STRUCTURAL AND BEHAVIORAL COMPONENTS OF RESIDENTIAL ENERGY CONSUMPTION

By

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STRUCTURAL AND BEHAVIORAL COMPONENTS

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

In the past 15 years energy consumption, coupled with the 1973 Oil Embargo and the 1978 energy crisis has caused the nation to become concerned with energy consumption. "The American public is aware that energy is no longer the inexpensive, plentiful resource that had been taken for granted" (Weber, McCray, 1984). An inexpensive, safe and productive approach to solving this country's energy crisis is through conservation (Stobaugh and Yergin, 1979). In looking for areas where energy consumption can be reduced, the U.S. government identified a major target to be the private household. A report by the Office of Technology Assessment stated, "Energy use in the home accounts for approximately 20 percent of our total energy use, and of that amount, about 60 percent is used for heating and cooling. Residential energy use grew about twice as fast as the number of households between 1950 and 1970, reflecting the increased use within each household" (Peterson, DeSimone, 1979). A large portion of this country's current housing stock was built on the premise that energy was

abundant and affordable, which further encourages the consumption of energy in a household (Weber, McCray 1984).

Gladhart (1977) states that two options are available to families for reducing energy use and energy costs. Households may:

1. Enhance the energy efficiency of some mechanical system in the structure or;

2. Increase the energy efficiency and thriftiness of human behaviors.

The two options available have differing implications for lifestyle changes and decision making in households. Monetary resources, knowledge, and other resources are required in order for a household to increase the energy efficiency of its housing structure, but this energy conserving option rarely requires lifestyle changes. Changes in behavior efficiency of a household requires conscious adjustment in lifestyles.

Much of the existing research on energy consumption in the private sector has been concerned primarily with structural aspects. Behavioral patterns of households have not been extensively explored. A working group of the Office of Science and Technological Policy recognizes the lack of behavioral research and a notable weakness [in Department of Energy (DOE) research] is the tendency to view obstacles to adoption of new energy systems as purely technological. "Important obstacles to the adoption of new energy systems or expansion of existing ones will

increasingly be recognized to be to some degree political, sociological, economic, institutional, and environmental in character. Research which could assist in addressing these issues is virtually nonexistant within the DOE" (Burns, 1980).

A large portion of existing studies of adoption, decision making, and consumer choices in energy consumption were not designed or conducted in a way that applied or contributed to further development of behavior and social models. The predominance of physical scientists in the areas of energy research aids in reducing the explicit use of behavioral and social science models (Burns, 1980). Concern has focused on structural and technological aspects of home energy consumption McDougall, Ritchie, and Claxton (1981) summarized that programs aimed at improving the energy efficicency of housing stock should receive top priority. Also, a major portion of household energy consumption is circumscribed by the dwelling. Design and construction features of a residence greatly impact the amount of energy used or wasted in a structure. Through structural design and improvements, the potential for reducing energy use in new and existing homes is 30 to 60 percent. Technologies available today can substantially reduce home energy use with no loss in comfort to families occupying the residence (Williams, Lauener, & Braun, 1979). Available research supports the idea that structure has a significant impact on energy consumption.

Recent studies have begun to examine the relationship between structure, behavior, and energy consumption. According to the Office of Technology and Assessment, "the level of energy use within a home is greatly influenced by the attitudes, choices, and behaviors of its occupants, within a range circumscribed by the limitations of the structure itself." In addition, "within similar homes energy consumption may vary by as much as a factor of two, depending solely on attitudes, choices, and behaviors" (Peterson and DeSimone, 1979).

Gladhart (1977) states that, "The family as a group is engaged in sets of regular, patterned behaviors that require complementary process of energy conversion for their support." Also that the amount of energy consumed depends upon the structure, the norms or standards of the family, and the family behaviors. All three of these dimensions are under some control of the family members (Gladhart, 1977).

Although attitudes toward energy conservation and energy consumption are not highly predictive of behavior, there is a real relationship between actual behavior and consumption (Van Raaij and Verhallen, 1981). Behavioral changes in households will not produce as vast of savings in energy as those achieved through structure, however, there are savings to be had and behavior plays a large role in reducing energy use in existing housing (Williams, 1979).

Statement of the Problem

Verhallen and Van Raaij (1981) found that there were large differences between energy consumption in identical homes that were related to behavior, activities, and lifestyles of household members. A research study found that the more efficient the housing unit is structurally, the less efficient the behavior was in the use of the structure (Weber, Shuter, 1982). A family's use of energy and technological home improvements will determine the level of energy usage in the home. The behavior patterns exhibited by individuals can negate or enhance the energy efficiency of a structure.

Studying effects of behavior on energy consumption will:

"1. help families anticipate the future related to fossil fuel energy--its imperative price increase and decreasing supply;

2. help families make creative but rational decisions about family lifestyles given these constraints;

3. develop energy programs for formal and nonformal education;

4. design future household energy research" (Maas, 1978).

Purpose and Objectives

The purpose of this study is to compare the impact of demographic and behavioral patterns of households on residential energy consumption. Specifically the objectives include:

1. To assess the relationship between household consumption patterns and their demographic characteristics including education, occupation, marital status, family size.
2. To ascertain specific behavior patterns practiced by household members and the effects of those patterns on energy consumption.
3. To compare attitudes of husbands and wives relating to energy consumption and conservation.
4. To identify those behaviors that households perceive as being more energy efficient.
5. To determine if behavior saving patterns affect lifestyle satisfaction of household members.

Definitions:

The following definitions clarify the terms used in this study:

Conservation- the achievement of the same level of perceived well-being by using less energy as a result of substituting economically efficient technology and behavior,

and adapting preferences to conform to an era of energy scarcity (Jacobs, Shama, 1982).

Behavioral Actions- changes in preferences to a lifestyle of voluntary simplicity.

Structural Features- adoption of either proven or innovative conservation technology.

Lifestyle- sets of activities, engaged in by a family, that are perceived as being instrumental in meeting some need or achieving some objectives (Gladhart, 1977).

Assumptions

The following assumptions are included in this study:

1. Respondents answered the questionnaire truthfully and accurately.
2. Respondents did not confer with spouses or other persons when answering.
3. Respondents are representative of a sample living in newly constructed housing, in the 1000 square foot range.

Limitations

The limitations affecting the results of this study include:

1. Purposive sampling was utilized to control for structure, therefore findings can not be generalized for the entire population.

2. The data is limited to those persons residing in the Eastridge Subdivision in homes built by Kraybill Construction.

Summary

Past research has suggested that structural features in the home are the most important factor in determining energy consumption. Behavioral influences on energy consumption has often been overlooked. This research studied the structure of homes in relationship to behavior in the homes. As one researcher states, when, "behaviors are coupled with the emerging technological home improvements, they significantly add to the arsenal used to combat the country's energy crisis" (McNeill and Hutton, 1981).

CHAPTER II

REVIEW OF LITERATURE

Introduction

In the past Americans had access to cheap energy and expected to continue to have cheap energy. There was little incentive in previous years to spend money for energy conservation measures.

In 1973 the Arab oil embargo changed the ideas Americans held about energy. During this time the Organization of Petroleum Exporting Countries (OPEC) more than doubled its price for crude oil. Prices continued to increase in the years that followed. By 1978 the fuel oil used in heating homes cost almost three times more than it did in 1967. Natural gas and electricity prices also had doubled from their 1967 levels (Lindamood and Hanna, 1979).

The price increases have had an affect on energy consumption in American households. Households are increasingly more concerned with conservation and energy reduction in the home. Although many households may want to reduce consumption there are a number of barriers and incentives involved in reducing that consumption. Decision making and lifestyle satisfaction, resources, attitudes and

values, and demographic variables all have an impact on energy usage.

Lifestyle Satisfaction and Decision Making Styles

Gladhart (1977) found that changes in structure and changes in behavior have very different implications in terms of lifestyle and decision making. Findings suggest that increasing the energy efficiency of a structure rarely reflects lifestyle changes, but does require money, knowledge, or other resources. Opposite of structure, daily behaviors that consume energy are habits or non-decisions and changing those requires regular useful feedback. This change demands a conscious adjustment in lifestyles.

Further, the household members determine the ultimate amount of energy used in a home. Decisions that affect usage are under the household members' direct control. Characteristics and perceptions of a family's lifestyle influence its decision to adopt energy conservation practices. Williams (1979) found that one reason families may fail to take conservative action is because of "conflicts between conservation objectives and other goals such as comfort, convenience, and 'fairness'".

Another study stated that "lifestyle considerations are critical determinants of the adoption decision" to conservation. Although conservation is cheap and effective it may not be adopted because of conflicts with lifestyle

attitudes and values held by the household (Darney, 1981).

High consumption of energy in the home is often thought to contribute to satisfaction of household members. The more energy available for consumption, the happier the energy consumer should be. Graef (1981), however, found that there was no positive relationship between household satisfaction or happiness and level or energy consumption. He felt that households have "inadvertently taken much of the enjoyment out of life by precluding active involvement on the part of the participant."

In conclusion Heslop (1981) wrote that "Conservation activities may be performed where convenient, and may or may not result in significant energy saving." The amount and type of conservation utilized have an important impact on the amount of energy saving.

Information

Information available to and knowledge held by household members can contribute to energy usage in the home. With an increase in knowledge it would appear that families would reduce consumption.

Palmer (1977) conducted a study on feedback and electrical usage in the home. An important finding of his research was that with increased information and knowledge of consumption and cost through the use of feedback, electrical consumption decreases. Feedback increases

family knowledge of consumption and aids the family that wishes to reduce usage.

Van Raaij (1981) supports the idea that feedback increases the information base of families. The study results found that, "information in the form of feedback seems to be very effective to maintain new and stable behavior patterns and to create energy-conscious attitudes." Further the study indicated that "individual feedback information approaches are effective in reducing energy consumption."

Feedback is not the usual means that families use to gather information about energy. Maas (1978) questioned families about their sources of energy use information. A large portion of reported energy information sources of families were, "news broadcasts, newspapers, television specials, books, magazine articles,and commercials". Another important information base is through structural audits of homes. Gaskel (1981) found that audits given in a personal manner are the most effective instruments in producing reductions in energy consumption. The information base provided by the audit influences consumption.

Maas (1978) performed a study on four groups of families that were given information on reducing energy consumption. The idea was to determine if educating families would aid in energy use reduction. The follow up study of this research determined that those families who

received information did use the information gained from the original study to initiate specific changes.

Economics

Economics can play an important role in adoption or nonadoption of energy reducing efforts--both in terms of structure and behavior. Financial resources of a family serve as both a barrier and an incentive.

Families with greater discretionary incomes are better able to make adjustments in their energy use (Williams, 1979). In studying response to the federal and state energy tax credits for encouraging energy saving features in the home it was found that, "the decision is such that the amount of consumer purchase is dictated by need and the ability to make the necessary purchase" (Pitts, 1980). The financial resources play an important role. Lower income households spend virtually all of their disposable income on consumption items and are not in a position to save enough money necessary to retrofit homes.

Price changes also affect consumption. Smith (1980) says that, since energy is an input into almost every household function, these changes in price and use suggest significant changes in demand for consumer goods and services."

Social science research has frequently neglected price and its impact on energy consumption. A study by Schipper

and Kethoff (1981) reveals a relationship between energy cost and energy use. The researchers found that in countries with low electricity rates there were high levels of appliance electricity use. In those countries with high electricity rates lower levels of appliance use were found. In this case it seems that price is an important influence on energy use and intensity of use.

Although cost may cause some individuals to lower energy consumption, it does not always insure energy reduction. Low income households are at a disadvantage when conservation practices require monetary resources. Poor households may reduce usage through behavior or inexpensive structural changes, but lack the resource of money to make further reductions. Perlman and Warren (1977) feel,

> "If energy policy is to be equitable as well as effective, the attractiveness of allowing prices to rise 'with the market' must be tempered by the awareness of the disproportionate burden that higher prices place on the poor."

With the government's idea price of energy will discourage energy wastefulness and encourage voluntary conservation, the administration is placing the poor at a disadvantage.

As mentioned before, behavioral changes in habits and routine are an inexpensive way of reducing consumption in the home. Households are using behavior as a means of combating the high cost of energy. While behavioral changes in households will not produce as vast of savings in energy as those achieved through structure, there are savings to

be had. Behavior plays a large role in reducing energy use in existing housing (Williams, 1979).

Attitudes and Values

Attitudes toward energy conservation and energy consumption are not highly predictive of behavior. Attitudes are not necessarily precursors of actions. Frequently there are reports of low or nonsignificant correlations between attitudes and behaviors of a household. However, Weigel (1976) found that, "the likelihood of engaging in a particular action should be better predicted by one's attitude toward the act itself than by one's attitude toward an associated object or class of objects."

Allen, Schewe, and Liander (1981) studied the concept of conservation-oriented consumers. A conservation-oriented consumer, "perceives the energy problem as real and serious, believes his/her own behavior is linked to the problem." In the study American and Swedish individual attitudes and values were compared to determine if these components explain the substantially lower Swedish energy consumption. Researchers found that less than one-fourth of the Swedish sample altered consumption habits in response to the energy situation. Two-thirds of the American sample, however, altered consumption habits and expressed the belief that their own behavior is effective in reducing the nation's energy use. The findings indicate that attitudes toward

energy conservation do not necessarily indicate conservation practices.

In another study the relationship between homeowners' attitudes toward energy use and their actual summer electric consumption was examined. Two factors were found to be important in the relationship of attitudes to consumption. The best predictor of consumption levels was the comfort and health factor. This factor relates to the importance of personal comfort and health in decisions to regulate energy use. The second best predictor was the savings and results factor. These attitudes pertain to the effort that is required in conservation, and the savings that are received through the effort. The study found that the attitudes a person held concerning the two factors contributed to total energy consumption (Seligman et al, 1979).

Bailey (1980) found that attitudes related to energy conservation contributed the greatest proportion of total variance in energy consuming behavior. The findings stated that attitudes influence behavior alone, and also when combined with socioeconomic variables. In summary, the research discovered that attitudes between energy conservative behavior was stronger than any other factor including age, income of household, education level of household head, and size of household.

Demographics

Demographic characteristics have a large impact on household energy consumption. Newman and Day (1975) found that energy use is positively affected by such characteristics as age of household head, education of household head, income level of the household, and family size. Higher income households are more likely to make adjustments in their energy consumption. They would also more frequently try to make further adjustments with increasing energy prices than lower income families. Smith (1980) states that, "higher income households have more adjustment alternatives."

Perlman and Warren (1977) state that one of the most significant factors that affects energy usage is the flow of money into the household. Monetary resources are the major way households acquire other resources. In addition, Newman and Day (1975) found, "The more money you have, the more energy you use at home...This is regardless of any other condition...the size of your home; your age; number of people in your household."

Larger households, and households with an increased level of education are more likely to make energy reducing measures. Younger households use less energy because more time is spent out of the home. Most adjustments in energy consumption are made by lower middle age groups and least are made by the elderly. Elderly households spend much of

the time at home and are more directly affected by reductions in energy use (Smith, 1980). In addition, Murray (1974) found that age of household members impacts the type and adoption of energy conservation practices.

Lower income families use less energy than higher income families and spend less money on their utility bills. However, energy costs of the poor consume a larger proportion of monthly income than that of the average household. The lower income have a larger burden of cost, yet this group can least afford the expenditure (Van Raaij, 1981).

Summary

Many factors other than structure influence the amount of energy that is consumed in the home. Lifestyle satisfaction, decision making styles, information and knowledge, economics, attitudes and values, and demographics all impact energy usage. This study will primarily consider the impact of behavior on energy consumption.

CHAPTER III

METHODOLOGY

Introduction

The previous chapter discussed barriers and incentives to structural and behavioral components of energy consumption. Chapter III investigates the research methods and procedures of the study. Included are methods of sample selection, description of the instrument, and methods of data collection and analysis. Also described is the population from which the sample is taken.

Type of Research

Descriptive research involves the relationships between nonmanipulated variables and is a nonexperimental type of research (Best, 1981). This study deals with the relationship of variables such as structure, behavior, energy usage, and demographic variables. Therefore, the conditions have already taken place and the study is descriptive.

Description of the Population and Sample Selection

The population for this study consists of current residents of the Eastridge subdivision located in Stillwater, Oklahoma. The population specifically comprises those persons who live in homes built by Kraybill Construction, a Stillwater construction company. These homes were selected to control for similarity in construction techniques, design, and square footage, as well as energy conservation details. The central air in this housing operates on electrical usage. Water heating and home heating are natural gas.

Eighty-six homes in the Eastridge subdivision were identified as being built by Kraybill Construction. An Eastridge subdivision map was obtained with the block numbers and lot numbers of each home built by Kraybill Construction clearly identified (Figure 1). Homeowners names and addresses were obtained from Eastridge subdivision records located in the Payne County Courthouse in Stillwater, Oklahoma. Warranty deed holders of each lot on each block are listed in the subdivision records. In this research, the warranty deed holders are assumed to be the residents and owners of the home.

The 86 homes in the original population were reduced to an actual response rate of 30 households. The reduction in the original population was caused by 7 households moving, 15 households refusing to participate during the telephone

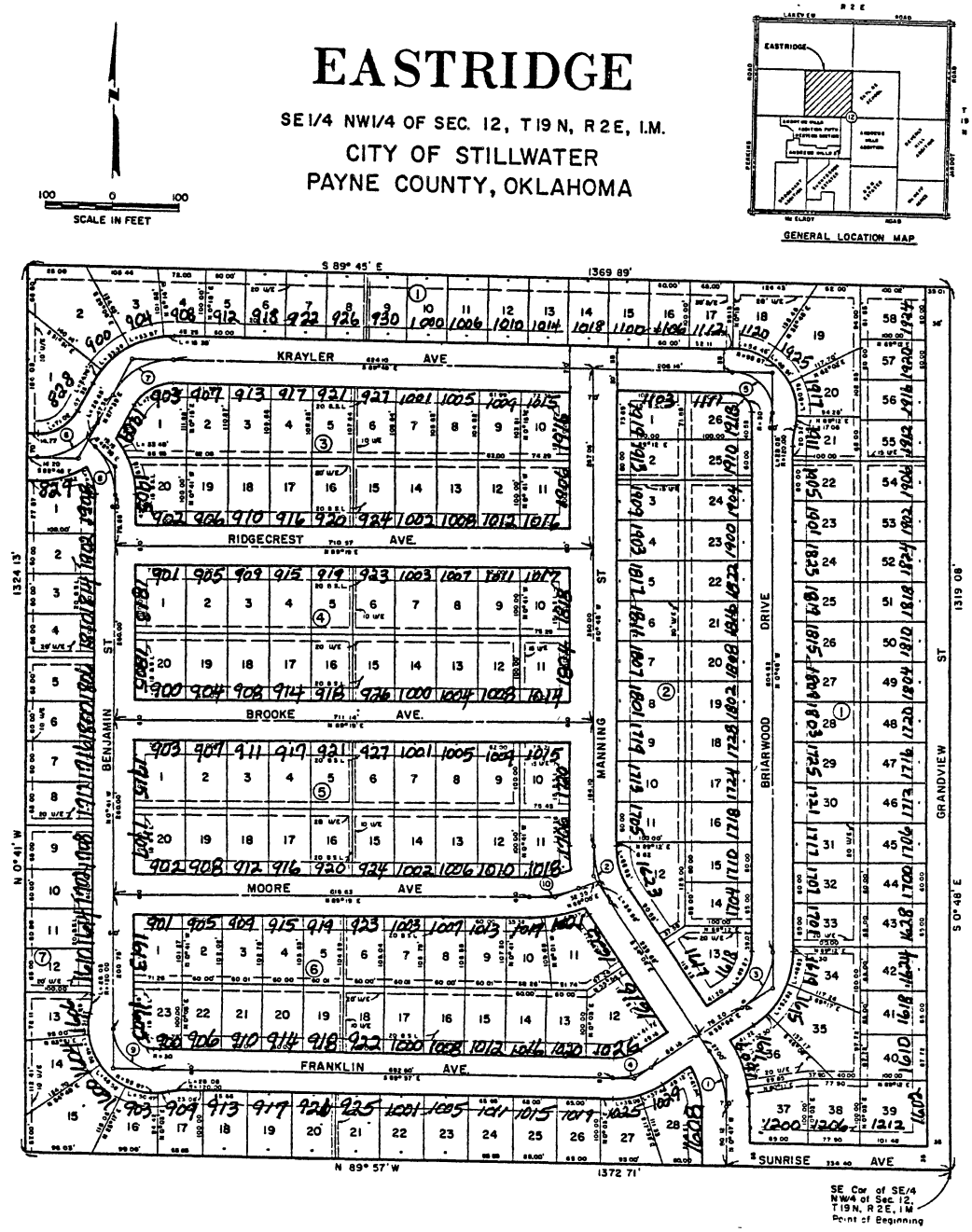

Figure 1. Eastridge Subdivision Map

interview, and 33 households failing to return the instrument. Included in the nonresponses were some homes that were vacant or for sale. The households where name could not be identified were sent surveys addressed to the resident living at the address.

The total number of responding households was 30. Of the 30 responding households, 15 consisted of married couples. The remaining households consisted of single individuals or only returned one instrument. Therefore the total number of responding individuals was 45. Twenty-three females and 22 males responded to the questionnaires.

The Instrument

The instrument (Appendix A) was developed from previous research studies in the area of household energy consumption. The past studies explored energy management behaviors and attitudes of families. Questions from the instruments utilized in these studies were adapted to the research.

The instrument consisted of multiple choice questions, open ended questions, order ranking, and five point Likert scale choices. Areas of information the instrument concentrated on are structure, behavior, and attitude. The instrument was pretested with 10 individuals. Some of the individuals were familiar with housing and energy consuming relationships, while others were not. The pretest proved

the questionnaire to be satisfactory for the individuals in terms of content and understanding.

Respondents were questioned about their general housing satisfaction. Structural features of the home were also examined. Also queried were changes made or planning to be made in the home.

Household members were asked about certain energy consuming behaviors which are practiced. Responses by household members included feelings as to the importance of the behaviors in terms of reducing consumption, and whether or not the behavior was a part of household routine. Basic information was also gained on how well informed the resident was about energy conservation. Another portion of the instrument questioned respondents on attitudes toward energy consumption and conservation.

Information on attitudes, behaviors, and structures paired with demographic information helped to build a profile of the households. The profile was later used in analysis of objectives to determine if differences in household characteristics had an effect on electrical energy usage.

Data Collection

Letters explaining the purpose of the research study were sent to residents of each home. The letter (Appendix B) explained that researchers would contact each household

by telephone and then be mailed a survey. In the case of married households, each household head would be mailed an instrument.

Two methods of data collection were utilized for the study. Using a modified version of Dillman's Total Design Method, data was first collected through a telephone interview, (Appendix A) a questionnaire was then used to collect further data (Appendix A). The Total Design Method approach is based on a theoretical view of why people do and do not respond to questionnaires. The method combines both telephone and mail surveys using the best advantages of each method to collect the most data. The method is concerned with the maximization of quantity and quality of response (Dillman, 1978).

Each household identified through examination of Payne County court records was mailed a letter (Appendix B). The letter explained the purpose of the research and the necessity of participation from each household in the sample. In addition, the letter informed the households that researchers would be contacting them by phone in order to gain basic demographic information. Phone numbers for households were obtained from the Stillwater telephone directory. Each household was then contacted in order to gain basic demographic information and to answer questions concerning the study. Demographic information gathered consisted of sex, relationship to household head, age,

marital status, education, and occupation of each person living in the home.

One week after households were contacted by telephone a survey was sent to households agreeing to participate. Married households were sent two instruments, one for each household head. Questionnaires for married couples were clearly marked "husband" or "wife" to insure gender identification during data analysis. Each questionnaire was coded with an identification number. The number was used solely to identify persons who had responded to the questionnaire. The questionnaire was included along with a postage paid return envelope.

One week after the first mailing, a postcard (Appendix B) was sent to each household in the sample. The postcard thanked those persons who had returned completed questionnaires and served as a reminder to those households who had not yet returned the questionnaire to do so. A follow up letter, (Appendix B) questionnaire, and postage paid return envelope was sent three weeks after the initial mailing to those nonresponding households. The letter reminded households to complete and return the instruments, and emphasized the importance of their participation.

Residents whose phone numbers were unobtainable, who had moved, or who owned more than one residence built by Kraybill in the subdivision were sent a letter (Appendix B) addressed to the resident at the address. The letter explained the purpose and importance of the research.

Included with the letter were two questionnaires and a demographic information sheet (Appendix A). Since the residents were not able to be contacted by telephone the demographic information sheet was to be completed by the household members and was to be returned with the instrument. Each instrument was clearly labeled "female household head" and "male household head". The letter explained that husbands and wives were to complete the proper instrument and single persons were to complete the one for their sex.

The same follow up postcard as used in the previous group was used. The postcard was mailed one week after the initial mailing. Three weeks after the initial mailing nonrespondents were mailed a second letter, instrument, demographic sheet, and return postage paid envelope.

Electrical energy usage data was collected from City of Stillwater electrical billing records. Natural gas usage for each household was unavailable. Electrical usage was gathered for each household for the years of 1983 and 1984. Two years of energy usage were used to gain a complete picture of average yearly household consumption. The household use was later used in the analysis of objectives for the study.

Data Analysis

The characteristics of the sample were analyzed using frequencies, means, and percentages. The statistics described the profile of the responding sample.

Energy consumption and demographic characteristics were analyzed using analysis of variance. Comparisons were made to determine if demographic variables influenced energy usage in the home. Analysis of variance and means were used to compare the differing attitudes between husbands and wives.

Pearson's correlation coefficient was used to test for a possible linear relationship between satisfaction with housing and energy consumed in the home. This statistical method was also used to test the significance of the relationship between behavioral patterns and energy consumption.

To identify behavioral practices that were perceived as energy efficient, the t-test statistic was utilized. The mean differences between the perceived importance of each behavior and the practice of each behavior were analyzed.

CHAPTER IV

FINDINGS AND DISCUSSION

Introduction

This chapter examines data analysis for this study. Statistical procedures used for this research include means, frequencies, percentages, t-test, and correlations. For this research the acceptable level of significance is a probability less than and/or equal to 0.05. The study compares the impact of demographic and behavioral patterns of households on household energy consumption.

Characteristics of the Sample

A total of 45 individuals responded to the questionnaire. Twenty-three of those were female, while twenty-two were male. Over half, 64%, of the sample was married. Table I represents the marital status of respondents.

TABLE I

MARITAL STATUS OF RESPONDENTS

Status	n	%
Single	4	16
Married	16	64
Widow	5	2

In the sample 38 (84%) of the individuals lived in homes which they owned. Five persons (11%) rented their homes and two persons were students who resided in homes owned by parents. Table II and Table III represent monthly house or rent payments and total annual income per household.

TABLE II

MONTHLY HOUSE PAYMENT OR RENT

Payment	n	%
Under $100	2	4.65
$100 - 249	1	2.33
$250 - 399	6	13.96
$400 - 500	21	48.83
Over $500	13	30.23

TABLE III

ANNUAL INCOME OF RESPONDENTS

Income	n	%
Under $5,000	4	8.89
$ 5,000 - 9,999	2	4.44
$10,000 - 14,999	3	6.67
$15,000 - 19,999	5	11.11
$20,000 - 24,000	6	13.33
$25,000 - 34,999	7	15.56
$35,000 - 44,999	15	33.33
$45,000 and over	3	6.67

Over one-third of the sample had incomes over $35,000 which suggests an above average income. Monthly house payments appear to be within the accepted financial range of one-fourth the monthly income.

The mean age for the respondents was 36.24 years of age. The mean education level for a respondent was 14.36 years. Table IV shows educational variations.

TABLE IV

EDUCATION OF RESPONDENTS

Level	n	%
12 years and under	9	36
13 - 16 years	13	52
Over 16 years	3	12

Occupations for the sample varied. Table V represents occupational distribution.

TABLE V

OCCUPATION OF RESPONDENTS

Occupation	n	%
professional/technical	7	30
semi-professional	3	13
manager, officials, proprietors	4	17
clerical	1	4
sales	1	4
craftsman, foreman	1	4
service worker (other than domestic)	2	9
other	1	4
student	3	13

Analysis

Statistical procedures used vary according to each objective analyzed. Each objective along with its analysis follow.

Objective 1: to assess the relationship between household consumption patterns and demographic characteristics including age, marital status, education, income, and occupation.

Demographic characteristics are presented for household head 1, the first adult listed in each household. The

results compare response of the household head to the sum of total 1983 and 1984 energy use for each household. The variables of age, marital status, education, income, and occupation are analyzed with energy use in terms of analysis of variance. The total consumption for 1983 and 1984 was used due to the relative newness of the housing units and the residents. The combination of both years gives a more accurate overview of resident use because some of the residents in the sample have not lived in their homes a full two years.

Findings indicate that demographic characteristics of age, marital status, education, income, and occupation observed individually with energy use are not significant at the .05 level. Past research has found differing conclusions in demographics and its relationship to energy consumption.

Behavior patterns were the concern of objective two. Objective two purpose was: to ascertain specific behavior patterns practiced by household members and the effects of those patterns on energy consumption.

The questionnaire asked respondents to rate the importance of certain behaviors in reducing energy consumption (1=least important, to 5=most important). Respondents were then asked to indicate how often those behaviors were practiced as part of their daily routine.

An importance score was determined for each respondent by summing the responses of the importance of energy saving

routines. A routine score was calculated by summing responses pertaining to frequency of household routine. Each individual was given a lifescore which is the routine score subtracted from the importance score. Using Pearson's correlation coefficient 1983 and 1984 energy use for each household was compared with individual lifescores. No significant differences were found at the .05 level for lifescore and usage.

The smallest lifescore recorded was -4. This means that the individuals routine was inconsistant with feelings of importance. The largest lifescore recorded was 19. This individual believed in the importance of energy saving behaviors, but did not practice the behaviors. One score in the sample was recorded as 0. The respondent in this case was exactly consistent between importance of behavior and practicing of behavior.

The mean lifescore was 4.7. The positive score indicates that while individuals may believe in the importance of certain behaviors to reduce energy consumption, the behaviors are not always practiced regularly. Families appear to be ignoring energy reducing options that are available to them. Although the responses indicate that the behaviors are believed to be important to energy reduction, the households appear to be unconcerned with actual practice.

Attitudes of husbands and wives are examined in Objective Three. Objective Three: to compare attitudes of

husband and wife related to energy consumption and conservation.

The instrument contained twenty statements that relate to beliefs about energy consumption and conservation. Respondents were to indicate their feelings about the statements using a five point scale. A response of 5 meant the individual strongly agreed with the statement. A response of 1 signified that the individual strongly disagreed with the statement.

The answers of husband and wife in each household were compared using analysis of variance. The findings show that four statements were significant at the .05 level. Tables VI - IX reveal those statements and differences.

Two other differences between husband and wife approached significance at the .05 level. Those statements are revealed in Table X and XI.

TABLE VI - XI

ANALYSIS OF VARIANCE - HUSBAND AND WIFE ATTITUDE DIFFERENCES

TABLE VI

STATEMENT: I BELIEVE THAT I CAN CONTRIBUTE TO THE ENERGY CONSERVATION MOVEMENT.

SOURCE	df	SS	MS	F	PR>F
households	15	28.30	1.89	5.66	0.0012
error	14	4.67	0.33		
total	29	32.97			

TABLE VII

STATEMENT: I WOULD BE WILLING TO TRY A NEW PRODUCT IF IT WOULD SAVE ME MONEY EACH MONTH ON UTILITY BILLS.

SOURCE	df	SS	MS	F	PR>F
households	15	15.07	1.00	2.93	0.0257
errors	14	4.80	0.34		
total	29	19.87			

TABLE VIII

GOVERNMENT PRICE REGULATIONS HAVE CAUSED THE ENERGY CRISIS

SOURCE	df	SS	MS	F	PR>F
households	15	15.90	1.06	10.12	0.0001
error	14	1.47	0.10		
total	29	17.37			

TABLE IX

STATEMENT: THE 1973 - 1974 ARAB OIL EMBARGO CAUSED THE ENERGY CRISIS IN THE UNITED STATES.

SOURCE	df	SS	MS	F	PR<F
households	15	17.65	1.18	2.777	0.0361
error	13	5.52	0.42		
total	28	23.17			

TABLE X

STATEMENT: SCIENCE AND TECHNOLOGY HAVE NOT KEPT PACE WITH PRESENT ENERGY NEEDS.

SOURCE	df	SS	MS	F	PR<F
households	15	20.60	1.37	2.17	0.0781
error	14	8.87	0.63		
total	29	29.47			

TABLE XI

STATEMENT: THE UNITED STATES IS TOO DEPENDENT UPON OIL IMPORTED FROM FOREIGN COUNTRIES.

SOURCE	df	SS	MS	F	PR<F
households	15	9.17	0.61	2.04	0.0958
error	14	4.20	0.30		
total	29	13.37			

The mean responses of husbands and wives for each differing statement are represented in Table XII.

TABLE XII

MEAN RESPONSES FOR HUSBAND AND WIFE ATTITUDES

STATEMENT	Husband Response	Wife Response
I believe that I can contribute to the energy conservation movement	3.80	3.47
I would be willing to try a new product if it would save me money each month on utility bills	4.13	3.73
Government price regulations have caused the energy crisis	3.47	3.40
The 1973-1974 Arab oil embargo caused the energy crisis in the United States	2.21	2.67
Science and technology have not kept pace with present energy needs	2.60	3.13
The United States is too dependent upon oil imported from foreign countries	4.33	4.13

In each of the six statements husbands and wives have differing attitudes. In this sample husbands appear to have a more definite agreement or disagreement with the statement.

Husbands and wives do not always share similar

attitudes in relation to energy conservation. The differences between spouses may have an impact on usage in the home. If one spouse is unconcerned with conservation practices, his actions may negate the practices of a conservative oriented spouse.

The fourth objective deals with perceptions of behaviors. Objective Four: to identify those behaviors that households perceive as being more energy efficient. Differences between households perceived importance and actual behaviors were compared.

Residents were asked fourteen questions concerning energy saving behaviors. Respondents were to indicate the importance of the behavior using an importance scale of 1 through 5, 1 being not very important and 5 being very important. Respondents were then to indicate the role each behavior played in daily routine. Using a scale of 1 through 5, 1 being usually not part of routine and 5 being always part of routine. The routine score was subtracted from the importance score for each question. The difference in the responses for each question was then analyzed using t-test statistics.

The findings indicate that eight behaviors are perceived as being more energy efficient than others. Table XIII lists the 14 behaviors and identifies the 8 significant behaviors.

TABLE XIII

PERCEIVED ENERGY REDUCING BEHAVIOR

Behavior	Importance Mean	Routine Mean	T-test
different temperature settings during day	4.05	3.95	0.4860
shutoff or setback of air conditioner	4.63	4.70	0.3230
turning off lights	4.60	4.47	0.3230
adjusting clothing	4.30	4.23	0.2617
selective use of space	3.98	3.42	0.0001*
adjusting of habits	3.57	3.07	0.0008*
conscious changes	3.88	3.40	0.0001*
turn down hot water heater	3.53	2.93	0.0001*
shutoff or setback heater	4.67	4.60	0.4733
adjust cooking habits	3.56	3.10	0.0005*
double or freeze recipes	3.00	2.58	0.0092*
energy cycle on dishwasher	3.82	3.49	0.0137*
portable appliances	3.26	2.93	0.1350
peakload changes	3.64	2.98	0.0001*

*significant at .05

The behaviors that families see as most important are conscious changes in household routine, selective use of

space, turning down hot water heaters, and changing energy use during peakload times. Four other behaviors were significant at the .05 level. Those behaviors are: adjusting of habits to reduce consumption, adjusting of cooking habits, doubling or freezing recipes, and using the energy cycle on the dishwasher. Households in this study perceive certain behaviors as being more energy reducing than others. Households may not always practice the behaviors, but feel that if the behaviors were practiced lower levels of consumption would result. In addition, those behaviors that are perceived as being most energy efficient are not the greatest reducers of energy consumption.

Objective five deals with lifestyle satisfaction. The objective states: to determine if behavior saving patterns affect lifestyle satisfaction of household members.

The respondent was asked about satisfaction with his present dwelling. Respondents were to rate feelings on a scale from 1 to 5, 1 being very satisfied and 5 being very dissatisfied. Table XIV lists responses to satisfaction questions.

TABLE XIV

SATISFACTION WITH PRESENT DWELLING

Satisfaction	n	%
very satisfied	18	40.9
satisfied	23	52.3
neither satisfied or dissatisfied	3	6.8

Individual responses for question 2 were compared to the total sum of 1983 and 1984 energy use for each household. Using Pearson's correlation coefficients findings indicate that there is no significance between satisfaction and energy use at the .05 level.

None of the respondents in this study were dissatisfied with their present living conditions. Therefore, analysis can not reveal any significant difference between lifestyle satisfaction of household members and energy consumption.

Pertinent variables were chosen for analysis in terms of total energy usage for households. Of particular importance were demographic, behavioral, and attitudinal variables. Since the sample was small, there tended to be few significant differences among the relationships examined. However, this suggests that similar homes may house similar residents. Demographic characteristics may not have had an effect on total energy consumption because

household characteristics were not widely varied. There were some significant relationships between importance and practice of behavior, and between attitudes of husband and wife.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The purpose of this study was to compare the impact of demographic and behavioral patterns of households on residential energy consumption. The following five objectives were explored: (1) to assess the relationship between household consumption patterns and their demographic characteristics including education, occupation, marital status, income, age; (2) to ascertain specific behavior patterns practiced by household members and the effects of those patterns on energy consumption; (3) to compare attitudes of husbands and wives relating to energy consumption and conservation; (4) to identify those behaviors that households perceive as being more energy efficient; and (5) to determine if behavior saving patterns affect lifestyle satisfaction of household members.

Description of Respondents

Data used in this study were obtained from the Oklahoma State research project, "Residential Energy Management". A

total of 45 respondents involving 30 households comprised the sample. The sample was drawn from homes built by a Stillwater builder in the Eastridge subdivision located in Stillwater, Oklahoma. Mean home size was 1070 square feet while average family size was 2.56. The mean age of household heads was 36 years. The average level of education for respondents was 14 years. The majority of household heads (43%) held professional or semi-professional jobs. An above average annual income of $35,000 or more was earned by over one third of the families.

In addition to demographic data, the study utilized energy use information. The energy usage was gathered from City of Stillwater electrical usage records. The energy use information was used to determine relationships between energy use, demographic and behavioral characteristics. Mean electrical usage for the households during 1983 and 1984 was 16598 kilowatt hours.

Summary of Findings

In this study there were no significant relationships between demographic characteristics of education, occupation, marital status, or age. The findings indicate that factors other than or in combination with demographic variables are involved in the determination of energy consumption in the household. The findings were inconsistent with research by Newman and Day (1975) which

found that energy use was positively affected by demographic characteristics. These characteristics include age of household head, education of household head, income of household, and family size. Smith (1980) had also found that higher income households have more options available for reducing consumption. Smith's findings were not repeated in this study, although the sample did have an above average annual income of $35,000 or more. The sample in this study is limited so it is not possible to positively state that demographics have no impact on actual energy consumption.

Gladhart (1977) said that families are constantly involved in patterned behaviors which require energy for their support. The type and amount of the behaviors influence the amount of energy used in the home. The data in this study also show no specific behaviors practiced by household members that contribute to a higher or lower level of energy use within the home. Peterson (1979) had found that within similar homes energy consumption could vary by twice the use, depending on the attitudes, choices, and behaviors of the household. Although these and other studies have shown that behavior does have an influence on the amount of total energy use in the home, it is not possible to determine from this study which behaviors impact usage the most.

The research found that husbands and wives of the same household do have differing attitudes in relation to energy

consumption and conservation. Most attitudinal differences between husbands and wives relate to political or governmental issues. These differences were about United States dependency on foreign oil, governmental price regulations and their contribution to the energy crisis, and the pace with which science and technology has met present energy needs.

Two other attitude differences related to individual conservation efforts in the home. The variations occured in belief that the individual can contribute to the conservation movement and the willingness to try new products in order to increase energy saving.

The variations may be related to differing perceptions and orientations of males and females. Women are often home oriented and use home and family as a basis for making decisions. Women may relate more readily to changes and efforts that can occur within the home environment. Men use a different base for decision making. Males are often more politically oriented and better informed about governmental practices.

A study on spousal response consistency in decision-making found that response consistency decreases as spousal tension and education level of the married couple increases (Monroe, Bokemeir, Kotchen, McKean, 1985). The average education level of this sample is 14.36 years. The high education may influence the response inconsistency of husband and wife.

Attitudinal differences in the same home may account for the variations in consumption levels. Differences may serve as a barrier to the conservation practices in the home. Bailey (1980) stated that energy related attitudes contributed to the greatest amount of behavioral differences in usage. If husband and wife have differing attitudes in relation to energy, their behaviors may cancel out conservation efforts.

Households perceive certain behaviors to be more energy efficient than others. Among those identified were: selective use of space, adjusting of habits to reduce consumption, making a conscious effort to reduce consumption, turning down hot water heaters, adjusting cooking habits, doubling or freezing recipes, and adjusting energy use during peak load periods. Although not all households practice these behaviors, the household members do feel that practicing these behaviors will reduce energy consumption. This supports Heslop's (1981) statements that conservation behavior is often supported when it is convenient. The behaviors may or may not lower energy consumption. The frequency and type of behavior have the most impact on usage.

Actual consumption and lifestyle satisfaction were found to have no significant relationship. No households in this sample were dissatisfied with their present lifestyle. It is not possible to conclude from this study that a lesser or greater energy consumption contributes to life

satisfaction in the home. Graef (1981) also found no positive connection between energy usage and life satisfaction.

Recommendations

With depleting energy resources and the rising cost of energy, behavior is becoming increasingly important to reducing energy waste in the home. Differences in household members values, attitudes, and behaviors can negate conservation practices. In view of these observations and the experience with this project, the following recommendations are made:

1. A more in-depth study of differences between attitudes and values between husbands and wives in relationship to energy conservation. This would aid in determining if conflicts in values within the same household contribute to energy use.
2. A larger sample should be utilized to study the effects of energy usage and lifestyle satisfaction. The sample should include individuals who are both satisfied and dissatisfied with lifestyles. The level of satisfaction should then be used in comparison with actual energy use within the home.
3. Demographic information should continue to be studied in relationship to energy usage in the home. It would be

helpful in targeting households which would be more likely to waste or conserve energy.

4. The study should be repeated using housing and households that are dissimilar. The similarity of the persons and housing in this study may have contributed to nonsignificant findings. The repeated study should include a structural audit to account for differences that may occur in usage because of structural differences.

5. A study should be conducted involving women and men and their perceptions relating to the energy situation. Differing perceptions as to cause and effect may have a relationship to individual energy usage.

6. The relationship between perception of energy conservative behavior and actual energy behavior should be further explored. Although individuals perceive certain behaviors to be energy saving, the behaviors are not always performed. Individual reasons for non-performance should be discussed.

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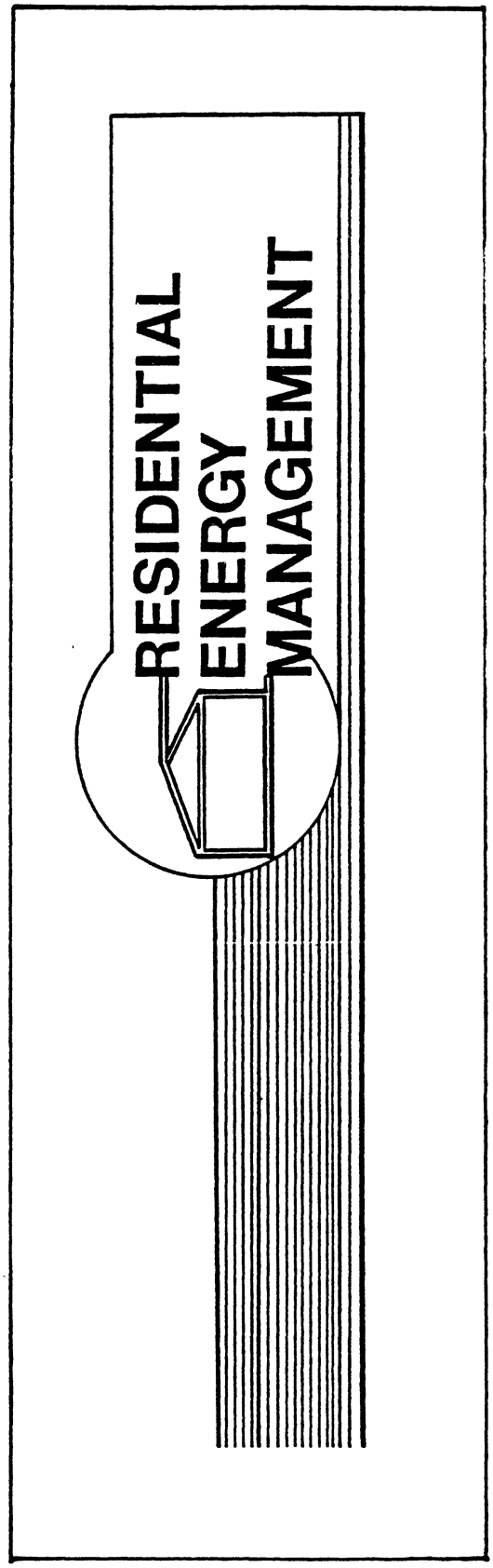
APPENDIXES

APPENDIX A

RESIDENTIAL ENERGY MANAGEMENT SURVEY

TELEPHONE INTERVIEW


RESIDENTIAL
ENERGY
MANAGEMENT

1. In what type of home did you last live?
   _____ 1. Single family
   _____ 2. Apartment
   _____ 3. Townhouse
   _____ 4. Mobile home
   _____ 5. Other (specify) _____

2. How satisfied are you with your present dwelling?
   _____ 1. Very satisfied
   _____ 2. Satisfied
   _____ 3. Neither satisfied or dissatisfied
   _____ 4. Dissatisfied
   _____ 5. Very dissatisfied

3. Why did you select the dwelling/housing you are now living in? (Check as many as apply).
   _____ 1. Affordable
   _____ 2. Location, neighborhood
   _____ 3. House design, plan and layout
   _____ 4. Built new house
   _____ 5. Provide more space
   _____ 6. Limited choice
   _____ 7. Innovative features
   _____ 8. Energy saving structure
   _____ 9. Other (specify) _____

4. What do you like best about where you live? (Check only one)
   _____ 1. Affordable
   _____ 2. Location, neighborhood
   _____ 3. House design, plan and layout
   _____ 4. Built new house
   _____ 5. Provide more space
   _____ 6. Limited choice
   _____ 7. Innovative features
   _____ 8. Energy saving structure
   _____ 9. Other (specify) _____

5. What do you like least about where you live? (Check only one)
   _____ 1. Affordable
   _____ 2. Location, neighborhood
   _____ 3. House design, plan and layout
   _____ 4. Built new house
   _____ 5. Provide more space
   _____ 6. Limited choice
   _____ 7. Innovative features
   _____ 8. Energy saving structure
   _____ 9. Other (specify) _____

6. How likely is it that you will move within the next three to five years?

_____ 1. Very likely
_____ 2. Likely
_____ 3. Unsure
_____ 4. Unlikely
_____ 5. Very unlikely

If very likely or likely, why do you plan to move? (Check only one)

_____ 1. Present house is wrong size
_____ 2. Plan to build or buy
_____ 3. Improve location
_____ 4. Dissatisfied with conditions of present dwelling
_____ 5. Change in family structure
_____ 6. Plan to change jobs
_____ 7. Dissatisfied with energy bills
_____ 8. Economics
_____ 9. Other (Specify) _____

IF YOUR HOME WAS NEW WHEN YOU MOVED IN, CONTINUE WITH THE FOLLOWING QUESTIONS. IF THE HOME WAS NOT NEW, SKIP TO QUESTION 11.

8. Did you work with the contractor when your home was under construction?

_____ 1. Yes
_____ 2. No If no, skip to question 11.

9. Did you consider any of the following design features related to energy?

		Yes	No	
1. Orientation	____			____
2. Window placement	____			____
3. Type of windows	____			____
4. Active solar collectors	____			____
5. Size of overhang	____			____
6. Masonry mass inside the home	____			____
7. Insulation	____			____
8. Other (specify) _____				

If the answer to any of the above was yes, where did you get the information for the energy consideration(s) incorporated in your house? _____

10. Are you using any supplemental source of heat not supplied by the utility company?
    _____ 1. Yes
    _____ 2. No

    If yes, what type? _____

11. Are you using methods other than central air conditioning to cool your home in summer?
    _____ 1. Yes
    _____ 2. No

    If yes, what type? _____

12. How much have these people been involved in making decisions about your housing?

	Not at all	Some	Very Much
You			
Your spouse			
Children			
Other household members			
Other relatives			
Housing professionals (real estate agents, engineers, etc.)			
Friends			

Others (specify) _____

13. This is a picture of a ladder. The top of the ladder (10) represents the best possible energy situation for our country; and the bottom (0), the worst possible energy situation for our country. Place a star on the step of the ladder where you think the United States is at the present time.

Ladder Scale

10
9
8
7
6
5
4
3
2
1
0

14. If things go pretty much as you now expect, where do you think the U.S. will be on the ladder five years from now? Place a star on the appropriate step.

Ladder Scale

10
9
8
7
6
5
4
3
2
1
0

15. Should the federal government be working toward energy independence with less reliance on foreign supply?
_____ 1. Yes _____ 2. No

16. In different parts of the nation, people have reported a variety of effects of the energy situation on their daily lives. How has the energy situation affected your family? (Check the one statement that best describes your household).
_____ 1. It really has had no effect on us.
_____ 2. We have had to make a few changes, but our lifestyle has not been affected.
_____ 3. Our life has been less comfortable and convenient but it is not serious.
_____ 4. We have had to make serious changes in our daily habits.
_____ 5. Don't know.

17. The following contains a number of statements. You may agree with some and disagree with others. For each statement circle the answer that best fits your feelings.

	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. I have a responsibility to help resolve our country's energy problems by cutting back on consumption, even if this means making some sacrifices in the way I live.	5	4	3	2	1
2. I trust the federal government to find a solution to the energy crisis.	5	4	3	2	1
3. Our energy problems will be resolved when energy companies have a free hand to find the energy we need.	5	4	3	2	1
4. We should pay more attention to the particular energy needs of each city or town and to meeting those needs through local resources whenever possible.	5	4	3	2	1
5. My household should be able to use all of the energy it can afford.	5	4	3	2	1
6. I believe I can contribute to the energy conservation movement.	5	4	3	2	1

7. I would be willing to try a new product if it would save me money each month on utility bills.	5	4	3	2	1
8. The average citizen influences the total amount of energy consumed in the United States each year.	5	4	3	2	1
9. I believe solar and earth sheltered homes are too complicated for most Americans.	5	4	3	2	1
10. In the past, Americans have been wasteful in their use of natural resources.	5	4	3	2	1
11. The *oil* companies in the United States are trying to make large profits.	5	4	3	2	1
12. The *utility* companies in the United States are trying to make large profits.	5	4	3	2	1
13. The United States is too dependent upon oil imported from foreign countries.	5	4	3	2	1
14. The 1973-1974 Arab oil embargo caused the energy crisis in the United States.	5	4	3	2	1
15. The world is running out of energy resources.	5	4	3	2	1
16. The energy shortage is a part of a political scheme.	5	4	3	2	1
17. Government price regulations have caused the energy crisis.	5	4	3	2	1
18. The energy crisis is a world wide problem, not just a problem in the United States.	5	4	3	2	1
19. Science and technology have not kept pace with present energy needs.	5	4	3	2	1
20. The shift away from the use of coal to the use of oil has caused the energy crisis.	5	4	3	2	1

18. In recent years, it has been possible to claim federal and, in some places, state tax benefits for improving the energy efficiency of one's home. Which best describes your awareness of these tax benefits? (Please check the appropriate response in each column).

	STATE	FEDERAL
Not Aware of this benefit		
Aware, but have made no claim		
Aware, and have filed a claim		

If a claim has been filed, would you have made these improvements if the tax benefits had not been available?

_____ 1. Definitely not
_____ 2. Probably no
_____ 3. Probably yes
_____ 4. Definitely yes

For what items have you received tax credits? (List) _____

_____

19. There are a variety of reasons that you may choose to conserve energy. Rank the following statements in the order of their importance to you. (1=Most important to 7=Least important).

_____ Because the government provides low interest rate loans for installing insulation, storm windows, and solar heating and cooling equipment.
_____ Because tax credits for energy conserving equipment are available.
_____ To protect energy resources for future generations.
_____ To preserve the environment.
_____ To save money on utility bills.
_____ Because friends and neighbors are involved in energy conservation.
_____ To simplify life styles to live more in tune with nature.

20. How well informed would you say you are about energy conservation?

_____ 1. Very well informed
_____ 2. Well informed
_____ 3. Somewhat informed
_____ 4. Slightly informed
_____ 5. Not at all informed
_____ 6. Don't know

21. In recent years, architects, engineers, and other housing professionals have designed new ways to reduce the amount of energy used in buildings and in heating or cooling houses. The following is a list of energy saving features that can be used by individual homeowners to produce energy. Indicate whether you have heard of the item, have read about, have seen, or own/use one of the features. (Check all that apply)

	Heard About	Read About	Seen	Own/ Use	Don't Know
Solar panels (or collectors) to heat water for homes					
Solar panels (or collectors) to heat homes					
Solar swimming pool, hot tub, or spa heaters					
Wood stoves to heat homes					
Attached solar green houses to heat homes					
Solar cells (photovoltaics) to produce electricity					
Small wind machines (or windmills) to produce electricity or pump water					
Bioconversion (such as gasahol and using farm wastes to produce gas for fuel)					
Passive solar design (such as using many south-facing windows to get heat from the sun, with few windows on the north; using water containers, walls, floors, or ceilings to collect and store the sun's heat).					

22. What temperature setting is used on the water heater? _____ F. or _____ low _____ medium _____ high

23. Here is a list of structural features that impact energy consumption. Have you added or changed any of these features since living in the home? Or do you plan to add any of these features not currently in your home within the next three years? (Check the appropriate box)

STRUCTURAL FEATURES	Added/Changed	Plan to add/change
Ceiling insulation		
Wall insulation		
Floor insulation		
Storm windows		
Double pane windows		
Plastic Covering on windows		
Storm doors		
Weather stripping		
Caulking		
Fireplace		
Energy management control system		
Exterior insulation around hot water heater		
Insulated draperies or window coverings		
Water flow restrictor		

24. Rate each of the following statements with respect to the importance (from not important to very important) for saving energy. Indicate the role each measure plays in your daily routine (from usually not part of your daily routine to almost always a part of your daily routine).

How Important? (Not Imp)				(Very Imp)	Lifestyle Parameters	Part of Daily Routine (Usually Not)				(Always)
1	2	3	4	5	A nighttime thermostat setting which differs from the day time setting	1	2	3	4	5
1	2	3	4	5	Shutoff or setback of air conditioner when house is unoccupied	1	2	3	4	5
1	2	3	4	5	Turning off lights which are not in use	1	2	3	4	5
1	2	3	4	5	Adjusting the type of clothing worn while inside to allow for warmer summer and cooler winter temperatures	1	2	3	4	5
1	2	3	4	5	Selective uses of space; closing off unused rooms	1	2	3	4	5
1	2	3	4	5	Adjusting living habits to more fully utilize those spaces that are the most comfortable at any given time of day	1	2	3	4	5
1	2	3	4	5	Making a conscious effort to change habits or to modify work to save on energy costs	1	2	3	4	5
1	2	3	4	5	Turning down your hot water heater temperature	1	2	3	4	5
1	2	3	4	5	Shutoff or setback of heating system when house is unoccupied	1	2	3	4	5
1	2	3	4	5	Adjusting cooking habits to more fully utilize appliances	1	2	3	4	5
1	2	3	4	5	Doubling recipes and cooking foods for freezing and later use	1	2	3	4	5
1	2	3	4	5	Using energy efficient drying cycle on your dishwasher	1	2	3	4	5
1	2	3	4	5	Using portable appliances (electric skillet, electric grill, electric griddle, etc) in place of the range	1	2	3	4	5
1	2	3	4	5	Change household energy use during "peak load"	1	2	3	4	5

25. What date did you move into your home? _____

26. Do you: _____ Own
_____ Rent or Lease
_____ Other (specify) _____

27. How much is your monthly house payment or rent?

_____ 1. Under $100
_____ 2. $100-149
_____ 3. $150-199
_____ 4. $200-249
_____ 5. $250-299
_____ 6. $300-349
_____ 7. $350-399
_____ 8. $400-449
_____ 9. $450-500
_____ 10. Over $500

28. Which of the following categories best represents the 1984 total annual income, before taxes of all persons living in your household?

_____ 1. Under $5000
_____ 2. $5000-6999
_____ 3. $7000-9999
_____ 4. $10000-11999
_____ 5. $12000-14999
_____ 6. $15000-19999
_____ 7. $20000-24999
_____ 8. $25000-34999
_____ 9. $35000-44999
_____ 10. $45000-55000
_____ 11. Over $55000
_____ 12. Don't know

Thank you for your time. If you have any questions, or if we can be of any assistance, please contact either Emily Shuter or Margaret Weber at 624-5048.

TELEPHONE SURVEY

Hello, my name is_____and I am working with the Energy Management Research Project at Oklahoma State University. We sent you a letter about this research recently. Did you receive the letter?

IF NO . . .Let me briefly explain why we are conducting this research.

IF YES. . .Do you have any questions about the letter?

Is now a convenient time to answer a few questions? If yes, let me verify your name and address:

Is your name:

and address:

If No, when could I call back?

You will be receiving questionnaires in the mail within a few days.

NAME	SEX	RELATIONSHIP TO HEAD	AGE	MARITAL STATUS	EDUCATION	OCCUPATION

NOW, I WOULD LIKE TO ASK YOU A FEW DEMOGRAPHIC QUESTIONS ABOUT YOUR HOUSEHOLD.

WHAT IS YOUR AGE?
WHAT IS YOUR MARITAL STATUS?
WHAT IS YOUR LEVEL OF EDUCATION?
WHAT IS YOUR OCCUPATION?

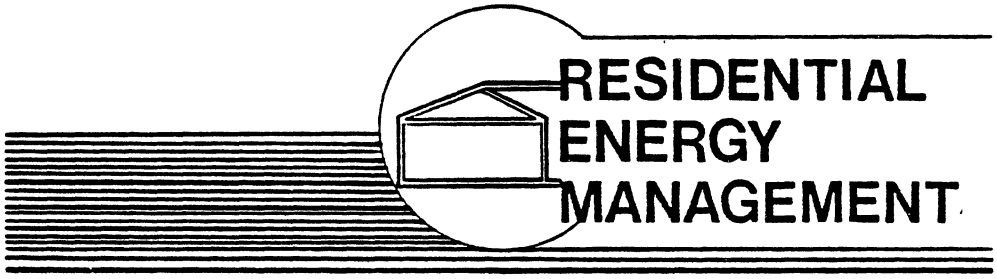
ARE THERE OTHER MEMBERS IN YOUR HOUSEHOLD? IF YES, WHAT ARE THEIR NAMES: (LIST ONE PER LINE). THEN ASK THE FOLLOWING QUESTIONS, AS YOU ENTER THE INFORMATION.

WHAT IS _____ RELATIONSHIP TO YOU?
WHAT IS THEIR AGE?
WHAT IS THEIR MARITAL STATUS?
WHAT IS THE HIGHEST LEVEL OF EDUCATION THEY HAVE COMPLETED?
WHAT IS THEIR OCCUPATION?

APPENDIX B

FOLLOW-UP POSTCARD

RESIDENT LETTERS



A questionnaire was recently sent to you regarding energy and your home. If you have returned the questionnaire, your time and effort are greatly appreciated. If you did not complete the questionnaire, would you take a few minutes to do so and drop it in the mail today.

It is very important that we hear from you via the questionnaire if our research is to accurately represent your subdivision. Thank you for your cooperation.

DATE

NAME
1904 Briarwood Drive
Stillwater, OK 74074

Thank you for agreeing to particiapte in our Residential Energy Management Study. We appreciate your response to the telephone interview and we are excited about the potential of this study.

As stated in the previous letter, energy is impacting our daily lives and living patterns. With this type of research, it is hoped that we can better understand the relationship between human behavior, structural design, and energy usage. The cost of human behavior on energy usage can be more closely determined as a result of this study.

The East Ridge Subdivision was chosen because of the similarity of the homes in construction methods and square footage. It is therefore important for each household in the subdivision to participate. Enclosed you will find a questionnaire for each head of household. For example, if your household has a husband and wife, each are asked to complete the appropriately labelled questionnaire. Please complete the questionnaire(s) and return in the envelope provided by March 20, 1985.

You may be assured of complete confidentiality. Each questionnaire has an identification number for mailing purposes only. This is so that we may check your name off of the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire. Information about your family gathered from the telephone interview will be used to ascertain how family structure and size impacts energy usage.

We would be most happy to answer any questions you might have. Please call either of us at 624-5058.

Thank you for your assistance with the study.

Sincerely,

Margaret Weber Emily Shuter

April 19, 1985

Resident
1623 N. Manning Street
Stillwater, OK 74074

Dear Resident:

Energy consumption and conservation continue to be of great concern to all of us. Energy impacts our lives in many areas. Many of us have experienced live style changes, behavior modification or changes in the structure of our dwellings to reduce energy cost. With all of these changes, few attempts have been made to measure the costs and benefits of these changes.

Your household is one of a small number in which people are being asked to give their opinion on these matters. As a resident of the East Ridge Subdivision, you were selected to participate in this study. Your home was selected because it is representative of the homes in your area in terms of square footage and construction methods. Therefore, your participation in the study is very important if the study is to be representative of the East Ridge Subdivision.

Enclosed you will find a questionnaire for each head of household (for example, if your household has a husband and wife, each are asked to complete the appropriately labelled questionnaire). Please complete the questionniare(s) and demographic information and return in the envelope provided by May 1, 1985.

You may be assured of complete confidentiality. Each questionnaire has an identification number for mailing purposes only. This is so that we may check your address off of the mailing list when the questionnaire(s) is returned. Your name will never be placed on the questionnaire or demographic sheet. Information about your family gathered from the demographic sheet will be used to ascertain how family structure and size impacts energy usage. The results of this study will help in establishing a data base to assess the interaction between structure, lifestyle, and energy use. We appreciate your participation in this study.

We would be most happy to answer any questions you might have. Please call either of us at 624-5048. Again, thank you for your assistance with the study.

Sincerely,

Margaret Weber Emily Shuter

Date

Name
912 Moore Avenue
Stillwater, OK 74074

Dear Mr. Name:

Energy consumption and conservation continue to be of great concern to all of us. Energy impacts our lives in many areas. Many of us have experienced life style changes, behavior modification or changes in the structure of our dwellings to reduce energy cost. With all of these changes, few attempts have been made to measure the costs and benefits of these changes.

Your household is one of a small number in which people are being asked to give their opinion on these matters. As a resident of the East Ridge Subdivision, you were selected to participate in this study. Your home was selected because it is representative of the homes in your area in terms of square footage and construction methods. Therefore, your participation in the study is very important if the study is to be representative of the East Ridge Subdivision.

Research assistants will be calling you in a few days to ask for some basic information. The researchers will identify themselves and be one of the following: Sarah Drummond, Asha Hegde, or Jackie Wieland. This call will take no longer than five minutes. Following the telephone interview, you will receive a questionnaire seeking additional information.

The results of this study will help in establishing a data base to assess the interaction between structure, lifestyle, and energy use. We appreciate your participation in this study.

Thank you for your assistance.

Sincerely,

Margaret Weber Emily Shuter

APPENDIX C

DATA FIGURES

Figure 2. Individual Energy Use 1983 and 1984

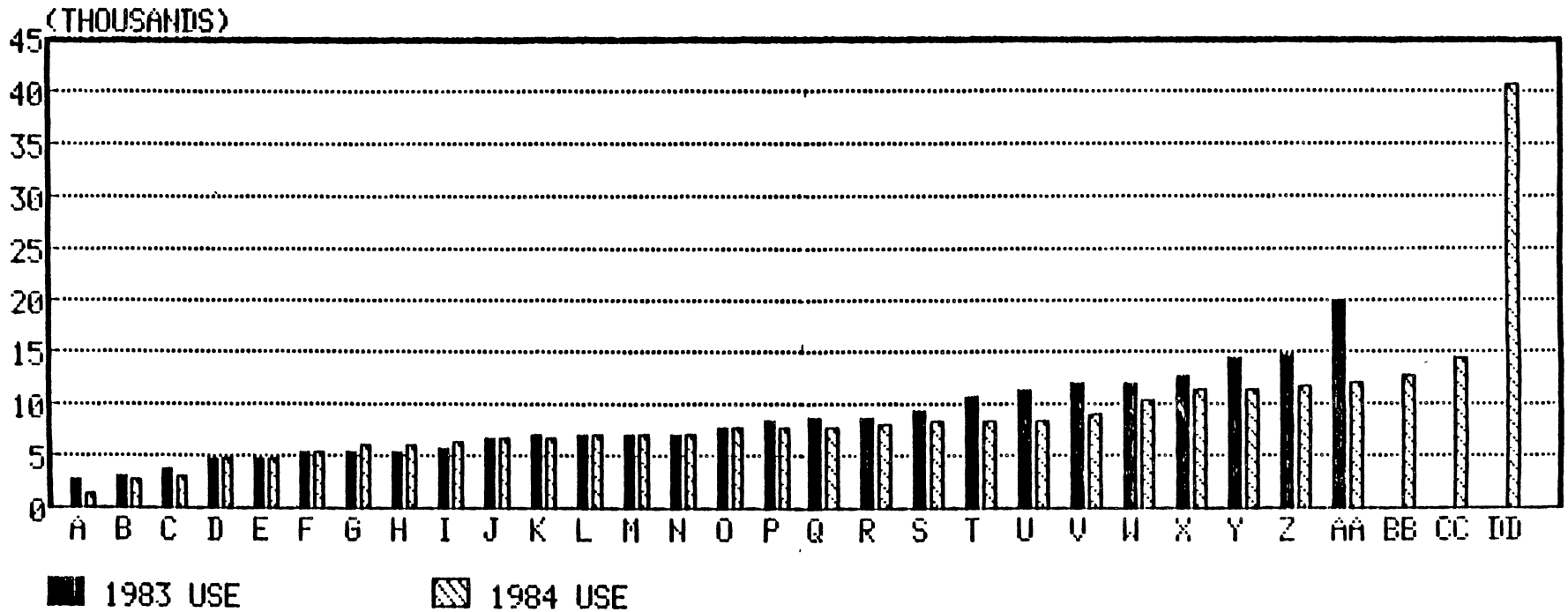


Figure 3. Energy Use 1983 and Mean Use

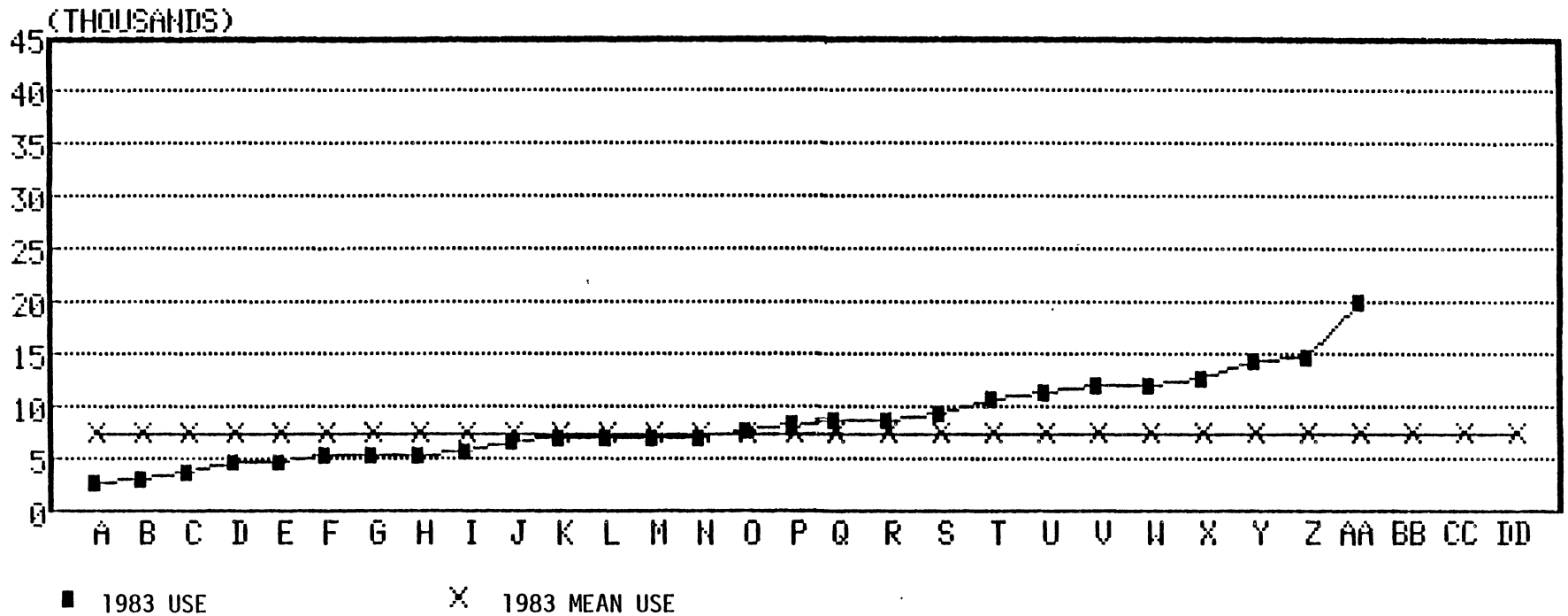


Figure 4. Energy Use 1984 and Mean Use

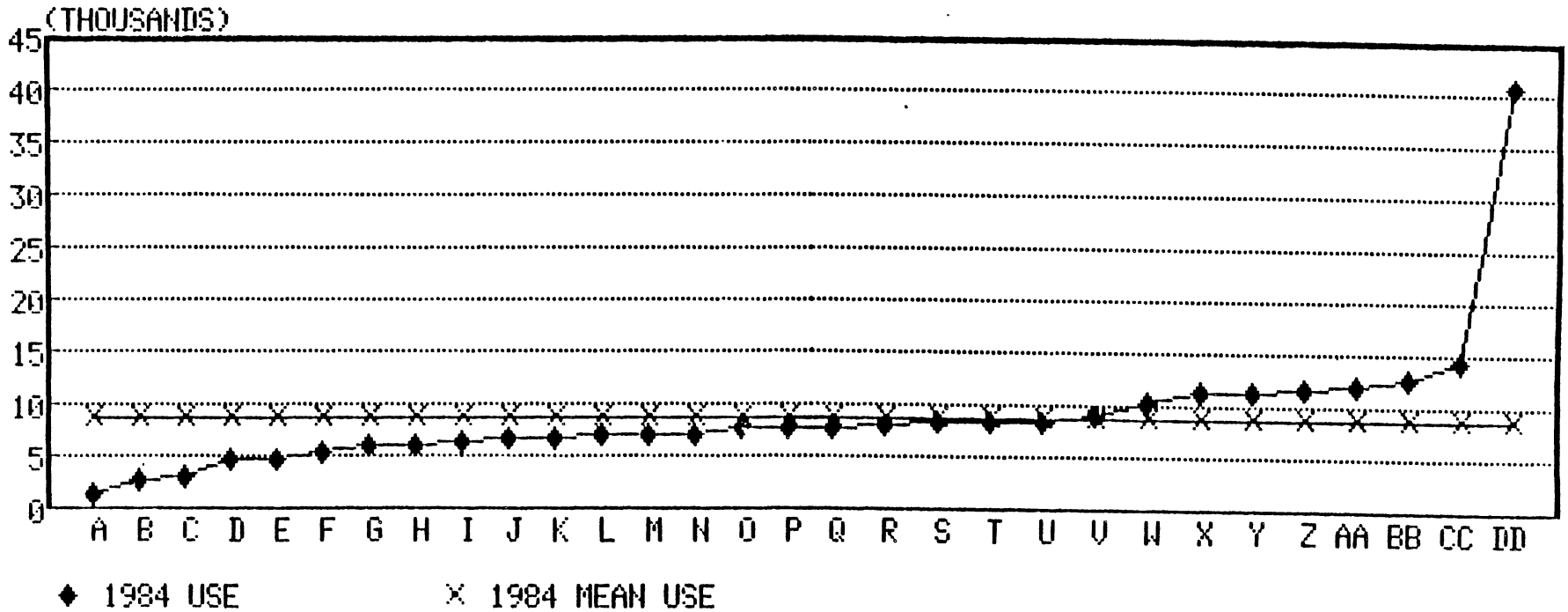


Figure 5. 1983 and 1984 Use with Square Footage

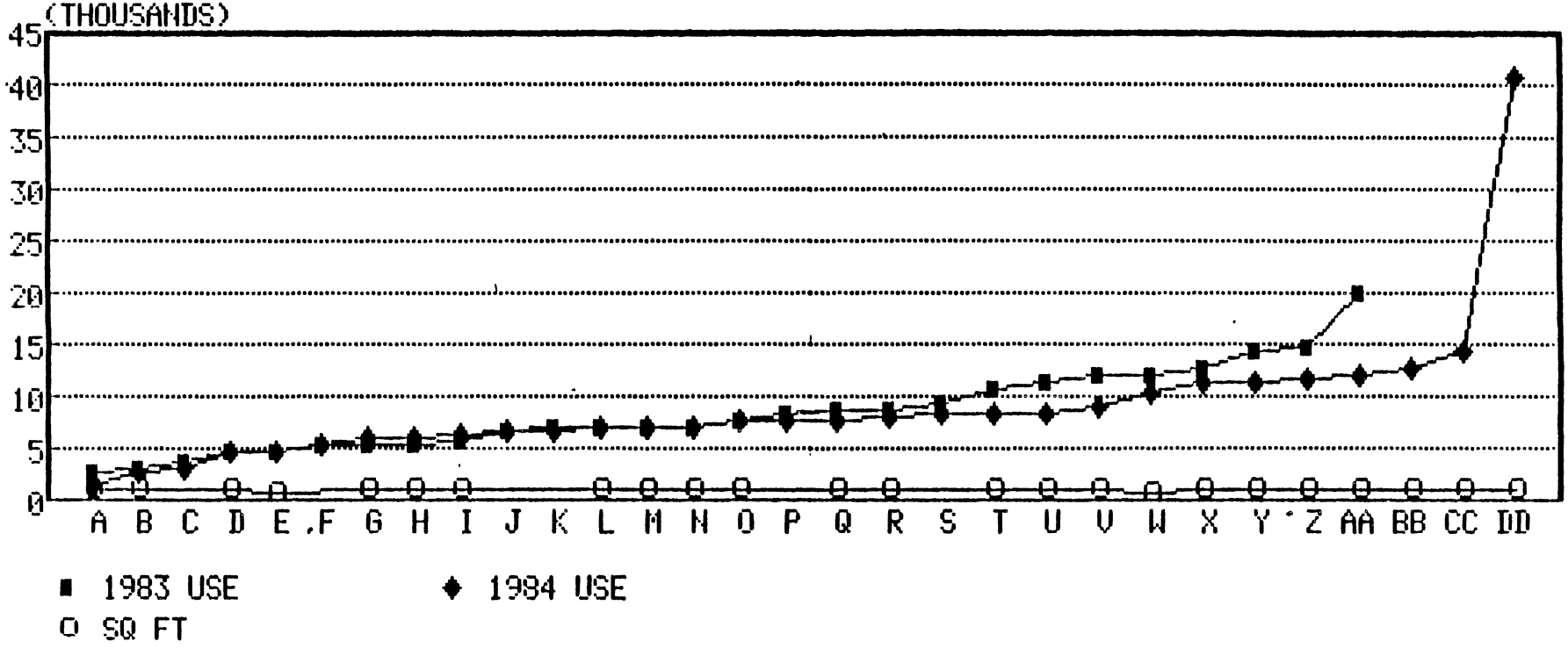
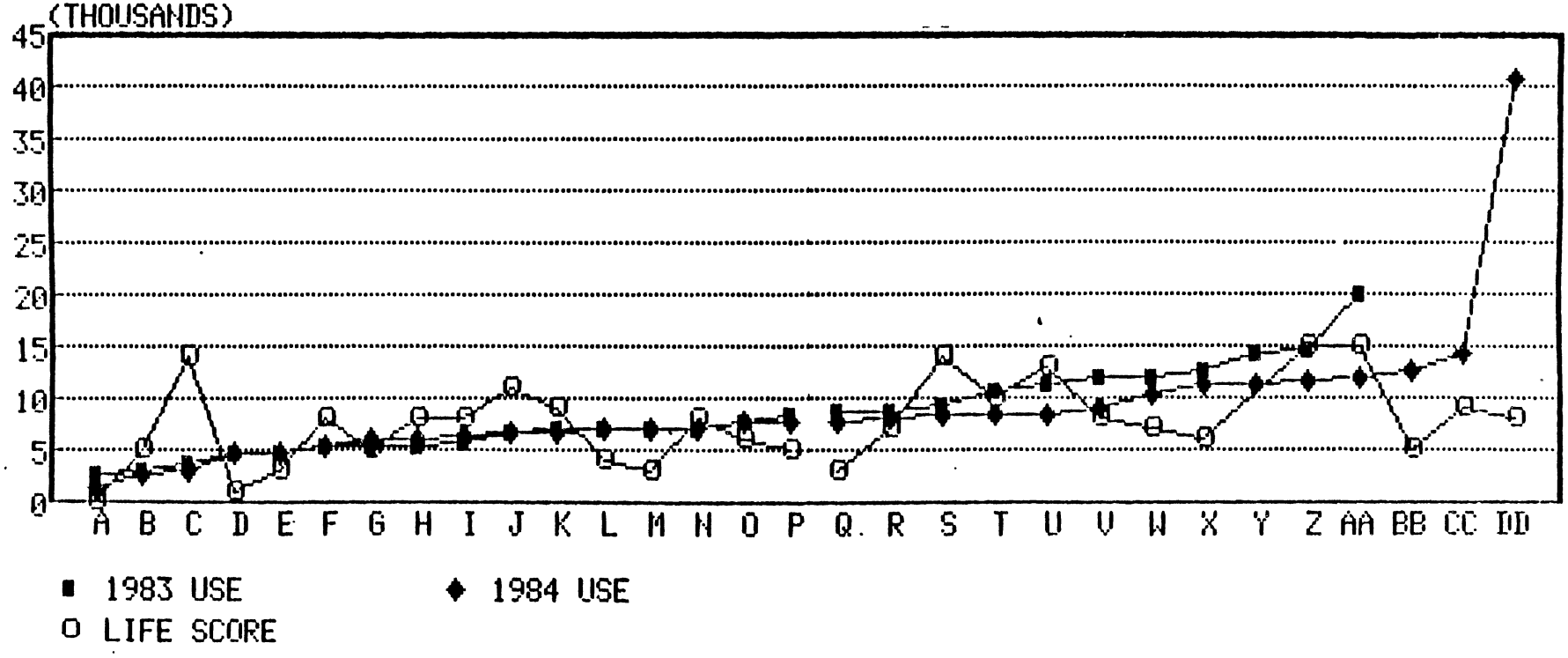


Figure 6. 1983 and 1984 Use with Lifescore



VITA

Sarah Elizabeth Drummond

Candidate for the Degree of

Master of Science

Thesis: STRUCTURAL AND BEHAVIORAL COMPONENTS OF RESIDENTIAL ENERGY CONSUMPTION

Major Field: Housing, Interior Design and Consumer Studies

Biographical:

Personal Data: Born in West Point, New York, August 23, 1962, the daughter of James E. and Helen H. Drummond.

Education: Graduated from Lawton High School, Lawton, Oklahoma, in May, 1980; received Bachelor of Science degree in Home Economics from Oklahoma State University; completed requirements for the Master of Science degree at Oklahoma State University in December, 1985.

Professional Experience: Assistant State Specialist for Housing and Interior Design, Home Economics Cooperative Extension, Oklahoma State University, September 1985 - present; Graduate Research Assistant, Department of Housing, Interior Design, and Consumer Studies, Oklahoma State University, June 1984 - August 1985; Graduate Teaching Assistant, Department of Housing, Interior Design, and Consumer Studies, Oklahoma State University, August 1984 - December 1984.