IMPACT OF ENERGY COSTS ON HOUSING RELATED DECISIONS OF ELDERLY HOUSEHOLDERS

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Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF EDUCATION
July, 1979

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ACKNOWLEDGMENTS

Appreciation is extended to all those who have assisted in making the completion of this study a possibility. Special appreciation is expressed to Dr. Elaine Jorgenson, major adviser, for her counsel and guidance, and to Dr. Margaret Callsen, thesis adviser, for her generous investment of time, guidance, and interest. Sincere thanks are also extended to Dr. Donald Allen, Dr. Carl Hall, and Mrs. Christine Salmon for their support, assistance and guidance. Dr. William Warde and Mrs. Iris McPherson provided valuable assistance with programming and statistical analyses.

Appreciation is also extended to Cooperative Extension Service, University of Arkansas for support and cooperation in the collection of data. Gratitude is extended to participants who supplied data for the study, and to Arkansas Power and Light Company and Arkansas Western Gas Company for their assistance and cooperation.

Special recognition is extended to the members of my family who have supported and encouraged my career in education.

Finally, deepest appreciation is reserved for my husband, for his encouragement, understanding, and support. Without your help, Bob, I could not have achieved this goal.

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CHAPTER I

INTRODUCTION

Energy costs have risen an average of 12.9 percent annually since 1970. The purchasing power of the dollar in April, 1979, was $.489 as based on the value of the dollar in 1967 (U.S. Department of Labor, 1979). This indicates the squeeze being placed on the American consumer due to the increase in commodity costs and the decrease in purchasing power. Families on fixed incomes, such as the elderly, have been especially affected. The elderly constitutes 10.5 percent of the population of the United States. In 1975, 15.7 percent of all persons over the age were below poverty level (Siegal, Herrenbruck, Akers, and Passel, 1976).

Senator Pete V. Domenici, addressing the Special Senate Committee on Aging, made the following comments concerning the energy crisis and older citizens:

> What happens to the older couple whose cost of heating has risen 66 percent in one year when the Consumer Price Index, which determines increases, has only risen 11 percent?
>
> . . . Another reason the elderly generally suffer more is that, by and large, there is less fat in their budgets to cut back on. Without luxuries, what does one give up; food, doctor visits, going to church, the telephone? Our elderly citizens are having to give up these things, but I think this is asking too much.
>
> Although usually the elderly aren't extravagant with energy, the high costs may cause them to cut back on the most expensive item - heat. Arthritis and other chronic conditions affecting many elderly are worsened with reduced heat, so

> that these elderly are bound to lose in this struggle of health against budget (Special Committee on Aging, United States Senate, 1975, p. 82).

According to Newman and Day (1975), the energy gap like the income gap poses significant public policy problems. The poor use less energy and pay a higher percentage of their income for energy. They use energy for essentials - space and water heating, cooking, food refrigeration, and lighting. The affluent can afford and use more energy, have and buy more energy-conserving features, such as micro-wave ovens, equipment with better energy efficient ratios, adequately insulated homes, and storm windows.

Housing is an area that relates directly to energy consumption patterns. There are nearly 70 million existing residences in the United States (U.S. Department of Commerce, Bureau of the Census, 1971) which make up nearly 20 percent of the annual energy consumption (Stanford Research Institute, 1972). Sixty percent of this is used for space heating and cooling alone. There is a potential for reducing the heating and cooling requirements in many existing residences, because a majority of these houses were built when energy was relatively inexpensive and there were few incentives to encourage energy conservation (Peterson, 1974). Single-family detached dwellings use more energy than multi-family dwellings (Real Estate Research Corporation, 1974). In the 1960's the number of households grew by 17 percent, reflecting a tendency toward smaller households, and the elderly and young adults living in their own homes (<u>Exploring Energy Choices</u>, 1974). Montgomery (1965) found that 84 percent of the married elderly families living in rural Pennsylvania owned their homes and that 73 percent of these homes were relatively old.

Statement of the Problem

The Arab oil embargo of 1973-74, rising energy costs, the harsh winters and extremely hot summers from 1976 to 1979, among other well-publicized problems have focused attention on the energy crisis being faced by Americans.

Much publicity has been given to the consumer's role in conserving energy by changing his consumption patterns. There are indications that the rapid increase of energy costs have placed a financial burden on many of the nation's elderly. A few recent studies have been made on the energy consumption practices of families, but studies on the impact of rising energy costs on the housing-related decisions of elderly people have not been published at this time.

How much does the elderly person know about energy-saving and energy-wasting practices? Are they decreasing energy consumption in their homes by energy conservation practices? Are they retrofitting their homes to make them more energy efficient? Is the energy crisis affecting the way they live? Government, educators, and industry need information on how the elderly deal with the energy crisis in their lives.

The purpose of this study is to determine the impact of rising cost of energy on certain housing-related decisions of the elderly. These include decisions to (1) conserve energy in the home, and (2) retrofit their houses to make them more energy efficient.

The findings of this study will serve two purposes: (1) use as a basis for planning educational programs for elderly citizens relative to energy conservation, and (2) possible input in the formulation of a more equitable energy policy toward the low and middle income groups of the elderly.

Objectives of the Study

The objectives of the study were to:

1. Obtain data concerning energy sources and the total cost of direct energy used in single family detached dwellings of elderly householders.
2. Compare selected socio-economic characteristics with the total cost of direct energy consumed in single-family detached dwellings of elderly householders.
3. Determine if selected dwelling features affected the total cost of direct energy consumed in single family detached dwellings of elderly householders.
4. Determine if (a) the total cost of energy consumed in dwellings of elderly householders, (b) knowledge of energy conservation, and (c) changed energy conservation practices were associated with decisions to retrofit their dwelling.
5. Determine if energy conservation knowledge affected energy conservation practices in the household.
6. Determine if there was a relationship between energy conservation knowledge and the total cost of energy consumed in dwellings of elderly householders.
7. Determine if the total cost of energy consumed in dwellings of elderly householders affected energy conservation practices in the household.

8. Make recommendations for energy saving programs for elderly householders.

Hypotheses

The hypotheses of the study, stated in the null form, were:

1. There is no significant difference between the total cost of energy consumed in households of elderly people and specified socio-economic characteristics.
2. There is no significant difference between the total cost of energy consumed in households of elderly people and selected dwelling features.
3. There is no significant difference between (a) the cost of energy consumed in households of elderly people, (b) knowledge of energy conservation, and (c) changed energy conservation practices and decisions to retrofit their dwelling.
4. There is no relationship between energy conservation knowledge and changed energy conservation practices in the household.
5. There is no relationship between energy conservation knowledge and the total cost of energy consumed in households of elderly people.
6. There is no relationship between changed energy conservation practices and the total cost of energy consumed in households of elderly people.

Assumptions

The following assumptions are basic to this study:

1. The cost of direct residential energy can be determined by examining household or utility company records combined with perceptual data from household members.
2. The cost of energy is based on, and proportionate to, the direct consumption of energy by the household.
3. Data supplied by the respondents and utility companies are relatively accurate.
4. The selected sample is typical of the elderly population in towns of less than 2,500 population.
5. Certain practices can be judged energy-saving while others are energy-wasting.

Limitations of Study

The results of the study were examined in terms of the following limitations:

1. The study was limited by the geographic area, perceptual information of the respondents, and data from certain utility companies.
2. The study was limited to households whose heads were 62 years of age and older.
3. The study was limited to people living independently (capable of taking care of their own affairs).
4. The study was limited to people living in small incorporated towns in a non-metropolitan area and using a purchased or non-purchased energy source.
5. The study was limited to people living in single-family detached dwellings, including mobile homes.

6. The study did not attempt to measure energy efficiency or transfer of heat of the dwelling; nor, was an attempt made to measure the degree of comfort experienced by the respondent.
7. Participants in the study were limited to household heads, aged 62 years of age or older, or his or her spouse, who were registered to vote in the incorporated towns of Marion County, Arkansas, as of January 1, 1978.

Definition of Terms

For the purpose of the study these terms were defined:

Decision Making - the choice or resolution of alternatives (Deacon and Firebaugh, 1975).

Elderly - a person 62 years of age or older.

Energy Conservation Practices - "activities which directly use mechanical energy in the household. Excluded are indirect uses of mechanical energy and use of solar and human energy" (Hogan, 1976, p. 11).

Energy-Saving Practice - "one in which the consumer makes a conscious decision concerning the benefits derived from a practice and/or selects a practice that uses the least possible energy in the circumstances" (Kilkeary and Thompson, 1975, p. 5).

Energy-Wasting Practice - "one which the consumer (a) derives no direct benefit, . . . or (b) when the consumer fails to recognize or consider an energy saving alternative, if he has one" (Kilkeary and Thompson, 1975, p. 5).

Household - one or more persons occupying a single housing unit (U.S. Department of Commerce, Bureau of the Census, 1970).

Household Membership - all persons living in a single housing unit (U.S. Department of Commerce, Bureau of the Census, 1970).

Non-Metropolitan Area - a region that does not have a city with a population of 50,000 or more.

Practice - a single action, the usual way of doing something.

Retrofit - any construction, improvement or material added to dwelling after the initial construction.

Small Incorporated Town - a populated area of 2500 people or less, who are united, or regarded as united, and having certain legal rights and privileges distinct from those of the individual members of the group.

Total Energy Cost - annual expenditure for direct residential energy from all sources.

CHAPTER II

REVIEW OF LITERATURE

Although prices have climbed rapidly in all segments of the economy since the Arab oil embargo of 1973-74, recent rises in energy prices have put the most strain on household finances (U.S. Department of Labor, 1979).

Energy consumption is influenced by many factors. Constraints are imposed upon family members' ability to decrease energy use beyond a certain point without a drastic change in life styles. Residential energy consumption depends upon a family's age, income, number of household members, region and climate, number and type of appliances used, type of heating and cooling equipment, and prices of utilities. Some of these can be modified by considerable capital investment and others are beyond the control of the family (Meeks and Oudekerk, 1978).

A brief summary of research and literature pertinent to this study is given in this chapter and organized in the following manner: (1) studies related to residential energy consumption, (2) dilemma of creating a national energy policy, (3) characteristics of the elderly population, and (4) energy and the decision making process.

Studies Related to Residential Energy Consumption

Studies relating to residential energy were escalated by the short-run shortage of 1973-74. However, at this time, 1979, the literature does not reveal a great number of studies dealing with this problem. Several studies have been reported from the Michigan Agricultural Experiment Station Project, "Functioning of a Family Ecosystem in a World of Changing Energy Availability" (Gladhart, 1975; Morrison, 1975; Eichenberger, 1975; Zuiches, 1976; and Hogan, 1976). Data from "Kentucky Goals Study," a survey conducted by Cooperative Extension Service, University of Kentucky, was used in a study by Donnermeyer (1977). A summary of these and other studies will be given in this review.

A 1971 study sponsored by the Ford Foundation and reported by Newman and Day (1975) was concerned with the relationship of energy use to people as consumers. This study consisted of two surveys: (1) a national survey of 1,455 households; and (2) a survey of the household's electric and natural gas companies to obtain energy cost and consumption data. The two sets of data were matched to compare the cost and consumption of electricity and natural gas with the respective household characteristics and the dwelling characteristics. Income groups were compared, especially the poor and the well-off. Correlation and descriptive statistics were used to analyze the data.

Findings of the Newman and Day study showed that households with higher incomes used more energy at home and in automobiles. Most homes were bought or rented. Householders had little choice about the design and built-in energy related features of homes that they did not plan or build.

Morrison (1975) studied the total amount of direct energy consumed in single family dwellings, the relative importance of a selected set of socio-physical factors on the total amount of direct energy consumed, the relationship between the family's belief in the reality of the energy problem, and the amount of energy consumed in single family detached dwellings. This study consisted of a sample of 97 households. Data were collected by survey, interview procedure, and energy data provided by utility companies and fuel oil distributors. Path analysis based on multiple-regression was the statistical method used for analyzing the data.

Morrison reported that energy consumption in single family dwellings was related to components of life-style and behavior as well as the physical housing factors. Belief in reality of the energy problem did not affect a change in energy consumption patterns. Therefore, this study indicated in the short-run (energy crisis period, winter 1973-74), energy consumption was determined by aspects of family life style which did not incorporate a new energy conservation ethic. Public policy and educational programs based on these findings were suggested as implications by this researcher.

A pilot level investigation of two procedures designed to encourage reduction of energy use by residential consumers was conducted by Winett and Nietzel (1975). The respondents for this study were 31 volunteer households in Lexington, Kentucky. Electric and natural gas consumption for an information group and an incentive group was monitored weekly over a two month period. The information group received detailed energy-conserving procedures for both electricity and natural gas. Subjects in the incentive group were also given the conservation manual, and, in addition, cash payment contingent on their meeting predetermined levels of energy conservation. At the initial contact with the participants, an Environmental Quality Questionnaire was administered, past utility bills were examined, and the remainder of the study was explained.

Methodology of the Winett and Nietzel study involved the establishment of the base line period, which was accomplished during the first two weeks. Utility meters were monitored, no information or contingency for energy reduction was given. The experimental condition was administered and the meters were monitored for the next four weeks. The monetary contingency was withdrawn and the meters were monitored for two more weeks. A second follow-up assessment of electricity and natural gas was conducted two months later. One-way, two-way, and repeated measures of analysis of variance and correlation were the statistical methods used. The experimental group with incentive used significantly less electrical energy than the information group. The natural gas consumption was related more to climate than to experimental treatment. The two month follow-up revealed a tendency for the experimental group to wane. Implications of this study revealed a need to assess the incentive program theory to change behavior in the long run.

The primary objective of an exploratory study as reported by Kilkeary and Thompson (1975) was to determine if exposure to a crisis situation resulted in different energy consumption practices. Two communities were studied in the Queens and Bronx sections of New York City. In 1973 the Queens community had experienced an extended power failure while the Bronx community had not.

An Energy Knowledge Inventory (EKI) and a Change Practice Inventory (CPI) were developed to record the respondent's energy knowledge and actual practices, respectively. The statistical methods used to analyze the data were analysis of variance, Pearson's Correlation and Chi square. The factors of car ownership, income, educational attainment, and family composition related positively with the EKI scores; while, exposure to extended blackouts, direct payment of utility bills, car ownership, belief in family effort, income, and family composition related positively to scores on the CPI. This study revealed that moderate income consumers strive to be energy-saving while the more affluent consumers do not change their energy use practices.

Hogan (1976) was concerned with determining if there were differences in the adoption rate of household energy conservation practices among families with varying husband-wife patterns of congruency and commitment to values. The values studied were self-esteem, familism, social responsiveness, and eco-consciousness. A scale of 14 practices was used to measure the adoption rate of household energy conservation practices. Contextual variables were also studied in respect to adoption of practices and intrafamilial value patterns. Contextual variables were: wife's education, husband's occupation, wife's employment status, husband's education, family income, family size, urban-rural residence, wife's age, and husband's age.

Hogan reported that the value of eco-consciousness is a meaningful predictor of energy conservation behavior. No systematic relationship was found between energy conservation behavior and the contextual variables. Social responsiveness and eco-consciousness were related to the contextual variables. Social responsiveness was positively related with husband's education, wife's education, and family income. Commitment and congruency levels of eco-consciousness were positively related to the husband's education, wife's education, and husband's occupational prestige. The adoption of conservation practices or contextual variables were not significantly related to the value of self-esteem and familism. Hogan recommended that educational programs examine the value of eco-consciousness and its positive relation to the adoption of energy conservation practices and the linkage between education and eco-consciousness.

Donnermeyer (1977) examined house-related factors such as size of house, and attitudes toward the environments and energy consumption with respect to their ability to predict levels of residential energy consumption. Also examined was the correlation of attitude and behavior. The sample size was 104. Results of this study revealed that total family income was the single best predictor of consumption. Opinions, salience or priority were not significantly correlated with consumption. However, some of the behavioral intention items showed moderately strong correlation with consumption.

The Dilemma of Creating a National Energy Policy

Energy shortages in the United States and the lack of a coherent policy to deal with them has presented the government with a very serious problem. This is a new situation for the American people who have built up customs and life-styles based on an abundant supply of everything. Representative Mike McCormack (1973, pp. 7-11), Chairman of the Sub-committee on Energy, explained the energy problem to the Pennsylvania Power Conference in 1973 as follows:

> The energy crisis that our nation faces today can be divided into four separate crises - each interrelated with the other and each of approximately equal concern to all of us. We must solve two of these at once:
>
> We have immediate shortages of petroleum products and electricity. To meet the crisis in energy caused by these shortages, we must find a way to improve distribution and availability both of petroleum products and of electricity.
>
> We must solve our immediate shortage problems - without undue harm to the environment.
>
> We have slightly more time to solve the other two crises, but they are equally pressing and urgent:
>
> We need much more accurate forecasts than we have had in the past of exactly what our nation's energy consumption and total energy production will be for the next 20 years.
>
> We need to develop long-range programs that will provide this country with adequate energy for our needs in 25 to 30 years.

At the present time, Spring, 1979, Congress and the Carter Administration have yet to agree on a National Energy Program. Conflicting opinions have been expressed about the cause of the energy problem, ways of dealing with it, and predictions as to the future supply and demands of fossil fuel. This is indicated by the following review of literature.

Public interest in conservation of energy seems to subside with the end of short-run shortages (Murray, Miner, Bradburn, Cotterman, Frankel, and Pisarski, 1974) but the conditions which make the nation vulnerable to withdrawal of foreign oil still exist. The environmental problem connected with energy production and consumption is also serious and could lead to a crisis if indifference and neglect of the problem continue (Ford Foundation Energy Policy Project, 1976).

The unexpected soaring prices being experienced by the American consumer creates the suspicion that the oil companies are profiteering on the situation, which leads to uncooperative attitudes in solving the energy problem. However, the appeal to save energy by saving money is likely to be more effective for conservation than is patriotism or civic pride (Freeman, 1974).

Freeman (1974, p. 10) stated:

> An alternative is to raise prices, encouraging more efficient energy use, by imposing taxes on energy that could fund research and development of new sources and new technology. This approach has the advantage of insuring that government rather than industry captures any windfall profits. On the other hand, industry would not have the same incentive to increase supplies. Congress has not been eager to assume responsibility for raising energy prices. If it does so, the taxes should be progressive. Lower income groups could be badly hurt by high energy prices, no matter where the money goes. The energy crisis we face is as deeply engrained as our life styles and the solutions mean reconciling changes in lifestyles and protecting the environment, maintaining our independent leadership role in the world and striking a fair balance between the prices consumers pay and the profits companies make.

Attempts have been made to develop long-run proposals on energy, but uncertainty about the actual dimensions of the crisis precluded much positive action. Adverse consequences of the energy crisis have been made by the leaders of business and government, but their predictions were often contradictory (Academy Forum, 1974).

In a congressional subcommittee hearing, Chairman Edward R. Roybal introduced two approaches to providing energy assistance to the elderly. One way was to provide financial assistance, such as fuel stamps, emergency assistance, income tax credits, or lifeline. Another way was to redesign rates and prices employed by utility companies to benefit consumers who use small amounts of energy (U.S. House of Representatives, 1978).

Acceptability of energy policies was the focus of a study by Zuiches (1976). From studying mid-Michigan families, Zuiches found that such residential end-use policies as restricting the use of electricity would be acceptable to only about 10 percent of the families; gasoline rationing was not supported by the majority with a wide difference between urban and rural residents. Energy conservation policies such as the re-establishment of local grocery stores, tax deductions for home insulation and home improvements, increased home gardening, and more food preparation at home were supported. However, key transportation policies, such as gasoline rationing and tax deductions for families with small cars or only one car, did not receive majority support, but 77 percent of those scoring high on energy awareness supported these policies. The potential for attitude change was evident as revealed by the association between education and policy acceptance.

Characteristics of the Elderly Population

The estimated population of the elderly in the United States is 22 million (U.S. Department of Commerce, Bureau of the Census, 1976). Census information revealed some interesting facts about this segment of the population. The elderly are increasing in numbers more rapidly than the whole population; there are more elderly women than men; the largest proportions of older people live in those states from which the younger population has left in search of economic improvement; more of the elderly are living alone; they are less educated and have lower incomes than younger segments of the population (U.S. Department of Commerce, Bureau of the Census, 1973a). Of the total population aged

65 years and over in the United States in 1974, 15.7 percent were classified below poverty level. Of those aged 64 years and over of the estimated 1975 total population, 8.8 percent were males and 12.1 percent were females; 79.3 percent of the males were married and 39.1 percent of the females were married; 33.4 percent of the males and 36.5 percent of the females had finished high school; 21.7 percent of the males and 8.3 percent of the females were still working (U.S. Department of Commerce, Bureau of the Census, 1976).

When considering the elderly population as a whole, studies point to certain characteristics which are representative of the group. Lawton and Azar (1965) found that the elderly faced physical changes as they got older. The older person reacted slower than the younger person, was unable to cope with environmental change as effectively, and required a longer time to accomplish readjustment. The elderly tired more quickly and easily than they did in their youth. There were certain common progressive impairments and disabilities which were limiting to the aging. The elastic fibers of connective tissue degenerated with passing years, influencing the ability of aged persons. Eye changes were conspicuous with advancing age. Hearing loss had the highest correlation with chronological age of any of the sensory diminutions. Changes in their sensory and perceptual processes included not only a decline in memory, weakness of attention and emotional instability, but also lack of responsiveness and slowness of movement.

Lersten (1974) pointed out that as aging advanced, self-concept and feelings about the body were altered by many persons. The lowered efficiency of the body contributed to decreased motivation to exert oneself physically. The results produced feelings of inadequacy and fear of failure.

Even though the elderly have physical problems of one sort or another, according to Chinn and Robins (1970), the vast majority of the elderly were not in poor health; they were not significantly dependent; they were not institutionalized. This does not mean that the elderly were not plagued by chronic ailments. The point that Chinn and Robins made was that most elderly were not bed-fast and unable to care for themselves. In spite of chronic disabilities, most elderly were still able to function. Some 96 percent of persons over 65 lived in their communities and, of this group, 82 percent were able to carry on the normal activities of daily living.

Chinn and Robins (1970, p. 210) further stated:

> In terms of 'chronic conditions' and 'most prevalent diseases' the process of aging would seem to lead inevitably toward debility, dependence, and despair. However, if we look at the aging person in terms of his or her capacity to function physically, mentally, and socially, we see great resources for adaptation, and great potential for independent and happy living.

Shanas (1974) reported from an international study that two to four percent of the elderly population are bedfast at home, irrespective of country. In every country more than three-fourths of the population are ambulatory.

Another characteristic of the elderly is that their educational attainment is much lower than younger adults. However, analysis of census data revealed that educational opportunities have been increasing in recent years, along with the means of taking advantage of these opportunities (U.S. Department of Commerce, Bureau of the Census, 1973d).

The elderly person is often depicted as deprived and disadvantaged. Reduced income is a characteristic also common to their age cycle (Montgomery, 1973). Kreps (1970) points out that in our society, man's capital or his productivity determines the size of his income. There are two non-earning periods in man's life; when he is young and when he is old. During the twentieth century these periods have become longer than in the past. This has resulted in more time which man does not work and has added to the problem of less income for the older person.

> Low incomes, perhaps the number one problem of the aged, are likely to persist. Particular attention is currently being drawn to the income problems of aged widows, to health needs and rising medical costs, to problems associated with home ownership and taxation, and to the implications of early retirement from the labor force. . . . Projections indicate that Social Security, private pensions, and other forms of retirement income are not improving fast enough to counter present economic trends (Kreps, 1970, pp. 82-83).

The above prediction is confirmed by the purchasing power of the dollar as based on the 1967 base period of the Consumer Price Index.

Heltsley (1971) in a study of the living patterns of aging persons of small towns, revealed that what are lesser problems to younger people often become major obstacles for the elderly. For example, the routine act of buying and preparing food often represents a major task. Fixed incomes, lack of transportation, poor health, and limited social interaction compound the problems of high costs and low incomes. Adequate diets for the older person have been a concern of nutritionists for years; many cannot afford the food they need. Inflation has drastically influenced the buying patterns of the aged on fixed incomes.

The aforementioned characteristics of the older person point to certain needs in housing for this group. The 1971 White House

Conference on Aging (1973) revealed that housing to the elderly is one of the most important elements in life. The older person spends more time at home and many satisfactions are house oriented. Housing to be good must deal with the individuals' need for independence, for security, for identity, and for well-being.

McGregor and Pfister (n.d.) found that good housing can contribute to or shorten the time a person can live independently at home. For older people, staying at home is very important, and it can also be very dangerous. Many things can be done to homes to make them safer for the aged to live independently. Many of these things require the use of energy.

Montgomery (1965) concluded that living in one's own home is not actually synonymous with total independence, but that as people get older they become more dependent. Good housing is conducive to independence. In a study of the housing needs of older people in rural areas, Cowles and Sweeney (1957) found that older people liked to live in familiar surroundings, close to their friends and associates. They did not like to be isolated. Roscow (1965) found that the number of older people's local friends varied with the proportion of old neighbors, and the aged tended to select their friends from older rather than from younger neighbors. From studies on relocation of the aged, Niebanck (1965) reported that the elderly do not readily find new friends, especially the single individuals. However, couples seemed to fare better.

Palmore (1971) studied certain variables as related to needs among the aged poor, and found that sex was the strongest factor related to housing needs. Older men had more housing needs than women. Those with less education, less income, and those who lived alone tended to have more housing needs. Education was cited as the most important variable of the last three.

Agan and Anderson (1961, p. 3) state: "Little research has been devoted to solving the problems of housing the aged in any group, and less to the special needs of the rural aged." In their study they found that the aged had, and to a great extent desired, independent living arrangements. Eighty percent are self-supporting and 83 percent own their homes. Montgomery (1965) found that a group of elderly people living in a small town and surrounding rural area in Pennsylvania desired to remain in their present residence. Economic, maintenance activity, and decision-making autonomy of these old people were studied. Montgomery also found a high percentage (84%) of the married persons owned their homes. The desire for independence was very evident, even though findings suggested that a high percentage was dependent upon help from their children or other relatives.

Montgomery (1965, p. 90) found while studying the rural aged in Pennsylvania that:

> The perceptions which these older persons had of their neighborhoods and housing are revealing. Seventy-eight percent of them said that they liked their neighborhoods 'very well,' and 76 percent stated that they liked their houses 'very well.' Meanwhile, 64 percent of the respondents perceived their houses as being safe.
>
> The interviewer's evaluation of housing gave a somewhat different impression. For example, 73 percent of the dwellings were relatively old houses having two or more stories. Almost 90 percent of all dwellings were reached by means of steps or stairs.

A study designed to add to the general understanding of housing (Montgomery, Sutker, and Nygren, 1959) revealed that older persons were relatively well satisfied with their housing. The study conducted in Oklahoma revealed that over 39 percent of the respondents were over 55 years of age. It is sometimes argued that older persons leave their farm homes and move to town. The findings of this study suggested that the proportion of younger people leaving the rural areas was much greater than older people. This also supported the statement that "states with the largest proportion of older people are those in which the younger population has left in search of economic improvement" (U.S. Department of Commerce, Bureau of the Census, 1973d, p. 1).

Few of the older people had made recent improvements or were making housing adjustments in preparation for their old age (Montgomery, 1965; Nygren and Sutker, 1964). This finding prompted Montgomery (1965) to recommend that adult education programs, such as the Cooperative Extension Service, need to devote greater effort to educating adults, especially older adults, in making and then implementing wise housing decisions.

Energy and the Decision Making Process

Decisions related to energy are present in just about everything that individuals and families do. Decisions concerned with the use of direct energy sources involve temperatures at which to keep living space, whether to retrofit dwellings, how much to use the automobile, how clean to keep the bath, shower and laundry, how the meals are cooked, use of the refrigerator and many more.

Indirect energy use involves decisions on housing, the type, size, location, and insulation. Consumer choices as to what kinds of appliances are purchased, clothing selected, and the amount and processing of food eaten are all included in the decision making process (Hogan, 1978).

People spend their lives making decisions. Decision making is the choice or resolution of alternatives (Deacon and Firebaugh, 1975). Most decisions are voluntary, so decision making is an important art. Decision making can be difficult, especially in a country which allows the citizenry to make their own decisions. It is a complex art, because decision making includes the procedures for reaching sound decisions on the basis of pertinent knowledge, beliefs, and judgments, in addition to procedures for obtaining the required knowledge, ideas and predictions. Decision making is an applied art. It involves the application of knowledge, experience, mental and moral skills and the power to determine what action should be taken to deal with a variety of problem situations (Fulcher, 1965).

Fulcher (1965, pp. 6-7) states that decisions may be classified into four types, depending on how they are made:

1. Impulsive decisions, determined by impulsive or emotional reactions to situations, without reflection;
2. Routine decisions, which deals with familiar situations in accordance with habits, customs, or rules;
3. Casuistic decisions, determined by accepted ethical, moral, or religious principles; and
4. Thoughtful decisions, made after giving thought to such pertinent factors as the problem situation, the alternative courses of action available, and the probable consequences of each.

It is thoughtful decision making that is of primary relevance to this study. Thoughtful decision making may involve these factors: (1) a problem situation; (2) a purpose to be achieved; (3) alternatives for dealing with the situation; (4) the probable consequences for each alternative; and, (5) values which the decision-maker may attach to the probable consequences of the alternatives (Fulcher, 1965).

Decision making in the home often grows out of specific needs. In various roles as family members, people are involved with several areas of decisions - economic, social, and technical. Economic decisions may have social implications; social decisions may have both economic and technical consequences; and technical decisions may have social and economic consequences. The amount of money the decision maker has affects the kinds of economic decisions he or she make. A certain amount of money is required for the decision maker to have a real choice about its use. At the subsistence level, money is usually spent on basic necessities, or occasionally, for avenues of escape from the problems of life. Many social decisions involve making changes in areas that are related to values. Actions are usually consistent with real values (Oppenheim, 1972).

Decision making is crucial to management. Management occurs when some change is desired or required, a problem to be solved or a choice to be made. One aspect of the action element in management is represented by decisions motivated by values and goals. The process of making a single decision is not as complex as the managerial process, which requires many interrelated decisions (Gross and Crandall, 1973).

The components in decision making do not always occur in a step-like manner. Individuals or groups, using the decision making process, may omit some, overlap others, or alter the sequence of use. Decision making steps can reflect the environment in which they are used as well as the personalities of the participants (Nickell, Rice, and Tucker, 1976). A probability expresses the likelihood of the occurrence of a particular outcome. Subjective probabilities are those assigned by the decision maker. The decision maker will draw on logical inference, personal experience, experience of others, in addition to other data to form a judgment as to the probability of an outcome. Utility is the total satisfaction associated with a particular outcome.

Maynes (1976, p. 192) states:

> . . . the more knowledgeable the decision maker, the better is the quality of decision-making. . . . The person whose factual knowledge of his environment and whose capacity for forming 'shrewd judgments' is greater, will utilize subjective probabilities, payoffs, and costs that correspond more closely to reality.

When a choice must be made among ends that are genuinely alternative, it is reasonable to choose in such a way as to receive the most benefits. Economizing occurs when two or more ends are in competition with each other, and is an evaluation and selection of ends. When an economic problem exists, in the sense that achievement of one end implies a sacrifice of the other end, economizing is necessary. No choice of ends need be made and no problem exists if no sacrifice is necessary. "Sacrifice of one end is necessary to achieve another only when both are dependent on common means which are scarce" (Deising, 1962, p. 44).

Summary

The literature reviewed revealed an extremely complex association of practices and habits of consumers in relation to energy conservation, and the causes and effects of attempts to change the energy use customs of various people. It also revealed that the lower income group is willing to restrict the use of energy, when possible, but due to economic pressure have always had to reduce energy use to a minimum. On the other hand, the wealthy are less concerned with conservation.

There are many conflicts of interest involved in dealing with the energy situation. Many opinions have been offered on how to deal with the problem, possible solutions and alternatives have been suggested, but no unified effort has been developed.

The incentive to change habits and life patterns seems more effective in the middle income class and the young, but is accomplished by education which is a slow process. The elderly find it harder to change the habits of a lifetime, and many times are less able due to economic pressure.

Decisions related to energy are present in just about everything people do. Decision making in the home often grows out of specific needs. When a choice is made it is reasonable to choose in such a way as to receive the most benefits. No choice need be made and no problem exists if no sacrifice is necessary.

CHAPTER III

METHODS AND PROCEDURES

The major purpose of this study was to examine the impact of the cost of residential energy on decisions made by elderly householders. These decisions included changed practices to conserve energy in the home and retrofitting dwellings to make them more energy efficient.

Discussion in this chapter will focus on: (1) research design, (2) development of the data gathering instrument, (3) population studied and selection of sample, (4) collection of data, and (5) procedures used in analyzing the data.

Research Design

Information for this study was gained through survey research design. Compton and Hall (1972, p. 139) reported that:

> purposeful surveys which are well-planned and analyzed have an important place in home economics research. Their principal contribution is in describing current practices or beliefs with the intent of making intelligent plans for improving conditions or processes in a particular local situation.

Sample surveys are conducted for purposes of understanding the larger population from which the sample was initially selected (Babbie, 1973). The accurate assessment of the characteristics of whole populations of people is the primary interest of the researcher. The beliefs, opinions, attitudes, motivations, and behavior of people are the foci of survey research (Kerlinger, 1964).

The interview technique was selected for gathering information for this survey research. More flexibility in obtaining information is provided by the interview than the self-administered questionnaire. Greater depth of response and more accurate information may be obtained in a face-to-face situation than is possible with a mailed questionnaire (Compton and Hall, 1972).

Development of the Questionnaire

A questionnaire was developed to elicit information in these specific areas: (1) energy source and cost, (2) energy conservation knowledge, (3) energy saving improvements, (4) dwelling features and household appliances, (5) energy conservation practices, and (6) selected socio-economic characteristics (Appendix A).

Energy Data

The accuracy of measurement of total energy cost was very important to the study because it was the dependent variable in many of the statistical procedures. Therefore, cooperation was gained from Arkansas Power and Light Company and Arkansas Western Gas Company to supply data on electricity and natural gas for the period of time between June 1977 and May 1978. Respondents were asked to sign authorization forms (Appendix B) allowing utility companies to release cost data. Household records were accepted in lieu of utility company records and estimates were accepted if respondents refused to sign authorization forms and had not kept household records (see Table XXI, Appendix C). Market value was used as a basis for establishing cost of wood that participants may have cut from their own property.

Energy Conservation Knowledge

The 17-item energy conservation test was adapted from the study conducted by Kilkeary and Thompson (1975) and used with their permission (Appendix B). According to Kilkeary and Thompson, ten of the questions were common sense type questions and seven required more technical knowledge of energy use. The technical questions dealt with electrical appliances and equipment. Some knowledge of electrical science is necessary to understand the internal efficiency of electrical equipment. See the questionnaire in Appendix A.

Energy Saving Improvements

The retrofitting techniques included in the questionnaire were those examined in a study by Peterson (1974) to determine the potential savings which could be realized over the lifetime of the investment. An open-ended category was included to list other improvements which had been made to the dwelling within the past five years.

Dwelling Features and Household Appliances

Information about selected characteristics of the dwelling and major household appliances was gathered making it possible to compare cost of energy with dwelling characteristics and appliances used in the household.

Energy Conservation Practices

A 14-item section on changed practices relative to energy conservation was an adaptation of and an addition to the Kilkeary and Thompson (1975) study. An open-ended question was included to gather information on other energy saving practices.

Socio-economic Characteristics

In this section questions were asked relative to the size of the household, sex, age, race, employment, education, health, and family income.

Doctoral students enrolled in a graduate seminar class made critical evaluation of the questionnaire. Suggestions for improvement were made by the Graduate Advisory Committee before the questionnaire was pretested. The questionnaire was field tested with a random sample drawn from the population remaining after the sample used in the study was selected.

Selection of the Sample

The population for the study consisted of lists of the names and addresses of registered voters, 62 years of age or older, of the five incorporated towns of Marion County, Arkansas. The addresses and last names of individuals were matched to determine household membership. Post office personnel checked the lists for accuracy. The revised lists were alphabetized according to towns and names (wards within the towns were listed in numerical order) and then combined to make a continuous list. A systematic sample with a random start (Babbie, 1973) was used to select the households. In selecting the systematic sample, the number three was drawn at random for the first number, then every sixth household was chosen for inclusion in the sample. Households constituted the secondary sampling unit and the household head or the spouse of the household head was the final sampling unit.

Collection of the Data

A letter explaining the study was mailed to the householders approximately one week before the anticipated interview (Appendix B). The first group of letters was mailed in June 1978. The letter was followed by a telephone call, if possible, to schedule an appointment for the interview. The addresses were in the form of route and box numbers, so the researcher relied on the householder for directions on how to reach the residence. For those householders who had no telephone, the researcher made inquiries from utility company personnel or public officials as to the location of the residence. Interviews were made during a three month period from June through August, 1978. The energy data supplied by the electric company was a computerized 15-month print-out, therefore, the interviews had to be completed within the three month period for the annual energy data to be consistent.

The researcher personally conducted the 97 interviews in this study. The questionnaire was studied carefully and practiced aloud before using it in a face-to-face situation. The question wording was checked in the pretest. The researcher consistently phrased questions as they appeared in the questionnaire, and recorded the respondent's answer while proceeding with the interview. Each questionnaire was identified by a code number and the respondents were assured that individuals would not be identified in the study. The household head or spouse was accepted as a respondent.

At least four attempts were made to contact subjects by telephone. If unsuccessful, two visits were made in an attempt to complete the interview. Thirteen householders refused to participate, thirteen could not be contacted, six did not fit the criteria, two were deceased and two had moved out of the area. See Table II in Chapter IV.

Analysis of Data

Questionnaires were coded, recorded on transfer sheets and key punched on IBM computer cards. A code book was constructed describing the location of variables in the data file and the numerical assignments given to specific variables. The Statistical Analysis System (Barr, Goodnight, Sall and Helwig, 1976) was used in analyzing the data. A computerized data summarization was tabulated for all questionnaire items.

To complete the preparation of data for analysis certain measures were developed. The total annual residential energy cost was a summation of the cost of energy from all sources. These sources included electricity, natural gas, liquid petroleum gas, fuel oil, and wood.

The energy conservation knowledge test was scored for each respondent. Points were given accordingly: one point for a correct response, no points were given for an incorrect response. The total number of points for each respondent was divided by 17, the total number of points possible. A percentage score was the statistic.

The measurement of selected physical characteristics of the dwelling is listed in Table I. Nineteen variables were selected for analysis in this part of the study.

An index was developed to measure changed energy conservation practices for a time period of the past five years, or since the energy crisis of 1973-74. There were 14 items in this section. A score of one point was given for a changed practice resulting in energy conservation; one point was deducted for a changed practice resulting in more energy use; zero was given for no change in practice. If the practice was not physically possible in the respondent's home, the number of items that did not apply was deducted from the total number of items, giving a total number possible for each individual. The summation of points divided by the number possible gave a percentage score for the statistic.

TABLE I

MEASUREMENT OF SELECTED DWELLING FEATURES

	Measurement of Variables
Physical Characteristics of Dwelling	1. Number years of occupancy
	2. Classification of floor levels
	3. Classification of exterior materials
	4. Types of foundations
	5. Presence of attic crawl space
	7. Presence of unheated garage
	7. Number of windows
	8. Presence of storm windows
	9. Presence of window weather stripping
	10. Presence of insulation (ceiling, wall and floor)
	11. Number of exterior doors
	12. Number of storm doors
	13. Exterior door orientation
	14. Presence of exterior door weather stripping
	15. Total square feet living space
	16. Type of heating equipment
	17. Number of fans to circulate heat
	18. Type of air conditioning
	19. Number of major appliances

Socio-economic variables included in the study were household size, sex, age, family employment status, education, health, family income and role of the respondent. These measures were standardized indices.

Test of Hypotheses

A t-test for independent samples was used to test the significance of the differences between the means involving two sample groups assumed to be drawn from normally distributed populations with equal variances. One-way analysis of variance was used to test the significance of differences of means involving more than two sample groups. These statistical procedures were used to test the following null hypotheses:

1. There is no significant difference between the total cost of energy consumed in the households of elderly people and the specified socio-economic characteristics (Hypothesis I).
2. There is no significant difference between the total cost of energy consumed in the households of elderly people and selected dwelling features (Hypothesis II).
3. There is no significant difference between (a) the cost of energy consumed in households of elderly people, (b) knowledge of energy conservation, and (c) changed energy conservation practices and decisions to retrofit the dwelling (Hypothesis III).

A probability of .05 was accepted as the criterion of significance. Pearson product-moment correlation was used to describe the relationship and level of significance between paired measures of quantitative variables. Pearson product-moment correlation coefficient was used to test the following null hypotheses:

1. There is no relationship between energy conservation knowledge and changed energy conservation practices in the household (Hypothesis IV).
2. There is no relationship between energy conservation knowledge and the total cost of energy consumed in households of elderly people (Hypothesis V).
3. There is no relationship between changed energy conservation practices and the total annual cost of energy consumed in households of elderly people (Hypothesis VI).

CHAPTER IV

ANALYSIS OF DATA

The presentation and analysis of the data collected through the use of a questionnaire is included in this chapter. The questionnaire is presented in Appendix A. Results of the statistical analysis are reported in relation to seven objectives of the study. The eighth objective is discussed in Chapter V.

Description of Households and Energy Data

Objective I of the study was to obtain data concerning energy sources and the total annual cost of direct energy used in single family detached dwellings of elderly householders.

Subjects of this study were elderly householders residing in small incorporated towns, ranging in population from 150 to 1500, of Marion County, Arkansas. The household head was 62 years of age or older. Marion County towns were selected because they are representative of communities in the Ozark region, which includes part of Arkansas, Oklahoma, and Missouri (U.S. Department of Commerce, Bureau of the Census, 1973a, b and c). The communities are a mix of natives and newcomers, mostly retirees, who have moved to the region for the scenic beauty and recreational aspects of the lakes country.

The following criteria were established for selecting participants: (1) the household head must be 62 years of age or older,

(2) the respondent must live in a single-family detached dwelling (includes mobile home), (3) the householder must have lived in his or her present dwelling for at least one year, and (4) the household head must be willing to participate in the study.

Interviews were successfully completed in August 1978 with 97 of the 133 selected householders. See Table II for distribution of selected sample.

TABLE II

DISTRIBUTION OF SELECTED SAMPLE OF ELDERLY HOUSEHOLDERS IN MARION COUNTY, ARKANSAS

	Households By Town					
	A	B	C	D	E	Total
Selected	60	23	4	11	35	133
Could not contact	9	1	-	2	1	13
Did not fit criteria	5	1	-	-	-	6
Refused	8	2	-	1	2	13
Moved	-	-	-	-	2	2
Deceased	-	-	1	-	1	2
Completed	38	19	3	8	29	97

Fuels used in sample households of the elderly included electricity, natural gas, liquid petroleum gas, fuel oil and wood (Table III). Electricity was used in all households; other fuels used in descending order were: natural gas (49.5 percent), wood (30.9 percent), liquid petroleum gas (19.6 percent), and fuel oil (1.0 percent). From one to a combination of three fuel sources were used in the households.

TABLE III

FUELS USED BY ELDERLY HOUSEHOLDERS IN MARION COUNTY, ARKANSAS

Fuel	Households (N=97)	Percent
Electricity	97	100.0
Natural gas	48	49.5
Wood	30	30.9
Liquid petroleum gas	19	19.6
Fuel oil	1	1.0

Note: Number and percentages do not total 100 percent because more than one fuel source was used by some households.

Expenditures for all sources were used in calculating the total annual cost. Householders in town A, which accounted for 39.2 percent of the sample, spent more annually for energy ($\overline{X}$=$676.95) with a range of $192 to $1524. Householders (8.2 percent) in town D spent an average of $531.75 annually with a range of $226 to $828. In town E, householders (29.9 percent) spent an average of $497.03 with a range of $221 to $983. In town C, an average of $452.33 was spent annually by householders (3.0 percent) with a range of $208 to $613, and in town B, householders spent an average of $389.00 annually with a range of $234 to $607. Mean, standard deviation and range of total fuel cost to householders according to towns are recorded in Table IV. The source of energy data is recorded in Appendix C.

TABLE IV

MEAN, STANDARD DEVIATION AND RANGE FOR ANNUAL FUEL COST BY TOWNS

Town	Household (N=97)	Percent	Mean[a]	Standard Deviation[b]	Range[c]
A	38	39.2	$676.95	$265.21	$192-$1524
B	19	19.6	389.00	82.94	234- 607
C	3	3.0	452.33	215.07	208- 613
D	8	8.2	531.75	209.30	226- 828
E	29	29.9	497.03	207.81	221- 983

[a]Overall mean: $547.84

[b]Overall standard deviation: $240.48

[c]Overall range: $192-$1524

Natural gas was used in 47.4 percent of the homes for heating, followed by electricity (29.9 percent) and liquid petroleum gas (13.4 percent). Electricity was used for cooking by 50.5 percent; while natural gas was used by 34.0 percent, and liquid petroleum gas by 14.4 percent. Most of the homes used electricity for cooling (95.9 percent). Only 3.1 percent used natural gas for cooling and one percent used no energy source for cooling (Table V).

TABLE V

FUEL REPORTED MOST FOR HEATING, COOKING AND COOLING

Purpose and Fuel	Households (N=97)	Percent
<u>Heating</u>		
Natural gas	46	47.4
Electricity	29	29.9
Liquid petroleum gas	13	13.4
Wood	8	8.2
Fuel oil	1	1.0
<u>Cooking</u>		
Electricity	49	50.5
Natural gas	33	34.0
Liquid petroleum gas	14	14.4
Wood	1	1.0
<u>Cooling</u>		
Electricity	93	95.9
Natural gas	3	3.1
None	1	1.0

Note: Number and percentage based on total responses for each purpose.

Natural gas was not available in towns A and C. Householders in town A used electricity and liquid petroleum gas more for heating; town C used wood more for heating; and towns B, D, and E used natural gas more for heating.

Analysis of Socio-Economic Characteristics

Objective II of the study was to compare selected socio-economic characteristics with annual expenditures for energy consumed in single family dwellings of elderly householders. The socio-economic characteristics examined were size of household, sex of household head, age of household head, age of spouse, employment status of household members, education of household head, education of spouse, health of household members, family income, and role of respondent.

The first null hypothesis examined in this study was that there is no significant difference between the total cost of energy consumed in households of elderly householders and specified socio-economic characteristics (Hypothesis I). The variables of sex of household head and family employment status was tested by the t-test for significant differences. The .05 criterion was chosen for the level of significance for the t statistic.

The t-test assumes equality of the population variances. When this assumption is untenable the ordinary t-test should not be applied. An adjustment in the number of degrees of freedom may be made in the value of t required for significance at a critical level (Ferguson, 1976). Bartlett's test for homogeneity (Steel and Torrie, 1960) was used to determine the assumption of equal or unequal variances. When the probability of the F value resulting from this test was greater than .05 level of significance, equal variance was assumed for the t statistic. When the F value was less than .05 level of significance, unequal variance was assumed for the t statistic and the degrees of freedom were adjusted. See Tables XXII and XXIII in Appendix C for additional statistical data of t-tests, including equal and unequal variances, degrees of freedom, and the probability of the F statistic for Bartlett's test for homogeneity.

Employment, full or part-time, with or without retirement income was compared with income from retirement only to establish the family's employment status. Only about one-fourth (25.8 percent) of the householders received income from employment of one or more family members. The remainder (74.2 percent) received retirement income only. The t-test revealed no significant difference at the .05 level for householders who received employment income and those who received retirement income only. The null hypothesis was accepted for this variable. The results of this test are given in Table VI.

One way analysis of variance was used to analyze significant differences in categories of other socio-economic characteristics. Based on the F test, using the .05 criterion for level of significance, the variables of size of household, age of household head, education of household head, education of spouse, family income, and role of the respondent were found to be significant. The null hypothesis was rejected for these variables.

Of these variables, the highest calculated F-value was for family income (Table VII). The amount spent for energy increased as income increased until the $16,000 and over level was reached. This group spent slightly less than the group with incomes from $12,000 to $15,999 (Table VIII).

Next in order of significance (F value 10.23) was the age of the household head. The amount spent for energy decreased as the age of the household head increased. Household heads who were 76 years of age

TABLE VI

THE T-TEST COMPARING ENERGY COSTS OF SPECIFIED SOCIO-ECONOMIC CHARACTERISTICS OF HOUSEHOLDERS

Variable	Households (N=97)	Percent	Mean	Standard Deviation	"t" Value	Prob>(t)
Sex of household head						
Male	66	68.0	$602.11	$245.78	3.4189	0.0009S[a]
Female	31	32.0	432.29	184.11		
Employment status						
Retirement only	72	74.2	538.15	245.69	-0.6710	0.5038NS[b]
Some employment	25	25.8	575.72	227.28		

[a]Significant difference at the .05 level.

[b]No significant difference at the .05 level.

and older spent an average of $407.25 annually for energy as compared to $675.58 for those from age 62 to 65 (Table VIII).

TABLE VII

ONE-WAY ANALYSIS OF VARIANCE COMPARING ENERGY COSTS AND SPECIFIED SOCIO-ECONOMIC CHARACTERISTICS (N=97)

Characteristic	DF	F Value	Level of Significance
Family income	5	12.30	0.0001 s[a]
Age of household head	5	10.23	0.0001 s
Education of household head	2	9.63	0.0002 s
Education of spouse	2	7.49	0.001 s
Size of household	2	7.04	0.0014 s
Respondent	2	5.28	0.0067 s
Age of spouse	2	2.39	0.0974 ns[b]
Family health	2	1.08	0.3429 ns

[a]Significant difference at .05 level.

[b]No significant difference at .05 level.

As the years of education increased for the household head so did annual energy costs. Those having eight years or less of education paid the least amount ($\overline{X}$=$460.68) for energy; those with nine through twelve years of education paid more ($\overline{X}$=$544.88); and those with thirteen years or more of education paid the most ($\overline{X}$=$738.56). See Table VIII.

TABLE VIII

FREQUENCY, PERCENTAGE AND MEANS OF CATEGORIES USED IN COMPARING ENERGY COSTS, FOR SPECIFIED SOCIO-ECONOMIC CHARACTERISTICS

Characteristic	Categories	Number	Percent	Mean
Size of household (N=97)	One member	31	32.0	422.58
	Two members	61	62.9	603.44
	Three or more members	5	5.2	646.00
Age of household head (N=97)	62-65 years	26	26.8	675.58
	66-75 years	43	44.3	561.53
	76 years or more	28	28.9	407.25
Age of spouse ($\overline{X}$ head and spouse) (N=97)	65 years or less	65	67.0	534.23
	66-75 years	24	24.7	624.62
	76 years or more	8	8.2	428.00
Education of head (N=97)	8 years or less	38	39.2	460.68
	9 through 12 years	41	42.3	544.88
	13 years or more	18	18.6	738.56
Education of spouse ($\overline{X}$ head and spouse) (N=97)	8 years or less	53	54.6	460.34
	9 through 12 years	29	29.9	626.69
	13 years or more	15	15.5	676.27
Family health (N=97)	All excellent or good	40	41.2	539.90
	Excellent/good; fair/poor	27	27.8	601.96
	All fair or poor	30	30.9	509.70
Family income (N=93)	$2,999 and less	19	20.4	366.47
	$3,000-$4,999	17	18.3	418.35
	$5,000-$6,999	15	16.1	482.27
	$7,000-$8,999	14	15.1	537.00
	$9,000-$11,999	10	10.8	758.80
	$12,000-$15,999	13	14.0	804.08
	$16,000 and over	5	5.4	768.40
Respondent (N=97)	Male head	28	28.9	601.21
	Female head	33	34.0	441.97
	Spouse	36	37.1	603.38

To analyze the effect of the education of the spouse on the total fuel costs, the mean number years of education of the spouse and household head was calculated and used as a basis for comparison. The same trend was reflected for education of the spouse as it was for the household head. Energy costs increased as the years of education of the spouse increased. See Table VIII for categories and means.

There was a greater difference in the amount spent for energy in one member versus two member households ($\overline{X}$=\$422.58 and \$603.44, respectively) than in two member versus three or four member households ($\overline{X}$= \$603.44 and \$646.00, respectively). As the number of people per household increased the cost of energy per person decreased (Table VIII). The mean annual cost of energy per person in one member households was \$422.58; in two member households, \$301.72; and in three or more member households, \$215.33 or less.

Interviews were conducted with 28 male heads of household, 33 female heads of household and 36 spouses of household heads. There was very little difference in total energy costs reported by the male head ($\overline{X}$=\$601.21) as compared to that reported by the spouse ($\overline{X}$=\$603.38). The female head of household spent considerably less for energy ($\overline{X}$= \$441.97) than either the male head or spouse of household head. See respondent characteristic in Table VIII.

Based on the .05 criterion for level of significance, the null hypothesis for the variables of age of spouse and health of family members was not rejected. There was no significant difference in the total annual cost of residential energy with the variation of the spouse's age and the condition of the health of family members (Table VII).

The mean age of the spouse and household head was used in analyzing the data to determine the influence of the spouse's age on the total cost of energy. Comparison of the means of the categories revealed that energy costs were greater for those aged 66 through 75 ($\overline{X}$=$624.62) and smaller for those aged 76 or older ($\overline{X}$=$428.00). The mean cost of energy for the category of 65 years of age or less was $534.23 (Table VIII).

In analyzing family health status, family members were categorized as all being in excellent or good health, some in excellent or good health and some in fair or poor health, or all family members as being in fair or poor health. Householders with all members in fair or poor health paid the least ($\overline{X}$=$509.70) for energy; those with members in excellent or good health and members in fair or poor health paid the most ($\overline{X}$=$601.96) for energy; while those with all family members in excellent or good health paid an amount ($\overline{X}$=$539.90) between these two categories (Table VIII).

Analysis of Selected Dwelling Features

Objective III of the study was to determine if selected dwelling features affected the total cost of energy consumed in single family dwellings of elderly householders. (The measurement of selected dwelling characteristic was discussed in Chapter III.) Hypothesis II was tested to meet this objective. The null hypothesis was there is no significant difference between the total cost of energy consumed by the households of elderly people and selected dwelling features.

The t-test was used to test the variables of floor level, presence or absence of insulation, unheated garage, attic crawl space, exterior door orientation and types of heating equipment. The .05 level of significance was chosen. See Table XXIII in Appendix C for complete statistical data. In this test, the calculated t-value was greater than the tabulated value at the .05 level for the variables of ceiling insulation, wall insulation, heating equipment types of fireplace, gas space heater, electric baseboard heater, and central electric furnace. From the above observation, the null hypothesis must be rejected for these variables. The null hypothesis was not rejected for the variables of floor level, floor insulation, unheated garage, attic crawl space, exterior door orientation, heating equipment types of portable electric heater, central gas furnace, wood stove, and other types (Table IX). Included in other types were: radiant electric heater, electric heat pump, electric wall heater, oil furnace, gas floor furnace, and electric ceiling coils.

Peterson (1974) reported that a considerable savings in energy could be made by the installation of adequate insulation. When comparing means of total energy costs, it was observed that more was spent for energy by householders whose dwellings were insulated than those whose dwellings were not insulated. The presence of ceiling and wall insulation was found to be significant but the presence of floor insulation was not significant (Table IX).

Findings of this study revealed that energy costs were greater for householders living in multi-level dwellings than those living in one level dwellings but the difference was not significant. Those living in one level dwellings had energy costs slightly below ($\overline{X}$=\$525.74) the overall mean of \$547.84, and those living in multi-level dwellings had costs slightly above ($\overline{X}$=\$627.81) the overall mean (Table IX).

TABLE IX

THE T-TEST COMPARING TOTAL ENERGY COST OF SELECTED DWELLING FEATURES

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Prob>(T)
<u>Floor Levels</u> (N=97)						
One level	76	78.4	$525.74	$234.99	-1.7398	0.0851^{ns}
Multi-level	21	21.6	627.81	248.88		
<u>Ceiling Insulation</u> (N=96)						
Presence	80	83.3	571.97	253.09	3.1666	0.0026^{s}
Absence	16	16.6	445.50	112.74		
<u>Wall Insulation</u> (N=91)						
Presence	64	70.3	600.19	243.96	4.8134	0.0001^{s}
Absence	27	29.7	404.44	139.79		
<u>Floor Insulation</u> (N=94)						
Presence	26	27.7	583.96	234.58	0.7423	0.4598^{ns}
Absence	68	72.3	542.57	244.46		
<u>Unheated Garage</u> (N=97)						
Do not have	91	93.8	542.52	243.48	-0.8470	0.3991^{ns}
Have	6	6.2	628.50	186.83		
<u>Attic Crawl Space</u> (N=97)						
Do not have	7	7.2	680.57	308.89	1.5266	0.1302^{ns}
Have	90	92.8	537.51	233.35		

TABLE IX (Continued)

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Prob>(T)
*Door Orientation						
North						
Do not have	46	47.4	$533.09	$213.95	-0.5716	0.5689^{ns}
Have	51	52.6	561.14	263.55		
South						
Do not have	39	40.2	529.90	243.38	-0.6007	0.5497^{ns}
Have	58	59.8	559.90	239.88		
East						
Do not have	42	43.3	558.79	277.64	0.3902	0.6973^{ns}
Have	55	56.7	539.47	210.04		
West						
Do not have	42	43.3	507.69	230.59	-1.4449	0.1518^{ns}
Have	55	56.7	578.49	245.41		
Northwest						
Do not have	95	97.9	542.72	234.59	-1.4533	0.14494^{ns}
Have	2	2.0	791.00	507.70		
Southwest						
Do not have	96	99.0	549.04	241.45	0.4822	0.6307^{ns}
Have	1	1.0	432.00			
Southeast						
Do not have	95	97.9	542.72	234.59	-1.4533	0.1494^{ns}
Have	2	2.0	791.00	507.70		

TABLE IX (Continued)

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Prob>(T)
<u>Heating Equipment</u> (N=97)						
Fireplace						
Do not use	80	82.5	491.55	199.46	-5.7846	0.0001^{s}
Use	17	17.5	812.71	245.29		
Portable Electric Heater						
Do not use	89	91.8	543.34	234.54	-0.6124	0.5417^{ns}
Use	8	8.2	597.87	313.72		
Gas Space Heater						
Do not use	56	57.3	639.87	262.33	5.4071	0.0001^{s}
Use	41	42.3	422.12	126.92		
Baseboard Heater (electric)						
Do not use	92	94.8	532.25	232.45	-2.8367	0.0056^{s}
Use	5	5.2	834.60	224.27		
Central Furnace (electric)						
Do not use	75	77.3	484.93	211.32	-5.4122	0.0001^{s}
Use	22	22.7	762.27	211.41		
Central Furnace (gas)						
Do not use	77	79.4	527.45	227.93	-1.6525	0.1017^{ns}
Use	20	20.6	626.30	276.07		
Wood Stove						
Do not use	85	87.6	534.25	226.53	-1.4905	0.1394^{ns}
Use	12	12.4	644.08	318.26		

TABLE IX (Continued)

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Prob>(T)
Other Types						
Do not use	86	88.7	$555.88	$241.48	0.9210	0.3594ns
Use	11	11.3	484.91	233.69		

*There were no northeast doors.

The presence of an attached unheated garage was not significant at the .05 level. Dwellings with an attached unheated garage had slightly higher energy costs ($\overline{X}$=\$628.50) than dwellings that did not have an attached unheated garage ($\overline{X}$=\$542.52). See Table IX.

Dwellings with attic crawl space had lower energy costs ($\overline{X}$= \$537.51) than dwellings without attic crawl space ($\overline{X}$-\$680.57). See Table IX. Mobile homes accounted for five of the seven dwellings that did not have attic crawl space.

Energy costs were not related to the orientation of exterior doors. A majority (59.8 percent) of the dwellings had doors opening to the south, 52.6 percent had doors opening to the north, 56.7 percent had doors opening to the east, and 56.7 percent had doors opening to the west (Table IX). The number of exterior doors ranged from one to seven per dwellings.

Types of heating equipment used in homes that had higher energy costs were the fireplace ($\overline{X}$=\$812.71), baseboard electric heater ($\overline{X}$=\$834.60) and central electric furnace ($\overline{X}$=\$762.27). All of these were higher than the overall mean of \$547.84. The gas space heater was used in households that had lower energy costs ($\overline{X}$=\$422.12) than the overall mean. Other types tested were not significantly different in the amount spent for residential energy (Table IX), but the mean for other types ($\overline{X}$=\$484.91) was less than the overall mean.

One-way analysis of variance was used to test the significant difference in categories of the variables of length of occupancy, exterior materials, types of foundations, number of windows, presence of storm windows or insulating glass, presence of window weatherstripping, number of exterior doors, presence of exterior storm doors or insulating glass, presence of exterior door weatherstripping, square feet of living space, number of fans to circulate heat, type of air conditioning, and number of major appliances.

Based on the .05 criterion for level of significance, the second null hypothesis was rejected for the variables of length of occupancy, type of exterior material, foundation types, number of windows, presence of storm windows, presence of window weatherstripping, presence of storm doors, presence of exterior door weatherstripping, number of square feet of living space, number of fans used to circulate heat, type of air conditioning, and number of major household appliances (Table X).

TABLE X

ONE-WAY ANALYSIS OF VARIANCE FOR COMPARING TOTAL ENERGY COSTS OF SELECTED DWELLING FEATURES

Variable	Degrees of Freedom	F Value	Level of Significance
Occupancy	3	2.77	0.0451s[a]
Exterior materials	3	4.21	0.0078s
Foundation types	1	5.86	0.0170s
Windows	2	3.99	0.0218s
Storm windows	2	6.45	0.024s
Window weatherstripping	2	6.75	0.0018s
Exterior doors	2	2.30	0.1058ns[b]
Storm doors	2	5.26	0.0069s
Exterior door weatherstripping	2	6.65	0.0020s
Living space	5	7.65	0.0001s
Fans for heat	2	8.45	0.0004s
Air conditioning	2	16.92	0.0001s
Major appliances	2	12.73	0.0001s

[a]Significant difference at the .05 level.

[b]No significant difference at the .05 level.

By comparing the means for length of occupancy, it was noted that householders consistently paid less for energy as length of occupancy increased. Householders who had lived in their dwellings for one to five years paid more ($\overline{X}$=$652.80) than those who had lived in their homes 21 years or more ($\overline{X}$=$466.10). See Table XI for means and categories.

Householders living in dwellings with wood exteriors spent less ($\overline{X}$=$480.82) for energy than those with masonry ($\overline{X}$=$602.86), metal ($\overline{X}$=$646.67) or combination ($\overline{X}$=$680.93) types of exterior materials. See Table XI. Combination materials were stone and wood, stone and asbestos siding, brick and wood, and stucco and tar paper.

Foundations of one level dwellings with concrete slab floors and floors with crawl space were used for comparison in the statistical analysis. Foundation types of the multi-level dwellings were so varied and some had a combination of slab and crawl space that the analysis was not meaningful. Householders with one-level dwellings built with crawl space under the floor spent considerable less ($\overline{X}$=$494.38) for energy than those with one-level dwellings with concrete slab floors ($653.27). See Table XI.

The means (Table XI) revealed that energy costs increased as the number of windows increased. There was a small difference in dwellings with 10 windows or less ($\overline{X}$=$502.66) and dwellings with 11 to 15 windows ($\overline{X}$=$520.33), but a considerably larger increase when the number of windows increased to 16 and over ($\overline{X}$=$670.50).

The means related to the presence or absence of storm windows and doors (or insulating glass) and weatherstripped windows and doors revealed that dwellings without these characteristics had lower energy

TABLE XI

FREQUENCY, PERCENTAGE AND MEANS OF CATEGORIES COMPARING ENERGY COSTS OF SELECTED DWELLING FEATURES

Variable	Categories	Number	Percent	Means
Occupancy (N=27)	1-5 years	25	25.8	652.80
	6-10 years	25	25.8	552.12
	11-20 years	26	26.8	508.81
	21 years and over	21	21.6	466.10
Exterior materials (N=97)	Metal	12	12.4	646.67
	Masonry	14	14.4	602.86
	Wood	57	58.8	480.82
	Combination	14	14.4	680.93
Foundation types (one level) (N=76)	Crawl space	61	80.3	494.38
	Concrete slab	15	19.7	653.27
Windows (N=97)	10 or less	36	37.1	502.66
	11-15	39	40.2	520.33
	16 and over	22	22.7	670.50
Storm windows (N=97)	None	25	25.8	407.56
	Partial	24	24.7	610.54
	All	48	49.5	589.54
Windows with weatherstripping (N=97)	None	58	59.8	480.12
	Partial	4	4.1	559.25
	All	35	36.1	658.74
Exterior doors (N=97)	2 or less	41	42.3	502.88
	3	40	41.2	552.02
	4 or more	16	16.5	652.56
Storm doors (N=97)	None	18	18.6	404.72
	Partial	23	23.7	523.35
	All	56	57.7	603.89
Door with weatherstripping (N=97)	None	31	32.0	452.16
	Partial	10	10.3	441.20
	All	56	57.7	619.84
Living space (N=97)	850 sq. ft. or less	23	23.7	384.30
	851-1000 sq. ft.	24	24.7	501.08
	1001-1300 sq. ft.	25	25.8	589.56
	1301-1600 sq. ft.	15	15.5	639.66

TABLE XI (Continued)

Variable	Categories	Number	Percent	Means
Living space (cont'd)	1601-1900 sq. ft.	6	6.2	678.83
	1901 sq. ft. and over	4	4.1	967.00
Fans/heat (N=97)	None	18	18.6	464.89
	One	63	64.9	519.49
	Two or more	16	16.5	752.75
Air conditioning (N=97)	Central	32	33.0	713.16
	Window	48	49.5	496.40
	None	17	17.5	381.88
Appliances (N=97)	7 or less	22	22.7	435.91
	8 to 12	65	67.0	539.48
	13 or more	10	10.3	848.40

costs than dwellings with complete storm windows, storm doors and weatherstripping (Table XI). Deviations from this pattern were dwellings with partial storm windows and partial weatherstripping on exterior doors. Energy costs for dwellings with storm windows on some of the windows were higher ($\overline{X}$=$610.54) than dwellings with complete storm windows ($\overline{X}$=$589.54). Dwellings with weatherstripping on some of the exterior doors had lower ($\overline{X}$=$441.20) energy costs than dwellings with no weatherstripping on exterior doors ($\overline{X}$=$452.16).

Energy costs consistently increased as the number of square feet of living space increased (Table XI). Householders living in dwellings with living space of 1901 square feet or more ($\overline{X}$=$967.00) spent 1.42 times as much for energy as those living in dwellings with 1601-1900 square feet of living space ($\overline{X}$=$678.83) and 2.52 times as much for energy as those living in dwellings with 850 square feet or less of living space ($\overline{X}$=$384.30).

Most householders (81.4 percent) used one or more fans to circulate heat. By examining the means it is noted that as the number of fans increased the energy costs increased (Table XI). This finding may be related to the type of heating equipment used in the household. Central heating systems are equipped with fans. Some space heaters are not equipped with fans, and the lowest energy costs were paid by householders who used space heaters (Table IX).

A great disparity in energy costs was noted when comparing types of air conditioning or no air conditioning (Table XI). Householders who had no air conditioning spent the least ($\overline{X}$=$381.88), those with window units spent more ($\overline{X}$=$496.40) and those with central air conditioning spent considerably more ($\overline{X}$=$713.16).

Energy costs increased as the number of major household appliances increased. Householders with 13 or more appliances ($\overline{X}$=$848.40) paid almost twice as much for energy as those with seven or less appliances ($\overline{X}$=$435.91). Energy costs for householders with eight to twelve appliances ($\overline{X}$=$539.48) were between these two categories (Table XI).

The second null hypothesis was not rejected for the variable of exterior doors (Table X). The means revealed that energy costs increased as the number of exterior doors increased, but the difference was not significant based on the .05 level. See Table XI for means and categories.

Reasons for Retrofitting Dwellings

Objective IV of the study was to determine if (a) the cost of energy, (b) knowledge of energy conservation, and (c) changed energy conservation practices were associated with decisions to retrofit dwellings. To meet this objective, Hypothesis III was tested by one-way analysis of variance. The null hypothesis states that there is no significant difference between (a) the cost of energy, (b) knowledge of energy conservation, and (c) changed energy conservation practices and decisions to retrofit dwellings.

Based on the F test, using the .05 level of significance, the calculated F values for comparing the main reason for retrofitting the dwelling and energy costs and the main reason for retrofitting the dwelling and knowledge scores were less than the value required for the significant level. Therefore, the null hypothesis for these variables was not rejected (Table XII).

TABLE XII

ONE-WAY ANALYSIS OF VARIANCE FOR COMPARING REASONS FOR RETROFITTING THE DWELLING AND ENERGY COSTS, KNOWLEDGE AND CHANGED PRACTICES

Variable	DF[a]	F Value	Level of Significance
Energy costs	5	1.00	0.4239[ns b]
Knowledge scores	5	0.99	0.4304[ns]
Changed practices scores	5	3.67	0.0046[s c]

[a]Degrees of freedom.

[b]Significant difference at the .05 level.

[c]No significant difference at the .05 level.

There was a significant difference at the .05 level between the main reason for retrofitting the dwelling and changed energy conservation practices scores. Thus, this part of the null hypothesis was rejected (Table XII).

The reasons given by the householders for retrofitting their dwellings were: (1) to make the house more comfortable (38.1 percent), (2) to save money on the cost of energy (18.6 percent), (3) some other reason (6.2 percent), (4) to save energy because the supply is scarce (4.1 percent), and (5) to save energy for future generations (1.0 percent). All other reasons were specified as: always have been conservative. If respondents had not made improvements within the past five years, the question did not apply. Thirty-two percent answered in this manner (Table XIII).

TABLE XIII

MEANS FOR ENERGY COSTS, KNOWLEDGE TEST AND CHANGED PRACTICES BY REASON FOR RETROFITTING DWELLING (N=97)

Reason*	Number	Percent	Energy Costs	Knowledge Test	Changed Practices
				%	%
Save money	18	18.6	$559.44	71.9	58.3
Comfort	37	38.1	506.49	68.0	41.8
Save energy	4	4.1	554.75	67.6	71.2
Save for future	1	1.0	983.00	76.5	50.0
Some other reason	6	6.2	614.67	70.6	40.0
Does not apply	31	32.0	562.58	75.7	33.9

*See questionnaire for complete statement (Appendix A).

By examining the means of energy costs compared with reasons for retrofitting dwellings, the respondent giving comfort as the main reason paid the least for energy ($\overline{X}$=\$506.49). Respondents giving the reason of saving money paid slightly more ($\overline{X}$=\$559.44). See Table XIII.

Respondents who gave comfort as the main reason for retrofitting their dwelling had a mean knowledge score of 68.0 percent; those who gave the reason of saving money had a mean score of 71.9 percent. These were in the lower range of mean scores. Respondents who had not made improvements had a mean knowledge score of 75.7. This was in the higher range of mean scores. The means for the knowledge scores ranged from 67.6 to 76.5 percent (Table XIII).

The mean scores of changed energy conservation practices compared with reasons for retrofitting dwellings ranged from 33.9 to 71.2 percent. The largest number of people (38.1 percent) gave comfort as the main reason for retrofitting and had a mean score of 41.8 percent. Householders who gave the reason of saving money (18.6 percent) had a mean score of 58.3 percent on changed practices (Table XIII).

Twenty-three different kinds of improvements were made by 68 percent of the householders. Attic insulation, insulating draperies, and storm windows were improvements made more often. The number and percentage of householders making improvements are listed in Table XIV.

Analysis of Energy Conservation Knowledge, Changed Practices and Energy Costs

Pearson product-moment correlation coefficient was used to test the relationships of energy conservation knowledge and changed energy conservation practices (Objective V); energy conservation knowledge and

TABLE XIV

FREQUENCY AND PERCENTAGE OF HOUSEHOLDERS MAKING HOUSING IMPROVEMENTS

Improvement	Number	Percent
1. Attic insulation	21	21.6
2. Insulating draperies	20	20.6
3. Storm windows	17	17.5
4. Storm doors	14	14.4
5. Weatherstripping	13	13.4
6. Carpeting	13	13.4
7. Caulking	11	11.3
8. Plastic over windows	6	6.2
9. Wall insulation	5	5.2
10. Insulated pipes	3	3.9
11. Attic ventilator	3	3.9
12. Steel siding	2	2.1
13. Aluminum siding	2	2.1
14. Attic fan	2	2.1
15. Floor insulation	1	1.0
16. Wood stove	1	1.0
17. Awnings	1	1.0
18. Asbestos siding	1	1.0
19. Fireplace	1	1.0
20. Painted roof - aluminum	1	1.0
21. Gable roof	1	1.0
22. Enclosed porch	1	1.0
23. Insulated hot water heater	1	1.0

Note: Respondent may have made more than one improvement.

total energy costs (Objective VI); and energy conservation practices and total energy costs (Objective VII). Table XV reports the correlation coefficients for the variables of knowledge versus practices, knowledge versus costs, and practices versus costs.

TABLE XV

PEARSON CORRELATION COEFFICIENT ANALYSIS FOR ENERGY KNOWLEDGE, CHANGED PRACTICES AND ENERGY COSTS

Variable	Correlation Values	Level of Significance
Knowledge versus Practices	-0.05788	0.5733ns[b]
Knowledge versus Costs	0.37622	0.0001s[a]
Practices versus Costs	0.05462	0.5952ns

[a]Significant difference at the .05 level.

[b]No significant difference at the .05 level.

There was no significant correlation between energy conservation knowledge scores and changed energy conservation practices. Therefore, the fourth null hypothesis that there is no relationship between energy conservation knowledge and changed energy conservation practices in the household was not rejected (Table XV).

There was a significant correlation at the .05 level between energy knowledge scores and total energy costs. Energy costs increased as knowledge scores increased. Based on this test, the fifth null hypothesis that there is no relationship between energy conservation knowledge and the total cost of energy was rejected (Table XV).

The sixth null hypothesis that there is no relationship between energy conservation practices and the total cost of energy was not rejected since there was no significant correlation between these variables (Table XV).

Scores on the energy conservation knowledge test ranged from 35.3 percent to 94.1 percent. The mean score was 71.4 percent (Table XVI).

TABLE XVI

MEAN, STANDARD DEVIATION AND RANGE OF KNOWLEDGE, CHANGED PRACTICES AND ENERGY COSTS (N=97)

Variable	Mean	Standard Deviation	Range
Knowledge scores (%)	71.4	14.8	35.3 - 94.1
Practice scores (%)	43.5	25.1	0 - 100
Energy costs ($)	547.84	240.48	192.00-1524.00

The more frequently missed questions on the knowledge test were related to household appliances and equipment (questions 13, 15 and 16). Questions receiving the highest number of correct responses were numbers 12, 11 and 10 (Table XVII). These questions referred to installing storm doors, closing draperies, and turning off lights.

TABLE XVII

FREQUENCY AND PERCENTAGE OF CORRECT RESPONSES ON ENERGY CONSERVATION KNOWLEDGE TEST BY ITEM

Item	Question Number	Number	Percent
1. Install storm windows	12	97	100.0
2. Close draperies	11	96	99.0
3. Turn off lights	10	95	97.9
4. Clean air filter	1	87	89.7
5. Wash full loads	3	85	87.6
6. Cold/warm wash only	9	85	87.6
7. Preheat oven less time	6	83	85.6
8. Pressure cooker vs ordinary pan	7	81	83.5
9. Frost-free refrigerator	17	78	80.4
10. Color vs b/w TV	14	74	76.3
11. Incandescent vs fluorescent bulbs	5	63	64.9
12. Self-cleaning ovens/broilers	8	58	59.8
13. Cooking fast vs slow	2	54	55.7
14. Pan of water on stove	4	53	54.6
15. "Instant on" TV	16	50	51.5
16. Solid state vs tube TV	15	36	37.1
17. EER of 6 vs 8	13	3	3.1

Note: See questionnaire for complete question (Appendix A).

Questions for the energy conservation knowledge test were adapted from the study by Kilkeary and Thompson (1975). The percentage of correct responses by item was similar to the Kilkeary and Thompson study. Scores for the present study were slightly higher with the exception of the question (number 13) about the energy efficiency ratio of household appliances.

The mean score of changed practices to conserve energy was 43.5 percent and ranged from zero to 100 percent (Table XVI). More householders had changed to the practice of closing off rooms (67.0 percent), turning down the thermostat (62.9 percent) and wearing heavier clothing (59.8 percent). Practices changed less often were cleaning the furnace air filter (20.6 percent) and checking the heating equipment (22.7 percent). However, some respondents remarked that they had always done many of these things. See Table XVIII for complete list.

"To save money" was given by 61.9 percent of the householders as being the main reason for adopting energy conservation practices. "Because the supply of energy is scarce" was given as the main reason by 21.6 percent. "It is everybody's patriotic duty to save energy" was given by 6.2 percent. "So future generations will have a supply of energy" was given by 4.1 percent. Some other reason was given by 5.2 percent. No change in practices had been made by only 1.0 percent. The other reason was specified as "have always been conservative." See Table XIX.

Responses to the open ended question on other ways of conserving energy in the home have been classified into five areas: (1) cooking, (2) heating and cooling, (3) appliances, (4) laundry, and (5) lighting. The greatest number of responses given were changes in cooking methods.

TABLE XVIII

FREQUENCY AND PERCENTAGE OF CHANGED PRACTICES RESULTING IN ENERGY CONSERVATION BY ITEM

Item	Question Number	Number	Percent
1. Close off rooms	6	65	67.0
2. Turn down thermostat	5	61	62.9
3. Wear heavier clothing	9	58	59.8
4. Turn off TV	2	51	52.6
5. Turn off light	1	48	49.5
6. Consider operation costs	4	48	49.5
7. Use warm/cold wash	11	40	41.2
8. Prepare one-dish meals	3	37	38.1
9. Turn down hot water heater	10	35	36.1
10. Use air conditioner less	13	32	33.0
11. Use fan instead of air conditioner	14	32	33.0
12. Use insulating draperies	12	26	26.8
13. Check heating equipment	8	22	22.7
14. Clean furnace air filter	7	20	20.6

Note: See questionnaire for complete statement (Appendix A).

TABLE XIX

MAIN REASONS FOR ADOPTING CONSERVATION PRACTICES (N=97)

Reason	Responses	Percent
To save money	60	61.9
Energy is scarce	21	21.6
Patriotic duty	6	6.2
Save for future	4	4.1
Other (always saved)	5	5.2
No change in practices	1	1.0

Note: See questionnaire for complete statement (Appendix A).

In the heating and cooling classification more householders used wood as a substitute for other fuels while almost as many saved energy by adjusting the thermostat. In the classification of laundry, the line drying of clothes predominated. In the remaining classifications, that of appliances and of lighting, only one respondent each mentioned saving energy in various categories. See Table XX.

Findings revealed by statistical analysis of the data have been presented in this chapter. The presentation was organized according to the objectives established for the study. In the following chapter, summary, conclusions and recommendations will be discussed.

TABLE XX

RESPONSES TO OPEN ENDED QUESTION ON OTHER WAYS TO CONSERVE ENERGY IN THE HOME

Area Classification	Number	Percent*
Cooking (N=15)		
Plan leftovers	4	26.7
Use slow cooker	3	20.0
Use portable oven	1	6.7
Use microwave oven	1	6.7
Reheat food on floor furnace	1	6.7
Use oven less	1	6.7
Change cooking methods (not specified)	4	26.7
Heating/Cooling (N=9)		
Adjust thermostat	3	33.3
Use wood	4	44.4
Use less heat	1	11.1
Close draperies in the daytime	1	11.1
Appliances (N=5)		
Do full loads in dishwasher	1	20.0
Installed switch for "instant on TV"	1	20.0
Turn off water heater every other day	1	20.0
Use radio less	1	20.0
Use vacuum cleaner less	1	20.0
Laundry (N=5)		
Installed suds saver	1	20.0
Line dry clothes	3	60.0
Do full loads in washer	1	20.0
Lighting (N=3)		
Installed fluorescent lights	1	33.3
Use smaller light bulbs	1	33.3
Go to bed before dark	1	33.3

*Note: Number and percentage based on number responses by area classification.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The primary purpose of this study was to ascertain the impact of residential energy costs on housing related decisions of elderly householders. Decisions related to changing conservation practices in the household and decisions relative to retrofitting their dwelling have been examined.

The sample selected for this study was identified and limited to registered voters 62 years of age or older of the five incorporated towns of Marion County, Arkansas. Participants were further limited to those living in single family dwellings, by age of household head (62 years or older), and one year minimum occupancy in their present dwelling. Householders were selected by a systematic sample with a random start.

Data were secured from 97 householders through personal interviews from June through August, 1978. The questionnaire was developed to collect data pertinent to these six areas: (1) energy source and cost, (2) energy conservation knowledge, (3) energy saving improvements, (4) dwelling features and household appliances, (5) energy conservation practices, and (6) selected socio-economic characteristics.

The data were processed at the Oklahoma State University Computer Center and the results were presented in the form of t-tests, one-way analysis of variance, Pearson correlation co-efficients, frequencies, means, standard deviations, and ranges. The objectives of the study were used as a basis for presenting the results from the statistical analysis. A probability of .05 was accepted as the criterion of significance when testing the null hypotheses.

Summary and Conclusions

The summary and conclusions are organized according to each of the objectives.

Objective I was to obtain data relative to energy sources and annual cost of residential energy. Findings were summarized as follows:

1. Fuels used in the households were electricity (100 percent), natural gas (49.5 percent), wood (30.9 percent), liquid petroleum gas (19.6 percent), and fuel oil (1.0 percent). A range of one to three energy sources were used in the households.
2. Natural gas was used most for heating, and electricity was used most for cooking and cooling.
3. The overall mean for annual energy cost was $547.84, the standard deviation was $240.48, the range was $192 to $1524.

This study revealed a wide range in the amount of money spent for residential energy by elderly householders. Types of energy sources used were related to availability. Natural gas was not available in towns A and C. In town A, liquid petroleum gas and electricity were used most in dwellings for heating, while wood was used primarily for heating in town C. Natural gas was used most for heating in towns where this energy source was available (towns B, D, and E).

Objective II was to compare selected socio-economic characteristics with total energy costs. The socio-economic characteristics examined were: size of household, sex of household head, age of household head, age of spouse, employment status of household members, education of household head, education of spouse, health of household members, family income, and role of the respondent, male or female head of household, or spouse of household head.

The t-test and one-way analysis of variance were used to accomplish Objective II and to test the first null hypothesis. Based on the t-test, there was significant difference between the groups for the sex characteristic (P=.0009) indicating that households headed by females paid less for energy than households headed by males. Therefore, the null hypothesis was rejected for the sex characteristic. There was no significant difference shown for employment status (P=.5308). The null hypothesis was not rejected for this characteristic.

Based on the F test, the first null hypothesis was rejected for the following socio-economic characteristics which are listed according to level of probability:

Characteristic	Level of Significance
Family Income	.0001
Age of Household Head	.0001
Education of Household Head	.0002
Education of Spouse	.001
Size of Household	.0014
Respondent	.0067

Income was found to be the most statistically significant socio-economic variable related to the amount of money spent for residential energy. Categories were established with a range of approximately \$2,000 for incomes from \$3,000 to \$9,000. The range was expanded as income levels increased. This was to accomplish a diminished loss of data. Householders with annual incomes of less than $2,999 paid a proportionately higher percentage (20.4 percent) of their incomes for energy than those with incomes of more than $16,000 (5.4 percent) with the exception of the $12,000 to $15,999 income category. This group paid more (14.0 percent) than the $9,000 to $11,999 income category (10.8 percent).

This finding was supported by Newman and Day (1975) by their statement that the poor used less energy, the well off used more than twice as much and middle income groups fell between. Donnermeyer (1977) found income related to energy consumption, especially electric consumption. Morrison and Gladhard (1976) found income the best indirect predictor of residential energy consumption.

Families with limited incomes restrict energy consumption according to the price they can afford to pay. For low income families, this means a sacrifice of comfort and convenience, and a change in life styles.

Age of household head was second in order of significant difference of age categories comparing annual energy costs as shown by the F test. The means of that paid for energy by the groups studied revealed that household heads 76 years of age and over paid less than the overall mean for energy and householders from 62 through 75 years of age paid more than the overall mean for energy costs.

Education of household head was third in level of significance according to the F test. Annual energy costs increased as years of education increased. Household heads with eight years or less of education paid less than the overall mean; those with nine through twelve years of education paid an amount very near the overall mean; and those with thirteen years or more paid more than the overall mean.

The mean number of years of education of the household head and spouse was used in comparing education of spouse with energy costs. This revealed that energy costs increased as the number of years of education of the spouse increased.

Findings showed that people with higher incomes spent more in dollars but a lower percentage of their income for energy and, also, that people with more years of education spent more for energy. Based on this, it seems that there is a relationship between income and education. Those with more education receive higher incomes. Fine (1967, p. 2) states that "education is worthwhile because it enables one to make the most of opportunities when they occur, and because of the higher payoff in wages and job satisfaction." However, Donnermeyer (1977) found that educational status was not correlated with energy consumption.

Size of household membership ranked next in level of significance, according to the F test. Findings revealed that energy costs increased as the number of household members increased. The size of households ranged from one to four. While households with two to four members paid more for energy, the cost per person was greater in smaller households. The mean annual cost of energy per person in one member households was $422.58; in two member households, $301.72; and in three or more member households, $215.33 or less.

Morrison (1975) ranked household size as the first variable of importance in magnitude of relationship with direct energy consumption. Assuming that energy costs are based on, and are proportionate to energy consumption, the findings of the present study indicate that family income, age of household head, education of household head, and education of the spouse were greater indicators of energy use than size of household. Basic household maintenance could account for a great part of the initial cost of energy regardless of the number of people living in the household. The first null hypothesis was not rejected for age of spouse and family health status of household members.

Objective III was to determine if selected dwelling features affected the total cost of direct energy consumer in dwellings of elderly householders. The second null hypothesis, that there is no significant difference between the cost of energy consumed in households of elderly people and selected dwelling features, was formulated from this objective.

The t-test was used to test the null hypothesis for part of the dwelling features. Based on this test the null hypothesis was rejected for the following dwelling features:

Dwelling Feature	Level of Significance
Insulation:	
Wall	.0001
Ceiling	.0026
Heating Equipment:	
Central Electric Furnace	.0001
Fireplace	.0001
Gas Space Heater	.0001
Baseboard Electric Heater	.0056

The null hypothesis was not rejected for: floor levels, floor insulation, unheated garage, attic crawl space, exterior door orientation, heating equipment types of portable electric heater, central gas furnace, wood stove, and other types.

Based on the F test the second null hypothesis was rejected for the following dwelling features:

Dwelling Feature	Level of Significance
Living Space	.0001
Air Conditioning	.0001
Major Appliances	.0001
Fans for Heat	.0004
Window Weather Stripping	.0018
Exterior Door Weather Stripping	.0020
Storm Doors	.0069
Exterior Materials	.0078
Foundation Types	.0170
Windows	.0218
Storm Windows	.0240
Occupancy	.0451

The second null hypothesis was not rejected for the dwelling feature of number of exterior doors.

Dwellings with the greatest level of significant difference in energy costs were those with wall insulation, fireplace, gas space heater, and central electric furnace (P=.0001 for each) as compared with dwellings which did not have these features. However, energy costs were above the overall mean for dwellings that had wall insulation, fireplace, or central electric furnace, and below the overall mean for dwellings that used gas space heaters. The number of square feet of living space, type of air conditioning, and number of major appliances revealed a high level of significance (P=.0001). Energy costs increased as living space increased, number of major appliances increased, and with the use of air conditioning.

These findings indicate that householders with larger, insulated dwellings, equipped with air conditioning, central heating, and more energy consuming appliances pay more for energy, because they can afford to do so, as shown by the results of the F test comparing energy costs and annual family income.

Objective IV was to determine if (a) the total cost of energy consumer in single family dwellings of elderly householders, (b) knowledge of energy conservation, and (c) changed energy conservation practices were associated with decisions to retrofit their dwelling. The intent of this objective was to test the third null hypothesis by using one-way analysis of variance. Based on the F test, the null hypothesis was rejected for changed energy conservation practices comparing reasons for retrofitting dwellings ($P=.0046$). Householders (4.1 percent) with the highest changed practices scores (71.2 percent) indicated that the main reason for retrofitting their dwellings was to save energy. However, the greatest number of householders (38.1 percent) said that comfort was the main reason for retrofitting their dwellings. These householders had a mean changed practices score of 41.8 percent.

Immediate benefits could be obtained from investment in improvements if comfort was the main reason. Whereas, it would take years to recoup the investment, and perhaps beyond the life expectancy of some of the respondents, if saving money on energy was the main reason for retrofitting. Even though improvements would save energy, only 4.1 percent of the householders were primarily concerned with saving energy when making decisions to retrofit their dwellings.

The null hypothesis was not rejected for energy costs and energy knowledge when comparing reasons for retrofitting dwellings.

Objective V was to determine if energy conservation knowledge affected energy conservation practices in the household. The fourth null hypothesis, that there is no relationship between energy conservation knowledge and changed energy conservation practices in the household, was devised to accomplish this objective.

Pearson product-moment correlation was used to test this null hypothesis. The results of this test showed no significant correlation between energy conservation knowledge scores and energy conservation practice scores (P=.5733). This indicates that knowledge of energy conservation does not necessarily mean that this knowledge is being practiced. Therefore, the fourth null hypothesis was not rejected.

Objective VI of the study was concerned with determining if there was a relationship between energy conservation knowledge and the total cost of energy consumed in dwellings of elderly householders. The intent of this objective was to test the fifth null hypothesis, that there is no relationship between energy conservation knowledge and the total cost of energy consumed in households of elderly people. Pearson product-moment correlation was used to test this null hypothesis. The interrelation between energy conservation knowledge and cost of energy showed a significant correlation (P=.0001). Therefore, the fifth null hypothesis was rejected.

Scores on the energy conservation knowledge test ranged from 35.3 percent to 94.1 percent, with a mean of 71.4 percent. Total fuel costs ranged from $192 to $1524 with a mean of $547.84. It seemed that householders that know more about energy conservation spend more for residential energy. This is supported by the significant difference of energy cost and education as reported in findings relevant to the first null hypothesis. Energy costs increased as number of years of education increased.

Objective VII was to determine if the total cost of energy consumed in the dwellings of elderly householders affected energy conservation practices in the household. Pearson product-moment correlation was used to test the sixth null hypothesis, that there is no relationship between changed energy conservation practices and the total cost of energy consumed in households of elderly people. This test revealed that there was no significant correlation between changed energy conservation practices and energy costs (P=.5952). Therefore the sixth null hypothesis was not rejected.

The mean score of changed practices was 43.5 percent and ranged from zero to 100 percent. Practices changed more often were: closing off rooms (by 67.0 percent of the householders), turning down the thermostate (by 62.9 percent), and wearing heavier clothing (by 59.8 percent). Practices changed less often were: cleaning the furnace air filter (by 20.6 percent), and checking the heating equipment (by 22.7 percent).

Changed practices in the home such as closing off rooms, lowering the thermostat and wearing heavier clothing in the winter, are not accomplishing a reduction in the monthly utility bill due to the inflation factor. Changed practices scores indicate that most families will continue to use energy in the amount they can afford as long as the supply lasts. Changes that are being made do not sacrifice comfort unless the income level indicates that it is necessary.

Objective VIII was to make recommendations for energy saving programs for elderly householders. This will be discussed in the following sub-topic of this chapter.

Recommendations

From the review of literature and analysis of the data, the following recommendations are offered by the researcher:

1. New incentives, such as visible savings in money or an intrinsic benefit such as comfort, are needed to encourage energy conservation practices. The consumer must be convinced that saving energy is necessary. Only then will life styles relative to energy use be changed.
2. Even though knowledge of energy conservation does not mean that those who possess the knowledge will practice conservation, those who, by necessity, need to practice energy saving techniques may not know how. Greater efforts should be made by educators to reach the poor and less affluent people with educational programs.
3. There is a need for more energy efficient household appliances and major household equipment. Educators need to communicate information on efficient energy use of appliances and equipment so consumers can make intelligent choices.
4. Educators need to help families make decisions by looking at alternatives and assessing both short time and long time costs of adopting energy saving practices.
5. Policy makers should develop a more equitable system of energy use rather than forcing energy conservation by raising prices and taxes on energy. This inhibits use only by those who are already making sacrifices.

Implications for further research include:

1. Replicate this study with families in other stages of the family life cycle to determine if energy costs are affecting their life style.

2. Replicate study using a wider sample in terms of area covered and in parts of the country where more extreme climatic conditions exist.
3. More study is needed to identify how and under what conditions people put knowledge into practice.
4. More study is needed to determine ways of reaching elderly householders with energy knowledge that is practical for them to use, both physically and financially.

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APPENDIXES

APPENDIX A

QUESTIONNAIRE

Respondent Number ___ ___ ___ 1-3 Card Number 1 4

Interview Schedule

ENERGY SURVEY OF ELDERLY HOUSEHOLDERS

TOWN

___ 1. Bull Shoals ___ 5

___ 2. Flippin

___ 3. Pyatt

___ 4. Summit

___ 5. Yellville

RESIDENCE TYPE ___ 6

___ 1. Single Family (House)

___ 2. Single Family (Mobile Home)

I am talking with people to find out how the energy crisis is affecting them, what they think and are doing about saving energy.

The interview will take about 45 minutes and I will appreciate your help. Your views and all the information received will remain confidential and will be used in preparing summaries of the total community. The identity of individuals will not be revealed.

Do you have time to talk with me now?

SECTION I. ENERGY SOURCE AND COST

1. What fuels are used in your home?

____ 1. Electricity ____ 7

____ 2. Natural gas ____ 8

____ 3. Liquid Petroleum gas (bottled or tank) ____ 9

____ 4. Coal or coke ____ 10

____ 5. Fuel oil ____ 11

____ 6. Wood ____ 12

____ 7. Other (specify) ____________ ____ 13

2. What fuel is used <u>most</u> for (a) heating? (b) cooking? (c) cooling (air-conditioning)? ____ 14

____ 15

____ 16

	(a) Heating	(b) Cooking	(c) Cooling
1. Electricity	____	____	____
2. Natural gas	____	____	____
3. Liquid petroleum gas (bottled or tank)	____	____	____
4. Coal or coke	____	____	____
5. Fuel oil	____	____	____
6. Wood	____	____	____
7. Other (specify) ____________	____	____	____

3. How do you pay for your utilities? ____ 17

   ___ 1. Paid for directly

   ___ 2. Included in rent

   ___ 3. Paid some other way (specify) ______________

4. Will you please estimate what you paid for the following for the past 12 months? (Round to the nearest dollar)

	Energy Source	Cost					
1.	Electricity	____	____	____	____	____	18-21
2.	Natural gas	____	____	____	____	____	22-25
3.	Liquid petroleum	____	____	____	____	____	26-29
4.	Coal or coke	____	____	____	____	____	30-33
5.	Fuel oil	____	____	____	____	____	34-37
6.	Wood	____	____	____	____	____	38-41
7.	Other (specify) _____	____	____	____	____	____	42-45

5. If you don't know how much you paid for energy, may I have your permission to authorize your electric, gas and/or fuel oil companies to provide that information to me for research purposes only?

PRESENT FORMS TO RESPONDENT TO SIGN

____ 1. Electric authorization completed

____ 2. Natural gas authorization completed

____ 3. Fuel oil and/or liquid petroleum authorization completed

____ 4. All necessary forms completed

____ 5. Forms not completed. Explain. ________________________

6. What is the source of the energy data? ____ 46

____ 1. Estimate

____ 2. Household records

____ 3. Utility Company records

____ 4. Combination of above
Specify ______________

SECTION II. *ENERGY CONSERVATION KNOWLEDGE

6. Do you think these save or use more energy?

	Saves 1	No Effect 2	Uses More 3	Don't Know 4	
1. Cleaning air conditioner filter	_____	_____	_____	_____	___47
2. Cooking food fast at high heat rather than slowly at low heat	_____	_____	_____	_____	___48
3. Doing full loads rather than small loads in the washer (So you do fewer in a week)	_____	_____	_____	_____	___49
4. Using a pan of water on the stove or radiator in the winter	_____	_____	_____	_____	___50
**5. Switching from regular (incandescent) to fluorescent light bulbs	_____	_____	_____	_____	___51
6. Preheating oven for 10 rather than 15-20 minutes	_____	_____	_____	_____	___52
7. Using a pressure cooker rather than an ordinary pan	_____	_____	_____	_____	___53
**8. Using the self-cleaning features on oven and broilers	_____	_____	_____	_____	___54
9. Washing clothes in cold water rather than hot water	_____	_____	_____	_____	___55
10. Turning off lights whenever you leave the room for 30 minutes or more	_____	_____	_____	_____	___56
11. Closing draperies at night in the winter	_____	_____	_____	_____	___57

	Saves 1	No Effect 2	Uses More 3	Don't Know 4	
12. Installing storm windows	____	____	____	____	___58
**13. Using an air-conditioner with an energy efficiency ratio of 6 rather than 8	____	____	____	____	___59
**14. Using a color TV rather than a black & white	____	____	____	____	___60
**15. Using a Solid State rather than a tube TV	____	____	____	____	___61
**16. Using "Instant-on" TV	____	____	____	____	___62
**17. Using frost-free refrigerator	____	____	____	____	___63

SECTION III. ENERGY SAVING IMPROVEMENTS

7. Have you added any of the following to your home in the past five years?

___ 1. Attic insulation ___64

___ 2. Wall insulation ___65

___ 3. Floor insulation over unheated areas ___66

___ 4. Insulation of ducting or hot water pipes ___67

___ 5. Storm windows ___68

___ 6. Storm doors ___69

___ 7. Weather stripping ___70

___ 8. Insulating draperies or shades ___71

___ 9. Other (specify) ____________________ ___72

*Adapted from Kilkeary and Thompson (1975) and used with permission.

**More technical information required.

8. If you have made any of these improvements, what was the <u>main</u> reason for making them? ___73

___ 1. To save money on the cost of energy

___ 2. To make the house more comfortable

___ 3. To save energy because the supply is scarce

___ 4. To save energy for future generations

___ 5. Some other reason (specify) ________________

___ 6. Does not apply

CARD TWO REPEAT

Respondent Number ___ ___ ___ ___ 1-3

Card # 2 ___ 4

SECTION IV: DWELLING FEATURES AND HOUSEHOLD APPLIANCES

9. How long have you lived in this house? ___ ___ 5-6

Number years ___

Don't know ___

10. Do you rent or do you own your home? ___ 7

___ 1. Rent

___ 2. Own

___ 3. Some other arrangement

11. What type of structure is your home? ___ 8

___ 1. One floor

___ 2. Two-story

___ 3. Three-story

___ 4. Split level

___ 5. Other (specify) ______________________________

12. What type of exterior material is in this house? ___ 9

___ 1. Aluminum siding

___ 2. Asbestos siding

___ 3. Brick

___ 4. Cement block

___ 5. Stone

___ 6. Stucco

___ 7. Wood

___ 8. Combination of some of the above (specify)

___ 9. Other (specify)

13. Which of these do you have in your home?

___ 1. Heated basement ___10

___ 2. Unheated basement ___11

___ 3. Crawl space under the house ___12

___ 4. Attached unheated garage ___13

___ 5. Attached heated garage ___14

___ 6. Unfinished attic or crawl space above the living area ___15

___ 7. Concrete slab floor ___16

14. How many windows are in your house? ___ ___17-18

(Don't include windows in unheated areas) Number _____

15. How many windows have storm windows or insulating glass? Number _______ ___ ___19-20

16. How many windows have weather stripping? Number ___________ ___ ___21-22

17. Do you have insulation in your home, either in the ceiling, walls or under the floor?

    1. Have ceiling insulation

       ___1. Yes ___2. No ___3. Don't know ___23

    2. Have wall insulation

       ___1. Yes ___2. No ___3. Don't know ___24

    3. Have floor insulation

       ___1. Yes ___2. No ___3. Don't know ___25

18. How many doors in your house open to the outside? (Include those to unheated areas) ___26
    Number _______

19. How many exterior doors have storm doors or insulating glass? Number _______ ___27

20. To what direction do outside doors open?

    ___ 1. North ___ 5. Northwest ___ ___28-29

    ___ 2. South ___ 6. Southwest ___ ___30-31

    ___ 3. East ___ 7. Northeast ___ ___32-33

    ___ 4. West ___ 8. Southeast ___ ___34-35

21. How many outside doors have weather stripping?
    Number _______ ___36

22. How many square feet of living space do you have in your home (not including unfinished areas in an attic or basement and unheated garage)
    Number of square feet ___________ ___37-40

23. What heating equipment do you use in your house?

    ___ 1. Fireplace (wood) ___41

    ___ 2. Portable heater/s (electric) ___42

    ___ 3. Fixed space heaters ___43

    ___ 4. Baseboard heaters (electric) ___44

    ___ 5. Central furnace (electric) ___45

    ___ 6. Central furnace (gas) ___46

    ___ 7. Baseboard heaters or radiators (hot water) ___47

___ 8. Wood stove ___48

___ 9. Other (specify) ________________ ___49

24. How many fans are used to circulate heat? ___50-51
Number __________

25. What type of air conditioning is used in your home? ___52

___ 1. Central air conditioning

___ 2. Window units

___ 3. Not air conditioned

___ 4. Combination of some of the above (specify) ____________

26. How many of these appliances do you use in your home?
(Write number in blank)

___ 1. Dishwasher ___53

___ 2. Microwave oven ___54

___ 3. Refrigerator or refrigerator/Freezer
(automatic defrost) ___55

___ 4. Refrigerator or refrigerator/Freezer
(manual defrost) ___56

___ 5. Range, with oven (electric) ___57

___ 6. Range, with self cleaning oven (electric) ___58

___ 7. Range, with oven (gas) ___59

___ 8. Range, with self cleaning oven (gas) ___60

___ 9. Freezer (manual defrost) ___61

___10. Freezer (automatic defrost) ___62

___11. Clothes dryer (gas or electric) ___63

___12. Washing machine (automatic) ___64

___13. Washing machine (non-automatic) ___65

___14. Water heater (electric) ___66

___15. Water heater (gas) ___67

___16. Air conditioner (window unit) ___68

____17.	Heater (portable, electric)	____69
____18.	Attic fan	____70
____19.	Electric fan (portable, ceiling, and for window)	____71-72
____20.	Television (black and white, tube)	____73
____21.	Television (black and white, solid state)	____74
____22.	Television (color, tube)	____75
____23.	Television (color, solid state)	____76

SKIP COLUMN 77-80

CARD THREE REPEAT

Respondent Number ____ ____ ____ ____ 1-3

Card # 3 ____ 4

SECTION V. ENERGY CONSERVATION PRACTICES

27. Please tell me if the members of your household have changed their way of doing any of the following in the past five years for the purpose of saving energy?

	More 1	Less 2	No Change 3	Doesn't Apply 4	
1. Turn off lights that are not in use	_____	_____	_____	_____	____ 5
2. Turn off TV when not in room	_____	_____	_____	_____	____ 6
3. Prepare one-dish meals	_____	_____	_____	_____	____ 7
4. Consider the cost of operation before buying energy consuming equipment	_____	_____	_____	_____	____ 8
5. Turn down the thermostat at night	_____	_____	_____	_____	____ 9
6. Close doors and turn off heat to unused areas of your house	_____	_____	_____	_____	____10
7. Clean furnace air filter often to maintain efficiency	_____	_____	_____	_____	____11

	More	Less	No Change	Doesn't Apply	
	1	2	3	4	
8. Check, clean and adjust heating equipment for top efficiency	___	___	___	___	___12
9. Wear heavier clothing at home in cold weather	___	___	___	___	___13
10. Turn down temperature control on hot water heater	___	___	___	___	___14
11. Use only warm or cold water cycles for washing clothes	___	___	___	___	___15
12. Use insulating draperies in your home	___	___	___	___	___16
13. Use air conditioner in your home	___	___	___	___	___17
14. Use attic, window or portable fan/s in your home	___	___	___	___	___18

28. What other ways have you used to save energy in your home?

____ ___ ___19-20

____ ___ ___21-22

____ ___ ___23

29. What was the <u>main</u> reason for adopting conservation practices, if you have done so? ___24

___ 1. To save money

___ 2. Because the supply of energy is scarce

___ 3. Because of a possible blackout

___ 4. Because of a possible fuel cut off

___ 5. It is everybody's patriotic duty to save energy

___ 6. So future generations will have a supply of energy

___ 7. Some other reason (specify) __________

___ 8. Have not adopted conservation practices

SECTION VI. SOCIO-ECONOMIC CHARACTERISTICS

30. Please tell me about the people who live in this household?

1. Number of people living in this household____ ____25

2. Characteristics of household head

Sex: Male___ Female___ ____26

Age: Number of years___ ___ ___27-28

Race: ___ 1. Whiate ___29

___ 2. Black or Negro

___ 3. Native American

___ 4. Other (specify) ____________

Employment: ___30

___ 1. Fully retired

___ 2. Employed part time

___ 3. Employed full time

___ 4. Unemployed

___ 5. Retired from one career and employed part time

___ 6. Retired from one career and employed full time

Education: Number years __________ ___ ___31-32

Health: ___33

___ 1. Excellent

___ 2. Good

___ 3. Fair

___ 4. Poor

3. Characteristics of spouse of household head

Sex: Male___ Female___ ___34

Age: Number years_____ ___ ___35-36

Race: ___ 1. White ___37

___ 2. Black or Negro

___ 3. Native American

___ 4. Other (specify)

Employment: ___38

___ 1. Full retired

___ 2. Employed part-time

___ 3. Employed full-time

___ 4. Unemployed

___ 5. Retired from one career and employed part-time

___ 6. Retired from one career and employed full-time

Education: Number Years ___________ ___ ___39-40

Health: ___41

___ 1. Excellent

___ 2. Good

___ 3. Fair

___ 4. Poor

31. Who is the respondent? ___42

___ 1. Male head

___ 2. Female head

___ 3. Female spouse of head

___ 4. Male spouse of head

32. Do you mind telling me the range which best described your total gross family income for the past year? ___ ___43-44

___ 1. Under $1500

___ 2. $1500 - $2999

___ 3. $3000 - $4999

___ 4. $5000 - $6999

___ 5. $7000 - $8999

___ 6. $9000 - $11,999

___ 7. $12,000 - $15,999

___ 8. $16,000 - $24,999

___ 9. $25,000 or over

___10. Refused or don't know

SUPPLEMENT TO ENERGY SURVEY OF ELDERLY HOUSEHOLDERS

RESPONDENT NUMBER ___ ___ ___

Characteristics of other household members
relationship to head ___45

___ 1. Child

___ 2. Other relative (specify) ______________

___ 3. Non-relative

Sex: Male___ Female___ ___46

Age: Number years_____ ___ ___47-48

Race: ___ 1. White ___49

___ 2. Black or Negro

___ 3. Native American

___ 4. Other (specify)

Employment: ___50

___ 1. Fully retired

___ 2. Employed part-time

___ 3. Employed full-time

___ 4. Unemployed

___ 5. Retired from one career and employed part-time

___ 6. Retired from one career and employed full-time

Education: Number Years__________ ___ ___51-52

Health: ___53

___ 1. Excellent

___ 2. Good

___ 3. Fair

___ 4. Poor

APPENDIX B

AUTHORIZATION FORMS AND CORRESPONDENCE

ELECTRIC COMPANY AUTHORIZATION

I hereby give my permission to Arkansas Power and Light Company to release to Beverly M. McNew, for research purposes only, a copy of the amount paid by my household for electricity each month for June 1977 through May 1978.

A photocopy of this authorization may be accepted with the same authority as the original.

Signed ______________________________

Please Print

Name of person who received monthly bill: ______________________

Route and/or Box Number: ______________________________

City, State: ______________________________

Date: ______________________________

GAS COMPANY AUTHORIZATION

I hereby give my permission to Arkansas Western Gas Company to release to Beverly M. McNew, for research purposes only, a copy of the amount paid by my household for natural gas each month for the months of June 1977 through May 1978.

A photocopy of this authorization may be accepted with the same authority as the original.

Signed: ______________________________

Please Print

Name of person who receives monthly bill: ____________________

Route and/or Box Number: ______________________________

City, State: ______________________________

Date: ______________________________

HERBERT H. LEHMAN COLLEGE
OF THE CITY UNIVERSITY OF NEW YORK

BRONX, NEW YORK 10468

FAMILY AND CONSUMER STUDIES

(212) 960-8160

June 20, 1978

Ms. Beverly M. McNew
Rt. 1 Box 232
Yellville, Ar. 72687

Dear Ms. McNew:

In response to your recent inquiry addressed to Rovena Kilkeary and me. We are delighted to know that EKI and CPI'S developed for the energy study will be of use to you in your current research project.

We would appreciate your citing our study as the basis for your questionnaire and would like a copy of your study on completion.

Cordially,

/s/ Patricia Thompson

Patricia Thompson
Lecturer

COOPERATIVE EXTENSION SERVICE

UNIVERSITY OF ARKANSAS Division of Agriculture,

U. S. Department of Agriculture and County Governments Cooperating

Courthouse Building
P.O.Box 386
Yellville, Arkansas 72687

Your name has been selected at random to request your permission to participate in a research study I am conducting in Marion County. The study deals with the problem of rising energy costs and the impact these costs are having on the lives of families and the decisions they are making. The purposes for conducting the study are to learn more about how families are coping with this situation, and to use the information for developing educational programs in this area. The information is to be used as part of the study and your household will not be identified individually. I hope you will be willing to talk with me approximately 45 minutes about this.

Do you know how much you have spent for fuel this past year (this includes electricity, gas, liquid petroleum gas, wood, etc...)? I'll need this in addition to information about your house, household practices, and the people who live in your home.

I will be contacting you in the near future, hopefully in a week or two, about the interview. If you have questions about the study you may call me at 449-6349.

I am looking forward to talking with you soon.

Sincerely yours,

/s/ Beverly M. McNew

Beverly M. McNew
County Extension Agent -
Home Economics
Marion County

BMM/lm

APPENDIX C

SOURCE OF ENERGY DATA AND ADDITIONAL DATA ON T-TESTS

TABLE XXI

SOURCE OF ENERGY DATA FROM
SAMPLED HOUSEHOLDERS
(N=97)

Data Source	Number of Responses	Percent
Utility company records	34	35.05
Household records	33	34.02
Household and utility company records	16	16.50
Estimate and utility company records	7	7.22
Estimate	5	5.16
Estimate and household records	2	2.06

TABLE XXII

THE T-TEST COMPARING ENERGY COSTS OF SPECIFIED SOCIO-ECONOMIC CHARACTERISTICS

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Variances	Degrees of Freedom	Prob>(T)	Prob>F[1]
<u>Sex of Household Head</u>									
Male	66	68.0	$502.11	$245.78	3.7890	U	76.5	0.0003[s][a]	0.0836
Female	31	32.0	432.29	184.11	3.4189	E	95.0	0.0009[s]	
<u>Employment Status</u>									
Retirement only	72	74.2	538.15	245.69	-0.6970	U	44.9	0.4894[ns][b]	0.6876
Some employment	25	25.8	575.72	227.28	-0.6710	E	95.0	0.5038[ns]	

[a]Significant difference at the 0.05 level.

[b]No significant difference at the 0.05 level.

TABLE XXIII

THE T-TEST COMPARING TOTAL ENERGY COSTS OF SELECTED DWELLING FEATURES

Variable	Number Households	Percent	Mean	Standard Deviation	"t" Value	Variances	Degrees of Freedom	Prob>(T)	Prob>F[1]
<u>Floor Levels</u> (N=97)									
One level	76	78.4	$525.74	$234.99	-1.6835	U[a]	30.6	0.1025[ns][c]	0.6942
Multi-level	21	21.6	627.81	248.88	-1.7398	E[b]	95.0	0.0851[ns]	
<u>Ceiling Insulation</u> (N=96)									
Presence	80	83.3	571.97	253.09	3.1666	U	50.7	0.0026[s][d]	0.0013
Absence	16	16.6	445.50	112.74	1.9539	E	94.0	0.0537[ns]	
<u>Wall Insulation</u> (N=91)									
Presence	64	70.3	600.19	243.96	4.8134	U	80.7	0.0001[s]	0.0025
Absence	27	29.7	404.44	139.79	3.8998	E	89.0	0.0002[s]	
<u>Floor Insulation</u> (N=94)									
Presence	26	27.7	583.96	234.58	0.7562	U	47.0	0.4533[ns]	0.8448
Absence	68	72.3	542.57	244.46	0.7423	E	92.0	0.4598[ns]	
<u>Unheated Garage</u> (N=97)									
Do not have	91	93.8	542.52	243.48	-1.0691	U	6.2	0.3251[ns]	0.5782
Have	6	6.2	628.50	186.83	-0.8470	E	95.0	0.3991[ns]	
<u>Attic Crawl Space</u> (N=97)									
Do not have	7	07.2	680.57	308.89	1.1990	U	6.5	0.2724[ns]	0.2364
Have	90	92.8	537.51	233.35	1.5266	E	95.0	0.1302[ns]	

TABLE XXIII (Continued)

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Variances	Degrees of Freedom	Prob>(T)	Prob>F[1]
*Door Orientation (N=97)									
North									
Do not have	46	47.4	$533.09	$213.95	-0.5778	U	94.0	0.5648^{ns}	0.1579
Have	51	52.6	561.14	263.55	-0.5716	E	95.0	0.5689^{ns}	
South									
Do not have	39	40.2	529.90	243.38	-0.5987	U	80.9	0.5511^{ns}	0.9066
Have	58	59.8	559.90	239.88	-0.6007	E	95.0	0.5497^{ns}	
East									
Do not have	42	43.3	558.79	277.64	0.3761	U	73.9	0.7080^{ns}	0.0549
Have	55	56.7	539.47	210.04	0.3902	E	95.0	0.6973^{ns}	
West									
Do not have	42	43.3	507.69	230.59	-1.4571	U	90.9	0.1485^{ns}	0.6827
Have	55	56.7	578.49	245.41	-1.4449	E	95.0	0.1518^{ns}	
Northwest									
Do not have	95	97.9	542.72	234.59	-0.6901	U	1.0	0.6150^{ns}	0.0660
Have	2	02.0	791.00	507.70	-1.4533	E	95.0	0.1494^{ns}	
**Southwest									
Do not have	96	99.0	549.04	241.45	-	U	-	-	
Have	1	1.0	432.00	-	0.4822	E	95.0	0.6307^{ns}	
Southeast									
Do not have	95	97.9	542.72	234.59	-0.6901	U	1.0	0.6150^{ns}	0.0660
Have	2	2.0	791.00	507.70	-1.4533	E	95.0	0.1494^{ns}	

TABLE XXIII (Continued)

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Variances	Degrees of Freedom	Prob>(T)	Prob>F'
Heating Equipment (N=97)									
Fireplace									
Do not use	80	82.5	$491.55	$199.46	-5.0549	U	20.7	0.0001^{s}	0.2326
Use	17	17.5	812.71	245.29	-5.7846	E	95.0	0.0001^{s}	
Portable Electric Heater									
Do not use	89	91.8	543.34	234.54	-0.4798	U	7.7	0.6447^{ns}	0.1976
Use	8	8.2	597.87	313.72	-0.6124	E	95.0	0.5417^{ns}	
Gas Space Heater									
Do not use	56	57.3	639.87	262.33	5.4071	U	84.0	0.0001^{s}	0.0001
Use	41	42.3	422.12	126.92	4.9063	E	95.0	0.0001^{s}	
Baseboard Heater (Electric)									
Do not use	92	94.8	532.25	232.45	-2.9302	U	4.5	0.0379^{s}	1.0000
Use	5	5.2	834.60	224.27	-2.8367	E	95.0	0.0056^{s}	
Central Furnace (Electric)									
Do not use	75	77.3	484.93	211.32	-5.4109	U	34.3	0.0001^{s}	0.9461
Use	22	22.7	762.27	211.41	-5.4122	E	95.0	0.0001^{s}	
Central Furnace (Gas)									
Do not use	77	79.4	527.45	227.93	-1.4759	U	26.1	0.1519^{ns}	0.2450
Use	20	20.6	626.30	276.07	-1.6525	E	95.0	0.1017^{ns}	
Wood Stove									
Do not use	85	87.6	534.25	226.53	-1.1549	U	12.6	0.2695^{ns}	0.0822
Use	12	12.4	644.08	318.26	-1.4905	E	95.0	0.1394^{ns}	

TABLE XXIII (Continued)

Variable	Number of Households	Percent	Mean	Standard Deviation	"t" Value	Variances	Degrees of Freedom	Prob>(T)	Prob>F[1]
<u>Heating Equipment</u> (Continued)									
Other types									
Do not use	86	88.7	$555.88	$241.48	0.9448	U	12.9	0.3621[ns]	0.9912
Use	11	11.3	484.91	233.69	0.9210	E	95.0	0.3594[ns]	

*There were no northeast doors.

**Sample size inadequate for comparison.

[a]Unequal

[b]Equal

[c]Not significant at the .05 level.

[d]Significant at the .05 level.

VITA

Beverly Martin McNew

Candidate for the Degree of

Doctor of Education

Thesis: IMPACT OF ENERGY COSTS ON HOUSING RELATED DECISIONS OF ELDERLY HOUSEHOLDERS

Major Field: Home Economics Education

Biographical:

Personal Data: Born in Steprock, Arkansas, September 22, 1926, the daughter of Boyce and Minnie Martin. Married to Robert D. McNew, June 20, 1970. A daughter by a previous marriage, Terrie Lynn Morris, was born January 9, 1957.

Education: Graduated from Pleasant Plains High School, Pleasant Plains, Arkansas, May, 1944; received the Bachelor of Science in Education degree from University of Central Arkansas, Conway, Arkansas, in May, 1951; received the Master of Science degree in General Home Economics from the University of Arkansas in May, 1975; completed requirements for the Doctor of Education degree in Home Economics Education at Oklahoma State University in July, 1979.

Professional Experience: Elementary school teacher, Arkansas and New Mexico public schools for five years; High school teacher, Russell Schools, Russell, Arkansas, 1948-49; Home Economics teacher, West Ridge Public Schools, West Ridge, Arkansas, 1951; Assistant Home Demonstration Agent, Independence County, Batesville, Arkansas, 1951; Home Demonstration Agent, Baxter County, Mountain Home, Arkansas, 1951-57; Home Economics teacher, Pleasant Plains Schools, Pleasant Plains, Arkansas, 1959-60; County Extension Agent-Home Economics, Randolph County, Pocahontas, Arkansas, 1964-76; County Extension Agent-Home Economics, Marion County, Yellville, Arkansas, 1977-present.

Professional Organizations: American Home Economics Association; Arkansas Home Economics Association; National and Arkansas Association of Extension Home Economists; Epsilon Sigma Phi; Gamma Sigma Delta; Kappa Delta Pi.