passive solar and active solar housing was found to have little association with its acceptance. It was found that the awareness of both retrofitted solar and earth sheltered housing had a moderate negative relationship with its acceptance. TABLE XVII summarizes these findings.

Summary

Those respondents reporting many energy conservation behaviors tended to be those with lower age, education, income and fuel bills, and those who had lived in their current homes only a few years. The size and age of their housing was not related to conservation behavior. Energy knowledge was found to be positively related and belief in an energy crisis negatively correlated with behavior.

Respondents reporting conservation efforts through structural changes tended to be younger, have larger, older homes, and larger fuel bills. Education and income were irrelevant. Energy knowledge was found to be positively associated with energy related structural changes. No association was found with attitude toward the energy situation.

Comfort and convenience were the major reasons listed by respondents for making improvements in their homes. The major reason listed by respondents for not making further

TABLE XVII

CORRELATION COEFFICIENTS OF AWARENESS VERSUS ACCEPTANCE OF INNOVATIVE HOUSING

	Acceptance			
Awareness	Passive	Active	Retrofitted	Earth Sheltered
Passive	-0.02115			
Active		-0.04862		
Retrofitted			-0.39888	
Earth Sheltered				-0.44550

improvements was that additional changes were not needed.

Passive solar housing was found to be better accepted among older respondents and those with little education. Those with smaller, newer homes and smaller fuel bills also reported better acceptance. Income and length of stay were not related to acceptance. Energy knowledge was found to be positively associated with the acceptance of passive solar housing. Awareness of this type housing and attitude toward the energy situation had little to do with its acceptance.

Characteristics liked most about passive solar housing were the money-saving and energy-saving features. Cost/payback was listed as a disadvantage. Many respondents indicated a lack of information about passive solar housing.

Those respondents indicating a higher acceptance of active solar housing tended to have lower fuel bills and less education. Acceptance was not affected by energy knowledge or attitude toward the energy situation. It was also found that awareness of active solar housing had little relationship to its acceptance.

The money-saving and energy-saving features of active solar housing were those listed most as characteristics liked by the respondents. Characteristics disliked included cost/payback and appearance/design. Many respondents indicated a lack of information to make a judgement about active solar housing.

Retrofitted solar housing was better accepted by those who were older and those with lower fuel bills. Energy

knowledge had no relationship. Belief in an energy crisis had a low negative relationship. The awareness of retrofitted solar housing was negatively related to its acceptance.

Saving energy was listed most often as an important feature of a retrofitted solar house. Listed as a disadvantage most often was cost/payback. Lack of information was listed as a concern by many respondents.

None of the demographic characteristics were correlated with the acceptance of earth sheltered housing. In addition, energy knowledge and attitude toward the energy situation were not found to be related to earth sheltered housing.

Comfort/convenience and safety are the characteristics most liked about earth sheltered housing. The appearance/design and psychological confinement were listed as disadvantages.

Sources most often used by respondents for energy information are newspaper, television, utility companies, friends and relatives, and other sources. They place the highest reliability on utility companies, friends and relatives, and other sources.

Energy policies most favored by the elderly include education/information, minimum efficiency standards, and economic incentives.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The dependence on nonrenewable energy sources sets American society in a vulnerable position. The elderly population is affected more than other groups because of their income, housing, health and lifestyle. Dependence on energy supplies can be lessened through appropriate technologies and behavior. Research is needed to understand the energy conservation decisions made by elderly consumers.

Objectives of Study

The purpose of this study was to determine the energy conservation decisions of elderly homeowners, especially their acceptance of innovative energy efficient housing. Specific objectives include: 1) to analyze the relationship between energy conservation decisions and socio-demographic characteristics; 2) to analyze the relationship between energy conservation decisions and attitude toward the energy situation; 3) to analyze the relationship between energy conservation decisions and energy knowledge; 4) to determine the relationship between the awareness of innovative energy efficient housing and its acceptance; 5) to determine

motives and barriers related to energy conservation decisions; 6) to determine sources used for energy information and their perceived reliability; and 7) to determine energy policies acceptable to the elderly.

Summary and Conclusions

Demographics

The sample of 30 elderly heads of households was drawn from voter registration records in Payne County, Oklahoma. Respondents were questioned by personal interview during June and July 1987.

Respondents' average age was 74.2 years. Half had college degrees. The average annual income was near $30,000 with fuel bills of $100.71 per month.

Most of the households lived in single-family detached dwellings with an average size of 1868.38 square feet. The average age of the homes was near 30 years and respondents had lived there over 21 years.

Age was found to be negatively related to energy conservation behaviors and structural changes. Age had little to do with the acceptance of active solar or earth sheltered housing but was found to be positively related to the acceptance of passive solar and retrofitted solar housing.

Education was found to be negatively related to conservation behavior and to the acceptance of active solar housing. It was positively related to passive solar

housing. Structural changes and the acceptance of retrofitted solar and earth sheltered housing were not influenced by education.

Structural changes were found to be positively associated with house size. Passive solar housing was negatively related. House size was not related to behavior or to the acceptance of other innovative energy efficient housing types.

Passive solar housing was found to be negatively related to house age. The age of the respondent's housing had little to do with energy conservation behaviors or the acceptance of other innovative housing types. Age of house was, however, found to positively related to structural changes made, statistically significant at the 0.01 level.

Length of stay was positively associated with structural changes and negatively associated with behavior. It made little difference in the acceptance of innovative housing.

It was found that fuel bills were negatively associated with behavior and with the acceptance of passive solar, active solar and retrofitted solar housing. Fuel bills were positively associated with structural change. They were not related to the acceptance of earth sheltered housing.

Income was found to be negatively related to conservation behavior. Structural changes and the acceptance of innovative housing was not related to income.

Energy Knowledge

Energy knowledge was found to be positively related to behavior, structural change, and to the acceptance of passive solar housing. It had little to do with the acceptance of other housing types.

Attitude Toward Energy Situation

The acceptance of retrofitted solar housing and energy conservation behavior were found to be positively associated with attitude toward the energy situation. No relationship was found between attitude and structure changes or acceptance of other innovative housing types.

Awareness Versus Acceptance of Innovative Housing

It was found that awareness was negatively related to the acceptance of retrofitted solar and earth sheltered housing. Awareness was not related to the acceptance of active and passive solar housing.

Implications

Cooperative Extension

The results of this study indicate that educational agencies such as Cooperative Extension can have an impact of the energy conservation decisions of elderly homeowners. Of eight energy policies, respondents most favored education.

Energy education is a meaningful strategy as energy knowledge resulted in increased energy conservation behavior, structural changes made, and in the acceptance of passive solar housing. The elderly admittedly lack information about innovative energy efficient housing. Because the awareness of retrofitted solar and earth sheltered housing is negatively associated with its acceptance, Cooperative Extension should consider additional programming in this area to dispell any false perceptions.

However, Extension was not listed as a reliable source of energy information. For this reason, it is suggested that cooperative efforts with utility companies be investigated. Additionally, it is important for Extension to identify opinion leaders in the elderly population and focus educational efforts there to be diffused throughout the community.

Housing and Related Businesses

Those in the housing business, including architects, builders, realtors, etc., must begin thinking about the needs and desires of the elderly as the number of senior citizens increases. Overall, the elderly do not widely accept innovative housing types, but are interested in the money-saving features they possess. This study indicates that marketing innovative housing to a sub-section of the elderly population will be difficult, as demographic characteristics were not strong enough to identify a target

population. Education and awareness through housing tours is a suggestion for marketing such housing.

Decision Makers

The elderly population has historically had little participation in energy conservation programs. As their numbers increase, it is important for policy makers to understand the views of the elderly consumer.

In this study, respondents most favored educational programs to encourage energy conservation. They also favored minimum efficiency standards and economic incentives. Because the elderly are rightfully concerned with the long payback periods of energy conservation investments, decision makers must look at the economic incentives available to the elderly.

Recommendations

With an increasing number of elderly consumers and a depleting supply of energy resources, it is important to know how these two situations are related. Recommendations for further research include:

1. A similar study conducted with a different sampling frame to negate any sampling error voter registration cards may have caused.

2. Studies conducted to determine the decision maker(s) in elderly households, such as the head-of-household, spouse, children, or significant other. This study

may have been biased toward males. Further studies should investigate joint decision-making by all members of the household.

3. Studies conducted to identify opinion leaders in the elderly population.

4. A pre-test/post-test research design to more accurately assess the influence of knowledge on the acceptance of innovative housing.

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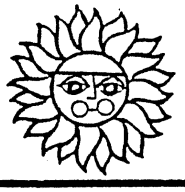
APPENDIXES

APPENDIX A

LETTER TO PARTICIPANTS

ENERGY CONSERVATION DECISIONS
OF ELDERLY HOMEOWNERS



2422 North Husband Place
Stillwater, OK 74075

Dear

Nearly everyone in America is concerned about rising energy costs. This is particularly true of the elderly who tend to live in larger, older homes that require more energy to heat and cool. In addition, the elderly tend to be more sensitive to temperature extremes and spend most of their time at home. The problem becomes more severe for those trying to pay these bills on fixed retirement incomes.

Unfortunately, we know very little about how homeowners such as yourself are coping with these rising energy costs. Without such information, energy conservation programs are difficult to formulate.

Within a week or so, I will be calling you about my research as a graduate student at Oklahoma State University. This is a county-wide study in which I am seeking to understand what older Payne County residents are doing to conserve energy in their homes. When I call, I will first determine whether you meet the qualifications I am looking for: Homeowner, head-of-household, age 65 or older, residing in Payne County. Then I would like to set up an appointment to visit in your home to conduct a personal interview that will only take about an hour.

Your help and that of others being asked to participate in this effort is essential to the study's success. I greatly appreciate it.

At the conclusion of the interview, I will offer you printed information explaining how you can increase the energy efficiency of your home. Also, if you desire, I will be happy to supply you with the results of the study when it is completed.

Again, you can expect to hear from me by telephone in about a week so that we may set up an appointment for an interview. I look forward to talking with you about your energy conservation efforts.

Sincerely,

Carla Earhart

Carla Earhart
Graduate Student

Margaret Weber

Dr. Margaret Weber
Graduate Advisor

APPENDIX B

INTERVIEW SCHEDULE

INTERVIEW SCHEDULE

1. Age _____

2. How much education have you completed?

   1. Less than 12 years
   2. High school graduate
   3. Some college, business, or technical training
   4. Bachelor's Degree
   5. Beyond Bachelor's Degree

3. Housing type:

   1. Single-family detached 2. Mobile home

   3. Condominium/multi-family 4. Other _____

4. Size of residence _____

5. Age of residence _____

6. Length of stay _____

7. Planning to remain at this address:

   1. Yes 2. No

8. Utility provider:

   1. CREC 3. OGE 5. Arkla

   2. ONG 4. SEU 6. Other _____

9. Average monthly fuel bill _____

10. Where is the most effective place to put insulation in a house? (open-ended)

11. What accounts for the greatest amount of energy usage in a house? (open-ended)

12. In which direction should most of the windows in a house face? (open-ended)

13. What is the largest single cause of energy loss in a house? (open-ended)

14. What is the purpose of a fan? (open-ended)

15. On what side(s) of the house should trees be planted to reduce summer air conditioning costs? (open-ended)

16. On what side(s) of the house should trees be planted to reduce winter heating costs? (open-ended)

17. How did you learn about energy conservation? (read from list and list as many as apply)

1. Newspaper 2. Radio 3. Television

4. Government 5. Cooperative Extension

6. Utility Company 7. Hardware/Lumber Store

8. Friend/relative 9. Other _____

18. Which one of these (in question 17) do you consider to be the most reliable?

_____

19. How serious do you consider the energy situation to be? (open-ended)

1. A crisis 2. Serious 3. Somewhat serious

4. Not serious 5. No opinion

20. Please rank these options (1-most favored to 8-least favored) for policies the government might focus on in response to the energy situation. (provide cards for respondents to arrange in order of preference)

___1. Rationing the supply of energy
___2. Set minimum efficiency standards for houses/equip
___3. Help elderly people pay their bills
___4. Provide economic incentives such as tax credits and/or low cost loans
___5. Raise the price of energy
___6. Education/information programs to help people learn about energy conservation
___7. Increase use of nuclear energy
___8. Reduced utitliy rates for elderly

21. What behaviors do you regularly perform to reduce your utility bill or be more comfortable? (read from list and list as many as apply)

    1. Reduce heating in winter
    2. Reduce cooling in summer
    3. Lower water heater thermostat
    4. Close off rooms
    5. Wear extra layers of clothing in winter
    6. Add moisture to the air in winter
    7. Stop drafts around doors, windows with paper, rags, etc.
    8. Use a fan to circulate air
    9. Other _____
    10. No behaviors performed

22. What changes have you made in your house to reduce your utility bill or be more comfortable? (read from list and list as many as apply)

    1. Added insulation
    2. Installed storm or double-pane windows
    3. Installed storm door
    4. Weatherstripped
    5. Caulked
    6. Hung heavy drapes or curtains on windows
    7. Added a ceiling fan
    8. Installed high efficiency appliances
    9. Installed a heat pump
    10. Added solar collectors
    11. Added a sun space
    12. Other _____
    13. No changes made

23. What motivated you to make these changes? (open ended, list as many as apply)

24. What caused you not to make any/additional changes? (open-ended, list as many as apply)

25. Have you ... a passive solar house? (read from list)

1. Never heard of
2. Heard of
3. Read about
4. Seen
5. Considered living in
6. Lived in

(SHOW PICTURES OF PASSIVE SOLAR HOUSE WITH EXPLANATION)

26. Would you consider buying a passive solar house? (open-ended)

1. Definitely would consider
2. Probably would consider
3. Undecided
4. Probably would not consider
5. Definitely would not consider

27. What characteristics do you like about a passive solar house? (open-ended, list as many as apply)

28. What characteristics do you dislike about a passive solar house? (open-ended, list as many as apply)

29. Have you ... an active solar house? (read from list)

1. Never heard of
2. Heard of
3. Read about
4. Seen
5. Considered living in
6. Lived in

(SHOW PICTURES OF ACTIVE SOLAR HOUSE WITH EXPLANATION)

30. Would you consider buying an active solar house? (open-ended)

1. Definitely would consider
2. Probably would consider
3. Undecided
4. Probably would not consider
5. Definitely would not consider

31. What characteristics do you like about an active solar house? (open-ended, list as many as apply)

32. What characteristics do you dislike about an active solar house? (open-ended, list as many as apply)

33. Have you ... a retrofitted solar house? (read from list)

1. Never heard of
2. Heard of
3. Read about
4. Seen
5. Considered living in
6. Lived in

(SHOW PICTURES OF RETROFITTED SOLAR HOUSE WITH EXPLANATION)

34. Would you consider retrofitting your present home? (open-ended)

1. Definitely would consider
2. Probably would consider
3. Undecided
4. Probably would not consider
5. Definitely would not consider

35. What characteristics do you like about a retrofitted solar house? (open-ended, list as many as apply)

36. What characteristics do you dislike about a retrofitted solar house? (open-ended, list as many as apply)

37. Have you ... an earth sheltered house? (read from list)

1. Never heard of
2. Heard of
3. Read about
4. Seen
5. Considered living in
6. Lived in

(SHOW PICTURES OF EARTH SHELTERED HOUSE WITH EXPLANATION)

38. Would you consider buying an earth sheltered house? (open-ended)

1. Definitely would consider
2. Probably would consider
3. Undecided
4. Probably would not consider
5. Definitely would not consider

39. What characteristics do you like about an earth-sheltered house? (open-ended, list as many as apply)

40. What characteristics do you dislike about an earth-sheltered house? (open-ended, list as many as apply)

41. Concerning the Income Tax Credit for certain energy saving investments: (read from list)

1. unaware, would not use
2. unaware, but would use
3. aware of, but have not used
4. aware of and intend to use
5. aware of and have used

42. Concerning the low interest loans offered by utility companies for certain energy-saving investments: (read from list)

1. unaware, would not use
2. unaware, but would use
3. aware of, but have not used
4. aware of and intend to use
5. aware of and have used

43. Concerning the equipment rebate offered by utility companies for certain energy-saving investments: (read from list)

1. unaware, would not use
2. unaware, but would use
3. aware of, but have not used
4. aware of and intend to use
5. aware of and have used

44. Concerning the reduced utility rate offered by utility companies for meeting energy efficiency standards: (read from list)

1. unaware, would not use
2. unaware, but would use
3. aware of, but have not used
4. aware of and intend to use
5. aware of and have used

45. Concerning the government weatherization project:

1. unaware, would not use
2. unaware, but would use
3. aware of, but have not used
4. aware of and intend to use
5. aware of and have used

46. Concerning the home energy audit provided by utility companies:

1. unaware, would not use
2. unaware, but would use
3. aware of, but have not used
4. aware of and intend to use
5. aware of and have used

47. In which of the following yearly income categories is your total household income?

1. $9,999 or less	6. $30,000 - 34,999
2. $10,000 - 14,999	7. $35,000 - 39,999
3. $15,000 - 19,999	8. $40,000 - 44,999
4. $20,000 - 24,999	9. $45,000 - 49,999
5. $25,000 - 29,999	10. $50,000 and up

48. Is there anything else you would like to add to this interview?

_____

_____

_____

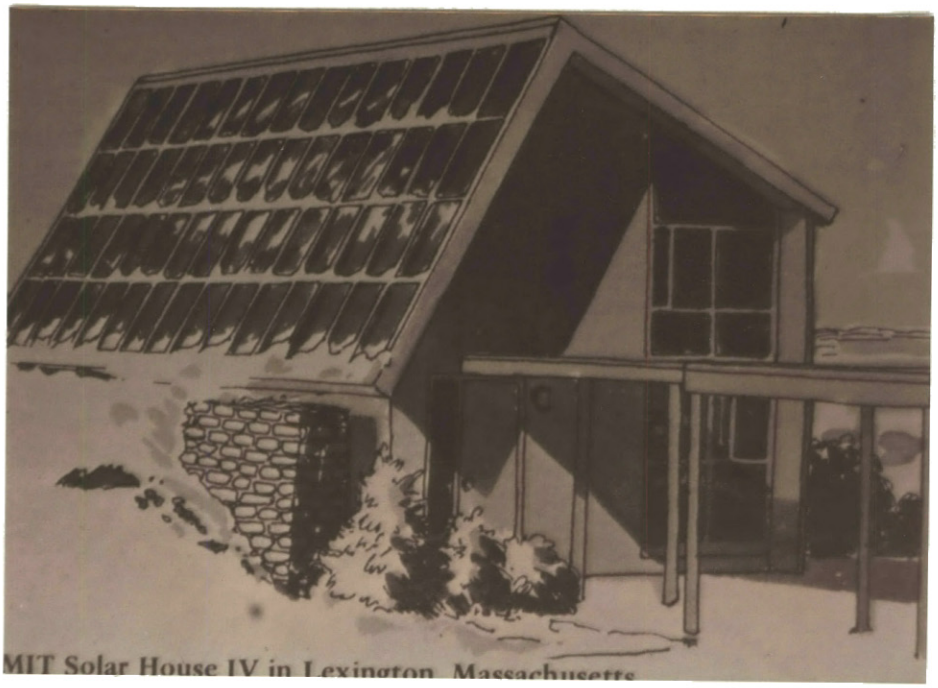
_____

APPENDIX C

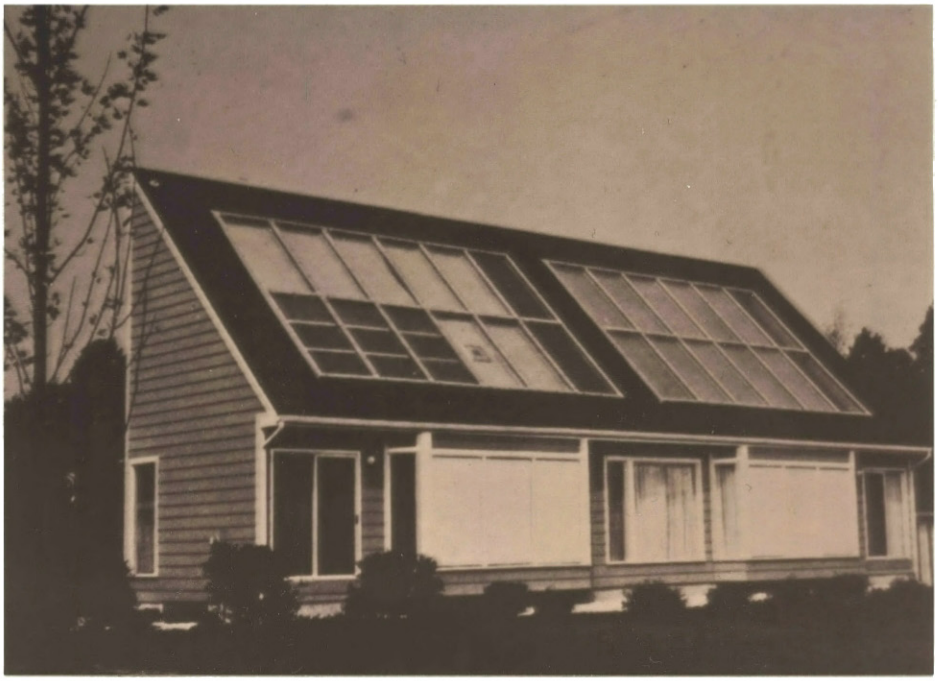
SHOW AND TELL NOTEBOOK

A housing unit using the sun's rays for heating or cooling energy through construction, design site placement, materials, and landscaping to maintain coolness in summer and warmth in winter.


JUNE 21



MIT Solar House IV in Lexington, Massachusetts



ACTIVE SOLAR HOME

A housing unit equipped with solar collectors which collect and use incoming sun's rays to heat and cool the unit.

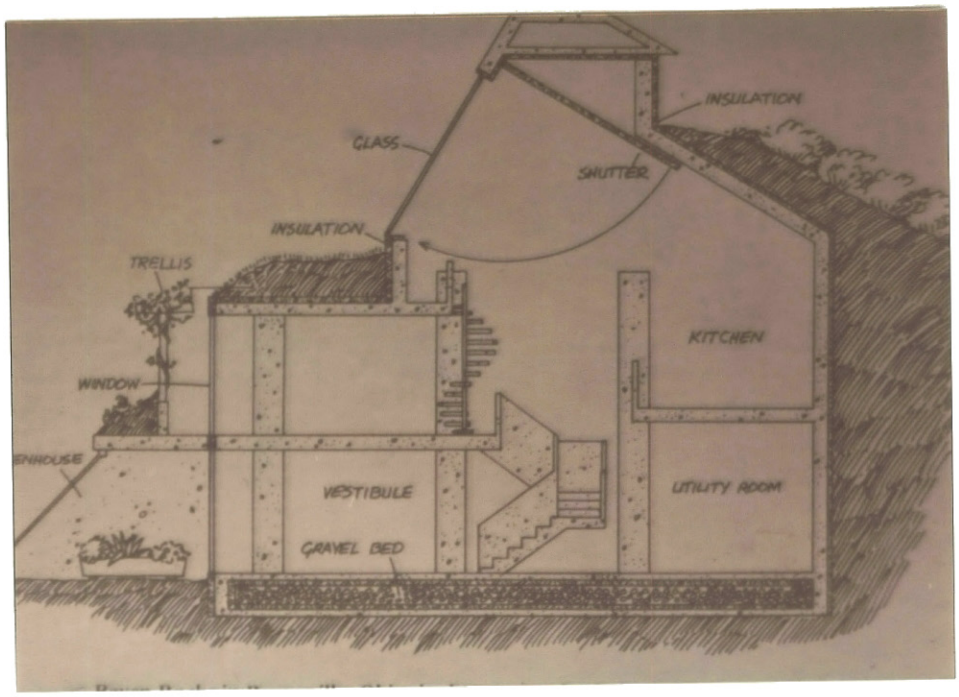
BEFORE IMPROVEMENT

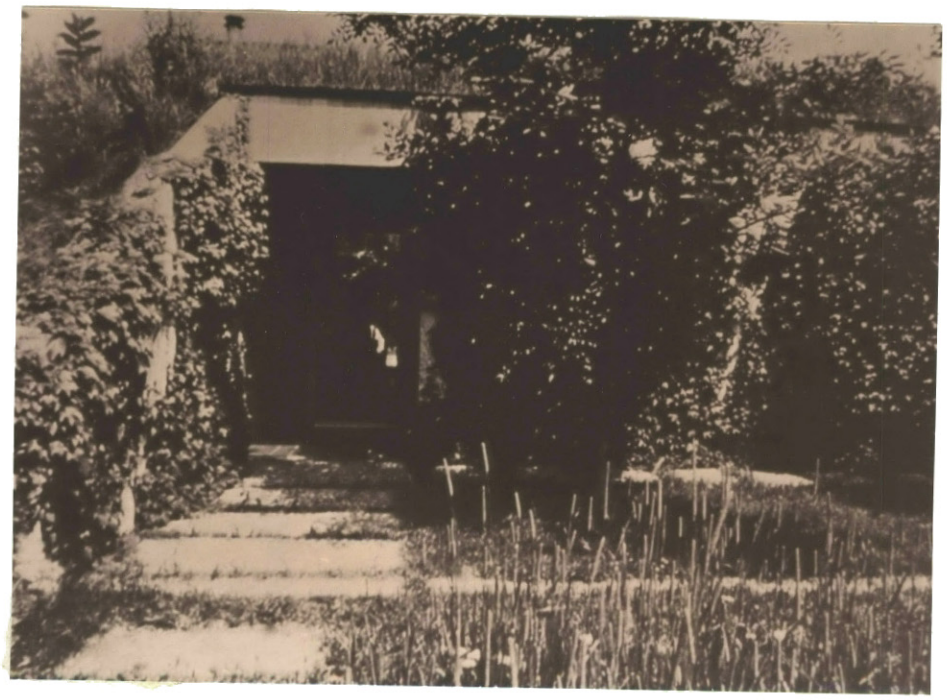
AFTER IMPROVEMENT

AFTER
IMPROVEMENT

RETROFITTED SOLAR HOME

An existing housing unit which is improved using solar technology by altering the structure to increase energy savings.


INSULATION
GLASS
SHUTTER
INSULATION
TRELLIS
KITCHEN
WINDOW
VESTIBULE
UTILITY ROOM
GRAVEL BED



EARTH SHELTERED HOME

A housing unit surrounded partially or completely by soil, using the earth's natural ability to cool in hot weather and warm in cold weather.

VITA

Carla Crosby Earhart

Candidate for the Degree of

MASTER OF SCIENCE

Thesis: ENERGY CONSERVATION DECISIONS OF ELDERLY HOMEOWNERS

Major Field: Housing, Interior Design and Consumer Studies

Biographical:

Personal Data: Born in Stuttgart, Arkansas, January 22, 1958, the daughter of Ray Carlton Crosby, Jr. and Elsie M. Crosby. Married to C. Myron Earhart; children Lindsey Earhart and Allison Earhart.

Education: Graduated from Stuttgart High School, Stuttgart, Arkansas, in May 1976; received Bachelor of Science degree in Home Economics from the University of Arkansas in May, 1980; completed requirements for the Master of Science Degree at Oklahoma State University in December, 1987.

Professional Experience: Payne County Extension Home Economist, Oklahoma Cooperative Extension Service, August 1984 - present; LeFlore County Extension Home Economist, Oklahoma Cooperative Extension Service, March 1981 - July 1984.